

KIRTLANDIA[®]

The Cleveland Museum of Natural History

March 2004

Number 54:43-90

THE SNAIL-KILLING FLIES OF OHIO (INSECTA: DIPTERA: SCIOMYZIDAE)

B. A. FOOTE

Department of Biological Sciences
Kent State University, Kent, Ohio 44242-0001

AND **J. B. KEIPER**

The Cleveland Museum of Natural History
1 Wade Oval Drive, Cleveland, Ohio 44106-1767
jkeiper@cmnh.org

ABSTRACT

The snail-killing flies (Insecta: Diptera: Sciomyzidae) are a moderately speciose family of true flies with more than 200 species in North America. The biology of all species appears tied intimately to freshwater and terrestrial Mollusca, including snails, snail egg masses, slugs, and fingernail clams. Keys are presented to adults of 99 species of snail-killing flies that occur in Ohio and bordering states. Locality records, habitat, seasonal distribution, larval feeding habits, and references to descriptions of immature stages are given for the 72 species known to occur in Ohio.

Introduction

The family Sciomyzidae, commonly known as snail-killing flies or marsh flies, is worldwide in distribution, with over 500 described species (Rozkošný, 1995). There are nearly 200 species in North America (Knutson et al., 1986), and 72 species have now been recorded from Ohio. The larvae of most species in Ohio are known to attack a variety of prey belonging to aquatic, shoreline, and terrestrial species of snails and slugs. Interesting adaptive divergences from the habit of consuming snails include the genus *Renocera* which has larvae that attack fingernail clams (Foote, 1976, p. 123). Young larvae of *Antichaeta* feed within the egg masses of pulmonate snails, whereas older larvae attack larger, hatched snails (Knutson, 1966).

In this paper, we summarize the distribution, larval feeding habits, and life histories of the 72 species actually recorded from Ohio. Keys are presented for these plus an additional 27 species that have been recorded in states bordering Ohio.

Collecting Sciomyzidae

Most species of Sciomyzidae are associated with wetlands, riparian areas, vegetated road-side ditches, and pond and lake margins, but a number of more terrestrial species are found exclusively in moist areas of herbaceous understorey in forests. Many specimens were obtained using an aerial sweep net. Swinging a net briskly and keeping the opening fully within herbaceous vegetation will obtain

specimens taking refuge within plant stands. When a particular stand of vegetation is swept and is identifiable (e.g., sweeping a cattail stand), specimens should be collected in separate vials for each vegetation type and these data included on specimen labels.

Trapping will also procure many specimens, and may obtain species only rarely taken with sweep netting. Pan traps and malaise traps should be positioned near or within vegetation where preliminary sweep netting indicates that adults are active, or in areas where freshwater mollusks are found. Sticky traps may also be employed, but unless a proper solvent is used, adhesives remain and obscure specimens.

Adult Sciomyzidae are killed effectively with killing jars or freezing. Freezing is often preferred because they can be thawed, pinned, and the male postabdomen easily removed before the specimens become dry and brittle. Adult specimens can be placed directly in ethanol for storage and removal of male postabdomens. However, critical point drying or chemical drying (e.g., use of hexamethyldisilazane or other drying agent) is necessary to produce pinnable or pointable material. For those specimens requiring genitalic examination, it is often desirable to simply remove half of the abdomen with iris scissors or ultra-fine forceps. Removing the male postabdomen from completely dry specimens (as in older pinned material) should be done carefully to prevent damage of the genitalic structures and the body anterior of the abdomen.

Rearings have provided invaluable information on the trophic adaptive radiation that has occurred in the Sciomyzidae (Berg and Knutson, 1978; Foote, 1996a). All North American species are restricted to feeding on Mollusca, including snails, snail egg masses, slugs, and fingernail clams. Keeping infested molluscs in the laboratory may produce new host association data when adults emerge from puparia. Species that pupariate away from their hosts can be collected from leaf litter, or can be found next to emergent objects in standing water. Puparia should be placed in rearing jars with a moist substrate, such as peat moss. Rearing species from egg to adult should be done following the methods of Foote (1996a, p. 4).

Identification of Sciomyzidae

Terminology used in this paper follows that of Knutson (1987). The keys rely heavily on external adult characters for identification, including unique color patterns of the body, wing patterns, position of setae (i.e., chaetotaxy), and morphology of specific body parts such as antennae. However, examination of the male postabdomen is frequently necessary to identify specimens to species, or to confirm determinations based on external morphology. This is especially true of the genera *Dictya* and *Linnia*, many *Pherbellia*, and some *Tetanocera*.

Genitalia must be cleared with potassium hydroxide (KOH) for proper examination of diagnostic characters. Genitalia were removed from males with microdissection forceps or scissors, placed into 10 percent KOH, and either left overnight or gently heated for 20–30 minutes. A few drops of glacial acetic acid was added to specimens once cleared, neutralizing the KOH and preventing further maceration of the tissues during permanent storage. Genitalia were placed in 70 percent ethanol for examination, then in genitalia vials (rubber or plastic caps are preferred to cork) containing liquid glycerol for permanent storage. The genitalic vial caps were pierced with the specimen pin below the adult and positioned above all data labels.

The most important, and obvious, character used during genitalic examination is the surstylus (Figure 11F). This is a triangular or rectangular structure that can be exposed by unfolding the genitalia. In some species it should be viewed from both lateral and posterior perspectives. In other cases, viewing the gonite, hypandrium, or the aedeagus is necessary. The cerci and epandrium (Figure 11F) are of little or no diagnostic use during genitalic examination. The examination is done with the point of fine forceps or a dissecting needle placed near the sixth sternite and pulling the genitalic structures out to expose them. This method also exposes the gonite (Figure 10E) and hypandrium (Figure 10E) when necessary. Most of the useful details of the hypandrium are found on the ventral process, which may be triangular, rectangular, or multi-lobed (Figure 11A). The aedeagus is membranous protrusion exposed when the genitalia are unfolded, and is occasionally useful for species identification.

Material Examined

The data for most specimens presented in this work were maintained on a database by the senior author since the 1960s. Many are currently housed at The Cleveland Museum of Natural History (CMNH), the Carnegie Museum of Natural History (CMNH), the Illinois Natural History Survey (ILNHS), Iowa State University (IASU), Florida State Collection of Arthropods (FSCA), the University of Minnesota (UMN), the United States National Museum (USNM), or the Ohio State University (OSU). Others reside in the personal collection of the senior author (BAF), which will eventually be deposited in The Cleveland Museum of Natural History. We summarized North American distributional data for many species from the catalog of Knutson et al. (1986), unless otherwise cited.

Key to Species Occurring in Northeastern North America

Keys are given to 99 species that occur in Ohio and neighboring states (Indiana, Kentucky, Michigan, Pennsylvania, and West Virginia). The 72 species occurring in Ohio are indicated by an asterisk (*).

Key to Genera of Sciomyzidae

1. Proepisternal bristle well developed (Figure 1A); or, proepisternal bristle hairlike and first tarsomere white, strongly contrasting other tarsomeres (*Atrichomelina*) SCIOMYZINI 2
- 1'. Proepisternal bristle absent; all tarsomeres dark or subdued TETANOCERINI 7
- 2(1). Proepisternal bristle hairlike; first tarsomere white and remaining tarsomeres dark; gray fly approximately 6 mm long; widespread and common *Atrichomelina*
1 species, *A. pubera* (Loew)*
- 2'. Proepisternal bristle thick, well-developed; all tarsomeres dark or subdued; size and color variable 3
- 3(2'). Fore tibia with one preapical dorsal bristle 4
- 3'. Fore tibia with two preapical dorsal bristles 6
- 4(3). Anal vein (A1) not reaching posterior margin of wing; frons dull black; uncommon, not recorded from Ohio *Colobaea*
1 species, *C. americana* Steyskal
- 4'. Anal vein (A1) reaching posterior margin of wing or nearly so (Figure 1A); frons dull yellow or shiny, but never black 5
- 5(4'). Frons shiny; fore femur usually with a series of closely spaced, small spinules (pecten) anteromedially that appear as a short dark comblike structure (Figure 1B, Figure 2A); thorax dark and shiny; uncommon *Pteromicra*
- 5'. Frons dull; fore femur lacking pecten; thorax dull yellow, brown, or gray; variable sized flies (Figure 2B-C); common *Pherbellia*
- 6(3'). Arista black (Figure 1E); two orbital bristles present; presutural intra-alar bristle present; two postsutural dorsocentral bristles present. Face in profile sharply concave; grayish flies, somewhat uncommon *Sciomyza*
- 6'. Arista white (Figure 1F); one orbital bristle present; presutural intra-alar bristle absent; one postsutural dorsocentral bristle present; face in profile concave, but with upper area bulging somewhat; uncommon *Oidenatops*
1 species, *O. ferrugineus* Cresson*
- 7(1). Ocellar bristles present (Figure 1G); crossvein dm-cu straight or nearly so 8
- 7'. Ocellar bristles usually absent; crossvein dm-cu strongly curved 18
- 8(7). Body yellowish, heavily spotted (Figure 2D); wing with heavy pattern (Figure 4A); face convex; uncommon *Poecilographa*
1 species, *P. decora* (Loew)*
- 8'. Body lacking heavy spotting; other characters variable 9
- 9(8'). Subalar sclerite without valar bristles (Figure 1A) 10
- 9'. Subalar sclerite with valar bristles 16
- 10(9). Hind tibia with two preapical dorsal bristles (Figure 1C); only katepisternum with bristles, arista white; uncommon *Antichaeta*
- 10'. Hind tibia with one preapical dorsal bristle; setation on thoracic pleura various; arista white or black ... 11
- 11(10'). Second antennal segment less than one-third length of first flagellomere; arista black; wing not patterned (Figure 2E) *Renocera*
- 11'. Second antennal segment at least one-half length of first flagellomere (Figure 1F); arista black or white; wing patterned or not 12
- 12(11'). Anepisternum and anepimeron with bristles; one orbital bristle or three dorsoventral bristles present 13
- 12'. Anepisternum and anepimeron bare or with hairs; two orbital and two dorsocentral bristles present 14
- 13(12). Face white, without central black spot; two orbital bristles present; three dorsocentral bristles present; all thoracic pleurites banded; wing heavily and darkly patterned; uncommon, not recorded from Ohio *Hoplodictya*
1 species, *H. acuticornis* (Wulp)
- 13'. Face white, with central black spot (Figure 1G); one orbital bristle present; two dorsocentral bristles present; katepisternum with hairs but without bristles; wing heavily and darkly patterned (Figures 2F, 4B); common *Dictya*
- 14(12'). Arista black; wing hyaline, clouded (Figure 5C), or sometimes spotted (Figure 5D-E); body generally brownish or yellowish (Figure 3A); common *Tetanocera*
- 14'. Arista white; wing densely patterned with dark network around hyaline spots 15
- 15(14'). Face flat to slightly concave; pedicel less than twice as long as wide, compressed; wing relatively broad, dark with numerous hyaline spots (Figure 4C); locally abundant *Euthycera*
1 species, *E. arcnata* (Loew)*
- 15'. Face tuberculate; pedicel twice as long as wide (as in Figure 1E), cylindrical; wing not notably broad;

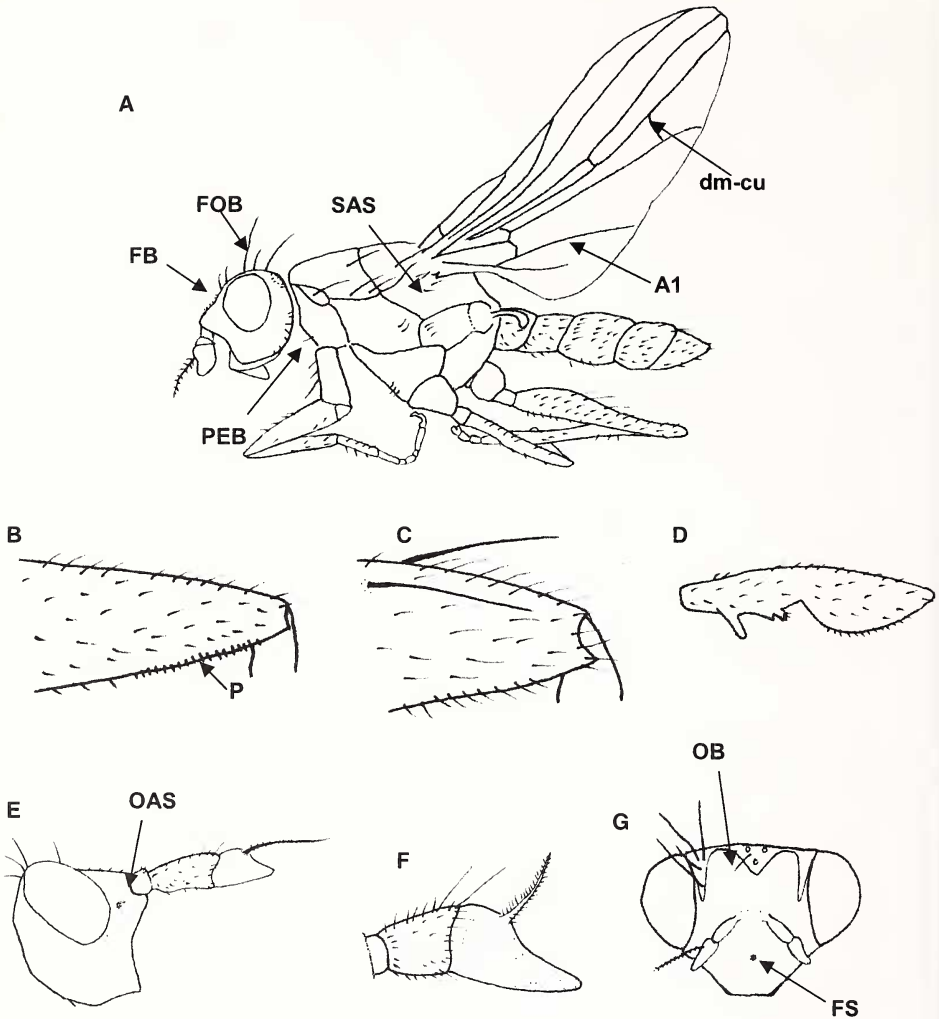


Figure 1. A, hypothetical Sciomyzidae adult, lateral view. A1 = anal vein; dm-cu = posterior cross vein; FB = frontal bristle; FOB = fronto-orbital bristle; PEB = propisternal bristle; SAS = subalar sclerite. B, left femur of *Pteromicra* sp. P = pecten. C, left femur of *Tetanocera* sp. D, left femur of *Sepedon armipes*. E, head of hypothetical Sciomyzidae, lateral view. OAS = orbitoantennal spot. F, antenna of hypothetical Sciomyzidae, lateral view. G, head of hypothetical Sciomyzidae, anterior view. FS = facial spot; OB = ocellar bristle.

- uncommon *Dietyacum* 4(3). Thoracic pleura entirely dark brown or black; meron and katepisternum with dense white pubescence; head mostly black *P. pleuralis* (Cresson)*
- 16(9'). Prescutellar acrostichal bristles absent; mid tibia without distinct preapical dorsal bristle; prosternum bare; arista black; uncommon, not yet recorded from Ohio *Pherbeta* 4'. Thoracic pleura mostly yellowish or light brown; meron yellow; meron and katepisternum with sparse, whitish pubescens *P. pectorosa* (Hendel)
- 1 species, *P. limentis* Steyskal
- 16'. Prescutellar acrostichal bristles present; mid tibia with at least one distinct preapical dorsal bristle; other characters variable 17 5(2). One pair of fronto-orbital bristles; arista brown, long plumose; first flagellomere usually darkened apicodorsally *P. sphennra* Steyskal*
- 17(16'). Arista white; frontal vitta broad, shiny; anepisternum and anepimeron haired but without bristles; wing with heavy pattern (Figures 3B, 6A—E); common *Limnia* 5'. Two pairs of fronto-orbital bristles; other characters variable 6
- 17'. Arista black; frontal vitta narrow, waxy; anepisternum and anepimeron haired and with bristles; wing patterned as in Figure 4D; uncommon *Trypetoptera* 6(5'). Metapleuron (area surrounding posterior spiracle) black; hind legs entirely yellow *P. albicalecta* (Cresson)
- 1 species, *T. canadensis* (Macquart)*
- 18(7'). Ocellar bristles present, well-developed; two pairs of scutellar bristles present; hind coxa with hairs posteromedially; crossvein dm-cu strongly bent (Figure 4E); body yellowish; common *Elgiva* 6'. Metapleuron (area surrounding posterior spiracle) mostly yellowish; apex of hind femur blackish *P. similis* Steyskal*
- 18'. Ocellar bristles absent, or occasionally hairlike; one or two pairs of scutellar bristles; hind coxa usually without hairs posteromedially; crossvein dm-cu straight to bent 19
- 19(18'). Two orbital bristles present, anterior one smaller; postpronotal bristle present; crossvein dm-cu S-shaped; uncommon, not recorded from Ohio *Hedria*
- 1 species, *H. mixta* Steyskal
- 19'. One orbital bristle present; postpronotal bristle absent; crossvein dm-cu straight to slightly curved; body reddish orange to reddish brown, often with elongate antennae (Figures 1E, 3C); common *Sepdon*

Key to Species of *Pherbellia* Robineau-Desvoidy

1. Wing with distinct pattern 2
- 1'. Wing lacking distinct pattern 4
- 2(1). Wing with dark bands or spots (Figures 2C, 5A-B) 3
- 2'. Wing lacking bands, cell r_1 darkened apically *P. albovaria* (Coquillett)*
- 3(2). Wing with costal margin darkened, distinct banding in cell r_{2+3} (Figure 2C); common *P. nana nana* (Fallén)*
- 3'. Wing with costal margin spotted, and spots throughout wing membrane (Figure 5B) *P. schoenherrii maculata* (Cresson)*
- 4(2'). Interfrontal stripe extending at least half way from anterior ocellus to anterior margin of frons 5
- 4'. Interfrontal stripe extending half distance or less from anterior margin of frons 9
- 5(4). Only one pair of fronto-orbital bristles; body grayish red; male genitalia as in Figure 7A *P. parallela* (Walker)*
- 5'. Two pairs of fronto-orbital bristles 6
- 6(5'). Arista almost bare; fronto-orbital bristles strong and nearly equal *P. tenuipes* (Loew)
- 6'. Arista pubescent, with short, fine, closely set hairs; anterior fronto-orbital bristle usually much smaller than posterior bristle 7
- 7(6'). Crossveins of wing clouded; frontal vitta extending narrowly to frontal margin; surstylus narrow apically (Figure 7B) *P. beatricis* Steyskal*
- 7'. Crossveins of wing not clouded; other characters
- Key to Species of *Pteromicra* Lioy**
1. Fore femur black, lacking pecten; anepimeron with two or three long bristles; two pairs of fronto-orbital bristles; antenna entirely black *P. anopla* Steyskal
- 1'. Fore femur color variable, with pecten; anepimeron with small patch of short hairs only; other characters variable 2
- 2(1'). Palpi entirely black 3
- 2'. Palpi entirely yellow, or yellow with black apically 5
- 3(2). Two pairs of fronto-orbital bristles, anterior pair much shorter; dorsum of thorax mostly yellowish, blackish only anteriorly *P. steyskali* Foote
- 3'. One pair of fronto-orbital bristles; other characters variable 4

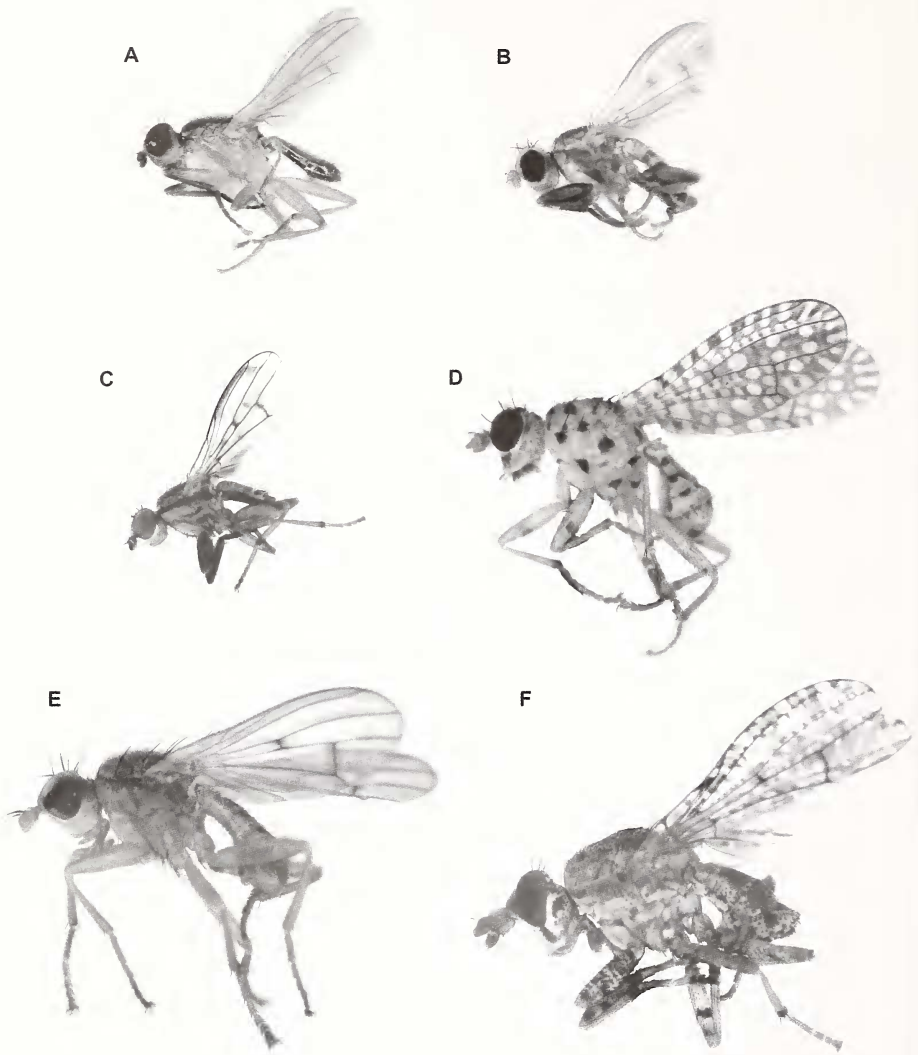


Figure 2. Sciomyzidae adults, lateral view. A, *Pteromicra* sp.; B, *Pherbellia* sp.; C, *Pherbellia nana nana*; D, *Poecilographa decora*; E, *Renocera brevis*; F, *Dictya* sp.

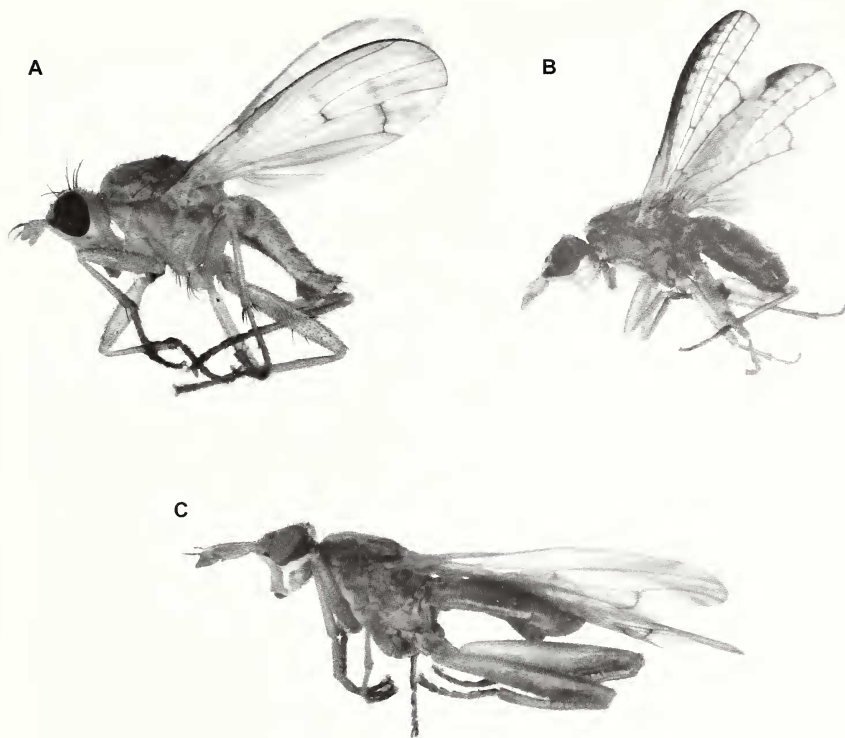


Figure 3. Sciomyzidae adults, lateral view. A, *Tetanocera plebeja*; B, *Limmia* sp.; C, *Sepedon* sp.

variable	8	11(10').	Aristal hairs long, plumose; hind coxa with a few hairs on dorsal apex; surstylus slightly curved in lateral view, gonite bilobed (Figure 7F)	<i>P. seticoxa</i> Steyskal*
8(7').	Aedeagus bulbous, pointed apically (Figure 7C)	11'.	Aristal hairs moderate to long; hind coxa bare on dorsal apex; male genitalia variable	12
8'.	Aedeagus tri-lobed apically (Figure 7D)	12(11').	Gonite tri-lobed apically (Figure 8A)	<i>P. quadrata</i> Steyskal
9(4').	Anepisternum with minute hairs over at least most of posterior half, or only along posterior margin	12'.	Gonite lacking lobes apically (Figure 8B)	<i>P. griseola</i> (Fallén)*
9'.	Anepisternum bare	13(9').	Halter black; arista nearly bare; small blackish species	<i>P. luctifera</i> (Loew)*
10(9).	Wing with pale yellow costal border; veins Sc, R ₁ , and R ₂₊₃ yellow; arista short, plumose; surstylus slightly curved and narrow in lateral view (Figure 7E)	13'.	Halter yellow or white; other characters variable	14
10'.	Wing hyaline; all veins brown; male genitalia variable			

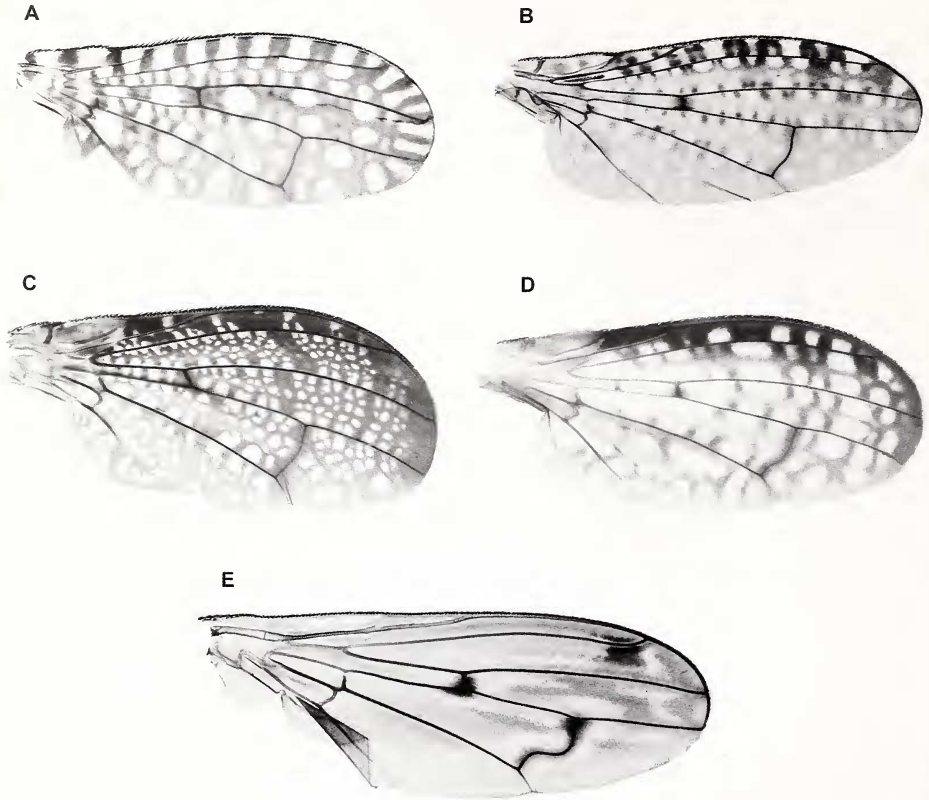


Figure 4. Right wing of adults, dorsal view. A, *Poecilographa decora*; B, *Dictya* sp.; C, *Euthycera arcuata*; D, *Trypetoptera canadensis*; E, *Elgiva sollicita*.

- 14(13'). Orbito-antennal spot lacking or indistinct; arista short-plumose; anepisternal stripe extending below middle posteriorly; fore legs not contrasting sharply with middle and hind legs 15
- 14'. Orbito-antennal spot present (cf., Figure 1E); arista pubescent or short-plumose; anepisternal stripe not extending below middle posteriorly; fore legs dark, often nearly black, contrasting with light colored middle and hind legs 16
- 15(14). Anterior margin of frons grayish; anepisternal stripe reaching lower posterior corner; surstylus narrow (Figure 8C) *P. argyra* Verbeke
- 15'. Anterior margin of frons with whitish yellow to yellow pubescence, with some grayish coloration at anterolateral corners; anepisternal stripe faint, extending below middle, but not reaching lower posterior corner; surstylus large and bulging basally (Figure 8D) *P. anubis* Knutson*
- 16(14'). Arista pubescent, with most hairs no longer than basal diameter of arista *P. vitalis* (Cresson)*
- 16'. Arista short-plumose *P. similis* (Cresson)*

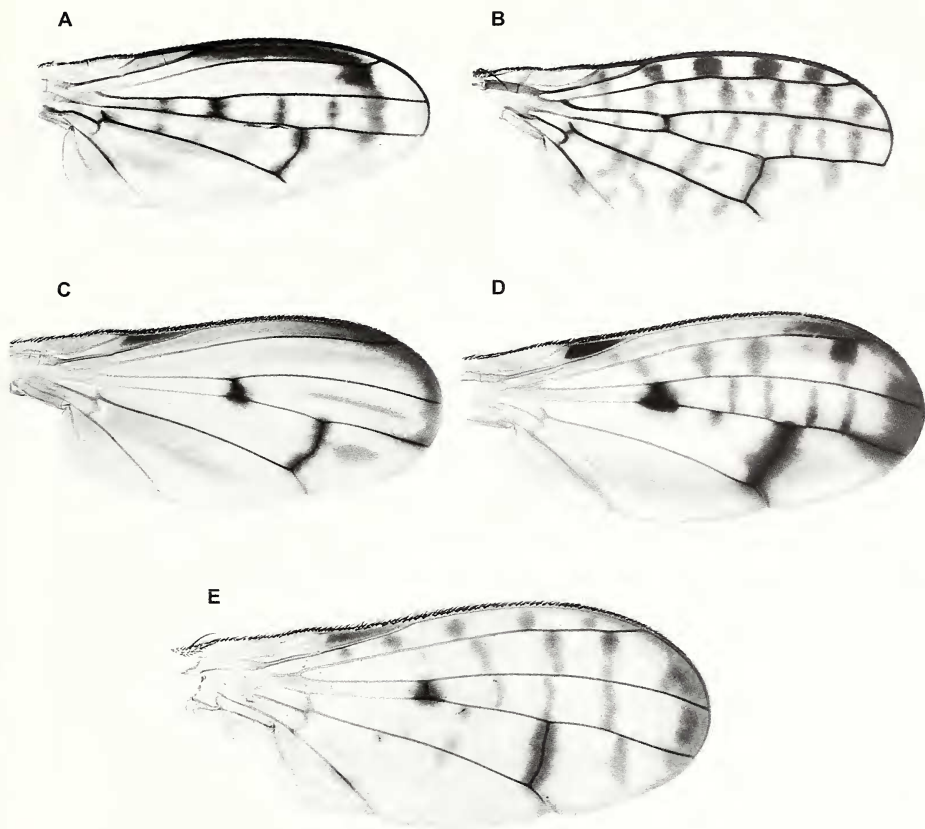


Figure 5. Right wing of adults, dorsal view. A, *Pherbellia nana nana*; B, *P. schoenherri maculata*; C, *Tetanocera plebeja*; D, *T. valida*; E, *T. clara*.

Key to Species of *Sciomyza* Fallén

1. Thoracic dorsum black; anepisternum bare posteriorly; fore femora black, at least on apical half *S. varia* (Coquillett)*
- 1'. Thoracic dorsum ferruginous to grayish; anepisternum with at least a few bristles posteriorly near suture 2
- 2(1'). Palpi blackish, at least apically; center of face strongly blackened; fore femur wholly yellow

- *S. aristalis* (Coquillett)*
- 2'. Palpi wholly yellow; face uniformly yellowish to reddish-brown *S. simplex* Fallén

Key to Species of *Antichaeta* Haliday

1. Scutellum with 2 bristles; 1 pair of dorsocentral bristles *A. johnsoni* (Cresson)
- 1'. Scutellum with 4 bristles; 2 pairs of dorsocentral

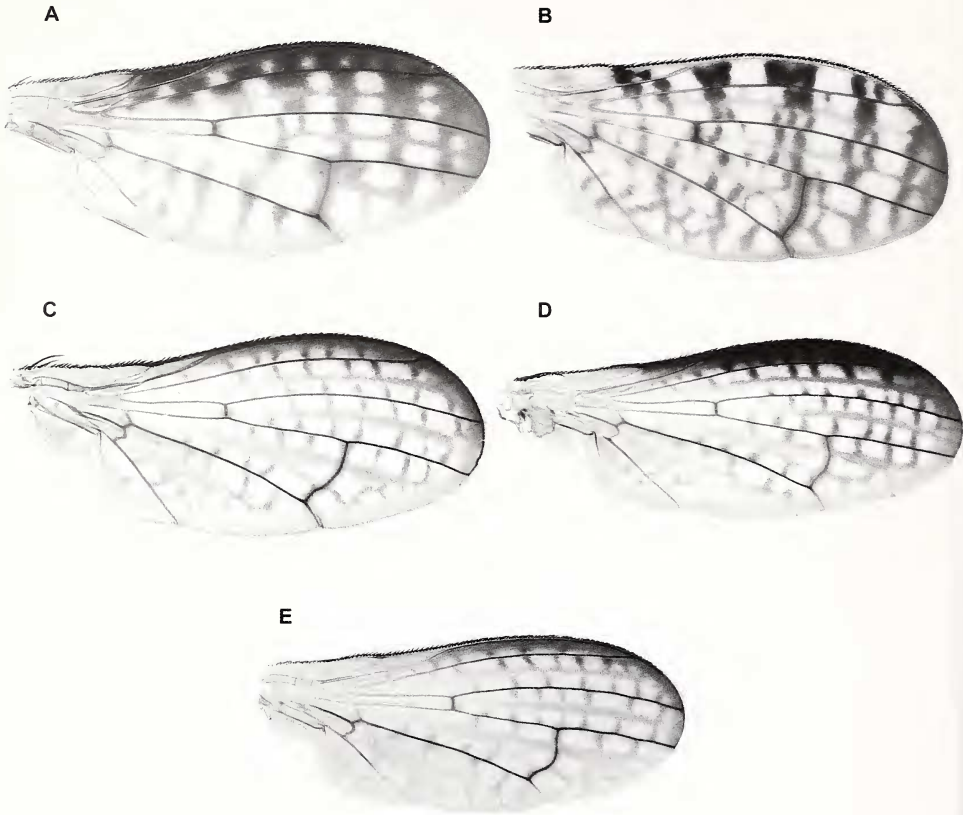


Figure 6. Right wing of adults, dorsal view. A, *Limmia loewi*; B, *L. boscii*; C, *L. fitchi*; D, *L. conica*; E, *L. ottawaensis*.

- bristles 2
- 2 (1'). One fronto-orbital bristle
..... *A. melanosoma* Melander*
- 2'. Two fronto-orbital bristles 3
- 3 (2'). Frons blackish, with yellow anterior margin; abdomen
and thorax black *A. canadensis* (Curran)
- 3'. Frons yellow to testaceous; thorax and abdomen
mostly testaceous or cinereous blue 4
- 4 (3'). Anterior fronto-orbital bristle approximately half
the length of posterior fronto-orbital bristle
..... *A. fulva* Steyskal*

- 4'. Anterior and posterior fronto-orbital bristles subequal
in length *A. borealis* Foote*

Key to Species of *Renocera* Hendel

- 1. Humeral and posthumeral bristles present 2
- 1'. Humeral and posthumeral bristles absent
..... *R. johnsoni* Cresson
- 2(1). Anterior margin of frons dull; prosternal bristles
present *R. brevis* (Cresson)*
- 2'. Anterior margin of frons shining; prosternal bristles
usually absent 3

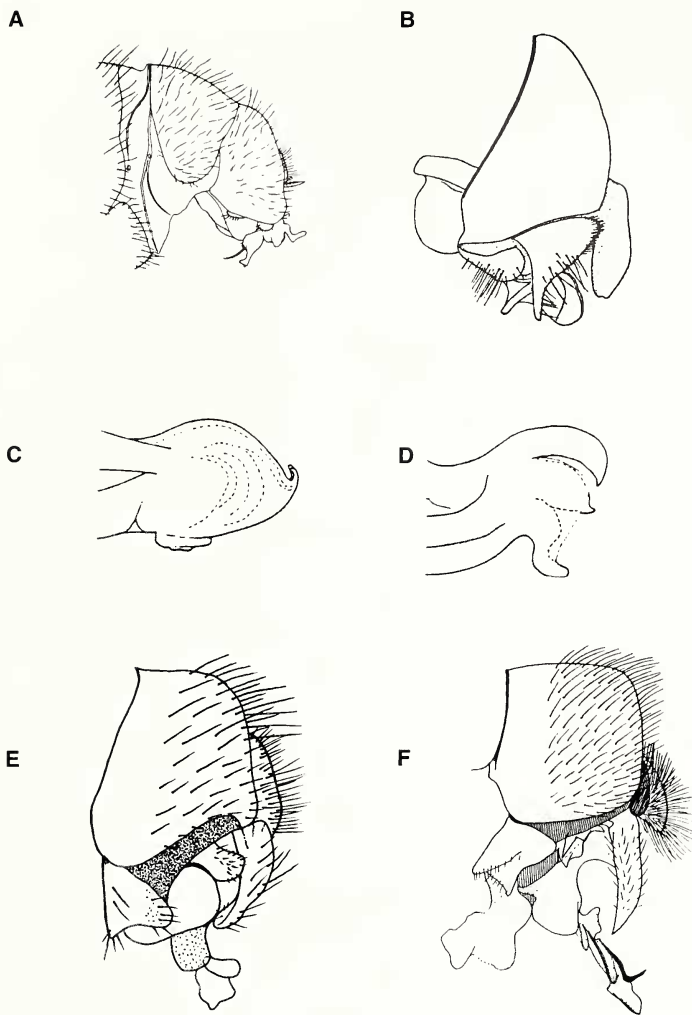


Figure 7. *Phorbettia* species male genitalia, lateral view. A, *P. parallela*, figure modified from Fisher and Orth (1983); B, *P. beatrix*, figure modified from Steyskal (1967); C, *P. paludum*, figure modified from Orth (1982); D, *P. propages*, figure modified from Orth (1982); E, *P. albocostata*, figure modified from Steyskal (1961); F, *P. seticoxa*, figure modified from Steyskal (1961).

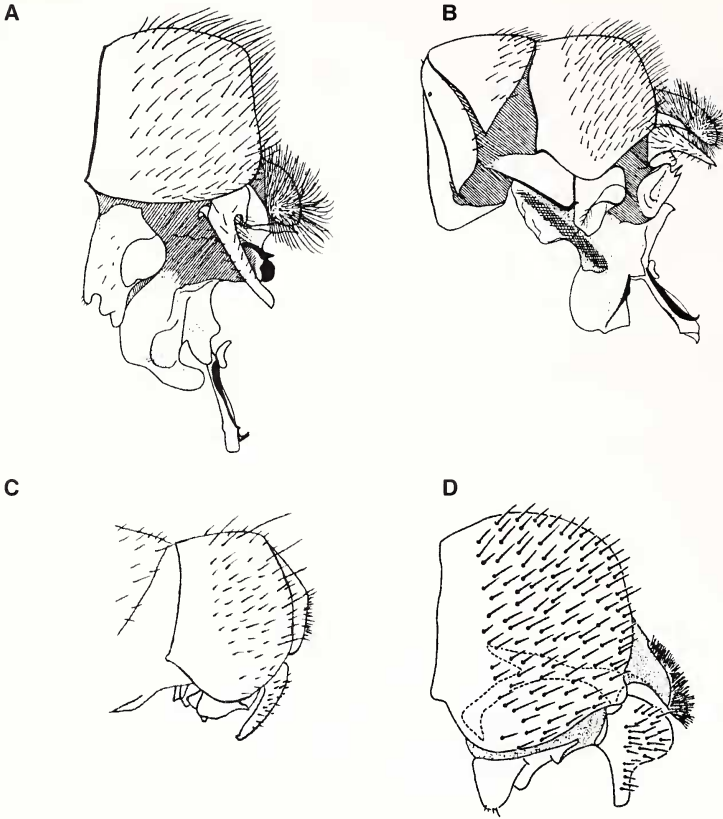


Figure 8. *Pherbellia* species male genitalia, lateral view. A, *P. quadrata*, figure modified from Steyskal (1961); B, *P. griseola*, figure modified from Steyskal (1961); C, *P. argyra*, figure modified from Fisher and Orth (1983); D, *P. anubis* figure modified from Bratt et al. (1969).

- | | |
|---|--|
| <p>3(2). Prescutellar bristles present; arisal hairs long, loosely plumose <i>R. amanda</i> Cresson*</p> <p>3'. Prescutellar bristles absent; arisal hairs short, dense, and black <i>R. longipes</i> (Loew)*</p> | <p>7</p> <p>2(1). Dorsal tip of surstylus with long, stiff bristles; hypandrium as in Figure 9A <i>D. pictipes</i> (Loew)*</p> <p>2'. Dorsal tip of surstylus lacking stiff bristles 3</p> <p>3(2). Surstylus with dorsal tip strongly projecting, angulate; hypandrium as in Figure 9B <i>D. hudsonica</i> Steyskal*</p> <p>3'. Surstylus with dorsal tip weakly projecting, rounded; hypandrium variable 4</p> |
|---|--|

Key to Species of *Dictya* Meigen

1. Ventral process of hypandrium with preterminal lobe (cf. Figure 9A) 2
- 1'. Ventral process of hypandrium lacking preterminal

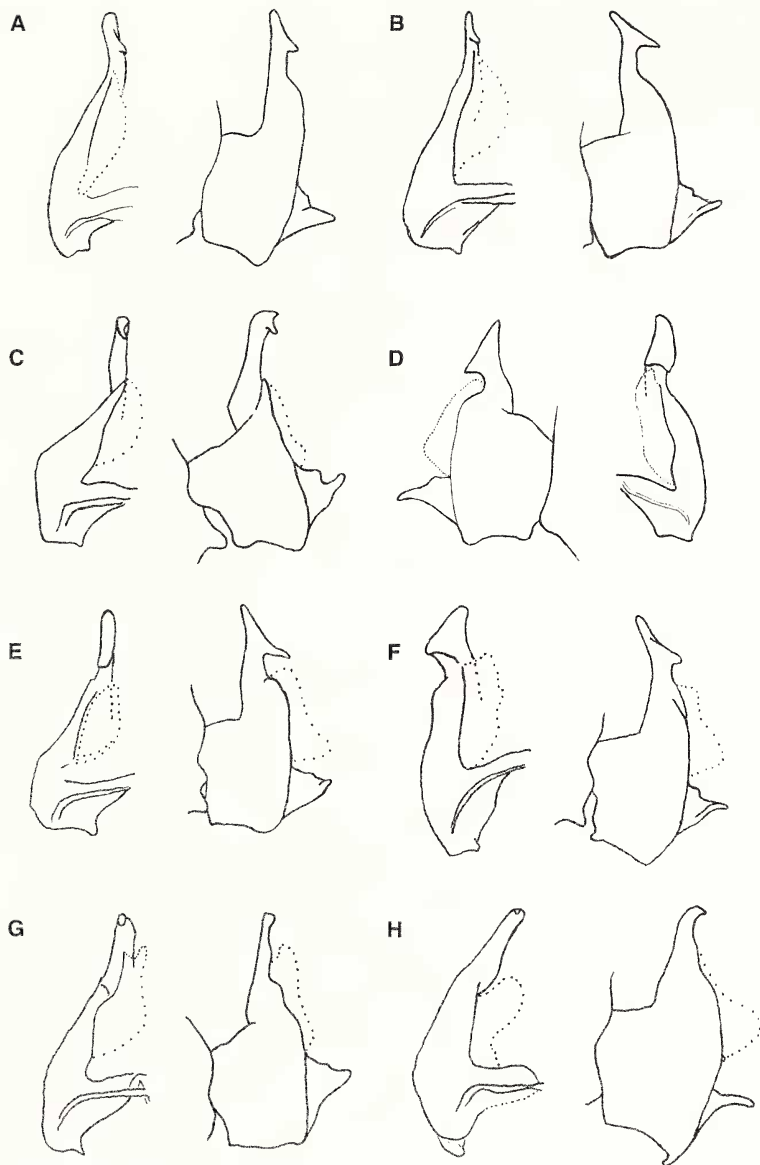


Figure 9. *Dictya* species hypandrium of male genitalia, ventral (left) and lateral (right) views. A, *D. pictipes*; B, *D. hudsonica*; C, *D. sabroskyi*; D, *D. expansa*; E, *D. stricta*; F, *D. atlantica*; G, *D. borealis*; H, *D. laurentia*. All figures modified from Orth (1991).

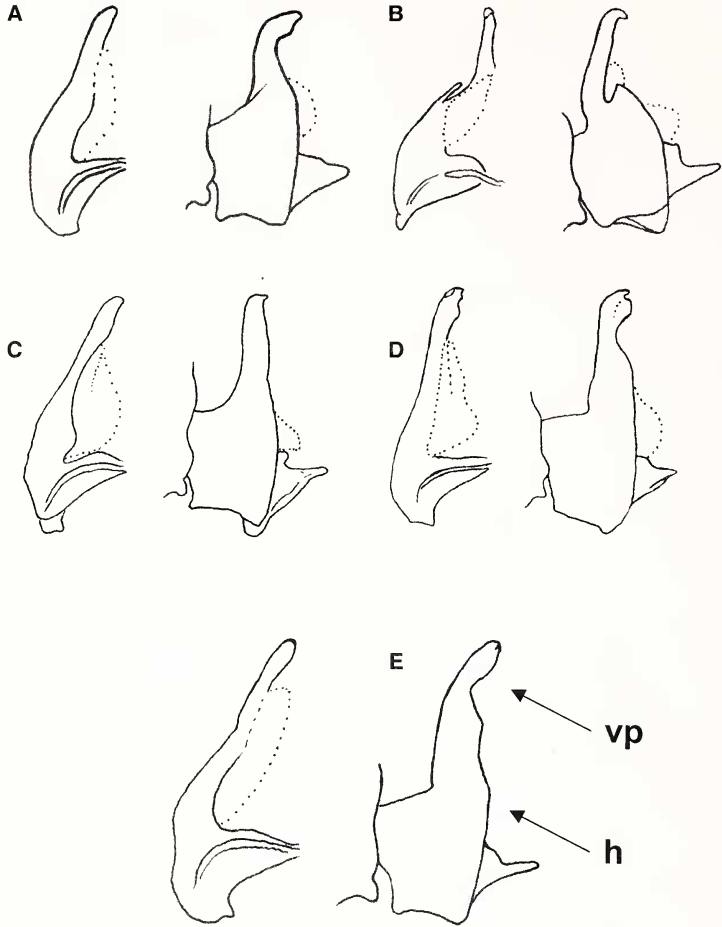


Figure 10. A, *D. umbroides*; B, *D. brimleyi*; C, *D. gaigei*; D, *D. steyskali*; E, *D. texensis*; h = hypandrium, vp = ventral process of hypandrium. All figures modified from Orth (1991).

- | | | | |
|-------|--|-------------------------------|---|
| 4(3). | Hypandrium with small preterminal lobe (Figure 9C) | <i>D. sabroskyi</i> Steyskal* | 6 |
| 4'. | Hypandrium with large preterminal lobe | 5 | 6(5). |
| 5(4). | Ventral process of hypandrium bent forward in lateral view (Figure 9D) | <i>D. expansa</i> Steyskal* | 6' |
| 5'. | Ventral process of hypandrium vertical or nearly so | 5 | 7(1). |
| | | | Surstylus with tip forming a lobe bearing a tuft of |

- long, stiff bristles; hypandrium as in Figure 9G *D. borealis* Curran* 5'
- 7'. Surstylus with tip not forming a lobe, usually with a few short bristles 8 6(5'). Surstylus tapered and slightly hooked apically (Figure 11D) *T. vicina* Macquart* 6'
- 8(7'). Surstylus with dorsal tip strongly to moderately projecting, usually angulate 9 6'. Surstylus rounded and not hooked apically (Figure 11E) *T. iowensis* Steyskal* 7(4'). Arista plumosity dense and black; blackish orbito-antennal spot present; wings with strong costal brown; surstylus curved to an acute point (Figure 11F) *T. loewi* Steyskal* 7'. Arista plumosity sparse; orbito-antennal spot faint or lacking; surstylus bent apically forming a point (Figure 12A) *T. mesopora* Steyskal 8(3'). Hind femur with posterodorsal bristle, opposite or nearly opposite to apical anterodorsal bristle; arista plumosity long but sparse 9 8'. Hind femur lacking posterodorsal bristle; arista plumosity variable 10 9(8). Crossvein dm-cu S-curved; male genitalia as in Figure 12B *T. montana* Day* 9'. Crossvein dm-cu straight or nearly so; male genitalia as in Figure 12C *T. rotundicornis* Loew* 10(8'). Wing with heavy pattern; interfrontal stripe broad and polished 11 10'. Wing lacking heavy pattern; interfrontal stripe variable 12 11(10). Both sides of M_{1+2} with spots; surstylus triangular in lateral view (Figure 12D); wing darkly spotted (Figure 5D) *T. valida* Loew* 11'. No spots along M_{1+2} ; surstylus narrow and sickle-shaped in lateral view (Figure 12E); spotting of wing moderately dark (Figure 5E) *T. clara* Loew* 12(10'). Interfrontal stripe not sharply demarcated, forming broad, triangular dull shining area anterior to ocellus; costal margin not browned; male genitalia as in Figure 13A *T. fuscinervis* (Zetterstedt)* 12'. Interfrontal stripe more or less parallel sided 13 13(12'). Interfrontal stripe narrow, ending well before anterior margin of frons, or indistinct; wings unicolorous; surstylus forming acute triangle in lateral view (Figure 13B) *T. ferruginea* Fallén* 13'. Interfrontal stripe robust, extending to or nearly to anterior margin of frons; other characters variable 14 14(13'). Interfrontal stripe broad, polished, reaching anterior margin of frons; parafacial stripes also broad and polished; orbito-antennal spot lacking in most specimens; wing tip and crossveins darkened (Figure 5C); surstylus narrow, slightly curved
- 11C *T. plumosa* Loew*

Key to Species of *Tetanocera* Duméril

1. Posterior surface of middle femur with 2–3 subapical bristles; prosternum bare or sparsely haired; dark orbito-antennal spot lacking 2
- 1'. Posterior surface of middle femur with 1 subapical bristle, or bristles lacking; prosternum bare; dark orbito-antennal spot present (cf., Figure 1E) 3
- 2(1). Prosternum sparsely haired; posterior femur with dorsal bristles on anterior side only; male genitalia as in Figure 11A *T. robusta* Loew
- 2'. Prosternum bare; posterior femur with posterodorsal preapical bristle; male genitalia as in Figure 11B *T. amae* Steyskal*
- 3(1). Posterior surface of middle femur with single subapical bristle; crossvein dm-cu strongly S-curved 4
- 3'. Posterior surface of middle femur with small hairs only; crossvein dm-cu variable 8
- 4(3). Parafacial area with hairs well above half-way between lower margin of eye and border of antennal socket 5
- 4'. Parafacial area with hairs extending less than halfway from lower margin of eye to border of antennal socket 7
- 5(4). R_{4+5} lacking stump veins; surstylus as in Figure

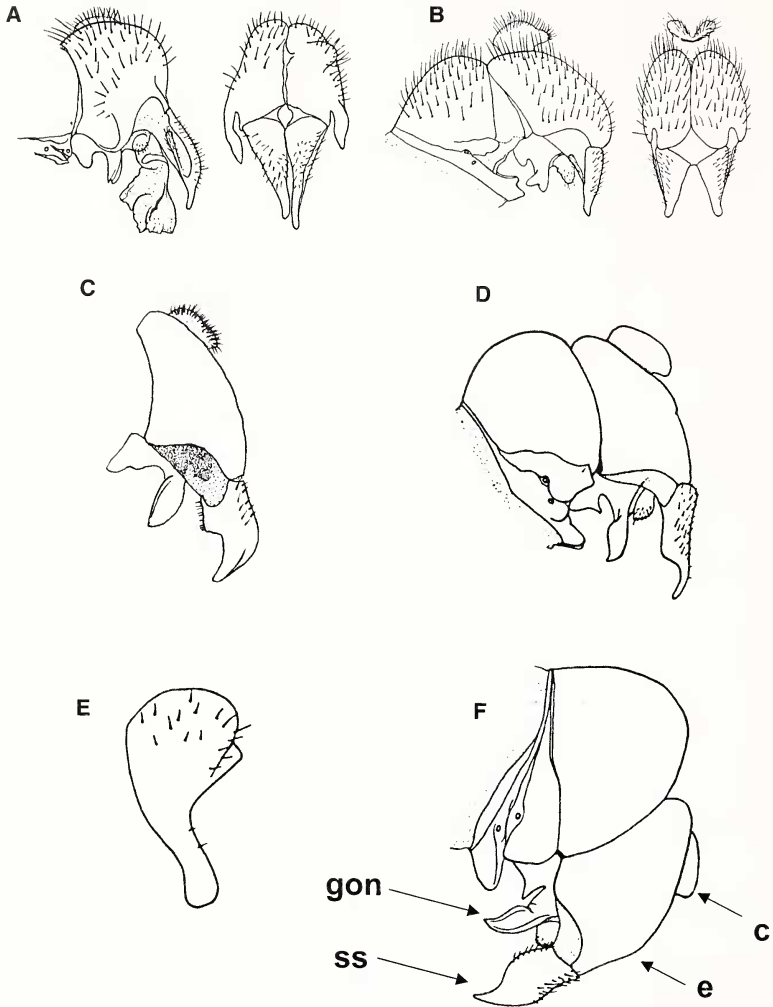


Figure 11. *Tetanocera* species male genitalia. A, *T. robusta*, lateral (left) and ventral (right) views; B, *T. amiae*, lateral (left) and ventral (right) views; C, *T. plumosa*, lateral view; D, *T. vicina*, lateral view; E, *T. iowensis*, lateral view; F, *T. loewi*, lateral view; c = cercus, e = epandrium, gon = gonite, ss = surstylus. All figures modified from Steyskal (1959).

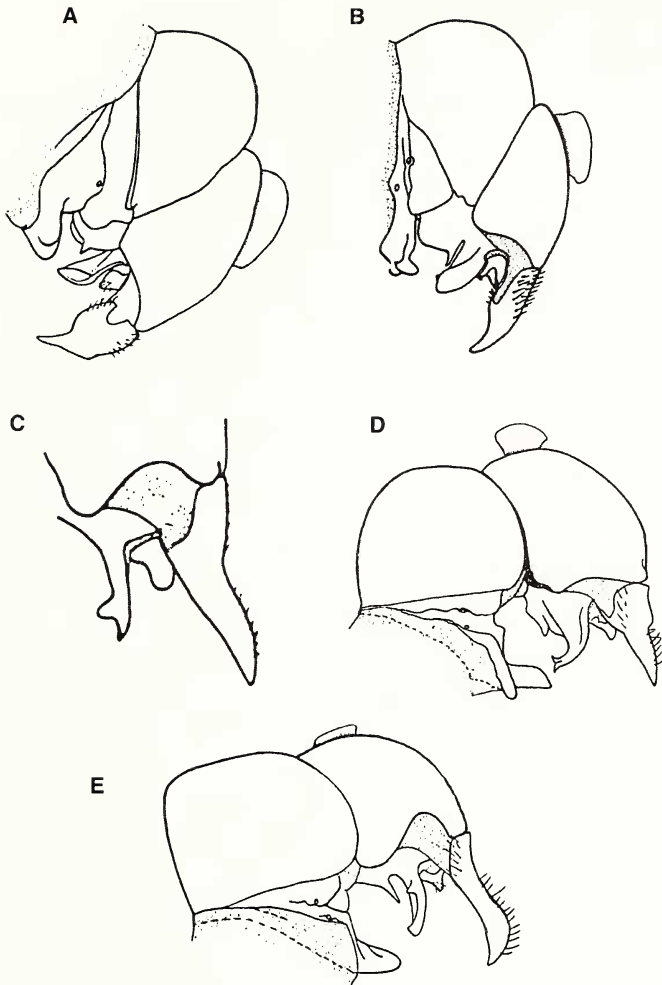


Figure 12. *Tetanocera* species male genitalia, lateral view. A, *T. mesopora*; B, *T. montana*; C, *T. rotundicornis*; D, *T. valida*; E, *T. clara*. All figures modified from Steyskal (1959).

- (Figure 13C) *T. plebeja* Loew*
 14'. Interfrontal and parafrontal stripes broad but not shining; male genitalia and wing variable 15
 15(14'). Second antennal segment 1.5 times as high as long; costal margin lacking brown coloration basally; surstylus strongly curved, with strong posterior ridge of hair (Figure 13D)
 *T. phyllophora* Melander
 15'. Second antennal segment as high as long; male genitalia variable 16
 16(15'). Stigma light brown; dorsum of thorax with faint stripes; surstylus broad basally, curving to a point apically (Figure 13E) *T. oxia* Steyskal*
 16'. Stigma dark brown; thorax lacking stripes; surstylus forming acute, slightly curved triangle (Figure 13F) *T. melanostigma* Steyskal*

Key to Species of *Dictyaciium* Steyskal

1. Fore basitarsus whitish, strongly contrasting with dark tibia; mesonotal coloration not forming stripes; facial protuberance occupying less than half the distance from the antennae to oral margin; eye oval *D. ambiguum* (Loew)
 1'. Fore basitarsus dark, sometimes pale basally, but not contrasting dark tibia; mesonotal coloration tending to form a pair of dorsocentral stripes; facial protuberance occupying half the distance from antennae to oral margin; eye round
 *D. firmum* Steyskal

Key to Species of *Limnia* Robineau-Desvoidy

1. Frons with polished area in anterior outer corner 2
 1'. Frons lacking polished area in anterior outer corner 4
 2(1). Wing pattern denser anteriorly than posteriorly (Figure 6A); posterior surstylus narrow, relatively straight; anterior surstylus curved anteriorly (Figure 14A) *L. loevis* Steyskal*
 2'. Wing pattern uniformly dense; male genitalia various 3
 3(2). Male genitalia as in Figure 14B; costal margin of wing uniformly dark *L. sandovalensis* Fisher and Orth*
 3'. Male genitalia as in Figure 14C; costal margin of wing adorned with spots (Figure 6B)
 *L. boscii* (Robineau-Desvoidy)*
 4(1). Second antennal segment swollen laterally, usually adorned with black spot of variable size; male genitalia as in Figure 14D *L. shamoni* Cresson*

- 4'. Second antennal segment not swollen, lacking black spot; male genitalia variable 5
 5(4'). Hypandrium bifid at apex, with two moderate or very small lobes 6
 5'. Hypandrium not bifid 7
 6(5). Hypandrium slender, straight, with two moderately large apical lobes (Figure 14E); costal margin darkened narrowly (Figure 6C) *L. fitchi* Steyskal*
 6'. Hypandrium hooked apically, lacking lobes (Figure 14F); costal margin of wing darkened more broadly *L. nanbai* Steyskal*
 7(5'). Surstylus conical; hypandrium hooked apically, broader basally (Figure 15A); prosternum bare; wing with dark costal margin (Figure 6D) *L. conica* Steyskal*
 7'. Not matching above description 8
 8(7'). Prosternum with three or more pairs of setae; surstylus in profile strongly curved forming rounded apical tooth; hypandrium strongly curved forming a rounded hook (Figure 15B)
 *L. lindbergti* Steyskal
 8'. Not matching above description 9
 9(8'). Hypandrium with apical hook rounded, short; surstylus roughly rectangular (Figure 15C)
 *L. georgiae* Melander*
 9'. Not matching above description 10
 10(9'). Hypandrium with strongly recurved, short apical hook; surstylus broadly triangular (Figure 15D); wing pattern as in Figure 6E *L. ottawensis* Melander*
 10'. Hypandrium broadly curved, forming squat hook shape; surstylus rectangular with small pointed process on antero-ventral corner (Figure 15E); wing pattern otherwise *L. septentrionalis* Melander*

Key to Species of *Elgiva* Meigen

1. Wing with dark spot near apex; surstylus with triangular process on anterior margin (Figure 16A); not recorded from Ohio *E. connexa* (Harris)
 1'. Wing without dark spot near apex (Figure 4E); surstylus with small bulge and adjacent indentation on anterior margin (Figure 16B); common
 *E. sollicita* (Steyskal)*

Key to Species of *Sepedon* Latreille

1. Katatergite callus with black setae 2
 1'. Katatergite callus lacking black setae 7
 2(1). Medifacies with fine black setae; katatergite callus densely setose 3

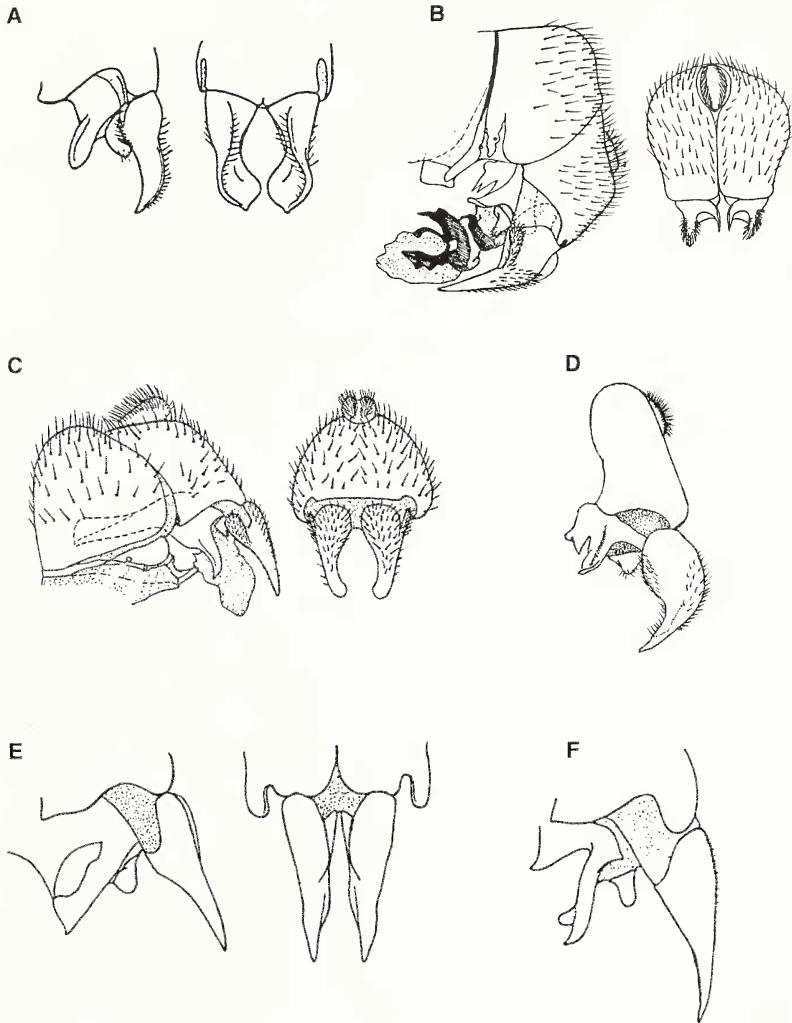


Figure 13. *Tetanocera* species male genitalia. A, *T. fuscinervis*, lateral (left) and ventral (right) views; B, *T. ferruginea*, lateral (left) and ventral (right) views; C, *T. plebeja*, lateral (left) and ventral (right) views; D, *T. phyllophora*, lateral view; E, *T. oxia*, lateral view (left) and ventral (right); F, *T. melanostigma*, lateral view. All figures modified from Steyskal (1959).

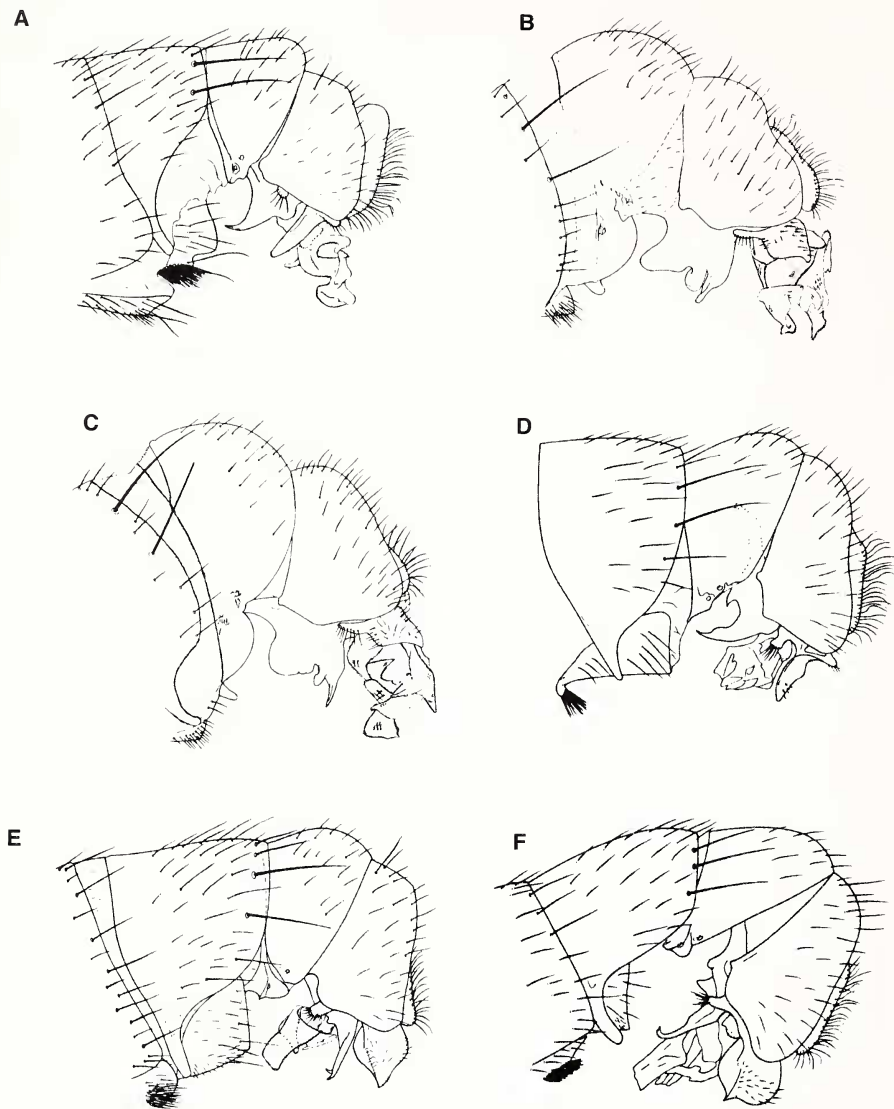


Figure 14. *Linnia* species male genitalia, lateral view. A, *L. loewi*; B, *L. sandovalensis*; C, *L. boscii*; D, *L. shannoni*; E, *L. fitchi*; F, *L. nambai*. All figures modified from Steyskal et al. (1978).

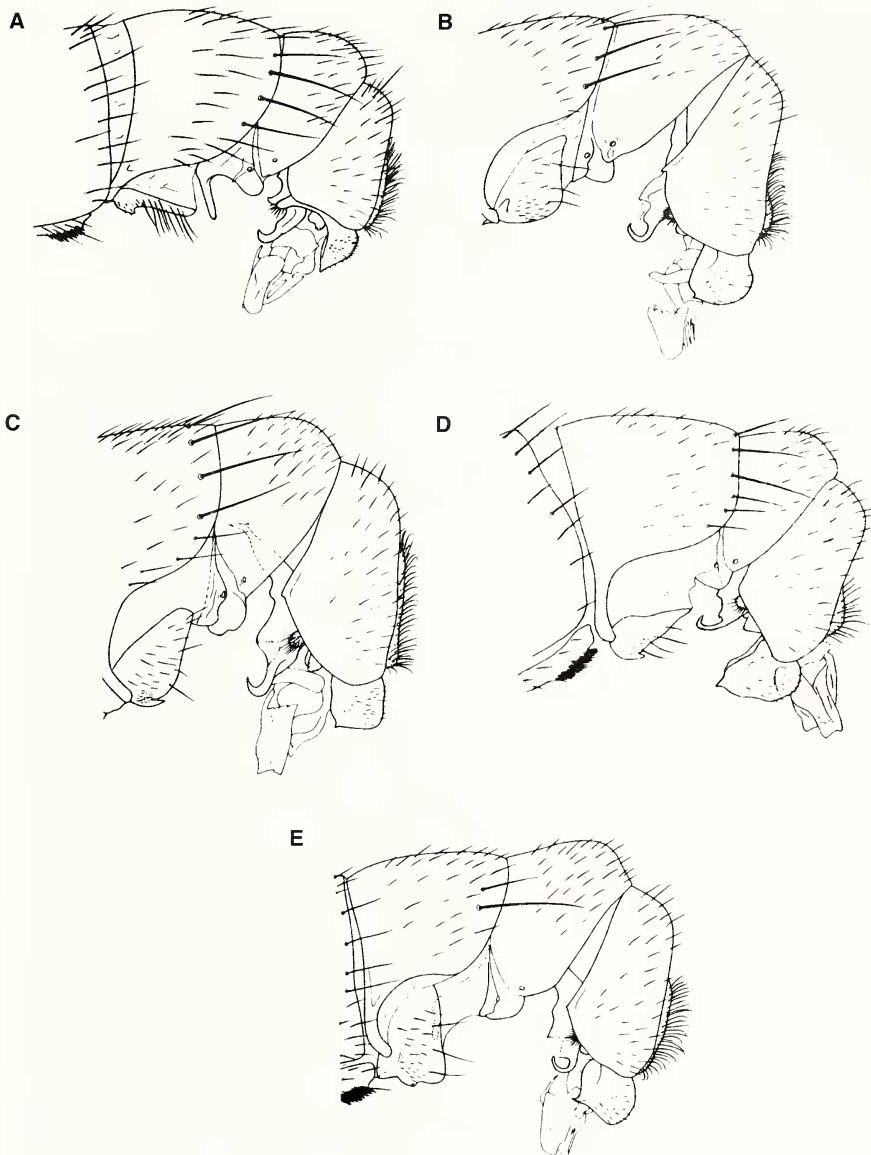


Figure 15. *Limnia* species male genitalia, lateral view. A, *L. conica*; B, *L. lindbergi*; C, *L. georgiae*; D, *L. ottawensis*; E, *L. septentrionalis*. All figures modified from Steyskal et al. (1978).

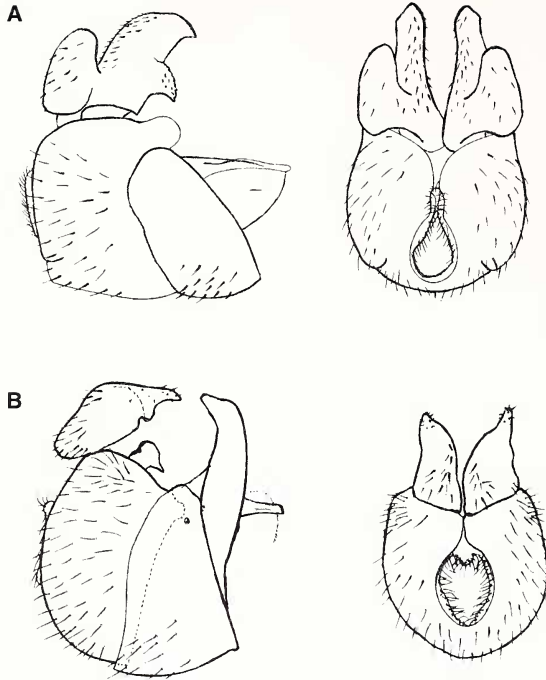


Figure 16. *Elgiva* species male genitalia. A, *E. comtexa*, lateral (left) and ventral (right) views; B, *E. sollicita*, lateral (left) and ventral (right) views. Figures modified from Orth and Knutson (1987).

<p>2'. Medifacies lacking fine black setae; katatergite callosus sparsely setose <i>S. spinipes americana</i> Steyskal*</p> <p>3(2). Hind femur of male with deep indentation on ventral surface (Figure 1D); small species <i>S. armipes</i> Loew*</p> <p>3'. Hind femur of male lacking deep indentation on ventral surface; size variable 4</p> <p>4(3'). Median stripe of pruinosity on face extending in a point to oral margin 5</p> <p>4'. Median stripe of pruinosity on face not reaching oral margin 6</p> <p>5(4). Oral margin generally low, in profile angle with face acute <i>S. neili</i> Steyskal*</p> <p>5'. Oral margin raised, in profile angle with face approximately at right angle. ...<i>S. lignator</i> Steyskal*</p> <p>6(4'). Dark-colored species; fronto-orbital spots large <i>S. borealis</i> Steyskal*</p>	<p>6'. Light-colored species; fronto-orbital spots small <i>S. pusilla</i> Loew*</p> <p>7(1'). Second antennal segment approximately 2.5 times as long as wide in lateral view; frons with distinct, velvety fronto-orbital black spot <i>S. fuscipennis fuscipennis</i> Loew*</p> <p>7'. Second antennal segment 4 or more times as long as wide in lateral view; fronto-orbital spot variable 8</p> <p>8(7'). Second antennal segment about 4 times longer than wide <i>S. gracilicornis</i> Orth*</p> <p>8'. Second antennal segment about 5 times longer than wide <i>S. tenuicornis</i> Cresson*</p>
---	--

Annotated List of Ohio Species

The following list provides data on the Nearctic distribution of each species recorded from Ohio, a detailed list of Ohio records, and general information on each species' habitat, phenology, biology, and immature stages that are described in the

literature. **General Distribution** gives the distribution for species in Canadian provinces, Mexico, and the United States, or provides a descriptive statement for widely distributed taxa.

Ohio Records provides details from the labels of the specimens examined from which the distribution maps were created. Details of **Habitat** refer to environments where larvae, pupae, and/or adults have been encountered. **Phenology** refers to both immature stages and adults, whereas **Biology** is a synopsis of larval feeding habits. We use the following abbreviations: **Date**, I–XII referring to January–December, respectively; **Immature stages** indicates those life stages described taxonomically in the literature where E = egg, L₁₋₃ = larval instars 1–3, respectively, and P = pupa.

1. *Atrichomeleina pubera* (Loew, 1862)

General Distribution: Transcontinental in southern Canada and USA south to Chiapas, Mexico.

Ohio Records (Figure 17A): **Ashtabula**, Conneaut Creek, reared from puparium on unionid mussel shell, V-04-1996, J. K. Bissell, 2♂, 3♀ (CMNH); **Champaign**, Cedar Swamp, X-08-1963, J. L. Williams, (OSU); **Franklin**, Columbus, III-04-1897, J. S. Hine (OSU); **Fulton**, Wauseon, VIII-29-1920, J. S. Hine (OSU); **Lake**, Mentor Marsh, VI-08-1981, A. D. Hury, 1♂ (CMNH), Mentor Marsh, V-30-2001, J. B. Keiper, 1♂ (CMNH); **Ottawa**, Put-in-Bay VI-18-1934, R. C. Osburn (OSU); **Portage**, 1 mile N Kent, III-20-1962, B. A. Foote, 1♂ reared from puparium (CMNH), 2.5 miles E Kent, VIII-18-1996, J. B. Keiper, 1♂ (CMNH); 10 miles E Kent, IV-25-1963, B. A. Foote (CMNH); **Wayne**, 0.5 miles S Rittman, IX-09-1969, B. A. Foote (CMNH).

Habitat: Marshes, wooded swamps, buttonbush swamps, fens, riparian areas.

Phenology: Multivoltine. Overwinters either as pupa in shell of prey snail or away from shell.

Biology: Predator/scavenger of stranded pulmonate aquatic snails (Foote et al., 1960).

Immature Stages: E, L₁₋₃, P (Foote et al., 1960).

2. *Oidematops ferruginus* Cresson, 1920

General Distribution: PQ: GA, KS, ME, MI, MO, NH, NY, OH, VT.

Ohio Records (Figure 17B): **Columbiana**, Beaver Creek State Park, V-25-2000, B. A. Foote, 1♀ (BAF); **Portage**, 4.5 miles E Kent, III-20-1966, B. A. Foote, 1♂ reared from puparium in shell of *Stenotrema hirsutum* (Say) (CMNH); VI-06-1967, K. Valley, 4♀ (CMNH).

Habitat: Floodplain forests.

Phenology: Univoltine. Flight period from late May to early June.

Biology: Larva parasitoid in the land snail *Stenotrema hirsutum* (Say) (Foote, 1977).

Immature Stages: None described.

3. *Pherbellia albovarva* (Coquillett, 1901)

General Distribution: Southeastern Canada and northeastern USA south to NC.

Ohio Records (Figure 17C): **Portage**, Jennings Woods NE of Ravenna, V-23-1972, 1♂ reared from puparium in the land snail *Anguispira alternata* (Say) (CMNH).

Habitat: Beech-maple forests.

Phenology: Univoltine. Flight period in Ohio occurs in late May. Overwintering takes place as pupa within the shell of host snail.

Biology: Larvae prey on land snails belonging to the genera *Anguispira*, *Discus*, *Triodopsis*, and *Zonitoides* (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt et al., 1969).

4. *Pherbellia anubis* Knutson, 1969 (*in* Bratt et al., 1969)

General Distribution: PQ: AK, MT, MN, MI, NY, OH.

Ohio Records (Figure 17D): **Portage**, 4.5 miles E Kent, VI-03-1968, B. A. Foote, 2♂ (CMNH).

Habitat: Marshes.

Phenology: Bi- or trivoltine. Flight period in Ohio occurs in early June. Overwintering occurs as pupa in shoreline leaf litter or occasionally in shell of host snail.

Biology: Larvae prey on pulmonate aquatic snails that have been exposed on shorelines by dropping water levels (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt et al., 1969).

5. *Pherbellia beatricis* Steyskal, 1949

General Distribution: ONT: IN, MI, MS, OH.

Ohio Records (Figure 17E): **Champaign**, Cedar Swamp, V-22-1954, R. E. Woodruff, 2♂ (FSCA); VI-17-1961, B. A. Foote, 8♂, 1♀ (CMNH); V-21-1964, B. A. Foote, 18♂, 12♀ (CMNH); VII-24-1964, J. L. Williams, 6♂ (OSU); VIII-17-1964, J. L. Williams, 8♂ (OSU); IX-15-1964, J. L. Williams, 1♂ (OSU); IX-16-1965, J. L. Williams, 15♂, 4♀ (OSU); X-08-1963, J. L. Williams, 1♂ (OSU).

Habitat: Fens.

Phenology: Trivoltine. Flight period occurs in Ohio from late May to early October. Overwintering habits unknown.

Biology: Larvae prey on stranded aquatic snails belonging to the genera *Aplexa* and *Physa* (Bratt et al., 1969).

Immature Stages: L₁₋₂ (Bratt et al., 1969).

6. *Pherbellia griseola* (Fallén, 1820)

General Distribution: Transcontinental in Canada and USA.

Ohio Records (Figure 17F): **Portage**, 7.0 miles E Kent, V-07-1962, B. A. Foote, 4♂, 4♀ (CMNH); 7.0 miles E Kent, V-13-1962, B. A. Foote, 10♂ (CMNH); 1.0 mile N Kent, VI-01-1963, B. A. Foote, 1♂, 1♀ (CMNH).

Habitat: Marshes, woodland vernal pools, swamps.

Phenology: Multivoltine. Flight period in Ohio occurs from early May to early June. Overwintering occurs as pupa in shell of host snail.

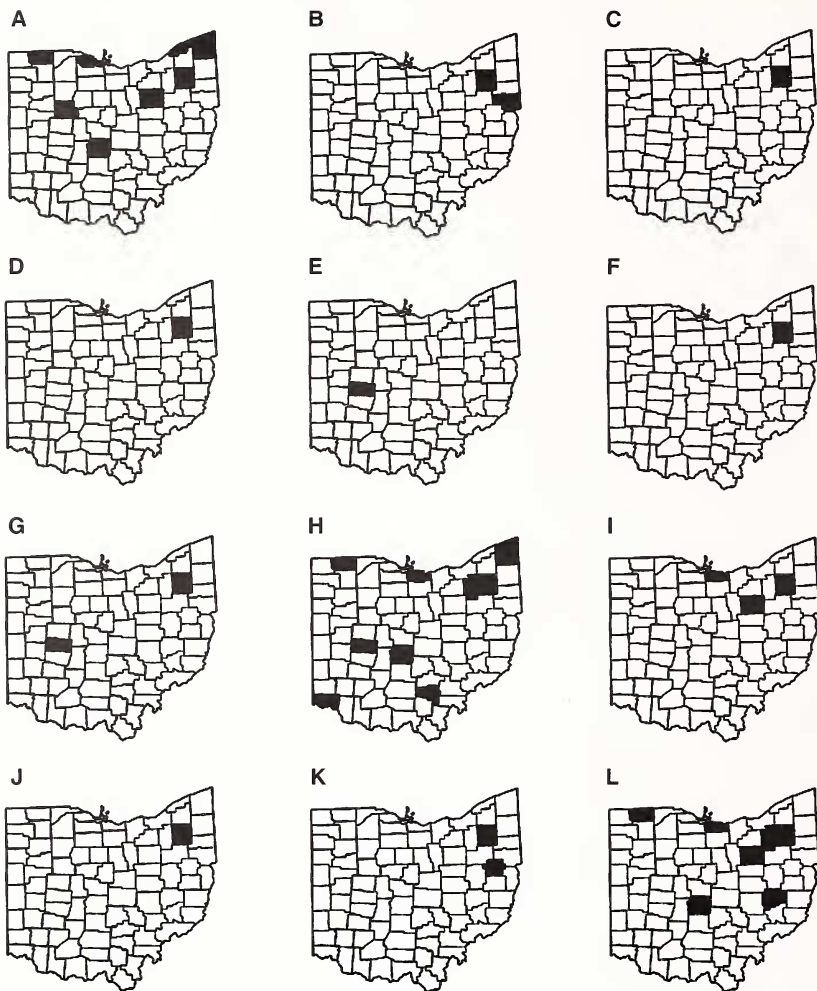


Figure 17. Distribution of Ohio Sciomyzidae. A, *Atrichomelina pubera*; B, *Oidematops ferrugineus*; C, *Pherbellia albovaria*; D, *Pherbellia anubis*; E, *Pherbellia beatricis*; F, *Pherbellia griseola*; G, *Pherbellia lucifera*; H, *Pherbellia nana*; I, *Pherbellia parvialla*; J, *Pherbellia propages*; K, *Pherbellia schoenherri maculata*; L, *Pherbellia seticoxa*.

Biology: Larvae prey on stranded pulmonate aquatic snails (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt et al., 1969).

7. *Pherbellia lucifera* (Loew, 1861)

General Distribution: NF, ON, PQ; IA, IN, NY, OH, PA.

Ohio Records (Figure 17G): **Champaign**, Cedar Swamp, R. E. Woodruff, 1♂ (CMNH); **Portage**, 1 mile E Kent, IV-29-1976, B. A. Foote, 1♀ (CMNH).

Habitat: Fens, marshes.

Phenology: Voltinism unknown. Flight period in Ohio is in late April. Overwintering habits are unknown.

Biology: Unknown.

Immature Stages: None described.

8. *Pherbellia nana nana* (Fallén, 1820)

General Distribution: Transcontinental in North America.

Ohio Records (Figure 17H): **Ashtabula**, Pymatuning Creek Fen, VI-21-2001, J. B. Keiper, 1♀ (CMNH); **Champaign**, Cedar Swamp, V-21-1964, B. A. Foote, 1♀ (CMNH); **Erie**, Sandusky, VII-15-1907, J. S. Hine, 1♂ (OSU); **Franklin**, Columbus, V-15-1902, J. S. Hine (OSU); **Fulton**, Wauseon, VIII-25 to 29-1902, J. S. Hine, 6 (OSU); IX-04-1902, J. S. Hine, 3♂ (OSU); **Hamilton**, Cincinnati, IX-04-1974, W. Downing 1♀ (CMNH); **Portage**, 7 miles E Kent, V-07-1962, B. A. Foote, 1♀ (CMNH), 1.0 mile E Kent, V-14-1962, B. A. Foote, 2♂ (CMNH); Wingfoot Lake, IX-08-1961, B. A. Foote, 1♂ (CMNH); **Summit**, Akron, V-21-1899, J. S. Hine, 1♂ (OSU); **Barberton**, VIII-01-1996, 1♂, 1♀, J. B. Keiper (CMNH); Cuyahoga Valley National Park (then Cuyahoga Valley National Recreation Area), VII-10-1998, B. A. Foote, 1♂ (CMNH); alkaline area near Barberton, VIII-26-1997, J. B. Keiper, 1♂ (CMNH); **Vinton**, VI-05-12-1900, J. S. Hine, 1♂ (OSU).

Habitat: Marshes, swamps, margins of lakes, roadside drainage ditches.

Phenology: Multivoltine. Flight period in Ohio occurs from early May to early September. Overwinters as pupa in the shell of host snail or in leaf litter.

Biology: Larvae prey on stranded pulmonate aquatic snails (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt, et al., 1969).

9. *Pherbellia parallela* (Walker, 1853)

General Distribution: Transcontinental in Canada and USA south to Costa Rica.

Ohio Records (Figure 17I): **Erie**, Sandusky, VII-15-1907, J. S. Hine, 1♀ (OSU); **Portage**, cemetery in north Kent, IX-1961, B. A. Foote, 1♂ (CMNH); 1.0 mile N Kent, V-14-1962, B. A. Foote, 3♂ (CMNH); **Wayne**, 0.5 mile S Rittman, IX-09-1969, B. A. Foote, 2♂ (CMNH).

Habitat: Marshes, open mud flats, vernal ponds, drainage ditches.

Phenology: Multivoltine. Flight period in Ohio occurs from mid-May to mid-September. Overwinters as pupa in leaf litter or in shell of host snail.

Biology: Predator of stranded pulmonate aquatic snails (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt et al., 1969).

10. *Pherbellia propages* Steyskal, 1967

General Distribution: AB, MB, NWT, SK; AK, ND east to OH. Ohio Records (Figure 17J): **Portage**, 7.0 miles E Kent, V-13-1962, B. A. Foote, 2♂ (CMNH).

Habitat: Marshes.

Phenology: Multivoltine. Recorded in Ohio only in mid-May. Overwinters as pupa in leaf litter.

Biology: Larvae prey on stranded pulmonate aquatic snails (Bratt et al., 1969).

Immature Stages: E, L₃, P (Bratt et al., 1969).

11. *Pherbellia schoenherri maculata* (Cresson, 1920)

General Distribution: Transcontinental in North America.

Ohio Records (Figure 17K): **Carroll**, 3.0 miles E Carrollton, VII-17-1964, R. E. Mannell, 1♀ (CMNH); **Portage**, 1.0 mile E Kent, VII-15-2000, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, drainage ditches.

Phenology: Multivoltine. Adults have been recorded in Ohio only in mid-July. Overwinters as pupa in leaf litter or in the shell of host snail.

Biology: Parasitoid on snails of family Succineidae (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt et al., 1969).

12. *Pherbellia seticoxa* Steyskal, 1961

General Distribution: MN east to PQ, south to MD, west to KS and MT.

Ohio Records (Figure 17L): **Erie**, Cedar Point near Sandusky, VII-07-20-1904, J. S. Hine, 1♀ (OSU); **Franklin**, Columbus, VII-07-1900, J. S. Hine, 1♂ (OSU); **Fulton**, Wauseon, IX-17-1902, J. S. Hine, 1♂, 2♀ (OSU); **Guernsey**, 10 miles S Cambridge, VII-31-1965, R. E. McConnell, 4♂ (CMNH); **Portage**, 7.0 miles E Kent, V-13-1962, B. A. Foote, 7♂ (CMNH); 1.0 miles N Kent, V-13-1962, B. A. Foote, 7♂ (CMNH); **Summit**, Akron, V-21-1899, J. S. Hine, 1♀ (OSU); **Wayne**, 0.5 miles S Rittman, IX-09-1969, B. A. Foote, 4♂ (CMNH).

Habitat: Marshes, vernal woodland pools, ponds.

Phenology: Multivoltine. Flight period in Ohio occurs from mid-May to mid-September. Overwinters as pupa in shell of host snail or in leaf litter.

Biology: Larvae prey on stranded pulmonate aquatic snails (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt et al., 1969).

13. *Herbellia similis* Cresson, 1920

General Distribution: PQ; DC, MA, MI, NY, OH, WI.

Ohio Records (Figure 18A): **Portage**, Dollar Lake near Twin Lakes, IV-24-1963, B. A. Foote, 1♂ (CMNH); 1 mile N Kent, III-20-1962, B. A. Foote, 3♂ reared from puparia in shells of *Planorbula jenkinsii* Carpenter (CMNH); Streetsboro Bog, III-27-1962, B. A. Foote, 1♂ reared from puparium in shell of *P. jenkinsii* (CMNH); 7.0 miles E Kent, V-07-1962, B. A. Foote, 1♂ reared from puparium in shell of *P. jenkinsii* (CMNH); **Wayne**, 0.5 mile S Rittman, IV-24-1963, 1♂ (CMNH).

Habitat: Woodland pools, buttonbush swamps, fens.

Phenology: Univoltine. Flight period in Ohio from late April to late May. Overwinters as pupa within floating shells of the aquatic snail *P. jenkinsii*.

Biology: Parasitoid of the aquatic snail *P. jenkinsii* (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt et al., 1969).

14. *Herbellia vitalis* (Cresson, 1920)

General Distribution: AB, BC, ON, AR, CO, ID, MT, OH, UT.

Ohio Records (Figure 18B): **Ashtabula**, Pymatuning Reservoir near Simmons, V-25-1963, B. A. Foote, 1♂ (CMNH); **Portage**, 1.0 mile N Kent, X-23-1963, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, swamps.

Phenology: Multivoltine. Flight period in Ohio occurs from late May to late October. Overwinters as pupa in shell of host snail or occasionally in leaf litter.

Biology: Larvae prey on stranded pulmonate aquatic snails (Bratt et al., 1969).

Immature Stages: E, L₁₋₃, P (Bratt et al., 1969).

15. *Pteromicra pleuralis* (Cresson, 1920)

General Distribution: AB, BC, NF; CO, NY, OH, PA, SD, WY.

Ohio Records (Figure 18C): **Champaign**, Cedar Swamp, X-08-1963, J. L. Williams, 1♂ (OSU); **Portage**, Kent, adult emerged from puparium, X-21-1965, B. A. Foote, 1♀ (CIMNH); 1.0 mile N Kent, III-27-1962, B. A. Foote, 1♂ reared from puparium (CMNH); 5.5 miles E Kent, IX-20-1965, B. A. Foote, 11 (gender not recorded) (CMNH); Mogadore Reservoir, IV-19-1962, B. A. Foote, 1♂ reared from puparium (CMNH).

Habitat: Marshes, fens, swamps.

Phenology: Multivoltine. Flight period in Ohio from early June to early October. Overwinters as pupa in floating or stranded host snail shell.

Biology: Larvae parasitoid on stranded pulmonate aquatic snails.

Immature Stages: None described.

16. *Pteromicra similis* Steyskal, 1954b

General Distribution: PQ; CT, MI, NJ, NY, OH.

Ohio Records (Figure 18D): **Portage**, 1.0 mile N Kent, III-20-1962, B. A. Foote, 13 reared from puparia in shells of *Planorbula jenkinsii* (CMNH); Streetsboro Bog, III-27-1962, B. A. Foote, 9 reared from puparia in shells of *P. jenkinsii* (CMNH); Mogadore Reservoir, IV-17-1962, B. A. Foote, 15 reared from puparia in shells of *P. jenkinsii* (CMNH); 7.0 miles E Kent, V-07-1962, B. A. Foote, 10 reared from puparia in shells of *P. jenkinsii* (CMNH); 6 miles SE Kent, IX-10-1965, B. A. Foote, 2♂, 1♀ (CMNH); 4.5 miles E Kent, III-16-1966, B. A. Foote, 12 reared from puparia in shells of *P. jenkinsii* (CMNH).

Habitat: Marshes, fens, swamps.

Phenology: Multivoltine. Flight period in Ohio occurs from early May to mid-September. Overwinters as pupa within shell of host snail.

Biology: Larva parasitoid of stranded aquatic snail belonging to *P. jenkinsii*.

Immature Stages: None described.

17. *Pteromicra spheura* Steyskal, 1954b

General Distribution: AZ, DC, MI, OH, SD.

Ohio Records (Figure 18E): **Lake**, Mentor Marsh, IX-25-1969, B. A. Foote, 4♂ (CMNH); **Portage**, 1.0 mile N Kent, III-20-1962, B. A. Foote, 7♂ reared from floating puparia (CMNH); Streetsboro Bog, III-27-1962, B. A. Foote, 2♂, 2♀ reared from floating puparia, Dollar Lake near Twin Lakes, VI-20-1962, D. Miletich, 1♂ (CMNH); 6 miles E Kent, X-01-1965, B. A. Foote, 1♀ (CIMNH); 6 miles SE Kent, IX-10-1965, B. A. Foote, 2♂, 1♀ (CMNH); Brady Lake, IV-26-1968, B. A. Foote, 1♂ reared from floating puparium (CMNH).

Habitat: Marshes, woodland pools.

Phenology: Multivoltine. Flight period in Ohio occurs from early June to mid-September. Overwinters as pupa within floating puparium.

Biology: Larva parasitoid/predator on stranded aquatic snails of the genera *Physa* and *Physella*.

Immature Stages: None described.

18. *Sciomyza aristalis* (Coquillett, 1901)

General Distribution: ONT, PQ; ME west to MI and OH.

Ohio Records (Figure 18F): **Portage**, 7 miles E Kent, VI-28-1963, E. J. Allen, 1♂ (CMNH).

Habitat: Marshes, floodplain forests.

Phenology: Trivoltine. Recorded in late June in Ohio. Overwinters as pupa in shell of host snail.

Biology: Larva parasitoid on land snails belonging to the genus *Succinea*. Egg deposited on shell of host snail (Foote, 1959).

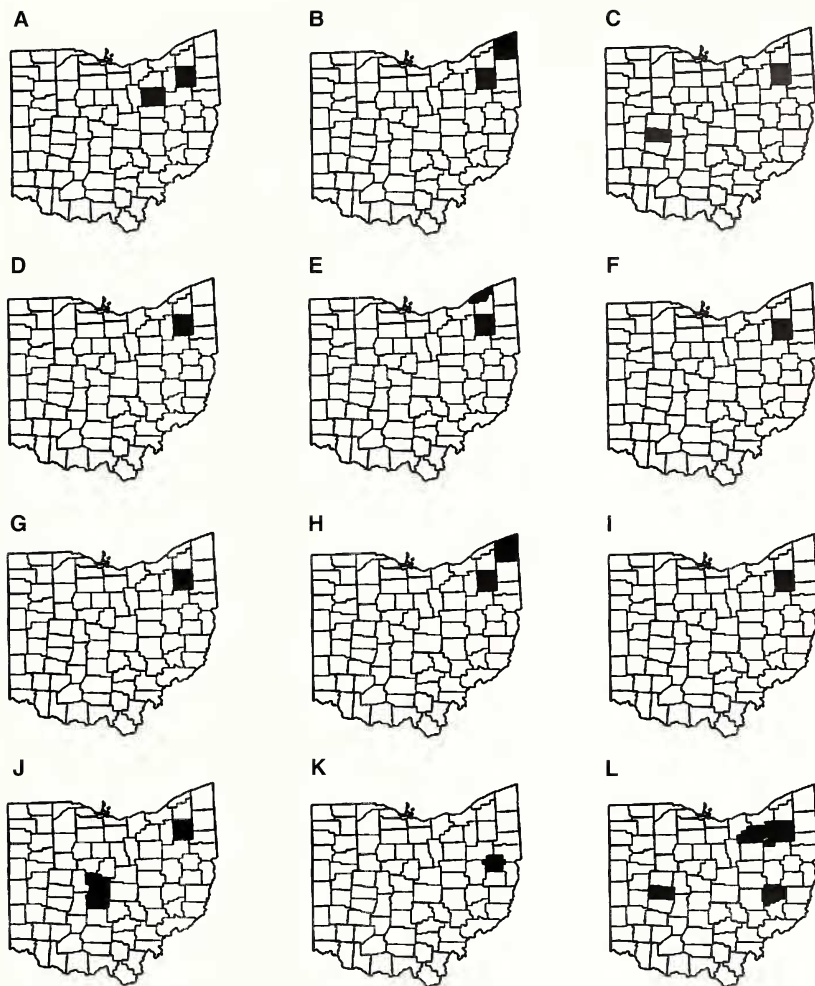


Figure 18. Distribution of Ohio Sciomyzidae. A, *Pherbellia similis*; B, *Pherbellia vitalis*; C, *Pteromicra pleuralis*; D, *Pteromicra similis*; E, *Pteromicra sphenura*; F, *Sciomyza aristalis*; G, *Sciomyza varia*; H, *Antichaeta borealis*; I, *Antichaeta fulva*; J, *Antichaeta melanosoma*; K, *Dictya atlantica*; L, *Dictya borealis*.

Immature Stages: E, L₃, P (Foote, 1959).

19. *Sciomyza varia* (Coquillett, 1904)

General Distribution: AB, ONT, PQ; CA, CT, MI, MN, MT, NY, OH, SD, UT.

Ohio Records (Figure 18G): **Portage**, 5.0 miles S Kent, IV-24-1962, B. A. Foote, 2♂ reared from puparia in shells of *Stagnicola* sp. (CMNH); 3.0 miles E Ravenna, V-01-1968, B. A. Foote, 1♂ reared from shell in floating shell of *Stagnicola* sp. (CMNH).

Habitat: Marshes, swamps, woodland pools.

Phenology: Uni- or bivoltine. Recorded in Ohio only during late April and early May. Overwinters as pupa within the shell of host snail.

Biology: Larva parasitoid on aquatic snails belonging to the genus *Stagnicola*. Egg deposited on shell of host snail (Barnes, 1990).

Immature Stages: E, L₁₋₃, P (Barnes, 1990).

20. *Antichaeta borealis* Foote, 1961a

General Distribution: CA, IA, ID, MT, OH.

Ohio Records (Figure 18H): **Ashtabula**, Pymatuning Reservoir near Linesville, V-25-1963, B. A. Foote, 2♂ (CMNH); **Portage**, Mogadore Reservoir, IV-17-1962, B. A. Foote, 2♂ reared from floating puparia (CMNH); 4.5 miles E Kent, IV-20-1964, B. A. Foote, 1♂ reared from floating puparium (CMNH); 4.5 miles E Kent, V-10-1968, B. A. Foote, 2♂, 2♀ reared from floating puparia (CMNH); Kent, IV-06-1965, W. Robinson, 1♂ reared from floating puparium (CMNH).

Habitat: Marshes.

Phenology: Univoltine. Flight period in Ohio occurs in late May. Overwinters as pupa.

Biology: Larvae prey on eggs of terrestrial pulmonate snails belonging to the genera *Catinella* and *Oxyloma*. Eggs deposited on egg masses of host snails (Robinson and Foote, 1978).

Immature Stages: None described.

21. *Antichaeta fulva* Steyskal, 1960

General Distribution: AB; ID, NY, OH.

Ohio Records (Figure 18I): **Portage**, 1.0 mile E Kent, V-23-1967, B. A. Foote, 1♀ reared from floating puparium (CMNH); 4.5 miles E Kent, VI-01-1968, B. A. Foote, 1♂ reared from floating puparium (CMNH); 3.0 miles E Ravenna, V-01-1968, B. A. Foote, 1♂ reared from floating puparium.

Habitat: Marshes.

Phenology: Univoltine. Flight period in Ohio occurs in May. Overwinters as pupa in leaf litter.

Biology: Larvae prey on exposed eggs of aquatic pulmonate snails belonging to the genus *Lymnaea*. Eggs laid on egg masses of host snail.

Immature Stages: None described.

22. *Antichaeta melanosoma* Melander, 1920

General Distribution: Transcontinental in North America.

Ohio Records (Figure 18J): **Delaware**, Delaware, VI-10-1961, B. A. Foote, 1♂ (CMNH); **Franklin**, Columbus, V-09-1899, 1♂ (OSU); **Portage**, Kent, V-23-1967, K. Valley, 2♂ (CMNH); 1.4 miles E Kent, IV-11-1967, B. A. Foote, 1♀ reared from puparium (CMNH); 3.0 miles E Kent, V-23-1967, B. A. Foote, 1♂ reared from puparium (CMNH); 4.5 miles E Kent, VI-01-1968, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, swamps, vernal woodland pools.

Phenology: Univoltine. Flight period in Ohio occurs from late May to mid-June. Overwinters as pupa in leaf litter.

Biology: Larvae prey on exposed eggs of the pulmonate aquatic snails *Aplexa hypnorum* (L.) and *Physa* sp. Egg laid on egg mass of host snail (Knutson and Abercrombie, 1977).

Immature Stages: None described.

23. *Dictya atlantica* Steyskal, 1954c

General Distribution: Nearctic. ONT, PQ; IL, MO, NC, NY, OH, PA, VA.

Ohio Records (Figure 18K): **Carroll**, Specht Marsh, VI-21-1964, J. C. E. J. Allen (CMNH).

Habitat: Marshes.

Phenology: Multivoltine. Flight period in Ohio is in late June. Overwinters as pupa in floating puparium.

Biology: Larvae prey on pulmonate aquatic snails (Valley and Berg, 1977).

Immature Stages: E, L₁₋₃, P (Valley and Berg, 1977).

24. *Dictya borealis* Curran, 1932

General Distribution: Nearctic. AB, MB, ONT; GA, IL, MI, ND, NY, OH, PA, TX, WA, WI.

Ohio Records (Figure 18L): **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 1♂ (CMNH); **Guernsey**, 11.0 miles S Cambridge, VII-31-1969, E. J. Allen, 3♂ (CMNH); **Medina**, Lodi, VI-26-1916, 1♂ (OSU); **Portage**, 7 miles E Kent, V-16-1962, B. A. Foote, 3♂ (CMNH); **Summit**, Akron, VI-1927, J. S. Hine, 1♂ (OSU).

Habitat: Marshes.

Phenology: Multivoltine. Flight period occurs in Ohio from mid-June to late July. Overwinters as pupa in floating puparium.

Biology: Unknown.

Immature Stages: None described.

25. *Dictya expansa* Steyskal, 1938

General Distribution: Nearctic. Nearly transcontinental, south to FL and AZ.

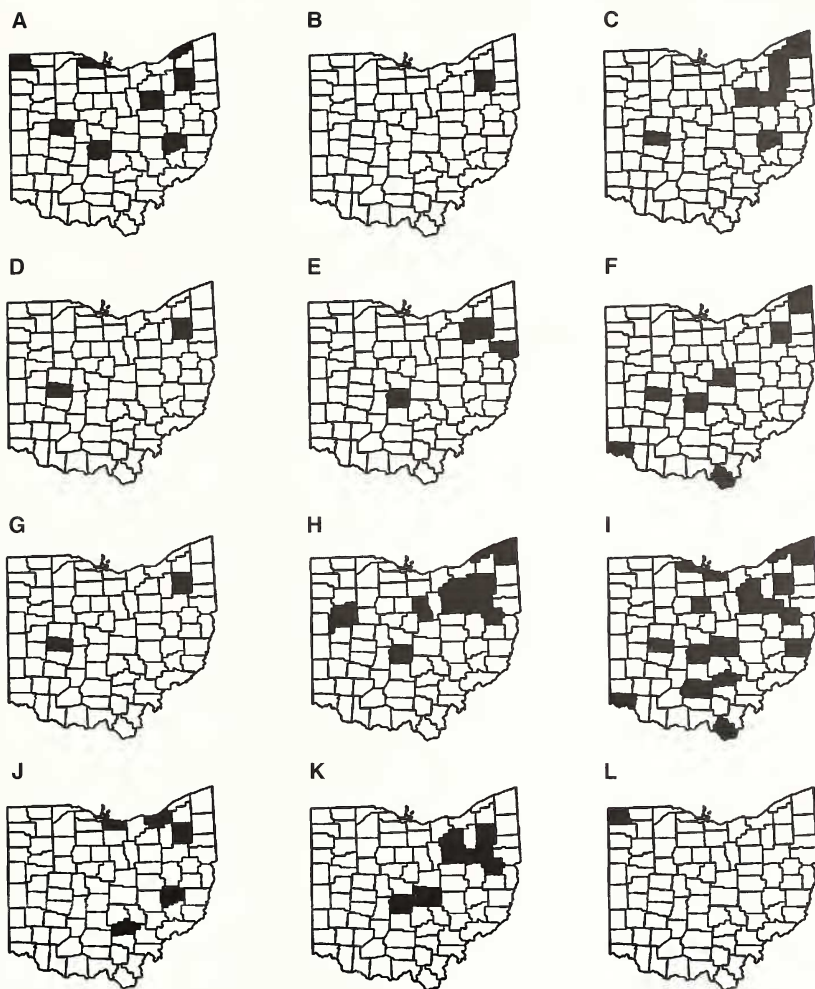


Figure 19. Distribution of Ohio Sciomyzidae. A, *Dictya expansa*; B, *Dictya hudsonica*; C, *Dictya pictipes*; D, *Dictya sabroskyi*; E, *Dictya steyskali*; F, *Dictya stricta*; G, *Dictya texensis*; H, *Elgiva sollicita*; I, *Euthycera arcuata*; J, *Limnia boscii*; K, *Limnia conica*; L, *Limnia fitchi*.

Ohio Records (Figure 19A): **Champaign**, Cedar Swamp, VII-24-1964, J. L. Williams, 2♂ (OSU); **Franklin**, Columbus, IV-13-1899, 1♂ (OSU); **Guernsey**, 11.0 miles S. Cambridge, E. J. Allen, 1♂ (CMNH); **Lake**, Mentor Marsh, VI-08-1981, A. D. Huryn, 1♂ (CMNH); **Ottawa**, Gypsum, V-16-1912, F. L. King, 1♂ (OSU); **Portage**, 1.0 mile E Kent, V-14-1962, B. A. Foote, 4♂, 1♀ (CMNH); 7.0 miles E Kent, V-07-1962, B. A. Foote, 1♂ (CMNH); 1.0 mile N Kent, VI-01-1963, B. A. Foote, 1♂ (CMNH); 5.0 miles NW Kent, VI-25-1963, B. A. Foote, 1♂ (CMNH); Dollar Lake near Twin Lakes, VI-20-1962, D. Miletich, 1♂ (CMNH); **Wayne**, Wooster, IV-16-1898, 2♂ (OSU); Moreland, V-17-1959, C. A. Triplehorn, 1♂ (OSU); **Williams**, Mud Lake Bog State Nature Preserve, VI-03-07-2001, J. B. Keiper, 1♂ (CIMNH).

Habitat: Marshes, roadside ditches, marshy borders of lakes, swamps.

Phenology: Multivoltine. Flight period in Ohio occurs from mid-April to late July. Overwinters as pupa within floating puparium.

Biology: Predacious on pulmonate aquatic snails (Valley and Berg, 1977).

Immature Stages: E, L₁₋₃, P (Valley and Berg, 1977).

26. *Dictya hudsonica* Steyskal, 1954c

General Distribution: BC, PQ; CT, DE, IA, ID, IL, MI, MN, MT, NJ, NY, OH, WI, WY.

Ohio Records (Figure 19B): **Portage**, 2.0 miles E Kent, VII-05-1962, B. A. Foote, 1♂ (CMNH); Streetsboro Bog, IV-11-1963, B. A. Foote, 1♂ (CMNH); Streetsboro Bog, IX-26-1962, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes.

Phenology: Multivoltine. Flight period in Ohio occurs from mid-April to late September. Overwinters as pupa in floating puparium.

Biology: Predacious on pulmonate aquatic snails (Valley and Berg, 1977).

Immature Stages: E, L₁₋₃, P (Valley and Berg, 1977).

27. *Dictya pictipes* (Loew, 1859)

General Distribution: ONT to MB, south to NC and AL.

Ohio Records (Figure 19C): **Ashtabula**, near Ashtabula/Geauga border at Route 322, VI-07-2002, J. B. Keiper, 2♂ (CIMNH); **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 1♂ (CMNH); **Geauga**, Koeliker Fen, VIII-16-2001, J. B. Keiper, 1♂ (CIMNH); **Guernsey**, 11.0 miles S Cambridge, IV-04-1965, E. J. Allen, 1♂ (CMNH); **Portage**, 4.5 miles E Kent, IX-29-1968, R. Mangan, 1♂ (CMNH); 5.0 miles NW Kent, VI-25-1963, B. A. Foote, 1♂ (CMNH); Jennings Woods northeast of Ravenna, IV-23-1975, B. A. Foote, 1♂ (CMNH); Ravenna Arsenal, VIII-20-1996, J. B.

Keiper, 1♂ (CMNH); **Stark**, 3.0 miles NE Canton, V-30-1965, K. Valley, 1♂ (CMNH); **Wayne**, 0.5 miles S Rittman, VII-04-1970, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, swamps.

Phenology: Multivoltine. Flight period in Ohio from early April to late September. Overwinters as pupa in floating puparium.

Biology: Larvae prey on pulmonate aquatic snails (Valley and Berg, 1977).

Immature Stages: E, L₁₋₃, P (Valley and Berg, 1977).

28. *Dictya sabroskyi* Steyskal, 1938

General Distribution: OH west to NE, south to FL and MEX. Ohio Records (Figure 19D): **Champaign**, Cedar Swamp, V-21-1964, B. A. Foote, 1♂ (CMNH); **Portage**, Kent State campus, VII-10-1995, J. B. Keiper, 1♂ (CMNH).

Habitat: Fens, marshes.

Phenology: Multivoltine. Collected in Ohio from late May to mid-July. Overwinters as pupa in floating puparium.

Biology: Larvae prey on pulmonate aquatic snails (Valley and Berg, 1977).

Immature Stages: E, L₁₋₃, P (Valley and Berg, 1977).

29. *Dictya steyskali* Valley, 1977 (in Valley and Berg, 1977)

General Distribution: NF, NS, ONT; MA, ME, MI, NY, OH, PA, VT.

Ohio Records (Figure 19E): **Columbiana**, Beaver Creek State Park, VII-03-2000, B. A. Foote, 1♂ (CMNH); **Fayette**, Deer Creek State Park, VI-08-1997, J. B. Keiper, 1♂ (CMNH); **Portage**, Herrick Fen, VIII-21-1989, B. A. Foote, 1♂ (CMNH); **Horning Road Marsh** in east Kent, VI-02-1989, B. A. Foote, 1♂ (CMNH); **Summit**, Singer Lake Bog, VII-10-2002, J. B. Keiper, 3♂ (CIMNH).

Habitat: Marshes, fens.

Phenology: Multivoltine. Flight period in Ohio occurs from early June to late August. Overwinters as pupa.

Biology: Larvae prey on pulmonate aquatic snails (Valley and Berg, 1977).

Immature Stages: E, L₁₋₃, P (Valley and Berg, 1977).

30. *Dictya stricta* Steyskal, 1938

General Distribution: BC; AL, CO, KS, KY, IL, LA, MS, MT, NC, NE, OH, TX.

Ohio Records (Figure 19F): **Ashtabula**, Pymatuning Creek Fen, VI-21-2001, J. B. Keiper, 1♂ (CIMNH); **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 1♂ (CMNH); Cedar Swamp, V-27-1961, R. E. Woodruff, 1♂ (FSCA); **Franklin**, Columbus, V-15-1902, J. S. Hine, 1♂ (OSU); **Hamilton**, Cincinnati, VI-26-1974, W. Downing, 1♂ (CMNH); **Knox**, Danville, V-19-1899, 1♂ (OSU); **Lawrence**, Ironton, V-1926, 1♂ (OSU); **Portage**, 1 mile N

Kent, VI-01-1963, B. A. Foote, 1♂ (CMNH); Streetsboro Bog, IX-26-1962, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, fens, swamps.

Phenology: Multivoltine. Flight period in Ohio occurs from mid-May to late September. Overwinters as pupa in floating puparium.

Biology: Larvae prey on pulmonate aquatic snails (Valley and Berg, 1977).

Immature Stages: E, L₁₋₃, P (Valley and Berg, 1977).

31. *Dictya texensis* Curran, 1932

General Distribution: PA to WY, south to FL and CA and MEX.

Ohio Records (Figure 19G): **Champaign**, Cedar Swamp, VII-12-1962, R. E. Woodruff, 2♂ (FSCA); Cedar Swamp, VII, VIII-1964, J. L. Williams, 24♂ (OSU); **Portage**, 4.5 miles E Kent, III-30-1964, 6♂ reared from floating puparia (CMNH); 5.0 miles E Kent, V-20-1964, B. A. Foote, 1♂ reared from floating puparium (CMNH); Dollar Lake near Twin Lakes, IV-21-1963, B. A. Foote, 2♂ reared from floating puparia (CMNH).

Habitat: Marshes, fens, swamps.

Phenology: Multivoltine. Flight period in Ohio occurs from early April to late August. Overwinters as pupa in floating puparium.

Biology: Larvae prey on pulmonate aquatic snails (Valley and Berg, 1977).

Immature Stages: E, L₁₋₃, P (Valley and Berg, 1977).

32. *Elgiva sollicita* (Harris, 1780)

General Distribution: Nearctic. AK to NF, south to VA and CA.

Ohio Records (Figure 19H): **Allen**, Spencerville, VII-18-2001, J. B. Keiper, 2♂ (CMNH); **Ashtabula**, Pymatuning Creek Fen, VI-21-2001, J. B. Keiper, 1♂, 8♀ (CIMNH); **Auglaize**, Grand Lake St. Marys State Park, VII-18-2001, J. B. Keiper, 2♂, 1♀ (CIMNH); **Carroll**, Specht Marsh, VII-27-1963, E. J. Allen, 3♂ (CMNH); **Franklin**, Columbus, VI-16-1963, A. Peterson, 1♀ (OSU); **Lake**, Mentor Marsh, VI-08-1981, A. D. Huryn, 5♂, 3♀ (CMNH); **Medina**, 2.0 miles N. Wadsworth E. J. Allen, 1♀ (CMNH); **Portage**, 5.0 miles S Kent, VI-22-1964, E. J. Allen, 2♂ (CMNH); 8.0 miles S Kent, VII-22-1964, E. J. Allen, 2♂, 4.0 miles E Kent, VI-29-1965, K. Valley, 1♂ (CMNH); 6.0 miles SE Kent, IX-02-1965, K. Valley, 1♂ (CMNH); Dollar Lake near Twin Lakes, VIII-09-1962, D. Miletich, 1♀ (CMNH); Herrick Fen, 3 miles NW Kent, VI-16-1989, B. A. Foote, 1♂ (BAF); Jay Lake, VII-02-1965, D. Miletich, 1♂ (CMNH); Streetsboro Bog, VIII-05-1964, R. C. McConnell, 1♀ (CMNH); West Branch State Park, VII-31-1997, J. B. Keiper,

2♂ (CMNH); **Richland**, Mansfield, swamp near Route 30/71, VII-18-2001, J. B. Keiper, 1♂, 6♀; **Stark**, KSU Stark campus, III-12-1995, E. G. Chapman, 1♂ (CMNH); wetlands near Route 30/Trump Road junction, VI-20-2001, J. B. Keiper, 1♂ (CIMNH); **Summit**, Akron, VI-1923, J. S. Hine, 1♂ (OSU); Ira, J. S. Hine, 1♂ (OSU); **Wayne**, Moreland, V-17-1959, C. A. Triplehorn, 10♂ (OSU); Rittman, VII-12-1964, W. B. Stoltzfus, 1♂ (CMNH).

Habitat: Marshes, fens, swamps, roadside ditches.

Phenology: Multivoltine. Flight period in Ohio occurs from mid-May to late September. Overwinters as adult.

Biology: Larvae prey on pulmonate aquatic snails (Knutson and Berg, 1964).

Immature Stages: E, L₁₋₃, P (Knutson and Berg, 1964).

33. *Euthycera arcuata* (Loew, 1859)

General Distribution: ON to WY, south to GA, LA, and TX.

Ohio Records (Figure 19I): **Ashtabula**, North Kingsville Sand Barrens, VI-12-2001, B. A. Foote, 1♂ (CIMNH); **Belmont**, Bethesda, V-25-1974, B. A. Foote, 1♂ (CMNH); **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 3♂, 3♀ (CMNH); Cedar Swamp, VII-11-1964, J. L. Williams, 1♂ (OSU); **Carroll**, Specht Marsh, VII-27-1964, E. J. Allen, 1♀; **Columbiana**, Beaver Creek State Park, VI-16-1996, J. B. Keiper, 1♀ (CMNH); **Crawford**, Galion, VI, 1♀ (OSU); **Erie**, Sandusky, VI-30-1900, J. S. Hine, 1♀ (OSU); **Fayette**, Deer Creek State Park, VI-08-1997, J. B. Keiper, 1♂ (CIMNH); **Hamilton**, Cincinnati, VI-09, 21-1974, W. Downing, 2♀ (CMNH); **Hocking**, Cantwell Cliffs, VI-07-1941, R. C. Osburn, 1♂ (OSU); **Lawrence**, Ironton, V-26-1899, J. S., Hine, 1♀ (OSU); **Licking**, Newark, VI-21, D. J. and J. N. Knull, 1♀ (OSU); **Medina**, Medina, VI-10-1899, J. S. Hine, 1♀ (CMNH); 2.0 miles N Wadsworth, VI-30-1964, E. J. Allen, 1♂ (CMNH); **Ottawa**, Gypsum, VII-12-1912, F. L. King, 1♂, 1♀ (OSU); **Portage**, 4.0 miles E Kent, VI-15-1963, B. A. Foote, 1♂ (CMNH); 11.0 miles W Kent, VII-04-1967, G. Piper, 2♀ (CMNH); Streetsboro Bog, VII-08-1964, E. J. Allen, 3♀ (CMNH); **Ross**, no locality given, VII-01-1943, D. J. Borror, 1♂ (OSU); **Wayne**, 1.0 mile E Rittman, VII-19-1964, W. B. Stoltzfus, 1♀ (CMNH).

Habitat: Woodland swamps, beech-maple forests, oak-hickory forests, mixed mesophytic forests, marshes.

Phenology: Univoltine. Flight period in Ohio occurs from late May to late September. Overwinters as larva within partially eaten land snails.

Biology: Poorly known. Nearly mature larvae have been found feeding within the land snails *Mesodon inflectus* (Say), *Stenotrena hirsutum* (Say), and *Ventridens lig-*

era (Say), but no complete life cycle is available.

Immature Stages: None described.

34. *Limnia boscii* (Robineau-Desvoidy, 1830)

General Distribution: Nearctic: ON and ME to MT, south to VA, IA, and NE.

Ohio Records (Figure 19J): **Cuyahoga**, Chagrin River, VI-22-2002, J. B. Keiper, 1♀ (CIMNH); **Erie**, Shimrock, V-23-1986, S. M. Clark, 2♂ (CMNH); **Guernsey**, Cambridge, IV-04-1965, R. E. MacConnell, 1♂ (CMNH); **Hocking**, near Conkles Hollow State Park, VII-14-1997, J. B. Keiper, 1♀ (CMNH); **Portage**, KSU campus, VII-10-1995, J. B. Keiper, 1♂ (CIMNH), 4.5 miles E Kent, VII-30-1961, D. Miletich, 1♂ (CMNH); 2 miles NE Kent, VI-12 1995, B. A. Foote, 1♂ (CIMNH).

Habitat: Marshes.

Phenology: Voltinism unknown.

Biology: Overwintered third-instar attacks a variety of pulmonate aquatic snails, but the food of newly hatched larva remains unknown.

Immature Stages: None described.

35. *Limnia conica* Steyskal, 1978 (in Steyskal et al., 1978)

General Distribution: Nearctic: NB to ON and MN, south to VA, AL, and AR.

Ohio Records (Figure 19K): **Carroll**, Specht Marsh, no further data given; **Franklin**, Columbus, Blacklick Woods; **Licking**, no date or locality data (Steyskal et al., 1978); **Medina**, 3 miles W Wadsworth; **Portage**, 1.0 mile E Kent, IX-10-1997, B. A. Foote, 3♂, 2♀ (CMNH); Towners Woods, VI-15-1999, B. A. Foote, 5♂, 4♀ (CMNH); **Stark**, 3 miles NE Canton; **Wayne**, 1 mile E Rittman (Steyskal et al., 1978).

Habitat: Old fields, borders of marshes and fens.

Phenology: Voltinism unknown. Flight period in Ohio occurs from mid-June to mid-September.

Biology: Unknown.

Immature Stages: None described.

36. *Limnia fitchi* Steyskal, 1978 (in Steyskal et al., 1978)

General Distribution: Nearctic: NF to BC, south to NJ, LA, and NM.

Ohio Records (Figure 19L): **Williams**, Mud Lake Bog State Nature Preserve, VI-03-07-2001, J. B. Keiper, 2♂ (CIMNH).

Habitat: Marshes.

Phenology: Voltinism unknown. Only one Ohio record from a malaise trap series. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

37. *Limnia georgiae* Melander, 1920

General Distribution: Nearctic: AL, GA, IL, KS, MI, NC, NJ,

NY, NC, OH, TN, VA, WV.

Ohio Records (Figure 20A): **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 1♂ (CMNH).

Habitat: Fens.

Phenology: Voltinism unknown. Only recorded from Ohio in mid-June. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

38. *Limnia loewi* Steyskal, 1965

General Distribution: Nearctic: NS to ON, south to GA and AL.

Ohio Records (Figure 20B): **Portage**, Jennings Woods, VII-24-1998, J. B. Keiper, 5♀ (CMNH); Jennings Woods, VIII-10-1994, B. A. Foote, 1♂ (CMNH); 6.0 miles E Kent, IX-02-1967, B. A. Foote, 1♂ (CMNH).

Habitat: Floodplain woods, swamps.

Phenology: Voltinism unknown. Flight period in Ohio occurs from late July to early September. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

39. *Limnia nanbai* Steyskal, 1978 (in Steyskal et al., 1978)

General Distribution: Nearctic: CT, GA, IA, IL, MI, NC, OH, VA, WI (Steyskal et al., 1978).

Ohio Records (Figure 20C): **Franklin**, Columbus, V-18-1899, J. S. Hine, 1♂ (OSU); **Fairfield**, Lancaster, VII-04-1930, J. S. Hine, 1♂, (USNM); **Lucas**, VII-1911, R. C. Osburn, 1♂ (OSU).

Habitat: Unknown.

Phenology: Voltinism unknown. Flight period in Ohio occurs from mid-May to early July. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

40. *Limnia ottawensis* Melander, 1920

General Distribution: Nearctic: NB to AB, south to AL and CA.

Ohio Records (Figure 20D): **Franklin**, Columbus, VII-27-1920, 1♂, no collector recorded (ILNHS).

Habitat: Marshes.

Phenology: Voltinism unknown. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

41. *Limnia saudovalensis* Fisher and Orth, 1978 (in Steyskal et al., 1978)

General Distribution: Nearctic: NF to AK, south to DC and NM (Knutson et al., 1986).

Ohio Records (Figure 20E): **Portage**, Streetsboro Bog, no further data given (Steyskal, 1978).

Habitat: marshes, fens.

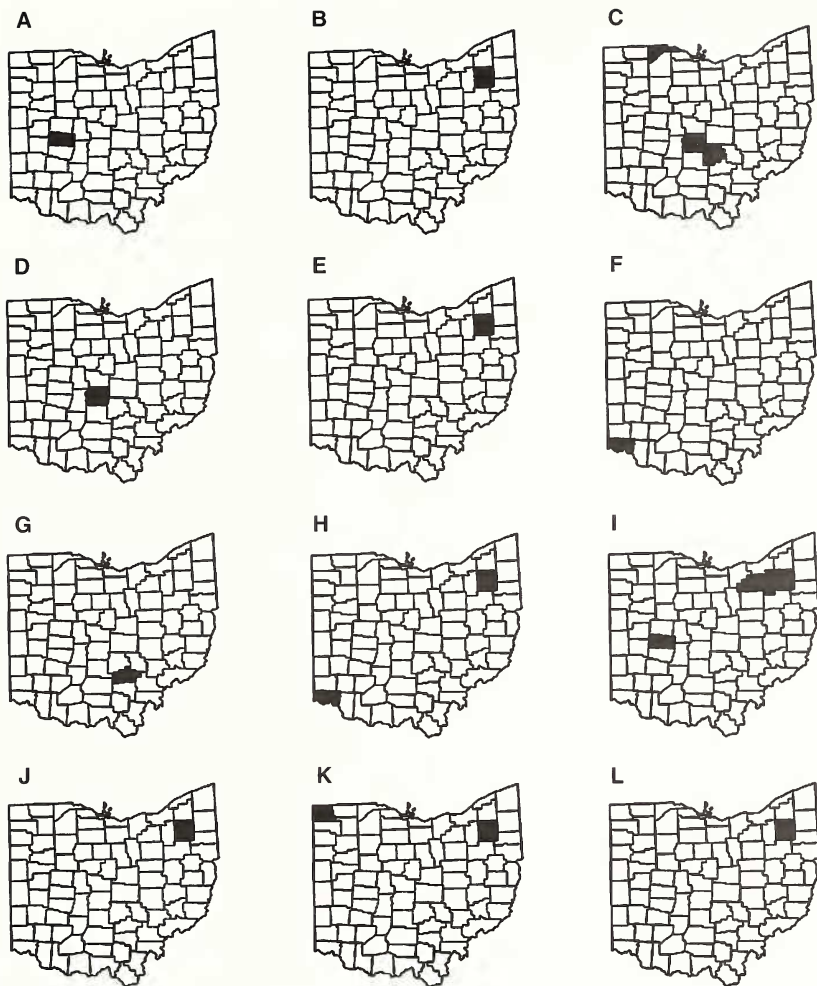


Figure 20. Distribution of Ohio Sciomyzidae. A, *Limnia georgiae*; B, *Limnia loewi*; C, *Limnia nambai*; D, *Limnia ottawensis*; E, *Limnia sandovalensis*; F, *Limnia septentrionalis*; G, *Limnia shannoni*; H, *Limnia sparsa*; I, *Pocilograpta decora*; J, *Renocera amanda*; K, *Renocera brevis*; L, *Renocera longipes*.

Phenology: Voltinism unknown. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

42. *Limnia septentrionalis* Melander, 1920

General Distribution: Nearctic; AL, AR, DC, IL, MD, NJ, NC, OH, PA, TN, VA.

Ohio Records (Figure 20F): **Hamilton**, Cincinnati, VI-29-1974, W. Downing, 1♂ (CMNH).

Habitat: Unknown.

Phenology: Voltinism unknown. Recorded from Ohio only in late June. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

43. *Limnia shannoni* Cresson, 1920

General Distribution: Nearctic; AL, AR, FL, GA, LA, MD, NJ, OH, TN (Steyskal et al., 1978).

Ohio Records (Figure 20G): **Hocking**, X-16-1941, D. J. and J. N. Knull, 1♂ (OSU).

Habitat: Unknown.

Phenology: Voltinism unknown. Recorded in Ohio only in mid-October. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

44. *Limnia sparsa* (Loew, 1862)

General Distribution: Nearctic. NF to BC, south to NC and OH.

Ohio Records (Figure 20H): **Hamilton**, Cincinnati, VI-02-1974, W. Downing, 1♂ (CMNH); **Portage**, J. Arthur Herrick State Nature Preserve, VII-10-1986, 2♂, B. A. Foote (CMNH).

Habitat: Marshes.

Phenology: Voltinism unknown. Recorded from Ohio only in early July. Overwintering habits unknown.

Biology: Unknown.

Immature Stages: None described.

45. *Poecilographa decora* (Loew, 1864)

General Distribution: Nearctic; NB to SK, south to VA, LA, and CO.

Ohio Records (Figure 20I): **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 1♂ (CMNH); **Medina**, Medina, VII-11-1898, J. S. Hine, 1♂ (OSU); **Portage**, 4.5 miles E Kent, VII-30, VIII-14-1962, D. Trelka, 5♂ (CMNH); 7.0 miles E Kent, VI-28, VII-09-1963, B. A. Foote, 2♀ (CMNH).

Habitat: Marshes, fens, swamps.

Phenology: Probably univoltine. Flight period in Ohio occurs from mid-June to mid-August. Overwinters as pupa (Barnes, 1988).

Biology: Largely unknown. Newly hatched larvae did not attack a wide variety of Mollusca in laboratory

rearings (Barnes, 1988).

Immature Stages: L₃, P (Barnes, 1988).

46. *Renocera amanda* Cresson, 1920

General Distribution: Nearctic. BC, NB, ONT, PQ; IN, ME, MN, NC, NY, OH, PA, SD.

Ohio Records (Figure 20J): **Portage**, Towners Woods, VI-01-1965, B. A. Foote, 1♂ (CMNH); 1.0 mile N Kent, V-14-1962, B. A. Foote, 4♂, 3♀ (CMNH); 4.0 miles N Kent, V-16-1962, B. A. Foote, 2♂ (CMNH); 4.5 miles E Kent, VI-28-1965, K. Valley, 1♂ (CMNH); Kent, V-23-1967, K. Valley, 2♂ (CMNH); Jennings Woods, V-07-1962, B. A. Foote, 1♀ (CIMNH).

Habitat: Swamps, woodland vernal pools.

Phenology: Univoltine. Flight period in Ohio occurs from early May to mid-July. Overwinters as pupa in leaf litter or floating debris.

Biology: Larvae prey on fingernail clams (Sphaeriidae) (Foote, 1976).

Immature Stages: None described.

47. *Renocera brevis* Cresson, 1920

General Distribution: Nearctic. AB, NF, ONT, YUK; AK, CA, CO, MT, NM, NY, OH, WA.

Ohio Records (Figure 20K): **Portage**, Kent, VI-19-1965, B. A. Foote, 1♂ (CMNH); 4.5 miles E Kent, III-30-1964, E. J. Allen, 3♂, 2♀ emerged from floating puparia (CMNH); VI-29-1964, E. J. Allen, 1♂ (CMNH); VII-23-1965, W. H. Robinson, 3♂ (CMNH); Dollar Lake near Twin Lakes, VI-20-1962, D. Miletich, 1♂ (CMNH); **Williams**, Mud Lake Bog State Nature Preserve, VI-03-07-2001, J. B. Keiper, 1♂ (CIMNH).

Habitat: Marshes, marshy borders of lakes and ponds.

Phenology: Bi- or trivoltine. Flight period in Ohio occurs from early May to late July. Overwinters as pupa floating in shallow water or in shoreline litter.

Biology: Larvae prey on fingernail clams of the genera *Musculium*, *Pisidium*, and *Sphaerium* (Sphaeriidae) (Foote and Knutson, 1970; Foote 1976).

Immature Stages: None described.

48. *Renocera longipes* (Loew, 1876)

General Distribution: Nearctic. NB, NF, ONT, PQ; CT, MA, NH, OH, PA, WV.

Ohio Records (Figure 20L): **Portage**, 4.0 miles N Kent, VI-15-1963, B. A. Foote, 2♂ (CMNH); 4.5 miles E Kent, VI-18-1965, W. H. Robinson, 1♂ (CMNH); VI-23-1965, K. Valley, 2♂ (CMNH); 7.0 miles E Kent, VI-24-1963, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, swamps.

Phenology: Univoltine. Flight period in Ohio occurs from late May to Late June. Overwinters as pupa.

Biology: Larvae prey on fingernail clams (Foote, 1976).

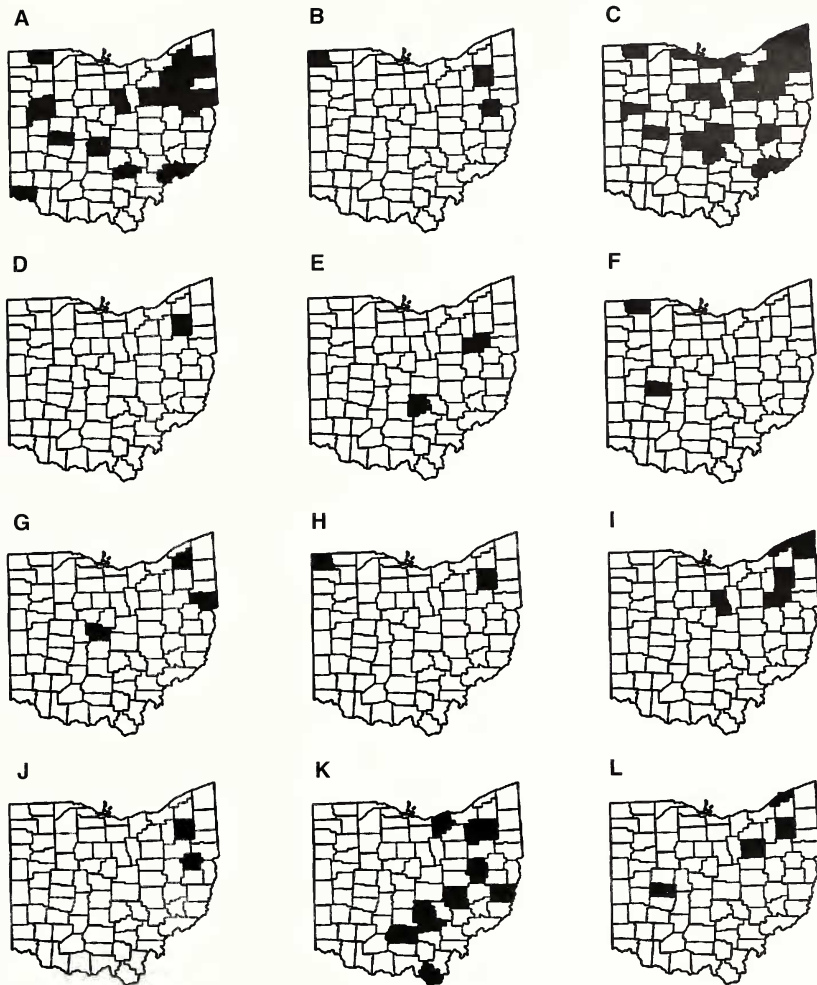


Figure 21. Distribution of Ohio Sciomyzidae. A, *Sepedon armipes*; B, *Sepedon borealis*; C, *Sepedon fuscipennis*; D, *Sepedon gracilicornis*; E, *Sepedon lignator*; F, *Sepedon neili*; G, *Sepedon pusilla*; H, *Sepedon spinipes americana*; I, *Sepedon tenuicornis*; J, *Tetanocera annae*; K, *Tetanocera clara*; L, *Tetanocera ferruginea*.

Immature Stages: None described.

49. *Sepedon arripes* Loew, 1859

General Distribution: Nearctic, Transcontinental, south to VA, OH, and northern Mexico (Knutson and Orth, 2001).

Ohio Records (Figure 21A): **Allen**, Spencerville, VII-18-2001, J. B. Keiper, 1♂ (CIMNH); **Ashtabula**, Pymatuning Reservoir near Simmons, VII-10-1962, D. Miletich, 1♂ (CMNH); **Auglaize**, near Lima, VII-18-2001, J. B. Keiper, 3♂ (CIMNH); **Carroll**, VII-27-1964, E. J. Allen, 2♂ (CMNH); **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 1♂ (CMNH); VII-12-1962, R. E. Woodruff, 1♂ (FSCA); VI-X-1964, J. L. Williams, 29 (OSU); **Columbiana**, Beaver Creek State Park, VI-16-1996, J. B. Keiper, 1♂ (CMNH); **Franklin**, Columbus, IV-19-1941, R. C. Osburn, 1♂ (OSU), IV-21, V-05, V-10-1899, J. S. Hine, 3♂ (OSU); VI-16-1936, A. Peterson, 3♂ (OSU); **Fulton**, Wauseon, VIII-25-1902, J. S. Hine, 1♀ (OSU); **Geauga**, Koelliker Fen, VIII-16-2001, J. B. Keiper, 1♂ (CIMNH); **Hamilton**, Cincinnati, VI, VIII-1974, W. Downing, 6♂, 7♀ (CMNH); **Hocking**, OSU Barneby Center, V-14-1983, 1♂ (OSU); Near Conkles Hollow State Park, VII-14-1998, 1♂ (OSU); **Portage**, 1.0 mile N Kent, V-14-1962, B. A. Foote, 1♂ (CMNH); 1.0 mile S Kent, VIII-07-1964, W. B. Stoltzfus, 1♂ (CMNH); 4.0 miles N Kent, X-04-1961, B. A. Foote, 1♂ (CMNH); 7.0 miles E Kent, V-07-1962, B. A. Foote, 1♂ (CMNH); 6.0 miles SE Kent, IX-02-1965, K. Valley, 1♂ (CMNH); Ravenna Arsenal, VII-12-1996, J. B. Keiper, 2♂ (CMNH); Streetsboro Bog, IX-26-1962, B. A. Foote, 1♂ (CMNH); 3.0 miles E Streetsboro, VII-19-1998, B. A. Foote, 1♂ (CMNH); **Richland**, Mansfield, swamp near Route 30/71, VII-18-2001, J. B. Keiper, 1♂ (CIMNH); 4.0 NE Plymouth, IX-08-65, J. A. Ferancak, 1♂ (CMNH); 4.0 miles W Plymouth, VIII-28-1965, K. Valley, 2♂ (CMNH); **Stark**, no locality given, VIII-18-1964, B. A. Foote, 1♂ (CMNH); **Summit**, Barberton, VIII-01-1996, J. B. Keiper, 1♂ (CMNH); alkaline area near Barberton, VIII-26-1997, J. B. Keiper, 1♂ (CMNH); **Washington**, Lake Veto Wildlife Area, VIII-05-1997, J. B. Keiper, 1♂ (CMNH); **Wayne**, Moreland, V-17-1959, V-17-1959, C. A. Triplehorn, 1♂, 1♀ (OSU).

Habitat: Marshes, marshy borders of ponds and lakes, drainage ditches, riparian areas.

Phenology: Multivoltine. Flight period in Ohio occurs throughout the year as adult overwinterers.

Biology: Larvae prey on pulmonate aquatic snails (Neff and Berg, 1966).

Immature Stages: E, L₁₋₃, P (Neff and Berg, 1966).

50. *Sepedon borealis* Steyskal, 1951

General Distribution: Transcontinental in Canada to AK, south to GA, west to CA (Knutson and Orth, 2001).

Ohio Records (Figure 21B): **Carroll**, Specht Marsh, VII-27-1964, E. J. Allen, 1♂ (CMNH); **Portage**, J. Arthur Herrick State Nature Preserve, VII-10-1986, B. A. Foote, 1♂ (CMNH); **Williams**, Mud Lake Bog State Nature Preserve, VI-03-07-2001, J. B. Keiper, 2♂ (CIMNH).

Habitat: Marshes, marshy borders of ponds and lakes, drainage ditches.

Phenology: Multivoltine. Flight period in Ohio is throughout the year, as this species overwinters as an adult.

Biology: Larvae prey on pulmonate aquatic snails (Neff and Berg, 1966).

Immature Stages: E, L₁₋₃, P (Neff and Berg, 1966).

51. *Sepedon fuscipennis* Loew, 1859

General Distribution: ON to AK, south to FL, TX, and WA (Knutson and Orth, 2001).

Ohio Records (Figure 21C): **Ashtabula**, Pymatuning Creek Fen, VI-18-2001, J. B. Keiper, 1♂, 1♀ (CIMNH); Pymatuning Reservoir near Simmons, VII-10-1962, D. Miletich, 1♀ (CMNH); Route 322, western area of county, VI-21-2001, J. B. Keiper, 4♀, 1♂ (CIMNH); **Auglaize**, Grand Lake St. Marys State Park, VII-18-2001, J. B. Keiper, 9♀ (CIMNH); **Champaign**, Cedar Swamp, IX-25-1963, VII-11-1964, J. L. Williams, 1♂, 1♀ (OSU); **Crawford**, Galion, VII (OSU); **Erie**, Sandusky, VI-15-1899, J. S. Hine, 1♂ (OSU); **Franklin**, Columbus, J. S. Hine, 2♂ (OSU); **Fulton**, Wauseon, VIII-24-1902, J. S. Hine, 2♀ (OSU); **Geauga**, Cuyahoga River at Route 422, VII-14-1979, 1♀ (OSU); South Newbury, XI-18-1934, RFK, 1♀ (CIMNH); **Guernsey**, 11.0 miles S Cambridge, VII-31-1964, E. J. Allen, 1♀ (CMNH); **Lake**, Mentor Marsh, VI-08-1981, V-30-1982, A. D. Hurny, 2♂, 3♀ (CIMNH); **Licking**, Newark, VIII-27-1899, R. C. Osburn, 1♂ (OSU); **Lorain**, Oakpoint west of Lorain, VIII-12-1961, D. Deonier, 1♂ (IASU); **Portage**, KSU campus, VII-16-1995, J. B. Keiper, 1♂ (CIMNH); 1.0 mile N Kent, V-14-1962, B. A. Foote, 1♀ (CMNH); 4.0 miles N Kent, V-16-1962, B. A. Foote, 1♂ (CMNH); 5.0 miles N Kent, X-25-1962, B. A. Foote, 3♂, 2♀ (CMNH); 6.0 miles SE Kent, IX-02-1962, K. Valley, 1♀ (CMNH); Wingfoot Lake, IX-08-1961, B. A. Foote, 1♂ (CMNH); Streetsboro Bog, IX-26-1962, B. A. Foote, 2♂ (CMNH); West Branch State Park, X-20-1994, J. B. Keiper, 1♀ (CIMNH); **Richland**, Mansfield, swamp near Route 30/71, VII-18-2001,

J. B. Keiper, 1♂, 11♀ (CIMNH); **Stark**, wetlands near Route 30/Trump Road junction, VI-20-2001, J. B. Keiper, 2♀; **Summit**, Akron, VI, J. S. Hine, 1♀ (OSU); **Hawkins**, VI-27-1902, J. S. Hine, 1♀ (OSU); **Sugar Grove**, V-17-1902, 1♂ (OSU); **Wayne**, Moreland, V-17-1959, C. A. Triplehorn, 3 (gender not recorded) (OSU).

Habitat: Marshes, fens, roadside ditches, swamps.

Phenology: Multivoltine. Flight period in Ohio is throughout the year as adults overwinter.

Biology: Larvae prey on pulmonate aquatic snails (Neff and Berg, 1966).

Immature Stages: E, L₁₋₃, P (Neff and Berg, 1966).

52. *Sepedon gracilicornis* Orth, 1986

General Distribution: Nearctic. ON, PQ; CT, IA, ME, MI, MN, NY, OH, PA.

Ohio Records (Figure 21D): **Portage**, 1.0 mile N Kent, V-24-1962, B. A. Foote, 1♂ (CMNH); 5.0 miles SE Kent, VII-04-1965, W. H. Robinson, 1♂, 1♀ (CMNH); 4.5 miles E Kent, VII-20-1967, B. A. Foote, 1♂ (CMNH); Dollar Lake near Twin Lakes, VIII-09-1962, D. Miletich, 1♂ (CMNH).

Habitat: Marshes, shrubby swamps.

Phenology: Multivoltine. Flight period in Ohio occurs throughout the year as adults overwinter.

Biology: Unknown.

Immature Stages: None described.

53. *Sepedon ligulator* Steyskal, 1951

General Distribution: Nearctic. AB, BC, NF, ONT; MT, NY, OH, WY.

Ohio Records (Figure 21E): **Fairfield**, Sugar Grove, V-17-1902, 2♂ (OSU); **Stark**, Stewart Bog, VIII-16-1964, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, fens, bogs.

Phenology: Multivoltine. Flight period in Ohio is probably throughout the year, as adults overwinter.

Biology: Larvae prey on pulmonate aquatic snails (Neff and Berg, 1966).

Immature Stages: None described.

54. *Sepedon neili* Steyskal, 1951

General Distribution: Nearctic. MB, PQ; GA, ID, MA, MI, MT, OH, UT.

Ohio Records (Figure 21F): **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 4 (CMNH); Cedar Swamp, VI-21-1964, B. A. Foote, 4♂ (CMNH); Cedar Swamp, VII-12-1962, R. E. Woodruff, 4♂ (FSCA); Cedar Swamp, VII-VIII-1964, R. L. Williams, 11♂ (OSU); **Fulton**, Wauseon, VIII-25-1902, J. S. Hine, 2♂ (OSU).

Habitat: Marshes, fens.

Phenology: Multivoltine. Flight period in Ohio is throughout

the year, as the adult overwinter.

Biology: Larvae prey on pulmonate aquatic snails (Neff and Berg, 1966).

Immature Stages: E, L₁₋₃, P (Neff and Berg, 1966).

55. *Sepedon pusilla* Loew, 1859

General Distribution: Nearctic. DC, GA, IN, MS, OH.

Ohio Records (Figure 21G): **Delaware**, Delaware, IV-23-1955, B. A. Foote, 1♂ (CMNH); **Geauga**, Koelliker Fen, VIII-16-2001, J. B. Keiper, 1♂ (CIMNH); **Columbiana**, Beaver Creek State Park, VI-16-1996, J. B. Keiper, 3♂ (CIMNH).

Habitat: Marshes, fens.

Phenology: Multivoltine. Occurs throughout the year as adult overwinter.

Biology: Larvae prey on pulmonate aquatic snails (Neff and Berg, 1966).

Immature Stages: E, L₁₋₃, P (Neff and Berg, 1966).

56. *Sepedon spinipes americana* Steyskal, 1951

General Distribution: Nearctic. NB to AK, south to OH, UT, and CA (Knutson and Orth, 2001).

Ohio Records (Figure 21H): **Portage**, 1.0 mile N Kent, V-24-1962, B. A. Foote, 1♀ (CMNH); 4.5 miles E Kent, VII-20-1967, D. Trelka, 1♂ (CMNH); Dollar Lake near Twin Lakes, VI-20-1962, D. Miletich, 1♂ (CMNH); Dollar Lake near Twin Lakes, VII-20-1967, D. Trelka, 1♂ (CMNH); **Williams**, Mud Lake Bog State Nature Preserve, VI-03-07-2001, J. B. Keiper, 1♂ (CIMNH).

Habitat: Marshes.

Phenology: Multivoltine. Occurs throughout the year as adults overwinter.

Biology: Larvae prey on pulmonate aquatic snails (Neff and Berg, 1966).

Immature Stages: E, L₁₋₃, P (Neff and Berg, 1966).

57. *Sepedon tenuicornis* Cresson, 1920

General Distribution: Nearctic. ONT, PQ; ME, MN, MT, NE, OH, PA, SC, TX.

Ohio Records (Figure 21I): **Ashtabula**, Pymatuning Creek Fen, VI-18-2001, J. B. Keiper, 1♂, 8♀ (CIMNH); **Lake**, Mentor Marsh, VI-08-1961, B. A. Foote, 1♂ (CMNH); **Portage**, 1.0 mile N Kent, V-14-1962, B. A. Foote, 3♂ (CMNH); 4.0 miles E Kent, V-16-1962, B. A. Foote, 1♂ (CMNH); 5.0 miles S Kent, V-25-1962, 1♂ (CMNH); 5.0 miles SE Kent, VII-04-1965, W. H. Robinson, 2♂ (CMNH); Streetsboro Bog, VI-17-1964, E. J. Allen, 1♂ (CMNH); **Richland**, Mansfield, swamp near Route 30/71, J. B. Keiper, 2♂, 2♀ (CIMNH); **Stark**, Jackson Bog, IV-09-2001, R. Schriff, 1♂ (CIMNH).

Habitat: Marshes, fens.

Phenology: Multivoltine. Flight period in Ohio is throughout

year as adults overwinter.

Biology: Larvae prey on pulmonate aquatic snails (Neff and Berg, 1966).

Immature Stages: E, L₁₋₃, P (Neff and Berg, 1966).

58. *Tetanocera annae* Steyskal, 1938

General Distribution: ON to BC, south to CT, OH, and WI.

Ohio Records (Figure 21J): **Carroll**, Specht Marsh, VI-21, VII-27-1964, E. J. Allen, 1♂ 1♀ (CMNH); **Portage**, 4.5 miles E Kent, V-10, VI-01-1968, B. A. Foote, 2♂ (CMNH); 5.0 miles SE Kent, VI-23-1954, E. J. Allen, 1♂ (CMNH); 6.0 miles SE Kent, X-01-1965, B. A. Foote, 1♂ (CMNH); Mogadore Reservoir, IV-17-1992, B. A. Foote, 1♂, 1♀ reared from floating puparium (CMNH); Ravena Arsenal, VIII-12-1996, J. B. Keiper, 1♂, 1♀ (CIMNH); Streetsboro Bog, III-27-1962, B. A. Foote, 1♀ reared from floating puparium (CMNH).

Habitat: Buttonbush swamps, floodplain swamps.

Phenology: Univoltine. Flight period in Ohio is from early May to early October. Overwinters as pupa in floating puparium.

Biology: Larvae prey on pulmonate aquatic snails (Foote, 1999).

Immature Stages: E, L₁₋₃, P (Foote, 1961b).

59. *Tetanocera clara* Loew, 1862

General Distribution: Nearctic. ON to PQ, south to GA, TN and IL.

Ohio Records (Figure 21K): **Belmont**, Bethesda, VI-15-1975, B. A. Foote, 2♀ (CMNH); **Fairfield**, no date/locality data given, 1♂ (OSU); **Hocking**, near Conkles Hollow State Park, VII-14-1998, J. B. Keiper, 1♂ (CMNH); **Lawrence**, Sharpes in Wayne National Forest, IX-10-1995, 1♂ (CMNH); **Lorain**, Amherst (Steyskal, 1959); **Muskingum**, Blue Rock State Forest, VII-14-1995, J. B. Keiper, 3♂ (CMNH); **Portage**, 4.5 miles E Kent, VI-25, VIII-15-1967, D. Trelka, 2♂ (CMNH); 7.0 miles E Kent, VI-24, VII-13, VIII-26-1964, E. J. Allen, 3♂ (CMNH); 7.0 miles N Kent, VII-10-1963, B. A. Foote, 2♀ (CMNH); **Ross**, no date/locality given, 1♂ (OSU); **Summit**, N. Cuyahoga Falls, VI-04-1967, G. Piper, 1♂ (CMNH), 1.0 mile N Peninsula, IX-03-1969, 1♀ (CMNH); **Tuscarawas**, 6.0 miles N Dover, VI-03-1968, W. B. Garnett, 1♂, 1♀ (CMNH).

Habitat: Floodplain forests, mesic forests.

Phenology: Multivoltine. Flight period in Ohio from occurs early June to early September. Overwinters as pupa in leaf litter.

Biology: Predator/parasitoid of the slug genera *Pallifera* and *Phylomyces* (Trelka and Foote, 1970).

Immature Stages: E, P (Foote, 1961b).

60. *Tetanocera ferruginea* Fallén, 1820

General Distribution: Holarctic. NF to AK, south to NJ, OH, and CA.

Ohio Records (Figure 21L): **Champaign**, Cedar Swamp, IX-15-1964, J. L. Williams, 1♀ (OSU); **Lake**, Mentor Marsh, VIII-04-1981, no collector given, 1♀ (CIMNH); **Portage**, Kent, VII-22-1965, W. H. Robinson, 5♂ (CMNH); 1.0 mile N Kent, III-26-1962, L. V. Knutson, 1♂ reared from floating puparium (CMNH); 1.0 mile N Kent, IX-07-1962, B. A. Foote, 1♂ (CMNH); 4.5 miles E Kent, V-12-1967, K. Valley, 1♂ (CMNH); 4.5 miles E Kent, VII-30-1967, B. A. Foote 1♂ (CMNH); 7.0 miles E Kent, V-15-1962, B. A. Foote, 2♂ (CMNH); 5.0 miles S Kent, V-25-1956, B. A. Foote, 2♂, 2♀ (CMNH); 6.0 miles SE Kent, IX-2, 6-1965, K. Valley, 3♂ (CMNH); 4.0 miles NW Kent, VI-15-1962, D. Miletich, 1♀ (CMNH); Mogadore Reservoir, IV-17-1962, B. A. Foote, 2♂ reared from floating puparia (CMNH); Streetsboro Bog, VIII-05-1964, R. C. McConnell, 1♂ (CMNH); Streetsboro Bog, IX-26-1962, B. A. Foote, 4♂, 2♀ (CMNH); **Wayne**, 0.5 mile S Rittman, IX-09-1969, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, ponds, swamps.

Phenology: Multivoltine. Flight period in Ohio occurs from mid-April to late September. Overwinters as pupa in floating puparium.

Biology: Larvae prey on pulmonate aquatic snails (Foote, 1999).

Immature Stages: E, L₁₋₃, P (Foote, 1961b); L₃, P (Rozkošný, 1965, 1967).

61. *Tetanocera fuscinervis* (Zetterstedt, 1838)

General Distribution: Holarctic. NF to AK, south to CT, OH, and AZ.

Ohio Records (Figure 22A): **Ashtabula**, near Ashtabula/Geauga border at Route 322, VI-07-2002, 1♂ (CIMNH); **Portage**, Kent, VI-05-1967, D. Trelka, 1♂ (CMNH); 4.5 miles E Kent, III-16-1966, B. A. Foote, 7♂, 3♀ reared from floating puparia (CMNH); 4.5 miles E Kent, IV-22-1964, B. A. Foote, 1♀ reared from floating puparium (CMNH); 4.5 miles E Kent, V-30-1964, E. J. Allen, 2♂, 1♀ (CMNH); 4.5 miles E Kent, VI-5, VII-08, VIII-04, VIII-14-1967, D. Trelka, 3♂, 2♀ (CMNH); Herrick Fen, VI-16-1985, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, fens.

Phenology: Multivoltine. Flight period in Ohio occurs from late May to mid-August. Overwinters as pupa in floating puparium.

Biology: Larvae prey on pulmonate shoreline or stranded aquatic snails (Beaver, 1972; Foote, 1996a).

Immature Stages: E, L₁₋₃, P (Foote, 1961b, as *T. unicolor* Loew; Rozkošný, 1967).

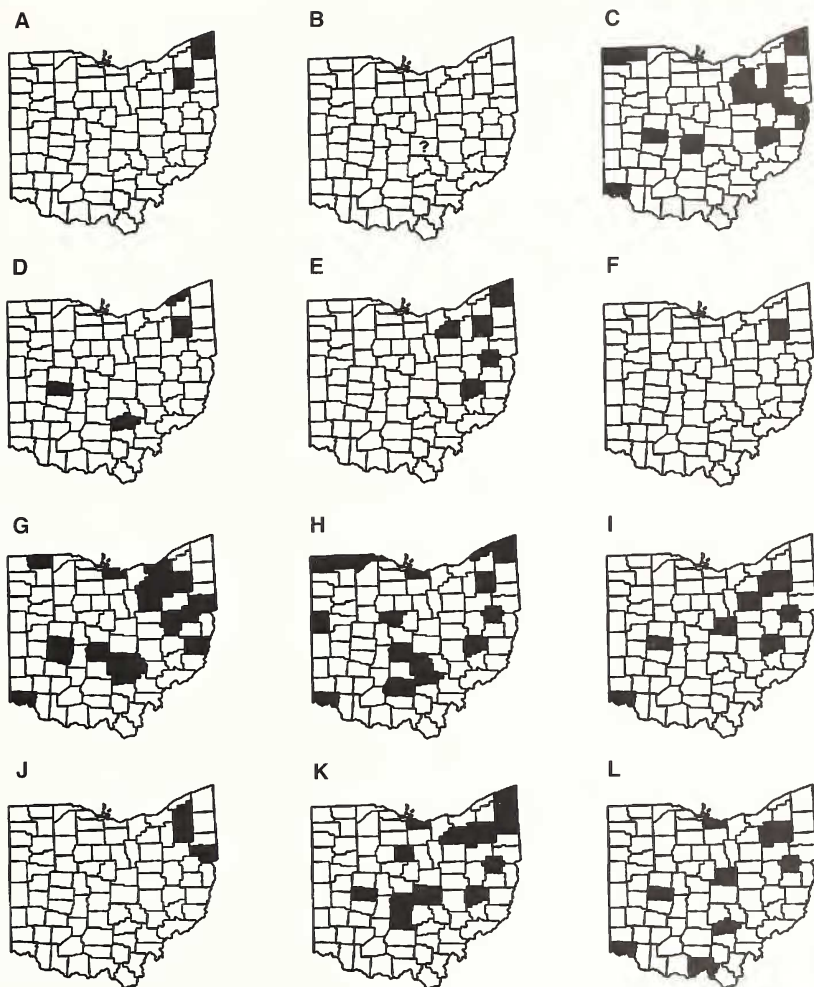


Figure 22. Distribution of Ohio Sciomyzidae. A, *Tetanocera fuscinervis*; B, *Tetanocera iowensis*; C, *Tetanocera loewi*; D, *Tetanocera melanostigma*; E, *Tetanocera montana*; F *Tetanocera oxia*; G, *Tetanocera plebeja*; H, *Tetanocera plumosa*; I, *Tetanocera rotundicornis*; J, *Tetanocera valida*; K, *Tetanocera vicina*; L, *Trypetoptera canadensis*.

62. *Tetanocera iowensis* Steyskal, 1938

General Distribution: Nearctic. IA, MO, OH.

Ohio Records (Figure 22B): (Steyskal, 1959; no specific locality given).

Habitat: Unknown.

Phenology: Unknown.

Biology: Unknown.

Immature Stages: None described.

63. *Tetanocera loewi* Steyskal, 1959

General Distribution: Nearctic: ON to BC, south to KY, CO, and CA.

Ohio Records (Figure 22C): **Ashtabula**, Ashtabula, no date/locality data given, 1♀ (OSU); Pymatuning Creek Fen, VI-21-2001, J. B. Keiper, 1♀ (CIMNH); **Carroll**, Specht Marsh, VII-19-1964, R. E. McConnell, 5 (CMNH), Specht Marsh, VII-27-1964, E. J. Allen, 13 (CMNH); **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 1♂ (CMNH); Cedar Swamp, VII-11, VIII-4-1964, J. L. Williams, 3♂ (OSU); **Crawford**, Galion, VI, no collector recorded, 1♀ (OSU) **Franklin**, Columbus, J. S. Hine, 1♂, 3♀ (OSU); **Guernsey**, 11.0 miles S Cambridge, IV-04-1965, E. J. Allen, 5 (CMNH); **Hamilton**, Cincinnati, VI-21-1974, W. Downing, 1♀ (CMNH); **Jefferson**, VIII-1908, R. Sim, 1♀ (OSU); **Medina**, 3.0 miles W Wadsworth, VIII-06-1964, E. J. Allen, 3 (CMNH); **Portage**, Kent, VII-13-1965, W. H. Robinson, 1♀ (CMNH); 1.0 mile N Kent, VII-02-1964, E. J. Allen, 1♀ (CMNH); 2.0 miles N Kent, IX-07-1962, B. A. Foote, 2♂ (CMNH); 4.0 miles N Kent, VI-15-1963, B. A. Foote, 8 (CMNH); 4.5 miles E Kent, VI-29, VIII-27-1964, E. J. Allen, 1♂, 1♀ (CMNH); 6.0 miles E Kent, VII-09-1967, J. Novak, 1♂ (CMNH); Lake Hodgson, VI-20-1996, J. B. Keiper, 1♂, 1♀ (CIMNH); Streetsboro Bog, IX-26-1962, B. A. Foote, 2♂, 1♀ (CMNH); Dollar Lake near Twin Lakes, VI-20-1962, D. Miletich, 1♂ (CMNH); **Stark**, VIII-16-1964, B. A. Foote, 2♂ (CMNH); **Wayne**, Wooster, VIII-19-1907, 1♂ (OSU); **Williams**, Dehnis Swamp in Florence Township, VI-11, IX-09-1950, H. E. Price, 3♀ (OSU).

Habitat: Marshes, fens, ponds, swamps.

Phenology: Univoltine. Flight period in Ohio occurs from early April to late September. Overwinters as unhatched first instar within egg.

Biology: Larvae prey on pulmonate aquatic snails (Foote, 1999).

Immature Stages: E, L₁₋₃, P (Foote, 1961b).

64. *Tetanocera melanostigma* Steyskal, 1959

General Distribution: Nearctic. NF to SK, south to CT, IL, and CO.

Ohio Records (Figure 22D): **Champaign**, Cedar Swamp, V-31-1961, R. E. Woodruff, (FSCA); **Hocking**, "Neotoma," VI-10-1958, C. A. Triplehorn, 1♀ (OSU); no locality given, VI-08-1956, F. W. Mead, 2♂, 2♀ (FSCA); **Lake**, Mentor Marsh, A. D. Huryn, 3♂ (CMNH); **Portage**, 1.0 mile E Kent, VI-25-1998, B. A. Foote, 1♂ (CMNH), Towners Woods, VI-01-1996, B. A. Foote, 1♂ (CMNH).

Habitat: Marshes, moist forests.

Phenology: Multivoltine. Flight period in Ohio occurs from late May to late June. Overwinters as pupa in puparium in leaf litter.

Biology: Larvae are predators/parasitoids of land snails belonging to the genus *Succinea* (Foote, 1996b).

Immature Stages: E, L₁₋₃, P (Foote, 1961b).

65. *Tetanocera montana* Day, 1881

General Distribution: Holarctic; ON to AK, south to NY, OH, and WY.

Ohio Records (Figure 22E): **Ashtabula**, Pymatuning Creek Wetland, V-27-1997, B. A. Foote, 1♂ (CMNH); **Carroll**, Specht Marsh, VI-28-1964, E. J. Allen, 1♂ (CMNH); **Guernsey**, 11.0 miles S Cambridge, VII-31-1964, R. C. McConnell, 1♂ (CMNH); **Medina**, 3.0 miles W Wadsworth, VIII-06-1964, E. J. Allen, 1♂ (CMNH); **Portage**, 3.0 miles W Kent, VII-21-1965, B. A. Foote, 1♂ (CMNH).

Habitat: Woodland ponds, swamps, marshes.

Phenology: Univoltine. Flight period in Ohio occurs from late May to early August. Overwinters as first instar within egg membranes or as young larvae.

Biology: Larvae prey on pulmonate aquatic snails (Foote, 1999).

Immature Stages: E, L₁₋₃, P (Foote, 1961b).

66. *Tetanocera oxia* Steyskal, 1959

General Distribution: Nearctic. AB, BC, MB, NF, SK; CO, CT, MI, MN, NT, NY, OH, WY.

Ohio Records (Figure 22F): **Portage**, Kent, VIII-02-1967, D. Trella, 1♂ (CMNH); 4.5 miles E Kent, VI-01-1968, B. A. Foote, 1♂ (CMNH); 7.0 miles E Kent, IV-20-1964, E. J. Allen, 1♂ reared from puparium (CMNH).

Habitat: Marshes.

Phenology: Multivoltine. Flight period in Ohio occurs from late April to early August. Overwinters as pupa.

Biology: Larvae are parasitoids or predators of land snails belonging to the genus *Catinella* (Foote, 1996b).

Immature Stages: P (Foote, 1961b).

67. *Tetanocera plebeja* Loew, 1862

General Distribution: Nearctic. Transcontinental to AK, south to CT, AZ, and CA.

Ohio Records (Figure 22G): **Belmont**, Bethesda, V-25-1974,

B. A. Foote, 1♂ (CMNH); VI-25-1975. B. A. Foote, 1♂ (CMNH); **Carroll**, Specht Marsh, VII-19-1964, R. E. McConnell, 1♂ (CMNH); **Champaign**, Cedar Swamp, V-31-1961, R. E. Woodruff, 1♂ (FSCA); VII-07-1962, R. E. Woodruff, 1♂ (FSCA); **Columbiana**, Beaver Creek State Park, VII-08-1996, J. B. Keiper, 1♂ (CMNH); **Cuyahoga**, Bedford, VII-02-1923, J. C. Pallister, 1♀ (CMNH); **Erie**, Sandusky, no date given, 1♂ (OSU); **Fairfield**, no further data given, 1♂ (Steyskal, 1959); **Franklin**, Columbus, no date given, 1♂ (OSU); **Fulton**, Wauseon, IX-05-1930, J. S. Hine, 1♀ (OSU); **Hamilton**, Cincinnati, VIII-10, IX-04-1974, W. Downing, 1♂, 1♀ (CMNH); **Hocking**, "Neotoma," VI-10-1958, C. A. Triplehorn, 1♀ (OSU); no date, locality, or collector given, 1♂ (OSU); **Logan**, no locality given, VII-14-1930, J. Patton, 1♂ (UMN); **Medina**, 2.0 miles W Wadsworth, VIII-01-1964, W. B. Stoltzfus, 1♂ (CMNH); 3.0 miles W Wadsworth, VIII-06-1964, W. B. Stoltzfus, 2♂ (CMNH); 6.0 miles S Wadsworth, VI-27, 1964, W. B. Stoltzfus, 1♂ (CMNH); **Perry**, no further data given (Steyskal, 1959); **Portage**, 1.0 mile N Kent, VII-08-1964, W. B. Stoltzfus, 1♂ (CMNH); 3.0 miles N Kent, VIII-05-1964, E. J. Allen, 1♂ (CMNH); 5.0 miles S Kent, VI-22-1964, E. J. Allen, 1♂ (CMNH); 5.0 miles SE Kent, VIII-31-1964, E. J. Allen, 1♂ (CMNH); 15 miles N Kent, VI-15-1964, E. J. Allen, 1♂ (CMNH); 16 miles NE Kent, VI-25-1964, E. J. Allen, 1♂ (CMNH); 4.5 miles E Kent, III-16-1966, B. A. Foote, 5 adults reared from floating puparia (CMNH); Streetsboro Bog, VII-10-1964, B. A. Foote, 1♂ (CMNH); **Summit**, Ira, no further data given, J. S. Hine, 1♂ (OSU); Twinsburg, VI-10-1931, no collector given, 2♂ (CMNH); **Tuscarawas**, 6.0 miles N Dover, VI-03-1968, W. B. Garnett, 3♂ (CMNH); **Wayne**, Wooster, VI-02-1951, no collector given, 1♂ taken at light (OSU); Browns Lake Bog near Shreve, VI-21-1959, C. A. Triplehorn, 1♀ (OSU).

Habitat: Marshes, fens, swamps, foodplain forests, mesic forests, old fields.

Phenology: Multivoltine. Flight period in Ohio occurs from late May to mid-September. Overwinters as pupa in leaf litter.

Biology: Larvae are parasitoids or predators of the slug *Deroceras laeve* (Müller) (Trelka and Foote, 1970; Trelka and Berg, 1977).

Immature Stages: E, L₁, P (Foote, 1961b), E, L₁₋₃, P (Trelka and Foote, 1977).

68. *Tetanocera plumosa* Loew, 1847

General Distribution: Nearctic; transcontinental, south to

NC, TX and northern MEX.

Ohio Records (Figure 22H): **Ashtabula**, near Ashtabula/Gaugauga border at Route 322, VI-07-2002, J. B. Keiper, 1♂ (CMNH); **Ashtabula**, no date or collector given, 1♀ (OSU); **Carroll**, 3.0 miles E Carrollton, VII-17-1964, R. E. McConnell, 2♂ (CMNH); **Specht Marsh**, VII-19-1964, R. E. McConnell, 5 (CMNH); **Erie**, Sandusky, VII-1914, J. S. Hine, 1♀ (OSU); **Franklin**, Blendon Woods Metro Park, VI-07-1961, F. W. Mead, 1♂ (FSCA); **Fulton**, Wauseon, J. S. Hine, VIII-25-1902, IX-05-1903, 1♂, 1♀ (OSU); **Guernsey**, 11.0 miles S Cambridge, IV-04-1965, E. J. Allen, 7 (CMNH); **Hamilton**, Cincinnati, IX-04-1974, W. Downing, 1♂ (CMNH); **Hocking**, no locality given, V-25-1930, 3♂ (OSU); **Lake**, Holden Arboretum, VII-10-1996, B. A. Foote, 1♂ (CMNH); **Lucas**, 6.0 miles W Toledo, VIII-20-1938, I. J. Cantrall, 1♂ (FSCA); **Marion**, Marion, VI-13-1941, R. C. Osburn, 1♂ (OSU); **Portage**, Kent, VII-13-1965, W. H. Robinson, 1♂ (CMNH); Dollar Lake near Twin Lakes, VI-20-1962, D. Miletich, 1♀ (CMNH); 1.0 mile N Kent, IX-07-1962, B. A. Foote, 1♂ (CMNH); 3.0 miles N Kent, VIII-05-1965, B. A. Foote, 1♂ (CMNH); 4.0 miles N Kent, VI-15-1962, D. Miletich, 1♂ (CMNH); Ravenna, VI-22-1964, E. J. Allen 1 third-instar larva (CMNH); West Branch State Park, VII-03-1993, B. A. Foote, 1♂ (CMNH); **Ross**, no further data (Steyskal, 1959); **Washington**, Marietta, no further data given (Steyskal, 1959); **Williams**, no further data (Steyskal, 1959).

Habitat: Marshes, fens, swamps, roadside ditches.

Phenology: Univoltine. Flight period in Ohio occurs from early April to early September. Overwinters as third instar.

Biology: Larvae prey on shoreline and aquatic pulmonate snails (Foote, 1961, as *T. nanciae* Steyskal).

Immature Stages: E, L₁₋₃, P (Foote, 1961b, as *T. nanciae*).

69. *Tetanocera rotundicornis* Loew, 1861

General Distribution: Nearctic. Transcontinental, south to NC, TN, and UT.

Ohio Records (Figure 22I): **Carroll**, Specht Marsh, VII-19-1964, R. E. McConnell, 1♂ (CMNH); **Specht Marsh**, VII-27-1964, E. J. Allen, 2♀ (CMNH); **Champaign**, Cedar Swamp, V-31-1954, R. E. Woodruff, 1♂ (FSCA); **Guernsey**, 11.0 miles S Cambridge, IV-04-1965, E. J. Allen, 7 (CMNH); **Hamilton**, Cincinnati, IX-04-1974, W. Downing, 1♂ (CMNH); **Knox**, Danville, VI-09-1899, 1♂, 1♀ (OSU); **Portage**, 1.0 mile N Kent, VI-01-1963, B. A. Foote, 1♀ (CMNH); 4.0 miles NW Kent, VI-15-1962, D. Miletich, 1♀ (CMNH); 4.5 miles E Kent,

VII-02-1963, VII-21-1965, B. A. Foote, 3 (CMNH); Dollar Lake near Twin Lakes, IV-30-1963, B. A. Foote, 1♂ (CMNH); **Summit**, Akron, VI-1916, J. S. Hine, 1♂ (OSU); **Wayne**, Wooster, VI-12-1959, C. A. Triplehorn, 1♂, 1♀ (OSU).

Habitat: Marshes, fens, moist fields, drainage ditches.

Phenology: Multivoltine. Flight period in Ohio occurs from late April to mid-July. Overwinters as pupa.

Biology: Larvae are parasitoids or predators of land snails of the genus *Oxyloma* (Berg, 1953; Foote, 1996b).

Immature Stages: E, L₁₋₂, P (Foote, 1961b).

70. *Tetanoecera valida* Loew, 1862

General Distribution: Nearctic. NF to BC, south to CT, IL, and CO.

Ohio Records (Figure 22J): **Columbiana**, Beaver Creek State Park, VII-10-1996, J. B. Keiper, 1♂ (CMNH); **Portage**, Kent, V-28-1967, D. Trelka, 1♂ (CMNH); 4.5 miles E Kent, VI-17-1965, B. A. Foote, 1♂ (CMNH); 4.5 miles E Kent, VIII-10, 29-1967, D. Trelka, 2♂ (CMNH); 4.5 miles E Kent, IX-15-1966, R. Miller, 1♂ (CMNH); 6.0 miles E Kent, VII-10-1963, B. A. Foote, 1♀ (CMNH); 7.0 miles E Kent, VII-02-1962, B. A. Foote, 6♂, 9♀ (CMNH); Streetsboro Bog, VII-08-1964, R. V. McConnell, 1♂ (CMNH); **Geauga**, Fern Lake Bog, VII-07-2002, E. Chapman, 1♂ (BAF).

Habitat: Swamps, floodplain forests, mesic forests, shrubby marshes.

Phenology: Multivoltine. Flight period in Ohio occurs from late May to mid-September. Overwinters as pupa in litter.

Biology: Larvae are parasitoids or predators of the slug *D. laeve* (Trelka and Foote, 1970).

Immature Stages: E, L₁ (Foote, 1961b).

71. *Tetanoecera vicina* Macquart, 1843

General Distribution: Nearctic. NF to BC, south to NC, NM, and CA.

Ohio Records (Figure 22K): **Ashtabula**, Fall, 1921, J. S. Hine, 1♀ (OSU); **Champaign**, Cedar Swamp, VI-17-1961, B. A. Foote, 2♂, 1♀ (CMNH); Cedar Swamp, VII-11, VIII-04, X-08-1963, J. L. Williams, 3♂ (OSU); **Carroll**, Specht Marsh, VII-19-64, R. C. McConnell, 1♂ (CMNH); **Crawford**, Galion, VI, no collector given, 1♂ (OSU); **Erie**, Sandusky, VI-15-1924, no collector given, 1♂ (OSU); **Franklin**, Columbus, no date/locality data given, 1♂ (OSU); **Guernsey**, 11.0 miles S Cambridge, IV-04-1965, E. J. Allen, 1♂ (CMNH); **Licking**, Newark, no collector given, 2♂ (OSU); **Medina**, no date/locality data given, 1♀ (OSU); **Pickaway**, no further data given (Steyskal, 1959); **Portage**, Aurora, VIII-24-1923, J. C. Pallister, 1♀ (CIMNH); Kent, VIII-30-1967, D.

Trelka, 1♂ (CMNH); 4.5 miles E Kent, III-16-1966, B. A. Foote, 1 third instar (CMNH); 8.0 miles SE Kent, VI-11-1964, E. J. Allen, 1♂ (CMNH); 4.5 miles E Kent, VIII-29-1967, D. Trelka, 1♀ (CMNH); 4.0 miles NW Kent, VI-15-1962, D. Miletich, 2♂, 1♀ (CMNH); 7.0 miles N Kent, VII-09-1963, B. A. Foote, 1♂ (CMNH); 16.0 miles NE Kent, VI-25-1964, E. J. Allen, 1♂ (CMNH); **Summit**, Cuyahoga Falls, no further data given (Steyskal, 1959); Cuyahoga Valley National Park (then Cuyahoga Valley National Recreation Area), VII-02-1998, B. A. Foote, 1♂ (CMNH); **Wayne**, 2.0 miles NE Wadsworth, VI-30-1964, W. B. Stoltzfus, 1♂ (CMNH).

Habitat: Marshes, fens, roadside ditches, swamps.

Phenology: Univoltine. Flight period in Ohio from early April to late September. Overwinters as larva.

Biology: Larvae prey on pulmonate aquatic snails (Foote, 1999).

Immature Stages: E, L₁₋₃, P (Foote, 1961b).

72. *Trypoptera canadensis* (Macquart, 1843)

General Distribution: Nearctic. ON to BC, south to NC, CO, and NM.

Ohio Records (Figure 22L): **Carroll**, 3.0 miles E Carrollton, VII-17-1964, R. E. McConnell, 1♀ (CMNH); Specht Marsh, VII-17-1964, E. J. Allen, 1♀ (CMNH); **Champaign**, VI-17-1961, B. A. Foote, 2♀ (CMNH); **Erie**, Cedar Point near Sandusky, V-30-1903, J. S. Hine, 2♀ (OSU); **Hamilton**, Cincinnati, VI-13-1902, J. S. Hine, 4♀ (OSU); **Hocking**, "Neotoma," VI-10-1958, C. A. Triplehorn, 2♀ (OSU); 7.0 miles S Lancaster, VI-04-1977, L. E. Watrous, 2♂, 1♀ (OSU); no locality given, VI-02-1957, F. W. Mead, 2♂ (FSCA); **Knox**, Danville, V-19-1899, J. S. Hine, 1♀ (OSU); **Scioto**, no locality given, VI-09-1945, D. J. and J. N. Knull, 1♂ (OSU); **Summit**, Ira, no date given, J. S. Hine, 1♀ (OSU).

Habitat: Floodplain forests, mesic forests, marshes, fens.

Phenology: Voltinism unknown. Flight period in Ohio occurs from late May to late July. Overwintering habits unknown.

Biology: Largely unknown. Preliminary data show that larvae prey on small pulmonate land snails (B. A. Foote, unpublished data).

Immature Stages: None described.

Discussion

Of the 21 genera of snail-killing flies found in the Nearctic region (Knutson, 1987), only *Sepedomeris* (Steyskal, 1973) (one species, *S. macropus* (Walker, 1849)) is not found in the Ohio region. This species has a southerly distribution and is more prominent in areas south of North America (Knutson et al., 1986, p. 28).

Over 200 species of Sciomyzidae from nearly all of the major biogeographic realms of the world have now been reared (Berg and Knutson, 1978; Knutson, 1987; B. A. Foote, unpublished data). Nearly all have larvae that prey exclusively on members of the molluscan classes Gastropoda and Pelecyopoda, and a considerable amount of adaptive radiation with respect to larval food preference has occurred. Fifteen feeding guilds (behavioral groups) have been recognized recently in the world fauna (Knutson and Vala, 2002), and nine of these feeding guilds can be recognized in the 72 species occurring in Ohio. These guilds are briefly described below:

Predators/parasitoids or saprophages of dead, moribund, or living snails on damp surfaces

A single Ohio species (1.4 percent of Ohio species), *Atrichomelina pubera*, belongs to this feeding guild. Feeding habits within this guild vary from being truly saprophagous on dead and decaying snails to active predation on actively moving snails occurring on moist surfaces. The feeding habits of *A. pubera* appear to be exclusively scavenging.

Parasitoids of aestivating aquatic snails on exposed surfaces

This is a very small guild of highly specialized sciomyzids that are intimately associated with aestivating pulmonate aquatic snails in wetland habitats. Eggs are placed directly on the shell of the host snail, and the entire larval life is usually spent within one host. Only *Sciomyza varia* (1.4 percent of Ohio species), a parasitoid of lymnaeid snails, belongs to this guild in Ohio.

Parasitoids of amber snails of the family Succineidae

The habit of utilizing wetland and terrestrial snails of the family Succineidae in a more parasitoid manner is not well developed in the Sciomyzidae, and only a few North American species fall into this category. The relationship with the food snail is much more intimate than it is with the terrestrial predators. Adult females usually deposit eggs only on or very close to the larval host, and each larva commonly completes its entire life within one snail. In Ohio, this guild is composed of *Pherbellia schoenherri maculata*, *Sciomyza aristalis*, *Tetanocera melanosigma*, *T. oxia*, and *T. rotundicornis* (6.9 percent of Ohio species).

Predators of snail eggs

Only three Ohio species of *Antichaeta* are known to have larvae that prey on snail eggs. Female flies lay their eggs directly on gelatinous egg masses, and the newly hatched larvae begin attacking the enclosed eggs. Older larvae frequently move from one egg mass to another. Puparia are formed on soil away from the egg masses. In Ohio, *Antichaeta borealis*, *A. fulva*, and *A. melanosoma* belong to this guild (4.2 percent of Ohio species).

Parasitoids of pulmonate terrestrial snails

A small group of the North American sciomyzid species occurs in terrestrial habitats where their larvae attack land snails. Females of species belonging to this guild lay eggs on low vegetation or surface litter in habitats harboring food snails. Younger larvae typically feed singly within one host for several days to a week or more, but then abandon the snail after killing it and seek out additional prey. Usually two to five gastropods satisfy the nutritional needs of each larva. Pupation usually occurs in surface litter. Only three Ohio species are known to compose this guild: *Oidematops ferrugineus*, *Pherbellia albovarva*, and *Pteromicra steyskali* (4.2 percent of Ohio species).

Predators of pulmonate terrestrial snails

Larvae of the single Ohio species (1.4 percent) having this feeding habit, *Trypetoptera canadensis*, appear to feed in a more predacious manner on small land snails. Preliminary observations show that newly hatched larvae remain with their prey for extended periods of time, but older larvae become more predacious and attack a number of snails before completing larval life (B. A. Foote, unpublished data).

Parasitoids/predators of slugs

Three (4.2 percent) Ohio species feed on slugs. Larvae of *T. plebeja* and *T. valida* prey on slugs belonging to the genus *Deroceras*, whereas those of *T. clara* attack slugs of the genera *Pullifera* and *Philomycus*.

Predators of aquatic snails

The aquatic predators form a distinctive group of species having larvae that attack pulmonate snails of the families Lymnaeidae, Physidae, and Planorbidae. Larvae of the Ohio species in this guild are not fully aquatic, because they usually remain in contact with the water surface and breathe atmospheric air. In general, they prey on aquatic snails that glide along the under side of the surface film. The larvae seemingly are nonselective in their choice of prey species except that they seem unable to attack operculate snails. Each larva can kill between 10 and 35 snails depending on the size of prey available. Younger larvae are restricted to prey measuring only a few mm in size, but older larvae can overcome snails measuring 10–20 mm in greatest diameter. The following 25 species (34.7 percent) of Ohio Sciomyzidae are known to be predators of aquatic snails: *Dicyra atlantica*, *D. borealis*, *D. expansa*, *D. hudsonica*, *D. pictipes*, *D. sabroskyi*, *D. steyskali*, *D. stricta*, *D. texensis*, *Elgiva sollicita*, *Sepedon arnipes*, *S. borealis*, *S. fuscipennis*, *S. gracilicornis*, *S. liguator*, *S. neili*, *S. pusilla*, *S. spinipes americana*, *S. tenticornis*, *Tetanocera amae*, *T. ferruginea*, *T. loewi*, *T. montana*, *T. plumosa*, and *T. vicina*.

Predators of fingernail clams

Among the North American Sciomyzidae, only larvae of species of *Renocera* are known to prey on fingernail clams of the family Sphaeriidae. Eggs are laid on shoreline vegetation and litter. In contrast to nearly all other aquatic Sciomyzidae, newly hatched larvae of *Renocera* leave the surface film and seek out completely submerged prey. The first instar usually remains within the mantle cavity of a clam for 4–6 days before killing it. Older larvae are more predacious and can kill up to 25 prey before pupating. In Ohio, *Renocera unananda*, *R. brevis*, and *R. longipes* belong to this trophic guild (4.2 percent of Ohio species).

Little to nothing is known of the life histories, larval feeding habits, and immature stages of 13 species of Ohio Sciomyzidae: *Pherbellia luctifera*, all 11 species of *Limnia*, *Tetanocera iowensis*, and *Poecilographa decora*. This list represents 22.2 percent of the known sciomyzid fauna of the state.

Many of the records we report are more than 30 years old, and some species have not been collected in Ohio since the 1960s. Ohio has undergone rapid changes since the early collecting by scientists such as J. Hine of Ohio State University during the early 1900s, and even during the time of later entomologists such as BAF and JBK, E. J. Allen, E. G. Chapman, A. D. Huryn, C. A. Triplehorn, and K. R. Valley. The lack of recent records of certain species (e.g., *Antichaeta borealis*, *Dictya borealis*, *D. hudsonica*, and *Tetanocera oxia*) may be due to rarity, natural population fluctuations, habitat loss, persistent drought conditions, loss of natural prey, or other factors. All species are reliant upon aquatic habitats or moist woodlands and these areas have undergone significant alteration and destruction due to extensive residential, commercial, and industrial development. Further collecting of Sciomyzidae and their deposition into established collections will be necessary for the continued documentation of species occurrence in Ohio and other areas of the midwest. Loss of sciomyzid species that were once collected with some frequency in Ohio should be viewed as a possible indicator of loss or degradation of natural habitat.

Acknowledgments

This research was supported by grants from the National Science Foundation (including current funding through NSF Award 0216039 to JBK), National Institute of Allergy and Infectious Disease, National Geographic Society, American Philosophical Society, Ohio Department of Natural Resources, and the Ohio Biological Survey. We express deep appreciation to the late G. C. Steyskal for his expert help in determining species of Sciomyzidae.

Appreciation is expressed to J. Abercrombie of the Geauga Park District, E. G. Chapman of Kent State University, L. V. Knutson of Gaeta, Italy, K. R. Valley of the Pennsylvania Department of Agriculture, and R. Chase and T. Pucci of The Cleveland Museum of Natural History for reviewing the manuscript and making suggestions for its improvement. Y. Gutierrez

of The Cleveland Museum of Natural History took the photographs of sciomyzid flies and their wings. We thank the following individuals for guiding us to Ohio field sites: R. Bartolotta, J. K. Bissell, R. Boronka, E. G. Chapman, and N. Talbot.

This paper is dedicated to the fond memory of the late C. O. Berg of Cornell University, who stimulated many students throughout the world to initiate biological studies of the family Sciomyzidae.

References

- Barnes, J. K. 1988. Biology and immature stages of *Sciomyza varia* (Diptera: Sciomyzidae). *Annals of the Entomological Society of America*, 83:925–938.
- Barnes, J. K. 1999. Notes on the biology and immature stages of *Poecilographa decora* (Loew) (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 90:474–479.
- Beaver, O. 1972. Notes on the biology of some British sciomyzid flies (Diptera: Sciomyzidae). II. Tetanocerini. *Entomologist*, 105:284–299.
- Berg, C. O. 1953. Sciomyzid larvae that feed on snails. *Journal of Parasitology*, 11:201–212.
- Berg, C. O., and L. V. Knutson. 1978. Biology and systematics of the Sciomyzidae. *Annual Review of Entomology*, 23:239–258.
- Bratt, A. D., L. V. Knutson, B. A. Foote, and C. O. Berg. 1969. Biology of *Pherbellia* (Diptera: Sciomyzidae). *New York Agriculture Experiment Station Memoir*, 404:1–247.
- Coquillett, D. W. 1901. New Diptera in the U. S. National Museum. *Proceedings of the United States National Museum*, 23:593–618.
- Coquillett, D. W. 1904. Several new Diptera from North America. *Canadian Entomologist*, 36:10–12.
- Cresson, E. T. 1920. A revision of the nearctic Sciomyzidae (Diptera, Acalyptratae). *Transactions of the American Entomological Society*, 46:27–89.
- Curran, C. H. 1932. The genus *Dictya* Meigen (Tetanoceridae, Diptera). *American Museum Novitates*, 517:1–7.
- Day, L. T. 1881. Notes on Sciomyzidae with descriptions of new species. *Canadian Entomologist*, 13:85–89.
- Fallén, C. F. 1820. *Sciomyzides Suevicae*. Lundae. 16 p.
- Foote, B. A. 1959. Biology and life history of the snail-killing flies belonging to the genus *Sciomyza* Fallén (Diptera: Sciomyzidae). *Annals of the Entomological Society of America*, 52:31–43.
- Foote, B. A. 1961a. A new species of *Antichaeta* Haliday, with notes on other species of the genus (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 63:161–164.
- Foote, B. A. 1961b. Biology and immature stages of the snail-killing flies belonging to the genus *Tetanocera* (Diptera: Sciomyzidae). Unpublished Ph.D. dissertation, Cornell University. 190 p.
- Foote, B. A. 1976. Biology and larval feeding habits of three species of *Renocera* (Diptera: Sciomyzidae) that prey on fingernail clams (Mollusca: Sphaeriidae). *Annals of the Entomological Society of America*, 69:121–133.
- Foote, B. A. 1977. Biology of *Oidematops ferrugineus* (Diptera: Sciomyzidae), a parasitoid enemy of the land snail *Stenotrema hirsutum* (Mollusca: Polygyridae). *Proceedings of the Entomological Society of Washington*, 79:609–619.

- Footo, B. A. 1996a. Biology and immature stages of snail-killing flies belonging to the genus *Tetanocera* (Insecta: Diptera: Sciomyzidae). I. Introduction and life histories of the predators of shoreline snails. *Annals of the Carnegie Museum*, 65:1–12.
- Footo, B. A. 1996b. Biology and immature stages of snail-killing flies belonging to the Genus *Tetanocera* (Insecta: Diptera: Sciomyzidae). II. Life histories of the predators of succineid snails. *Annals of the Carnegie Museum*, 65:153–166.
- Footo, B. A. 1999. Biology and immature stages of snail-killing flies belonging to the genus *Tetanocera* (Insecta: Diptera: Sciomyzidae). III. Life histories of the predators of aquatic snails. *Annals of the Carnegie Museum*, 68:151–174.
- Footo, B. A., and L. V. Knutson. 1970. Clam-killing fly larvae. *Nature*, 226:466.
- Footo, B. A., S. E. Neff, and C. O. Berg. 1960. Biology and immature stages of *Atrichomelina pubera* (Diptera: Sciomyzidae). *Annals of the Entomological Society of America*, 53:192–199.
- Harris, M. 1780. An exposition of English insects with curious observations and remarks, wherein each insect is particularly described; its parts and properties considered, the different sexes distinguished, and the natural history faithfully related. *Decads*, 3–5:73–166.
- Knutson, L. V. 1966. Biology and immature stages of malacophagous flies *Antichaeta analis*, *A. ariveta*, *A. brevipennis*, and *A. obliviosa* (Diptera: Sciomyzidae). *Transactions of the American Entomological Society*, 92:67–101.
- Knutson, L. V. 1987. Sciomyzidae, p. 927–940. *In* J. F. McAlpine (ed.), *Manual of Nearctic Diptera*. Research Branch Agriculture Canada Monograph 28.
- Knutson, L., and J. Abercrombie. 1977. Biology of *Antichaeta melanosoma* (Diptera: Sciomyzidae), with notes on parasitoid Braconidae and Ichneumonidae (Hymenoptera). *Proceedings of the Entomological Society of Washington*, 79:111–125.
- Knutson, L. V., and C. O. Berg. 1964. Biology and immature stages of snail-killing flies: the genus *Elgiva* (Diptera: Sciomyzidae). *Annals of the Entomological Society of America*, 57:173–192.
- Knutson, L., and R. E. Orth. 2001. *Sepedon mchersoni*, n. sp., key to North American *Sepedon* groups in *Sepedon* s. s., and intra- and intergeneric comparison (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 103:620–635.
- Knutson, L., R. E. Orth, T. W. Fisher, and W. L. Murphy. 1986. Catalog of Sciomyzidae (Diptera) of America North of Mexico. *Entomography*, 4:1–53.
- Knutson, L., and J.-C. Vala. 2002. An evolutionary scenario of Sciomyzidae and Phacomyiidae (Diptera). *Annales de la Société Entomologique de France* (n. s.), 38:145–162.
- Loew, H. 1847. Ueber *Tetanocera ferruginea* und ihre verwandten Arten. *Stettin. Entomologische Zeitschrift*, 8:194–202.
- Loew, H. 1859. Die nordamerikanische Arten der Gattungen *Tetanocera* und *Sepedon*. *Wiener Entomologische Monatschrift* 3:289–300.
- Loew, H. 1861. Diptera Americae septentrionalis indigena. *Centuria prima*. *Berliner Entomologische Zeitschrift*, 5:307–359.
- Loew, H. 1862. Monographs of the Diptera of North America. Part I. Smithsonian Institution Miscellaneous Collections, 6:1–221.
- Loew, H. 1864. Diptera Americae septentrionalis indigena. *Berliner Entomologische Zeitschrift*, 8:49–104.
- Loew, H. 1876. Beschreibungen neuer amerikanischer Dipteren. *Zeitschrift Gesamte Naturwissenschaft*, 48:317–340.
- Macquart, M. J. 1843. Dipteres exotiques nouveaux ou peu connus. *Memoirs of the Royal Society of Science, Agriculture, and Arts, Lille*, 1842:162–460.
- Melander, A. L. 1920. Review of the Nearctic Tetanoceridae. *Annals of the Entomological Society of America*, 13:305–332.
- Neff, S. E., and C. O. Berg. 1966. Biology and immature stages of malacophagous Diptera of the genus *Sepedon* (Sciomyzidae). *Bulletin of the Virginia Agricultural Experiment Station*, 566:1–113.
- Orth, R. E. 1986. Taxonomy of the *Sepedon fuscipennis* group (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 88:63–76.
- Orth, R. E. 1991. A synopsis of the genus *Dictya* Meigen with ten new species (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 93:660–689.
- Robineau-Desvoidy, J. B. 1830. *Essai sur les Myodaires. Mémoires présentés par divers savans L'Académie royale des sciences de l'Institut de France. Sciences, mathématiques et physiques*, 2:1–813.
- Robinson, W. H., and B. A. Footo. 1978. Biology and immature stages of *Antichaeta borealis* (Diptera: Sciomyzidae), a predator of snail eggs. *Proceedings of the Entomological Society of Washington*, 80:388–396.
- Rozkošný, R. 1965. Neue Metamorphosestadien mancher *Tetanocera* Arten (Diptera: Sciomyzidae). *Zoologie Listy*, 14:367–371.
- Rozkošný, R. 1967. Zur Morphologie und Biologie der Metamorphosestadien mitteleuropäischen Sciomyziden (Diptera: Sciomyzidae). *Acta Academiae Scientiarum Bmo*, 1:117–160.
- Rozkošný, R. 1995. World distribution of Sciomyzidae based on the list of species (Diptera). *Studia Dipterologica*, 2:221–238.
- Steyskal, G. C. 1938. New Stratiomyidae and Tetanoceridae (Diptera) from North America. *Occasional Papers of the Museum of Zoology, University of Michigan*, 386:1–10.
- Steyskal, G. C. 1949. New Diptera from Michigan (Stratiomyidae, Sarcophagidae, Sciomyzidae). *Papers of the Michigan Academy of Science, Arts, and Letters*, 33:173–180.
- Steyskal, G. C. 1951. The genus *Sepedon* Latreille in the Americas (Diptera: Sciomyzidae). *Wasmann Journal of Biology*, 8:271–297.
- Steyskal, G. C. 1954a. *Colobea* and *Hedria*, two genera of Sciomyzidae new to America (Diptera: Acalyptrata). *Canadian Entomologist*, 86:60–65.
- Steyskal, G. C. 1954b. The genus *Pteromicra* Lioy (Diptera: Sciomyzidae) with especial reference to the North American species. *Papers of the Michigan Academy of Science, Arts, and Letters*, 39:257–269.
- Steyskal, G. C. 1954c. The American species of the genus *Dictya* Meigen (Diptera, Sciomyzidae). *Annals of the Entomological Society of America*, 47:511–539.
- Steyskal, G. C. 1959. The American species of the genus *Tetanocera* (Diptera). *Papers of the Michigan Academy of Science, Arts and Letters*, 44:17–26.
- Steyskal, G. C. 1960. The genus *Antichaeta* Haliday, with special reference to the American species (Diptera: Sciomyzidae). *Papers of the Michigan Academy of Science, Arts, and Letters*, 45:17–26.
- Steyskal, G. C. 1961. The North American Sciomyzidae related to *Pherbellia fuscipes* (Macquart) (Diptera: Acalyptrata). *Papers of the Michigan Academy of Science, Arts, and Letters*, 46:405–415.

- Steyskal, G. C. 1965. Notes on types of some species described in *Sciomyza* and *Tetanocera* by Loew, Walker, and Van der Wulp (Diptera: Sciomyzidae, Muscidae, Neriidae, Pyrgotidae). *Studia Entomologica*, 8:445-448.
- Steyskal, G. C. 1967. The Nearctic species of *Pherbellia* Robineau-Desvoidy, subgenus *Oxytaenia* Sack (Diptera: Sciomyzidae). *Papers of the Michigan Academy of Science, Arts, and Letters*, 51:31-38.
- Steyskal, G. C., T. W. Fisher, L. Knutson, and R. E. Orth. 1978. Taxonomy of North American flies of the genus *Limnia* (Diptera: Sciomyzidae). University of California Publications in Entomology, 83:1-48.
- Trelka, D. G., and C. O. Berg. 1977. Behavioral studies of the slug-killing larvae of two species of *Tetanocera* (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 79:475-486.
- Trelka, D. G., and B. A. Foote. 1970. Biology of slug-killing *Tetanocera* (Diptera: Sciomyzidae). *Annals of the Entomological Society of America*, 63:877-895.
- Valley, K., and C. O. Berg. 1977. Biology and immature stages of snail-killing Diptera of the genus *Dictya* (Sciomyzidae). *Search Agriculture*, 7:1-44.
- Walker, F. 1849. List of the specimens of dipterous insects in the collection of the British Museum. Part 4, p. 689-1172. British Museum, London.
- Walker, F. 1853. Diptera (cont.), Part IV, p. 253-414. In W. W. Saunders (ed.), *Insecta Saundersiana: or characters of undescribed insects in the collection of William Wilson Saunders*. Esq. Van Voorst, London.
- Zetterstedt, J. W. 1838. Sectio tertia. Diptera, p. 477-467. In *Insecta Laponica*. Lipsiae.