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A New Species of *Anticheta* (Diptera: Sciomyzidae) from Mexico

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Abstract

***Anticheta patzcuaroensis* Pote, new species** (Diptera: Sciomyzidae), from Lake Pátzcuaro, Michoacán, Mexico, is described and illustrated. The most recent key to the genus *Anticheta* Haliday in the Nearctic region is edited to include the new species. Information is given about the Sciomyzidae holdings in the Cornell University Insect Collection.

Key words: taxonomy, description, Nearctic, Neotropical, Sciomyzoidea, Transition Zone, Tetanocerini

Resumen

Se describe e ilustra a *Anticheta patzcuaroensis* Pote (Diptera: Sciomyzidae) una nueva especie de Lago de Pátzcuaro, Michoacán, México. Se modifica la clave más reciente del género *Anticheta* Haliday en la región Neárctica para incluir la nueva especie. Se ofrece información sobre los espécimenes de Sciomyzidae de la Colección de Insectos de la Universidad de Cornell.

Palabras clave: taxonomía, descripción, Neártico, Neotrópico, Sciomyzoidea, Zona de transición, Tetanocerini

Introduction

The family Sciomyzidae (Diptera: Acalyptratae), marsh or snail-killing flies, currently contains at least 541 species placed in 61 genera (Murphy *et al.* 2022). This family is very well studied in terms of its ecological associations with various species of gastropods (snails and slugs) as well as with freshwater clams. Berg (1953) was the first to associate this family with snails, spending his career studying the unique ecology of this group (Brown *et al.* 1987). Much of his research focused on exploiting the host associations of sciomyzids as biocontrol agents for diseases such as schistosomiasis and sheep liver fluke (Berg & Knutson 1978). The Cornell University Insect Collection (CUIC; Ithaca, New York, USA), which includes over seven million insect specimens and represents one of the largest university collections in North America, is particularly diverse in Sciomyzidae material (Murphy, 2019). This is largely a result of the work of C.O. Berg and his many graduate students, including L.V. Knutson and others (Berg & Knutson 1978, Fisher & Orth 1983, Knutson & Vala 2011, Murphy & Vala 2020). Over the course of more than 60 years, sciomyzids from around the world have been collected and transported to Ithaca. Host rearing records and emergence data have been meticulously tracked. For many specimens, the shell of the host snail has been retained, the result being drawers filled with a wonderful mix of mollusks and flies (Fig. 1).

The Holarctic genus *Anticheta* Haliday includes 15 described species (Knutson & Vala 2011, Murphy *et al.* 2018), with eight Nearctic species—*borealis* (Foote, 1961), *canadensis* (Curran, 1923), *fulva* Steyskal, 1960, *johnsoni* (Cresson, 1920), *melanosoma* Melander, 1920, *robiginosa* Melander, 1920, *testacea* Melander, 1920, and *vernalis* Fisher and Orth, 1971—and seven Palearctic species: *analis* (Meigen, 1830), *atriseta* (Loew, 1849), *bisetosa* Hendel, 1902, *brevipennis* (Zetterstedt, 1846), *nigra* Karl, 1921, *obliviosa* Enderlein, 1939, and *shatalkini* Vikhrev, 2008. *Anticheta* is divided into two subgenera: *Anticheta*, which contains 14 species, and *Parantichaeta* Enderlein, with a single species, the Palearctic *A. bisetosa*. The Nearctic species comprise two groups based on overall color:

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"black forms," the dominant species from the Rocky Mountains to the Pacific Ocean (Steyskal 1960b), and "yellow forms" (actually testaceous, yellowish brown), the dominant species east of the Rocky Mountains (Fisher & Orth 1971). Studies indicate that both *A. borealis* and *A. testacea* oviposit onto egg masses of *Oxyloma* snails, family Succineidae (Robinson & Foote 1978, Fisher & Orth 1964). Other "yellow form" members of *Anticheta*, such as the Nearctic *A. fulva* and the European *A. analis*, use egg masses of *Lymnaea* snails, family Lymnaeidae (Murphy *et al.* 2018, Knutson 1966). Although not in the same mollusk family as *Oxyloma*, these snails share a propensity for laying their egg masses exposed, unsubmerged, and on the stalks of grasses, which Knutson (1966) theorized as a reason why the two families are targeted by a single genus of Sciomyzidae.

FIGURE 1. Drawer of *Ilione* (*Knutsonia*) sp. from the Cornell University Insect Collection. Note the adult flies on pins, along with puparia, dissected terminalia, snail shells, and plant material. Cajón de *Ilione* (*Knutsonia*) *sp.* de la Colección de Insectos de la Universidad de Cornell. Obseérvense las moscas adultas sobre alfileres, junto con el pupario, los terminalia disecados, las conchas de caracol y el material vegetal.

In this paper, we describe and illustrate a new species of *Anticheta*, *A. patzcuaroensis* Pote, from Mexico. This taxon was collected in the late 1960s by Karl R. Valley, at that time a graduate student at Cornell University, who identified it as a potentially new species. The addition of *A. patzcuaroensis* Pote **sp. n.** brings the total number of species in *Anticheta* to 16. We herein provide a key to the known species of *Anticheta* and present a summary of the Sciomyzidae holdings in the CUIC.

Material and Methods

All specimens in this paper are deposited in the CUIC. Morphological terminology mainly follows Murphy *et al.* (2018), except for the use of the term "first flagellomere," which follows the Manual of Central American Diptera

(Brown *et al.* 2009). Terminalia of two male specimens had been dissected previously by Dr. Valley and placed in vials containing a drop of glycerol. During the current study, the principal author (SLP) detached the wing of one specimen and mounted it on a slide using Euparal.

Habitus pictures as well as sinistral and dextral views of the male terminalia of *A. patzcuaroensis* **sp. n.** were taken with a Macroscopic Solutions (Tolland, Connecticut, USA; https://macroscopicsolutions.com) Macropod Pro® and a Canon EOS 6D DSLR camera body with a Macro Photo MP-E 65 mm f/2.8 1–5x manual focus lens for EOS. Stacked images were processed with Zerene Stacker (https://zerenesystems.com). Photos of the wing and the posterior view of the terminalia of *A. patzcuaroensis* were all taken using a Nikon SMZ1500 microscope with attached DS-L2 camera unit and processed using Zerene Stacker. Photos were edited and manipulated with paint.net. (available at https://www.getpaint.net/).

***Anticheta patzcuaroensis* Pote, sp. n.**
(Figs. 2–11)

DIAGNOSIS

Similar in coloration and size to *A. testacea* but with distal 4/5 of male forefemur more darkly pigmented, coloration on lower 2/3 of first flagellomere blue-gray. Aristal plumosity longer than that of *A. testacea* and *A. borealis* (0.15 mm on average). Sternite 5 elongated medially as in *A. borealis*; left epandrial lobe narrow, hook shaped with rounded tip in sinistral view; right epandrial lobe greatly elongated in lateral view.

FIGURE 2. Lateral habitus, *Anticheta patzcuaroensis* **sp. n.**, male holotype [CUIC#000055255]. Vista lateral del habitus, *Anticheta patzcuaroensis* **sp. n.**, holotipo macho [CUIC#000055255].

FIGURE 3. Lateral habitus, *Anticheta patzcuaroensis* **sp. n.**, female paratype [CUIC#000055260]. Vista lateral del habitus, *Anticheta patzcuaroensis* **sp. n.**, paratipo hembra [CUIC#000055260].

FIGURE 4. Dorsal habitus, *Anticheta patzcuaroensis* **sp. n.**, male holotype [CUIC#000055255]. Vista dorsal del habitus, *Anticheta patzcuaroensis* **sp. n.**, holotipo macho [CUIC#000055255].

DESCRIPTION

Male body length (head to abdomen, each segment measured separately then summed) 4.93–5.08 mm, wing 4.45–5.03 mm (n=5). The only known female, CUIC#000055260, is excluded from the measurements reported below (see *Female*).

FIGURE 5. Lateral view of head, *Anticheta patzcuaroensis* **sp. n.**, male holotype [CUIC#000055255]. Vista lateral de la cabeza, *Anticheta patzcuaroensis* **sp. n.**, holotipo macho [CUIC#000055255].

MALE

Head. Frons with midfrontal vitta pruinose blue-gray; medial frontal stripe, anterolateral to fronto-orbital setae, pruinose blue-gray. Frons otherwise dull, testaceous with black setulae. Facial carina and gena both entirely pruinose blue-gray. Occiput testaceous with blue-gray pruinosity below post-ocellar setae, between medial vertical setae. Three stronger setae on posterior margin of gena near occiput. Head posterior to eyes setulose from vertical setae

to gena. Two frontal-orbital setae of equal length. Chaetotaxy: 2 fronto-orbital, 1 ocellar, 1 post-ocellar, 1 medial vertical, and 1 lateral vertical setae. Palpi testaceous, with black setulae and one large seta on ventral surface. Labella dark testaceous to brown, largely setulose. Pedicel and first flagellomere testaceous. Basal 2/3 of first flagellomere infuscated blue-gray, base slightly darker. Arista testaceous basally, black on remainder of distal 2/3. Aristal plumosity somewhat sparse but long; longest hairs average 0.15 mm (Fig. 5).

Thorax. Scutum testaceous, with two laterodorsal blue-gray vittae and one thinner medial blue-gray vitta down the center; scutum and dorsal surface of scutellum with dark brown setae. All thoracic sclerites with testaceous ground color and blue-gray pruinosity except proepisternum largely bare and shining, with some small, fine setulae on ventral corner; anepisternum bare, shining; katepisternum setulose, shining but with blue-gray pruinosity centered from posterodorsal corner covering about 1/2 of the area of the sclerite. Chaetotaxy: 1 postpronotal, 2 notopleural, 1 presutural supra-alar, 1 postsutural supra-alar, 2 dorsocentral, 2 postalar, and 2 scutellar setae.

Wing. Uniformly infuscated smoky brown (Fig. 6), posterior 1/3 somewhat lighter, crossveins slightly darkened. Halteres testaceous.

FIGURE 6. Wing, *Anticheta patzcuaroensis* **sp. n.**, male paratype [CUIC#000055257]. Ala, *Anticheta patzcuaroensis* **sp. n.**, paratipo macho [CUIC#000055257].

Leg. Forecoxa light beige, about 2/3 the length of forefemur; mid and hind coxae shorter, concolorous with thoracic pleura. Femora testaceous, but forefemur distinctly darkened in distal 4/5. Foretibia infuscated in distal 2/3; mid and hind tibiae testaceous. Foretarsomeres dark, tarsomeres on mid and hind legs darker.

Abdomen. Abdomen testaceous with mottled black pattern on first four or five tergites (Fig. 7).

Sternite 5 elongated medially as in *A. borealis*, with indentation on right side deeper than on left side (Fig. 8). Cerci tightly associated, similar to those of *A. testacea* (Fig. 9). Medial section of epandrium with ventral edge rounded above cerci. Epandrium asymmetrical: in posterior view left lobe with indentation similar to that of *A. borealis*. In sinistral view left lobe narrowed hook shaped with rounded tip (Fig. 10). In lateral views right lobe of epandrium elongated (Fig. 11).

FEMALE

One female specimen is known, but the damaged abdomen precludes adequate description of the female terminalia (Fig. 3). This specimen is slightly larger and darker in color than any of the five known males (body length 5.27 mm, wing length 5.3 mm). Additionally, the foretibia of the female is nearly all dark, with only a small amount of testaceous coloring at the base.

FIGURE 7. Posterodorsal view of abdomen, *Anticheta patzcuaroensis* **sp. n.**, male holotype [CUIC#000055255]. Vista posterdorsal del abdomen, *Anticheta patzcuaroensis* **sp. n.**, paratipo macho [CUIC#000055257].

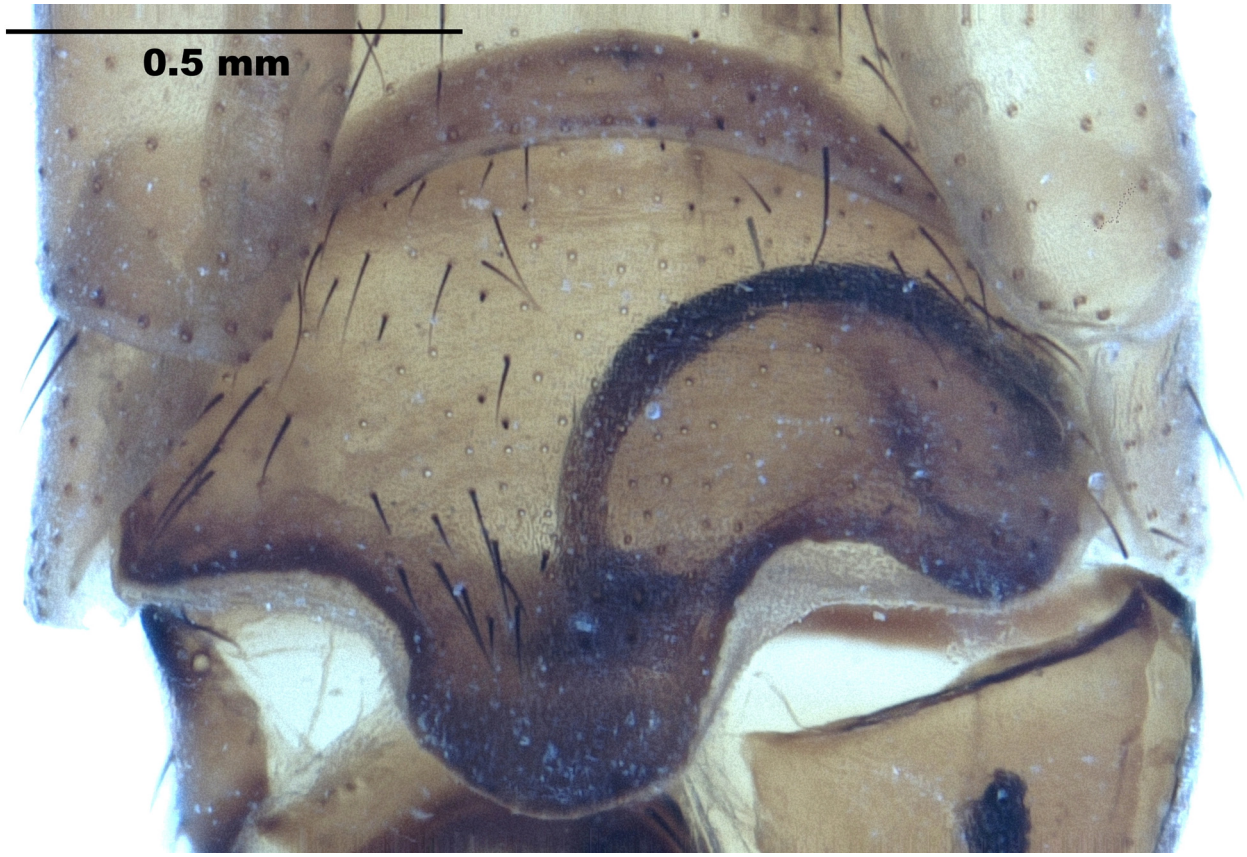

FIGURE 8. Fifth sternite of male, *Anticheta patzcuaroensis* **sp. n.**, male paratype [CUIC#000055256]. Quinto sternite del macho, *Anticheta patzcuaroensis* **sp. n.**, paratipo macho [CUIC#000055257].

SPECIMENS EXAMINED

Holotype: ♂, "**México**: Michoacan, Patzcuaro Lk on rd to Erongaricuaro, elevation ~1200 M; Karl R. Valley, 15.VIII.1969, taken sweeping.; *Anticheta* Berg, Knutson, Valley; L. Knutson det. 98" [CUIC#000055255]

Paratypes: 4 ♂, CUIC#000055256–CUIC#0055259. Same label data as holotype; abdomens of CUIC#000055256 and CUIC#000055257 dissected and macerated, in attached microvials. Abdomen of CUIC#000055258 missing. Right wing of CUIC#000055257 mounted on slide.

1 ♀, CUIC#000055260. Same label data as holotype.

All type specimens are deposited in the CUIC.

BIOLOGY. Although information about the larval food of *A. patzcuaroensis* is absent from the label data, Dr. Valley recently located a note on the biology of this species that he had written at the time of collection. He had observed that the oviposition site of *A. patzcuaroensis* was on the egg mass of *Oxyloma tlalpamense cuitseana*, a common Succineidae species in the Lake Pátzcuaro area. Valley's observation was corroborated by a field-collected female of *A. patzcuaroensis* that was recorded as feeding and ovipositing on egg masses of *Oxyloma* sp. in the laboratory; this record has not been published previously. The snails were identified by Dr. Joseph Rosewater of the U.S. National Museum of Natural History, Washington, DC, USA (pers. comm. Karl Valley, 2022).

ETYMOLOGY. This new species is named after the type locality from which all known specimens have been collected, Lake Pátzcuaro. This location is within the homelands of the indigenous Purépecha/P'urhepecha people, known sometimes as Iréchikwa Ts'intsúntsani. Lake Pátzcuaro remains an important cultural and economic center for the indigenous people living in the area (Villamar & Gonzalez 2018).

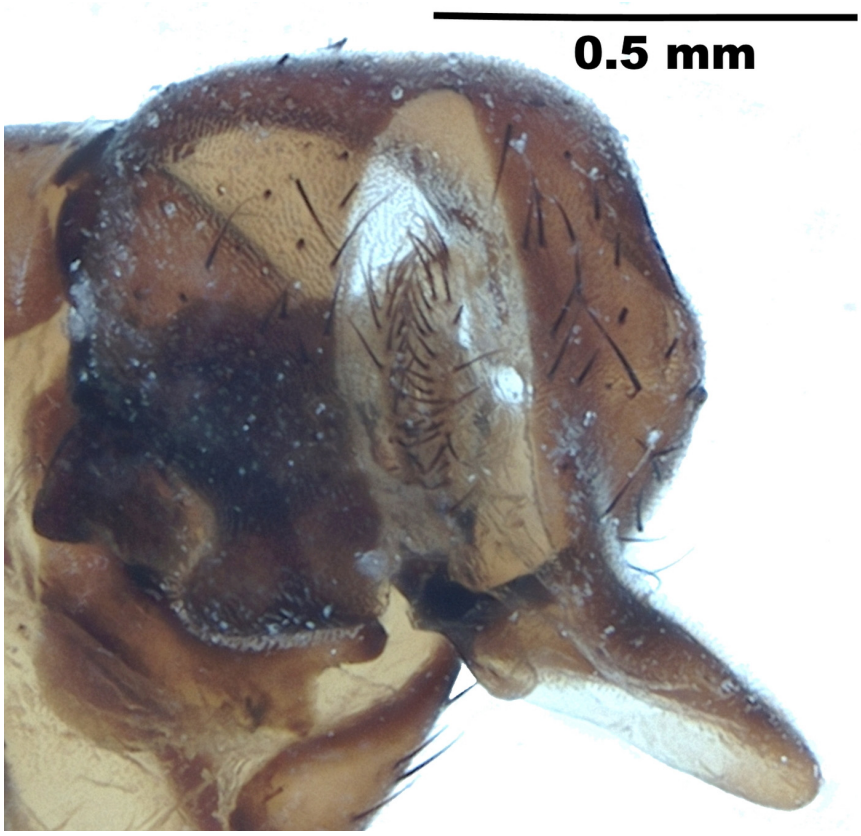

FIGURE 9. Posterior view of male terminalia, *Anticheta patzcuaroensis* **sp. n.**, male paratype [CUIC#000055256]. Vista posterior de la terminalia masculina, *Anticheta patzcuaroensis* **sp. n.**, paratipo macho [CUIC#000055256].

FIGURE 10. Sinistral view of male terminalia, *Anticheta patzcuaroensis* **sp. n.**, male paratype [CUIC#000055256]. Vista sinistral de la terminalia masculina, *Anticheta patzcuaroensis* **sp. n.**, paratipo macho [CUIC#000055256].

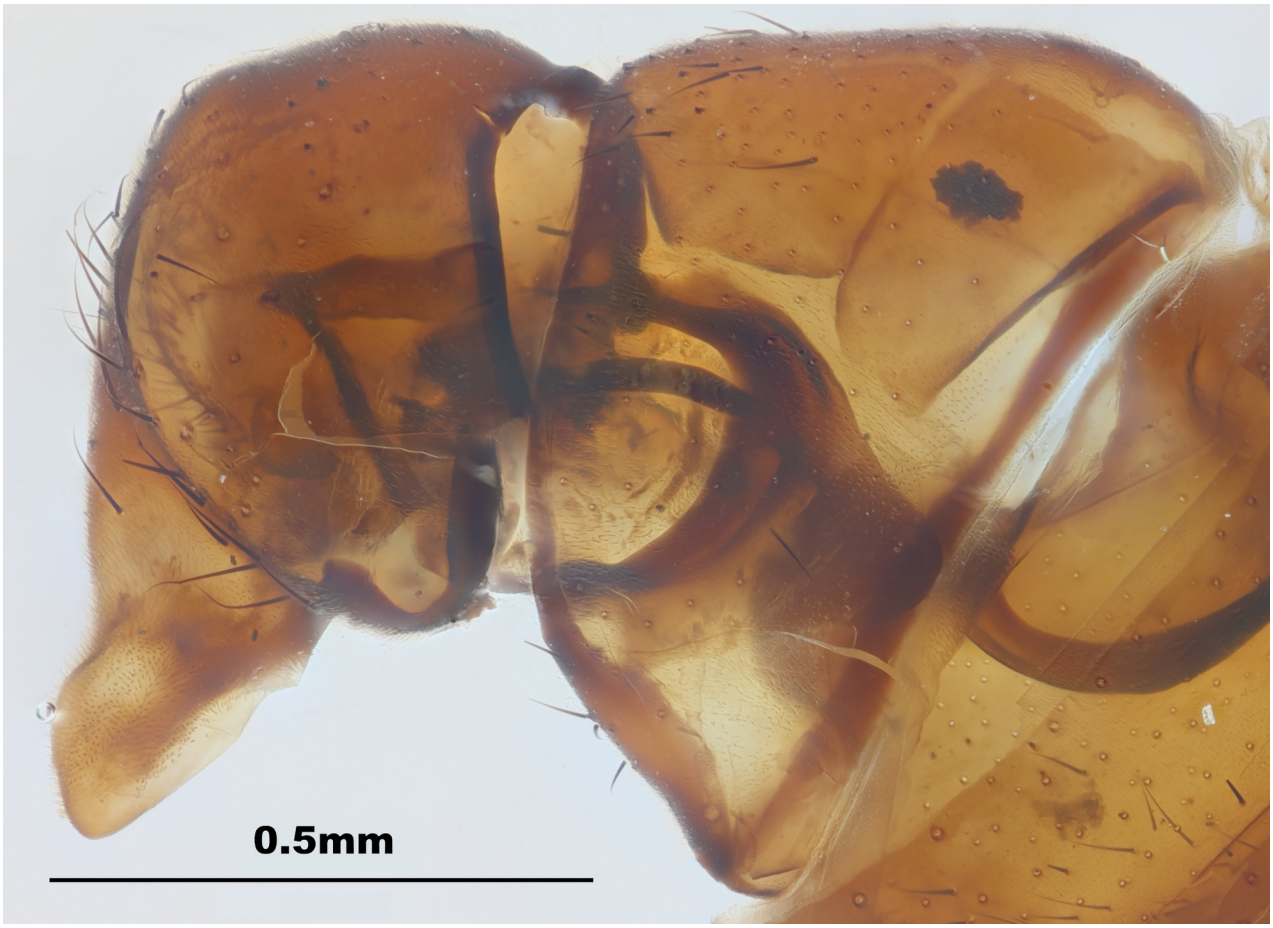

FIGURE 11. Dextral view of male terminalia, *Anticheta patzcuaroensis* **sp. n.,** male paratype [CUIC#000055256]. Vista dextral de la terminalia masculina, *Anticheta patzcuaroensis* **sp. n.,** paratipo macho [CUIC#000055256].

Discussion

Anticheta patzcuaroensis most closely resembles *A. borealis* and *A. testacea* in general habitus. However, the darkly pigmented forefemur of *A. patzcuaroensis* is distinct among the "yellow forms" of *Anticheta*, which otherwise all have uniformly testaceous forefemora (Steyskal 1960). The "yellow forms" (in contrast to the "black forms") include *A. borealis*, *A. fulva*, *A. robiginosa*, *A. testacea*, and *A. vernalis*, which key out to couplet 4 of Fisher & Orth's (1971) key to species.

The male terminalia of *A. patzcuaroensis* appears to be much more similar to that of *A. borealis* than to that of *A. testacea*. In lateral view, *A. borealis* and *A. patzcuaroensis* both have a medially elongated fifth sternite, a dorsal projection on the left lobe of the epandrium, and an elongated right lobe of the epandrium. However, as in *A. testacea*, *A. patzcuaroensis* has tightly associated cerci. Additionally, adults of all three species oviposit on, and their larvae consume, egg masses of *Oxyloma* species.

The southernmost species of *Anticheta* described prior to the discovery of *A. patzcuaroensis* was *A. testacea*, which had been found as far south as Baja California Norte, Mexico (Stone *et al.* 1965). Lake Pátzcuaro, located 1900 m. above sea level, is in the Trans-Mexican Volcanic Belt region; the discovery in that region of this new species of *Anticheta* represents a significant southward extension of the known range of the genus. Recent studies have classified this region as a transition zone between the Nearctic and Neotropical regions (Morrone *et al.* 2017). There are many examples of genera that are represented in lower latitudes mainly by high latitude species that colonize high elevation habitats in lower latitudes (*e.g.*, O'Grady and Heed 2001). Other sciomyzid species in the CUIC collected at the same locality as the new species include *Dictya valleyi* Orth, 1991, *Sepedon praemiosa* Giglio-Tos, 1893, *S. relicta* Wulp, 1897, and *Tetanocera spreta* Wulp, 1897. Excluding *S. praemiosa*, none of these species is found north of Mexico, indicative of the primarily Neotropical sciomyzid fauna of the Lake Pátzcuaro area.

The most recently published key to Nearctic species of *Anticheta* was by Fisher & Orth (1971). The following modified key includes *A. patzcuaroensis* **sp. n**. Distributional data and references to significant publications on the taxonomy and life histories of the included species are also provided, updated with records from Knutson et al. (1986) and label data of CUIC specimens. Distributions marked with an asterisk (*) are unpublished identifications by William L. Murphy (pers. comm.).

Key to the Nearctic Species of *Anticheta*

1. Scutellum with 2 setae. 1 pair of dorsocentral setae. Head and palpi black; 1 pair of fronto-orbital setae; antennae yellowish, aristal hairs short, dense, black. Thorax testaceous; dorsum with 2 broad, blackish vittae joined at anterior margin. Forecoxae whitish; legs yellowish, except for black foretibiae and foretarsi. Abdomen blackish brown. Canada: Ontario. USA: Massachusetts, New Hampshire, New York (Cresson 1920, Steyskal 1960b). Host species: Unknown . . . . . *johnsoni* Cresson, 1920
- Scutellum with 4 setae. 2 pairs of dorsocentral setae. 2

2. 1 pair of fronto-orbital setae. Head: frons and palpi black; anterior and ventral margins of eyes with pruinose whitish border; antennae yellowish, aristal hairs short, dense, black. Thorax black; forelegs black distad of middle of femur, basal half of forefemur and middle and hind legs yellowish except for brownish 4th and 5th tarsal segments. Abdomen black. Canada: Alberta, British Columbia*, Manitoba*, Nova Scotia*, Ontario, Quebec, Saskatchewan*, Yukon*. USA: Alaska, California*, Idaho, Indiana*, Maine*, Michigan, Minnesota*, Montana, Nebraska, New Hampshire*, New Jersey, New York, North Dakota, Ohio, South Dakota*, Utah, Wisconsin, Wyoming (Foote *et al.* 1999, Melander 1920, Steyskal 1960b). Host species: *Aplexa hypnorum* (Knutson & Abercrombie 1977) . . . . . *melanosoma* Melander, 1920
- 2 pairs of frontal-orbital setae. 3

3. Head: frons blackish, anterior margin slightly to extensively yellow; medifacies black to yellow; anterior fronto-orbital seta 1/2 to 2/3 length of posterior fronto-orbital seta; palpi brown to black; antennae yellow; aristal plumosity short, dense, black. Thorax black. Forelegs black distad of middle of femur; basal portion of forefemur and middle and hind legs yellowish except for brownish 4th and 5th tarsal segments. Abdomen black. Canada: Alberta, Manitoba, Ontario, Quebec, Saskatchewan. USA: Idaho, Maine, Michigan, North Dakota, New York, Wisconsin. (Curran 1923, Steyskal 1960b). Host species: *Aplexa* sp. (Schorno *et al.* 2020) . . . . . *canadensis* Curran, 1923
- Head yellow to testaceous; aristal hairs black. Thorax and abdomen mostly testaceous; dorsum with 2 narrow brown median vittae bordered by broader, pruinose vittae; legs yellowish to testaceous, 4th and 5th tarsal segments brownish, forelegs infuscated (tibia and tarsus black in female *A. borealis*). Females usually more intensely pigmented than males. 4

4. Anterior fronto-orbital seta approximately 1/2 length of posterior fronto-orbital seta. Antenna testaceous, first flagellomere blackish on apical half, more or less; aristal plumosity short, sparse (longest hairs averaging 0.073 mm, range 0.070–0.075 mm, n=2). Abdomen brown, infuscated; male postabdomen and female terminalia testaceous. Canada: Alberta. USA: Idaho, New York, Ohio. (Steyskal 1960b). Host species: *Lymnaea* spp. (Foote & Keiper 2004). . . . . .*fulva* Steyskal, 1960b
- Anterior and posterior fronto-orbital setae nearly equal in length 5

5. Thoracic dorsum mostly testaceous 6
- Thoracic dorsum mostly cinereous blue, with two narrow, brownish vittae 8

6. Forefemur broadly infuscated black; in lateral view left lobe of epandrium with hooklike projection. Arista with average length of hairs 0.15 mm. Mexico: Michoacán. Host species: *Oxyloma tlalpamense cuitseana* . . . . . *patzcuaroensis* Pote **sp. n.**
- Forefemur entirely testaceous; in lateral view left lobe of epandrium various, with or without projection but never hooklike. Aristal plumosity with average length of hairs less than 0.15 mm 7

7. Epandrium in sinistral view with left lobe extended straight and narrow with rounded tip , right lobe elongate, in lateral view curved somewhat curved, ventrally directed. Medial edge of epandrium above cerci rounded, cerci loosely associated. Sternite five of male elongated in center. Antenna testaceous, 3rd segment blackish on apical half. Apical plumosity sparse, hairs somewhat longer than in *A. fulva*, (longest hairs averaging 0.095 mm in length, range 0.09–0.10 mm, n=3). In female, distal 2/3 to 3/4 of foretibia black, proximally dark brown, all tarsi dark brown; in male, distal 1/2 of foretibia light brown, proximal 1/2 of foretarsus testaceous, distal ½ of foretarsus along with other tarsi testaceous. Canada : Quebec, Nova Scotia. USA: California, Idaho, Illinois*, Indiana*, Minnesota* Montana, Ohio, New York, Utah*. (Foote 1961). Host species: *Oxyloma*, *Catinella* (Robinson & Foote 1978). . . . . .*borealis* Foote, 1961
- Epandrium in sinistral view with left lobe blunt and with short, wide, rounded extension, right lobe elongate, in lateral view somewhat curved, dorsally directed. Medial edge of epandrium above cerci pointed, cerci tightly associated. Sternite five of male wide, without elongate central projection. Antenna testaceous, first flagellomere barely tinged with brown on apical half, sometimes testaceous at proximal end. Aristal plumosity sparse, longer than in *A. borealis* (longest hairs averaging 0.116 mm, range 0.112–0.127 mm, n=15). In female, distal 2/5 of foretibia dark brown, all tarsi dark brown; in male, distal foretibia barely infuscated, all tarsi light brown. USA: California, Colorado, Idaho, Montana, Oregon, New Mexico, South Dakota, Utah.

Mexico: Baja California Norte. (Melander 1920, Steyskal 1960b). Host species: *Oxyloma*, *Physa*, *Succinea*, *Radix*, *Stagnicola*, *Pseudosuccinea*, *Helisoma* (Fisher & Orth 1964) . . . . . *testacea* Melander, 1920

8. Epandrium in lateral view with right lobe extended, barely extending past the rest of the epandrium. Antennae testaceous; first flagellomere usually black on apical half, occasionally only lightly tinged with brown. Aristal plumosity long, sparse (Fisher & Orth 1971), longest hairs averaging 0.128 mm, range 0.120–0.142 mm, n=16. In male, sides of thorax pruinose whitish except upper half of proepisternum, anepisternum, and anepimeron testaceous. In female, thorax same as in male except katepisternum sometimes cinereous-blue. California, Idaho, Oregon, Washington (see section on variant in Fisher & Orth 1971). Host species: Unknown . . . . . *vernalis* Fisher & Orth 1971

- Epandrium in lateral view with right lobe strongly extended, extending almost the same distance away as from the base of the extension to the cerci. Apical 1/2 to 2/3 of first flagellomere lightly tinged with brown; aristal hairs short, sparse (Fisher & Orth 1971), longest hairs averaging 0.062 mm, range 0.055–0.067 mm, n=7. In male, sides of thorax pruinose whitish, more deeply cinereous-blue than in *robiginosa* but not as intense as in the female of *vernalis*; upper half of proepisternum, anepisternum, and anepimeron testaceous. In female, sides of thorax pruinose cinereous-blue except upper half of proepisternum, anepisternum, and anepimeron testaceous. California, Idaho, Oregon, Washington (see section on variant in Fisher & Orth 1971). Host species: Unknown . . . . . *vernalis* Fisher & Orth 1971

Cornell University Insect Collection—Sciomyzidae Holdings

The sciomyzid collection in the CUIC includes material from 49 genera and 308 species, representing about 57% of the world's described species in this family (Table 1) (Murphy *et al.* 2022). The CUIC holds type specimens of 56 species, including holotypes, allotypes, and paratypes (Table 2). In addition, at least 20 groups of sciomyzids, largely from the Neotropical region, have been segregated (some by Steyskal and Verbeke) as potentially undescribed species, These groups have been noted in the past as a resource for future taxonomic studies (Murphy 2019). The segregated groups include one species each of *Dictya* Meigen (USA: GA, NC, SC), *Euthycerina* Malloch (Chile), *Limnia* Robineau-Desvoidy (USA: CO, CT, IL, KS, MT, NY, UT), and *Retellia* Robineau-Desvoidy (Chile), as well as five species of *Parectinocera* Becker ([A: Argentina], [B: Chile], [C: Argentina, Bolivia], [D: Argentina], [E: Chile]) and twelve species of *Pherbellia* Robineau-Desvoidy ([A: Alaska, Alberta, Manitoba], [B: Greece, Spain], [C: Idaho], [D: Argentina], [E: Chile], [F: Peru], [G: Chile], [H: Argentina], [I, J, K: unknown Neotropical country], [L: Australia]).

TABLE 1. Sciomyzidae holdings in the Cornell University Insect Collection, by genus.

Genus	# of Described Species	# of Species in CUIC
Akebono Sueyoshi	1	0
Anticheta Haliday	16	11
Apteromicra Papp	1	0
Atrichomelina Cresson	1	1
Calliscia Steyskal	1	0
Chasmacryptum Becker	1	0
Colobaea Zetterstedt	15	5
Coremacera Rondani	10	2
Dichetophora Rondani	12	4
Dictya Meigen	44	32
Dictyacium Steyskal	2	2
Ditaeniella Sack	4	3
Ectinocera Zetterstedt	1	1
Elgiva Meigen	5	5
Ethiolimnia Verbeke	7	1
Eulimnia Tonnoir & Malloch	2	2
Euthycera Latreille	22	4
Euthycerina Malloch	3	1

...Continued on the next page

TABLE 1. (Continued)

Genus	# of Described Species	# of Species in CUIC
Eutrichomelina Steyskal	2	1
Guatemalia Steyskal	2	1
Hedria Steyskal	1	1
Hoplodictya Cresson	5	4
Hydromya Robineau-Desvoidy	1	1
Ilione Haliday	8	6
Limnia Robineau-Desvoidy	23	18
Neodictya Elberg	1	0
Neolimnia Tonnoir & Malloch	14	9
Neuzina Marinoni & Knutson	1	0
Oidematops Cresson	1	1
Oligolimnia Mayer	1	0
Parectinocera Becker	3	2
Pelidnoptera Rondani	4	2
Perilimnia Becker	2	2
Pherbecta Steyskal	1	1
Pherbellia Robineau-Desvoidy	96	51
Pherbina Robineau-Desvoidy	3	3
Poecilographa Melander	1	1
Protodictya Malloch	8	7
Psacadina Enderlein	6	3
Pseudomelina Malloch	1	0
Pteromicra Lioy	19	13
Renocera Hendel	6	6
Retellia Robineau-Desvoidy	2	1
Salticella Robineau-Desvoidy	2	1
Sciomyza Fallén	6	5
Sepedomerus Steyskal	3	3
Sepedon Latreille	79	39
Sepedonea Steyskal	13	6
Sepedonella Verbeke	5	2
Shannonia Malloch	2	2
Steyskalina Knutson	1	0
Tetanocera Duméril	39	29
Tetanoceroides Malloch	7	7
Tetanoptera Verbeke	1	0
Tetanura Fallén	1	1
Teutoniomyia Hennig	2	1
Thecomyia Perty	13	1
Trypetolimnia Mayer	1	0
Trypetoptera Hendel	2	2
Verbekaria Knutson	1	1

TABLE 2. Type material of Sciomyzidae in the Cornell University Insect Collection. HT = holotype, AT = allotype, PT = paratype. Specimens without a CUIC Type number are listed with a ~; the CUIC is transitioning away from using these type numbers in favor of individual barcode IDs, so no type number was assigned to these types prior to the publication of this paper. CUIC barcode numbers were assigned for each specimen of the new species.

Type Species	CUIC Type No. & [Types]	Valid Name (if different)
Anticheta borealis Foote, 1961	3938 [HT/AT/PT]	-
Anticheta fulva Steyskal, 1960b	3939 [PT]	-
Anticheta patzcuaroensis **n. sp.** Pote	CUIC#000055255-60 [HT/AT/PT]	-
Dichetophora finlandica Verbeke, 1964	~ [PT]	-
Dictya adjuncta Valley in Valley & Berg, 1977	5082 [HT/AT/PT]	-
Dictya bergi Valley in Valley & Berg, 1977	5083 [HT/AT/PT]	-
Dictya fontinalis Fisher & Orth, 1969(a)	4529 [PT]	-
Dictya laurentiana Steyskal, 1954(b)	5574 [PT]	-
Dictya matthewsi Steyskal, 1960(a)	3518 [HT/AT/PT]	-
Dictya neffi Steyskal, 1960a	3519 [HT/AT/PT]	-
Dictya oxybeles Steyskal, 1960(a)	3472 [PT]	-
Dictya pechumani Valley in Valley & Berg, 1977	5084 [HT/AT/PT]	-
Dictya steyskali Valley in Valley & Berg, 1977	5085 [HT/AT/PT]	-
Dictya valleyi Orth, 1991	7002 [PT]	-
Dictyacium firmum Steyskal, 1956	5573 [PT]	-
Guatemalia hubbelli Steyskal, 1960(a)	4390 [PT]	*Guatemalia straminata* (Wulp) (synonymized by Steyskal 1966a)
Hedria mixta Steyskal, 1954(a)	6267 [PT]	-
Hedroneura connexa Steyskal, 1954(c)	3474 [PT]	*Elgiva connexa* (Steyskal) (combination by Steyskal 1965)
Hoplodictya australis Fisher & Orth, 1972	5575 [PT]	-
Limnia conica Steyskal in Steyskal *et al.*, 1978	5576 [PT]	-
Limnia fitchi Steyskal in Steyskal *et al.*, 1978	5577 [PT]	-
Limnia lindbergi Steyskal in Steyskal *et al.*, 1978	5578 [PT]	-
Limnia sandovalensis Fisher & Orth in Steyskal *et al.*, 1978	5579 [PT]	-
Melina trivittata Cresson, 1920	1766 [HT]	*Ditaeniella trivittata* (Cresson, 1920) (combination by (Knutson *et al.* 1990)
Neolimnia repo Barnes, 1979	5236 [PT]	-
Neolimnia ura Barnes, 1979	5237 [PT]	-
Oidematops ferrugineus Cresson, 1920	1396 [PT]	-
Perilimnia cineritia Zuska in Kaczynski *et al.*, 1969	4697 [PT]	-
Pherbecta limenitis Steyskal, 1956	3473 [HT]	-
Pherbellia anubis Knutson in Bratt *et al.*, 1969	4395 [HT/AT/PT]	-
Pherbellia borea Orth, 1982	5645 [PT]	-
Pherbellia californica Orth, 1982	5646 [PT]	-
Pherbellia marthae Orth, 1982	5647 [PT]	-
Pherbellia paludum Orth, 1982	5648 [PT]	-
Pherbellia prefixa Steyskal, 1966(b)	5571 [PT]	-

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TABLE 2. (Continued)

Type Species	CUIC Type No. & [Types]	Valid Name (if different)
Pherbellia propages Steyskal, 1966(b)	5532 [PT]	-
Pherbellia rozkosnyi Verbeke, 1967	~ [PT]	-
Pherbellia subtilis Orth & Steyskal in Orth *et al.*, 1980	5572 [PT]	-
Pherbellia ursilacus Orth, 1982	5649 [PT]	-
Pteromicra inermis Steyskal, 1956	5465 [PT]	*Sciomyza varia* (Coquillett) (synonymized by Steyskal 1973)
Pteromicra rudis Knutson & Zuska, 1968	4410 [HT/AT/PT]	-
Pteromicra siskiyouensis Fisher & Orth, 1966	~ [PT]	-
Pteromicra steyskali Foote, 1959	3464 [HT/AT/PT]	-
Sepedon anchista Steyskal, 1956	3466 [HT]	-
Sepedon capellei Fisher & Orth, 1969(b)	4528 [PT]	-
Sepedon gracilicornis Orth, 1986	~ [PT]	-
Sepedon haplobasis Steyskal, 1960(a)	3520 [HT/AT/PT]	*Sepedon relicta* (synonymized by Knutson 1977)
Sepedon pseudarmipes Fisher & Orth, 1969(b)	4527 [PT]	-
Shannonia meridionalis Zuska in Kaczynski *et al.*, 1969	4473 [HT/PT]	-
Tetanocera hespera Steyskal, 1959	3467 [PT]	*Tetanocera latifibula* (synonymized by Steyskal 1965)
Tetanocera loewi Steyskal, 1959	3471 [PT]	-
Tetanocera melanostigma Steyskal, 1959	3470 [PT]	-
Tetanocera mesopora Steyskal, 1959	3468 [PT]	-
Tetanoceroides dentifer Zuska in Zuska & Berg, 1974	4507 [HT/PT]	-
Tetanoceroides mendicus Zuska in Zuska & Berg, 1974	4508 [HT/PT]	-
Tetanoceroides simplex Zuska in Zuska & Berg, 1974	4509 [HT/PT]	-
Verbekaria punctipennis Knutson, 1968	4409 [PT]	-

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Literature Cited

Barnes, J.K. (1979) Revision of the New Zealand genus *Neolimnia* (Diptera: Sciomyzidae). *New Zealand Journal of Zoology*, 6, 561–576.
https://doi.org/10.1080/03014223.1979.10428398

Berg, C.O. (1953) Sciomyzid larvae (Diptera) that feed on snails. *The Journal of Parasitology*, 39 (6), 630–636. https://doi.org/10.2307/3274083
Berg, C.O. & Knutson, L. (1978) Biology and systematics of the Sciomyzidae. *Annual Review of Entomology*, 23 (1), 239–258. https://doi.org/10.1146/annurev.en.23.010178.001323
Bratt, A.D., Knutson, L.V., Foote, B.A. & Berg, C.O. (1969) Biology of *Pherbellia* (Diptera: Sciomyzidae). *New York Agricultural Experiment Station Memoir, Ithaca*, 404, 1–247.
Brown, B.V., Borkent, A., Cumming, J.M., Wood, D.M., Woodley, N.E. & Zumbado, M. (Eds.) (2009) Morphology and Terminology. *In: Manual of Central American Diptera*. NRC Research Press, Ottawa, pp. 9–50.
Brown, W.L., Raffensperger, E.M. & Franclemont, J.G. (1987) Clifford Osburn Berg Obituary. 2 pp. Available from: https://ecommons.cornell.edu/bitstream/handle/1813/19194/Berg_Clifford_Osburn_1987.pdf (accessed 21 February 2023)
Cresson, E.T. (1920) A revision of the Nearctic Sciomyzidae (Diptera, Acalyptratae). *Transactions of the American Entomological Society*, 46 (1), 27–89.
Curran, C.H. (1923) New cyclorrhaphous Diptera from Canada. *The Canadian Entomologist*, 55, 271–279. https://doi.org/10.4039/Ent55271-12
Enderlein, G. (1939) Zur Kenntnis der Klassifikation der Tetanoceriden. *Veröffentilchungen des Deutschen Kolonial- und Ubersee-Museums*, 2, 201–210.
Fisher, T.W. & Orth, R.E. (1964) Biology and immature stages of *Antichaeta testacea* Melander (Diptera: Sciomyzidae). *Hilgardia*, 36 (1), 1–29. https://doi.org/10.3733/hilg.v36n01p001
Fisher, T.W. & Orth, R.E. (1966) A new species of *Pteromicra* from western North America and resurrection of *Pteromicra pleuralis* (Cresson) (Diptera : Sciomyzidae). *The Pan-American Entomologist*, 42 (4), 307–318.
Fisher, T.W. & Orth, R.E. (1969a) A new *Dictya* in California, with biological notes (Diptera: Sciomyzidae). *The Pan-Pacific Entomologist*, 45 (3), 222–228.
Fisher, T.W. & Orth, R.E. (1969b) Two new species of *Sepedon* separated from *S. armipes* Loew in western North America (Diptera: Sciomyzidae). *The Pan-Pacific Entomologist*, 45 (2), 152–164.
Fisher, T.W. & Orth, R.E. (1971) A synopsis of the Nearctic species of *Antichaeta* Haliday with one new species (Diptera: Sciomyzidae). *The Pan-Pacific Entomologist*, 47 (1), 32–43.
Fisher, T.W. & Orth, R.E. (1972) Synopsis of *Hoplodictya* Cresson with one new species (Diptera: Sciomyzidae). *Entomological News*, 83, 173–190.
Fisher, T.W. & Orth, R.E. (1983) *The Marsh Flies of California (Diptera, Sciomyzidae)*. University of California Press, Berkeley, 117 pp.
Foote, B.A. (1959) A new species of *Pteromicra* reared from land snails, with a key to the Nearctic species of the genus (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 61, 14–16.
Foote, B.A. (1961) A new species of *Antichaeta* Haliday, with notes on other species of the genus (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 63 (3), 161–164.
Foote, B.A. & Keiper, J.B. (2004) The snail-killing flies of Ohio. *Kirtlandia*, 54, 43–88.
Foote, B.A., Knutson, L.V. & Keiper, J.B. (1999) The snail-killing flies of Alaska (Diptera: Sciomyzidae). *Insecta Mundi*, 13 (1–2), 45–71.
Frey, R. (1924) Die nordpälaarktischen Tetanocera-Arten (Diptera: Sciomyzidae). *Notulae Entomologicae*, 4, 47–53.
Hendel, F. (1902) Revision der palaarktischen Sciomyziden (Dipteren-Subfamilie). *Abhandlungen der K.K. Zoologisch-Botanischen Gesellschaft in Wien*, 2 (1), 1–94.
Kaczynski, V.W., Zuska, J. & Berg, C.O. (1969) Taxonomy, immature stages, and bionomics of the South American genera *Perilimnia* and *Shannonia* (Diptera: Sciomyzidae). *Annals of the Entomological Society of America*, 62 (3), 572–592. https://doi.org/10.1093/aesa/62.3.572
Karl, O. (1921) Zwei neue Dipteren aus dem Kosliner Bezirk. *Stettiner Entomologische Zeitung*, 82, 125–126.
Knutson, L. & Abercrombie, J. (1977) Biology of *Antichaeta melanosoma* (Diptera: Sciomyzidae), with notes on parasitoid Braconidae and Ichneumonidae. *Proceedings of the Entomological Society of Washington*, 79 (1), 111–125.
Knutson, L.V. (1966) Biology and immature stages of malacophagous flies: *Antichaeta analis*, *A. atriseta*, *A .brevipennis*, and *A. obliviosa* (Diptera: Sciomyzidae). *Transactions of the American Entomological Society*, 92 (1), 67–101.
Knutson, L.V., Orth, R.E., Fisher, T.W. & Murphy, W.L. (1986) Catalog of *Sciomyzidae* (Diptera) of America North of Mexico. *Entomography*, 4, 1–53.
Knutson, L.V. & Vala, J.-C. (2011) *Biology of Snail-Killing Sciomyzidae Flies*. Cambridge University Press, Cambridge, xix + 506 pp.
Knutson, L.V. & Zuska, J. (1968) A new species of *Pteromicra* and of *Euthycera* from western North America (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 70 (1), 78–84.
Loew, H. (1849) Über *Sciomyza glabricula* Fall. und ihre nachsten Verwandten. *Stettiner Entomologische Zeitung*, 10, 337–341.
Meigen, J.W. (1830) *Systematiche Beschreibung der bekannten europäischen zweiflügen Insekten Vol. 6*. *Sechster Theil*. Schulz, Hamm, xi + 401 + [3] pp.
Melander, A.L. (1920) Review of the Nearctic Tetanoceridae. *Annals of the Entomological Society of America*, 13 (3), 305–332. https://doi.org/10.1093/aesa/13.3.305
Morrone, J.J., Escalante, T. & Rodriguez-Tapia, G. (2017) Mexican biogeographic provinces: Map and shapefiles. *Zootaxa*,

4277 (2), 277–279.
https://doi.org/10.11646/zootaxa.4277.2.8
Murphy, W.L. (2019) Untapped dipteran treasures in the Cornell insect collection. *Fly Times*, 63, 25–27.
Murphy, W.L., Mathis, W.N. & Knutson, L.V. (2018) Comprehensive taxonomic, faunistic, biological, and geographic inventory and analysis of the Sciomyzidae (Diptera: Acalyptratae) of the Delmarva region and nearby states in eastern North America. *Zootaxa*, 4430 (1), 1–299.
https://doi.org/10.11646/zootaxa.4430.1.1
Murphy, W.L. & Vala, J.-C. (2020) Lloyd Vernon Knutson, 1934-2018. *Proceedings of the Entomological Society of Washington*, 122 (1), 251–272.
https://doi.org/10.4289/0013-8797.122.1.251
Orth, R.E. (1982) Five new species of *Pherbellia* Robineau-Desvoidy, subgenus *Oxytaenia* Sack, from North America (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 84 (1), 23–37.
Orth, R.E. (1986) Taxonomy of the *Sepedon fuscipennis* Group (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 88 (1), 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 (3), 660–689.
Orth, R.E., Steyskal, G.C. & Fisher, T.W. (1980) A new species of *Pherbellia* Robineau-Desvoidy with notes on the *P. ventralis* group (Diptera: Sciomyzidae). *Proceedings of the Entomological Society of Washington*, 82 (2), 284–292.
Pilsbry, H.A. (1899) Descriptions of new species of Mexican land and freshwater mollusks. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 51 (2), 391–402.
Robinson, W.H & Foote, B.A. (1978) Biology and immature stages of *Antichaeta borealis* (Diptera: Sciomyzidae), a predator of snail eggs. *Proceedings of the Entomological Society of Washington*, 80 (3), 388–396.
Schorno, S., Marshall, S., Murphy, W.L. & Muzzatti, M. (2019) Sciomyzidae of northeastern North America. *Canadian Journal of Arthropod Identification*, 35, 1–331.
https://doi.org/10.3752/cjai.2019.35
Steyskal, G.C. (1954a) *Colobaea* and *Hedria*, two genera of Sciomyzidae new to America (Diptera: Acalyptrate). *Canadian Entomologist*, 86 (2), 59–65.
https://doi.org/10.4039/Ent8660-2
Steyskal, G.C. (1954b) The American species of the genus *Dictya* Meigen (Diptera, Sciomyzidae). *Annals of the Entomological Society of America*, 47 (3), 511–539.
https://doi.org/10.1093/aesa/47.3.511
Steyskal, G.C. (1954c) The Sciomyzidae of Alaska (Diptera). *Proceedings of the Entomological Society of Washington*, 56 (2), 54–71.
Steyskal, G.C. (1956) New species and taxonomic notes in the family Sciomyzidae (Diptera: Acalyptratae). *Papers of the Michigan Academy of Science, Arts, and Letters*, 41, 73–87.
Steyskal, G.C. (1960a) New North and Central American species of Sciomyzidae (Diptera: Acalyptratae). *Proceedings of the Entomological Society of Washington*, 62 (1), 33–43.
Steyskal, G.C. (1960b) 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., Fisher, T.W., Knutson, L. & Orth, R.E. (1978) Taxonomy of North American flies of the genus *Limnia* (Diptera: Sciomyzidae). *University of California Publications in Entomology*, 83, 1–48.
Stone, A., Sabrosky, C.W., Wirth, W.W., Foote, R.H. & Coulson, J.R. (1965) *A Catalog of the Diptera of America North of Mexico*. Agricultural Handbook No. 276. U.S. Dept. of Agriculture, Washington, D.C., iv + 1696 pp.
Valley, K.R. & Berg, C.O. (1977) Biology and immature stages of snail-killing Diptera of the genus *Dictya* (Sciomyzidae). *Search Agriculture Entomology, Ithaca*, 18.7 (2), 1–44.
Verbeke, J. (1964) Contribution à l'étude des diptères malacophages. II. Données nouvelles sur la taxonomie et la répartition géographique des Sciomyzidae paléarctiques. *Bulletin de l'Institute royal des sciences naturelles de Belgique*, 40 (8), 1–27.
Verbeke, J. (1967) Contribution à l'étude des diptères malacophages. V. Trois espèces paléarctiques nouvelles du genre *Pherbellia* Robineau-Desvoidy et quelques données sur l'identité de *P. scutellaris* (von Roser) (Diptera: Sciomyzidae). *Bulletin de l'Institute royal des sciences naturelles de Belgique*, 43 (18), 1–12.
Vikhrev, N.E. (2008) New species of *Anticheta* Haliday, 1838 (Diptera: Sciomyzidae) from Russian Far East. *Russian Entomological Journal*, 17 (2), 241–242.
Villamar, A.A. & Gonzalez, A.C. (2018) *Los P'urepecha, un pueblo renaciente*. Universidad Nacional Autonoma de México, Cuernavaca, Morelos, xix + 506 pp.
Zetterstedt, J.W. (1846) s.n. *In*: *Diptera Scandinaviae disposita et descripta. Tomus quintus.* Officina Lundbergiana, Lundae, pp. 1739–2162.
Zuska, J. & Berg, C.O. (1974) A revision of the South American genus *Tetanoceroides* (Diptera: Sciomyzidae), with notes on colour variations correlated with mean temperatures. *Transactions of the Royal Entomological Society of London*, 125 (3), 329–362.
https://doi.org/10.1111/j.1365-2311.1973.tb00546.x