

AN AMATEUR NATURALIST'S GUIDE TO NON-BITING MIDGES IN SASKATCHEWAN

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Non-biting midges (chironomids) belong to the insect order Diptera (true flies). Their life cycle consists of four stages: egg, larva, pupa and adult.

The larvae and pupae of chironomids inhabit almost every aquatic habitat in the world. Some species can withstand temperatures in excess of 50°C in Australian rockpools, while others inhabit glacial meltwaters at 0.5°C.^{18,19} In Canada, chironomids have been found living in petroleum pools and one species, *Cricotopus ornatus* Meigen, occurs abundantly in Waldsea Lake, Saskatchewan, where salinity exceeds 200,000 ppm (ten times the salinity of ocean water).^{38,42} Many species, particularly in the genera *Chironomus* and *Cryptochironomus*, have a characteristic red colour because their blood (hemolymph) contains the oxygen carrying pigment haemoglobin. These so-called "blood worms" live in the mud where oxygen levels are very low, such as at the bottom of Waskesiu Lake.³⁶

Some chironomid species form close relationships with other organisms. For example, certain species of *Cricotopus* live within colonies of the blue-green alga *Nostoc*.⁶ Species of the genus *Metricnemus* live in pitcher plants.³⁴ Many other species exhibit phoresy, a type of relationship in which one organism is carried on the body of a larger organism but does not feed on the latter, or parasitize other invertebrates, includ-

ing other aquatic insects and molluscs.^{14,15,41}

Chironomid larvae form an important part of many aquatic ecosystems. In Tobin Lake and nearby parts of the Saskatchewan River, two-thirds of the aquatic insect species are chironomids.²⁷ Chironomids also form the bulk of the aquatic insect species in marshes and ponds.^{17,50} Larvae in some nutrient-rich habitats occur in densities of more than 100,000/m².²⁰

The larvae of most species feed on algae and decaying plant material and therefore provide primary links in aquatic food webs. They are also important indicators of pollution at sublethal and lethal levels.^{29,45,46}

Chironomids are economically important in many parts of the world. Larvae of one semi-terrestrial species, *Bryophaenocladus furcatus* (Kieffer) are known to cause damage to seedling tomato and lettuce crops in England.⁹ In certain parts of Florida and California, large emergences of adult chironomids cause reduced use of recreational areas.^{2,7,22} In many areas people suffer from allergenic responses to either body hairs or haemoglobin of chironomid adults.¹⁰ In Saskatchewan, summer mass emergences of adult *Chironomus plumosus* (Linnaeus) at Tobin Lake have resulted in many complaints by local residents.

The objectives of this article are to provide the reader with some background information on these ecologically important insects and to list the species which have been recorded in Saskatchewan.

Life History

During the spring or summer the female deposits a mass of eggs embedded in a gelatinous matrix. When the egg matrix comes in contact with water, it expands and floats on the surface until it contacts a rock, vegetation or other solid surface, to which it adheres. The duration of the egg stage depends on the temperature.³¹

The larval stage is the longest of the life cycle and is essentially the only feeding stage. The larva sheds its skin (moult) four times. The first instar larva (the larva from the time of hatching until the first moult) is free-swimming which is important for dispersal in lakes and ponds.¹² In rivers and streams, dispersal is accomplished by drifting with the current or by upstream movement by the larvae.¹³ First instar larvae obtain nourishment from the remaining yolk and by feeding on suspended particles in the water.^{1,30}

When a suitable microhabitat is found, the larvae establish either a sedentary or free-living mode of life, which continues throughout the rest of larval development. Many sedentary species construct cases composed of particles of silt or sand cemented together with silk-like secretions from their salivary glands. Some species attach their cases to plants or animals while others make burrows a few centimetres into the substrate. Free-living larvae move over the bottom and skim plants in search of food. Many larvae feed by scraping algae, bacteria and organic debris from rocks or wood, or by engulfing quantities of sediment.^{44,51} The larvae of other species construct a net of silk-like salivary strands over the open-

ing of their larval case or burrow and filter particles such as bacteria, detritus and algae from the water.

Species of the subfamily Tanypodinae and a few species from other subfamilies are predators.³ The mouthparts of these larvae are modified to grasp prey. Small prey are engulfed whole; larger prey are held while the body fluids are sucked out.²⁸ A few species are parasitic on larger aquatic insects and molluscs.⁴¹

The length of time required to complete the life cycle depends on environmental conditions, especially temperature.³⁰ In warm regions, life cycles can be as short as two weeks.⁴³ In temperate regions, such as Saskatchewan, there are usually only one or two generations per year because development is interrupted during winter.³¹ In these regions the larvae are the usual overwintering stage.¹¹

Just before pupation the anterior part of the larva becomes enlarged and the adult leg, wing and antennae can be observed through the sheath during this stage. Pupation of burrow-dwelling chironomids usually occurs within the burrow. In free-living species the pupa is also free-living. The pupal stage typically lasts two to three days.^{5,31}

When mature, the pupa rises to the water surface; the skin, which is also an exoskeleton, splits lengthwise along the upper surface of the thorax; the adult emerges through this split. The adult is able to fly almost immediately. The adult stage may last for several weeks; its primary functions are dispersal and reproduction. The adults have reduced mouth parts and most do not feed, although adult females of some species imbibe nectar.¹⁶

Most chironomid species form mating swarms comprised of adult males.²¹ On a warm, calm summer evening, chironomid swarms commonly appear just before sunset at the edge of lakes.

The mass of hundreds of individuals gently moves up and down, similar to smoke rising from a smokestack. The swarms occur over a marker, such as a post or rock. Females are attracted to the swarm and fly into it in search of a mate. Mating can take place in midair or the pair may fly to the ground. Male chironomids identified by their long, plumose (feathery) antennae are attracted to the sound of females in flight.³⁵

After mating the females fly to oviposition sites where the egg masses are laid on the water surface at dawn or dusk. Adults may live for up to two weeks and the females of some species lay two egg masses. A few species can lay eggs without mating.³⁰

Collection and Preservation of Specimens

Egg masses may be collected from floating sticks or vegetation. A trap can be made by passing a string through a series of corks, arranged perpendicular to the prevailing winds or current to collect floating egg masses.

Larval and pupal specimens can be collected by several methods. A simple method involves scooping substrate from the bottom of a water body with a net or kitchen screen and washing the contents using a sweeping motion to remove fine silt particles from the sample. The contents are placed in a white pan partially filled with water. Live specimens are removed with a wire loop, dropper or forceps and either placed in jars for transport to the laboratory for rearing or preserved in 80% alcohol.

Larvae of some species are found in specialized habitats such as rotting wood, sponges, plant material or on rocks. These can be searched individually for larvae and pupae.

Pupal skins, which are shed when the

adults emerge, can be collected using a fine mesh net. In running water, the net is held in the current for a few minutes with half the opening below the water surface; in lakes or ponds the net is skimmed over the surface. The accumulated individuals are washed to the bottom of the net and the contents placed in a jar containing 80% alcohol. Foam along the shore of streams, lakes or ponds can also yield specimens.

Dusk is a particularly good time to collect adult specimens using an aerial sweep net. Males are attracted also to lights at night. Specimens are aspirated into a vial and preserved in 70% alcohol.

A label with the location, habitat type, approximate water depth, date and name of the collector should be placed on each sample. Labels should always be written in pencil.

Rearing

For many species of chironomids the larval, pupal and adult stages are known independently of each other and have yet to be associated. Rearing larvae to the adult stage is the best means to fill this important gap in our knowledge. Larvae can be reared with little or no specialized equipment. Prepupal individuals, identified by the enlarged area just behind the head, are placed in small vials half full of dechlorinated water (this is done using an aquarium dechlorinator or by letting the water stand for 24 h). The vials are placed in a tray of water out of direct sunlight. Tap water (15°C) can then be circulated through the tray using rubber hoses to keep the larvae cool if temperatures get much above 22°C. Vials should be checked daily and emerged adults placed in dry vials in a cold (5°C) refrigerator for 24 h. This hardens the cuticle and ensures that the wings are completely expanded and cleared, which is essential for identification. The adult is then preserved along with the associated larval and pupal

exuviae in 70% alcohol.

Preparation of Study Material

Identification to species or genus requires examination under a microscope. The preparation of specimens for microscopic analysis involves a number of chemicals and equipment not readily available to most naturalists. Interested individuals should refer to Mason, Pinder or Parker for a full account of the procedures used.^{23,33,35}

Species List

The chironomid fauna of Saskatchewan is not very well known. To date, only parts of the Saskatchewan River, Waskesiu and Waldsea Lakes, and ponds in the vicinity of Saskatoon have been studied. Four new species have been described and several other new species have yet to be described from material collected at these sites.²⁵

The chironomid fauna of the lakes and streams in and around Lake Athabasca, the boreal forest, Grasslands National Park and the Cypress Hills have yet to be studied. When these areas are studied many species not yet recorded for the province and even new species will likely become known. A list of chironomid species known to occur in Saskatchewan is presented in Table 1 (see end of article). The list is a summary of various works containing new records and significant range extensions for some species.^{17,23,24,29,33,50}

Taxonomic Information

Lists of described genera and North American species are available.^{4,9} Larval keys to genus are presented by Coffman and Ferrington, Oliver and Roussel and Wiederholm.^{8,32,47} Pupal keys for genera are found in Coffman and Ferrington and Wiederholm.^{8,48} Keys to genera for adult males are found in Oliver and Wiederholm and to adult females in Saether.^{31,39,49} Saether provided a glossary for the structural terms of all chironomid stages.⁴⁰

Species keys for known Saskatchewan River chironomids were written by Mason and for pond chironomids by Parker.^{23,24,33} Another useful key is Roback for adult male Tanypodinae.³⁷

An analysis of the origin and distribution of Saskatchewan River chironomids is found in Mason and Lehmkuhl.²⁶

Areas for Further Research

This group of insects provides a good opportunity for naturalists to contribute valuable scientific information. For example, a great deal of work is needed in associating larval, pupal and adult stages. Basic survey work is also needed in many parts of the province. Times of emergences are unknown for many species.

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Table 1. Chironomidae Known to Occur in Saskatchewan

Tanypodinae

Pentaneurini

- Ablabesmyia (Ablabesmyia) monilis* (Linnaeus)
- + *Ablabesmyia (Karelia) illinoense* (Malloch)
- + *Ablabesmyia (Karelia) pulchripennis* (Lundbeck)
- * *Conchapelopia (Conchapelopia) telema* Roback
- + *Derotanypus alaskensis* (Malloch)
- * *Hayesomyia senata* (Walley)
- * *Rheopelopia* sp.

Procladiini

- + *Procladius (Holotanypus) sp.*
- * *Procladius (Procladius) denticulatus* Sublette
- * *Procladius (Procladius) freemani* Sublette
- * *Procladius (Psilotanypus) bellus* (Loew)
- + *Procladius (Psilotanypus) nietus* Roback
- Psectrotanypus (Derotanypus) alaskensis* (Malloch)
- + *Psectrotanypus (Psectrotanypus) dyari* (Coquillet)
- *+ *Tanypus (Tanypus) punctipennis* Meigen

Diamesinae

Diamesini

- * *Diamesa cineralla* Meigen
- * *Potthastia longimana* Keiffer

Protanypini

- + *Protanypus* sp.

Chironominae

Chironomini

- * *Chernovskiiia amphitrite* (Townes)
- + *Chironomus (Camptochironomus) tentans* (Fabricius)
- Chironomus (Chaetolabis) atroviridis* (Townes)
- Chironomus (Chaetolabis) sp.*
- + *Chironomus (Chironomus) atrella* Townes
- * *Chironomus (Chironomus) anthracinus* Zetterstedt
- * *Chironomus (Chironomus) decorus* Johannsen
- *+ *Chironomus (Chironomus) plumosus* (Linnaeus)
- * *Chironomus (Chironomus) staegeri* (Lundstroem)
- + *Chironomus (Chironomus) riparius* Meigen
- + *Cladopelma viridulus* (Linnaeus)
- *+ *Cladopelma* sp.
- * *Cryptochironomus conus* Mason
- * *Cryptochironomus curryi* Mason
- *+ *Cryptochironomus digitatus* Malloch
- * *Cryptochironomus eminentia* Mason
- * *Cryptochironomus fulvus* Johannsen
- * *Cryptochironomus ramus* Mason
- * *Cryptochironomus scimitarus* (Townes)
- * *Cryptochironomus stylifera* Johannsen
- * *Cryptotendipes darbyi* Sublette
- Cryptotendipes casuaris* (Townes)
- * *Cyphomella gibbera* Saether
- * *Demicryptochironomus* sp.
- *+ *Dicrotendipes nervosus* Staeger
- + *Einfeldia pagana* Meigen
- *+ *Endochironomus nigricans* Johannsen
- + *Glypotendipes (Phytotendipes) barbipes* (Staeger)
- + *Glypotendipes (Phytotendipes) lobiferus* (Say)
- * *Glypotendipes (Phytotendipes) paripes* (Edwards)

- + *Glyptendipes* sp.
- * *Harnischia curtilamellata* (Malloch)
- * *Microtendipes caducus* Townes
- * *Microtendipes pedellus* (De Geer)
- * *Nilothauma babyi* (Rempel)
- * *Parachironomus abortivus* (Malloch)
- * *Parachironomus frequens* (Johannsen)
- Parachironomus tenuicaudatus* (Malloch)
- * *Paracladopemla nereis* (Townes)
- * *Paracladopemla winnelli* Jackson
- * *Paralauterborniella nigrohalterale* (Malloch)
- * *Paratendipes albimanus* (Meigen)
- * *Phaenopsectra obediens* (Johannsen)
- * *Polypedilum (Polypedilum) sp. nr. aviceps* Townes
- * *Polypedilum (Polypedilum) convictum* (Walker)
- * *Polypedilum (Polypedilum) fallax* (Johannsen)
- * *Polypedilum (Polypedilum) illinoense* (Malloch)
- * *Polypedilum (Polypedilum) laetum* (Meigen)
- * *Polypedilum (Polypedilum) obtusum* Townes
- * *Polypedilum (Tripodura) digitifer* Townes
- * *Polypedilum (Tripodura) scalaenum* (Schrank)
- * *Robackia claviger* (Townes)
- * *Robackia demeijerei* (Kruseman)
- * *Saetheria tylus* Jackson
- * *Stenochironomus hilarus* (Walker)
- * *Xenochironomus (Anceus) scopulus* Townes
- * *Xenochironomus (Xenochironomus) xenolabis* (Kieffer)

Tanytarsini

- *+ *Cladotanytarsus* sp.
- * *Constempellina* sp.
- + *Corynocera* sp.
- * *Micropsectra nigripila* (Johannsen)
- * *Micropsectra dives* (Johannsen)
- * *Micropsectra polits* (Malloch)
- * *Paratanytarsus confusus* Palmen
- * *Paratanytarsus laccophilus* (Edwards)
- * *Rheotanytarsus exiguus* (Johannsen)
- + *Stempellina* sp.
- * *Stempellina* sp.
- * *Tanytarsus glabrescens* Edwards
- * *Tanytarsus guerlus* Roback

Orthcladiinae

- + *Acricotopus senex* (Johannsen)
- * *Cardiocladius* sp.
- * *Corynoneura celeripes* Winnertz
- * *Corynoneura* sp. nr. *taris* Roback
- * *Cricotopus (Cricotopus) bicintus* (Meigen)
- * *Cricotopus (Cricotopus) curtuss* Jirvenjo
- * *Cricotopus (Cricotopus) politus* (Coquillett)
- * *Cricotopus (Cricotopus) slossonae* Malloch
- * *Cricotopus (Cricotopus) triannulatus* (Macquart)
- * *Cricotopus (Cricotopus) sp. nr. tremulus* (Linnaeus)
- * *Cricotopus (Cricotopus) trifascia* Edwards
- * *Cricotopus (Cricotopus) sp.*
- * *Cricotopus (Isocladius) intersectus* (Staeger)
- * *Cricotopus (Isocladius) ornatus* (Meigen)
- * *Cricotopus (Isocladius) sylvestris* (Fabricius)
- * *Epoicocladius* sp.

- * *Eukiefferiella* sp.
- + *Heterotanytarsus* sp.
- *+ *Hydrobaenus* sp.
- + *Limnophyes* sp.
- * *Nanocladius* (*Nanocladius*) *anderseni* Saether
- * *Nanocladius* (*Nanocladius*) *crassocornis* Saether
- * *Nanocladius* (*Nanocladius*) *spiniplenus* Saether
- * *Orthocladius* (*Euorocladius*) *rivicola* Kieffer
- * *Orthocladius* (*Euorocladius*) ?*rivicola* Kieffer
- * *Orthocladius* (*Orthocladius*) *carlatus* Roback
- * *Orthocladius* (*Orthocladius*) *mallochi* Kieffer
- * *Orthocladius* (*Orthocladius*) *nigritus* Malloch
- * *Orthocladius* (*Orthocladius*) *obrumbatus* Johannsen
- * *Orthocladius* (*Orthocladius*) *robacki* Sopenis
- * *Orthocladius* (*Orthocladius*) sp.
- * *Parakiefferiella* (*Parakiefferiella*) *tortulata* Saether
- * *Parametriocnemus* sp.
- *+ *Psectrocladius* (*Allosectrocladius*) *flavus* (Johannsen)
- * *Psectrocladius* (*Psectrocladius*) *simulans* (Johannsen)
- * *Pseudosmittia* sp.
- * *Synorthocladius* *semivirens* (Kieffer)
- * *Thienemanniella* cf. *xena* Roback
- * *Tvetenia* *vitracies* (Saether)

* Found in flowing water

+ Found in still water



Within the cells of the tiniest algae, behind the walls of the green leaf, everywhere that the unique compound chlorophyll occurs, the sun's power is held and transformed. Every living thing has been built from the products of this silent, unassuming industry. *Braun and Cavagnaro. 1971. Living Water. American West, Palo Alto, CA.*