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Chironomidae

The **Chironomidae** (informally known as **chironomids**, **nonbiting midges**, or **lake flies**) comprise a family of nematoceran flies with a global distribution. They are closely related to the Ceratopogonidae, Simuliidae, and Thaumaleidae. Many species superficially resemble mosquitoes, but they lack the wing scales and elongated mouthparts of the Culicidae. An example of mosquito-resembling species is *Tokunagayusurika akamusi*.

The name Chironomidae stems from the Ancient Greek word *kheironómos*, "a pantomimist".

Chironomidae	
Temporal range: Triassic–Present	
Pre€ € O S D C P T J K Pg N	

Male *Chironomus plumosus*

Scientific classification	
Kingdom:	Animalia
Phylum:	Arthropoda
Class:	Insecta
Order:	Diptera
Suborder:	Nematocera
Infraorder:	Culicomorpha
Superfamily:	Chironomoidea
Family:	Chironomidae Erichson, 1841
Subfamilies	
See text	

Contents

Common names and biodiversity

This is a large taxon of insects; some estimates of the species numbers suggest well over 10 000 world-wide.[1] Males are easily recognized by their plumose antennae. Adults are known by a variety of vague and inconsistent common names, largely by confusion with other insects. For example, chironomids are known as "lake flies" in parts of Canada and Lake Winnebago, Wisconsin, but "bay flies" in the areas near the bay of Green Bay, Wisconsin. They are called "sand flies", "muckleheads",[2] "muffleheads",[3] "Canadian soldiers",[4] or "American soldiers"[5] in various regions of the Great Lakes area. They have been called "blind mosquitoes" or "chizzywinks" in Florida.[6] However, they are not mosquitoes of any sort, and the term "sandflies" generally refers to various species of biting flies unrelated to the Chironomidae.

The group includes the wingless *Belgica antarctica*, the largest terrestrial animal of Antarctica.[7][8]

The biodiversity of the Chironomidae often goes unnoticed because they are notoriously difficult to identify and ecologists usually record them by species groups. Each morphologically distinct group comprises a number of morphologically identical (sibling) species that can only be identified by rearing adult males or by cytogenetic analysis of the polytene chromosomes. Polytene chromosomes were originally observed in the larval salivary glands of *Chironomus* midges by Balbiani in 1881. They form through repeated rounds of

DNA replication without cell division, resulting in characteristic light and dark banding patterns which can be used to identify inversions and deletions which allow species identification.


Two lake flies observed in Neenah, Wisconsin after the yearly hatch in Lake Winnebago.

Behavior and description

Larval stages of the Chironomidae can be found in almost any aquatic or semiaquatic habitat, including treeholes, bromeliads, rotting vegetation, soil, and in sewage and artificial containers. They form an important fraction of the macro zoobenthos of most freshwater ecosystems. They are often associated with degraded or low-biodiversity ecosystems because some species have adapted to virtually anoxic conditions and are dominant in polluted waters. Larvae of some species are bright red in color due to a hemoglobin analog; these are often known as "bloodworms".[9] Their ability to capture oxygen is further increased by their making undulating movements.[10]

Many reference sources in the past century or so have repeated the assertion that the Chironomidae do not feed as adults, but an increasing body of evidence contradicts this view. Adults of many species do, in fact, feed. The natural foods reported include fresh fly droppings, nectar, pollen, honeydew, and various sugar-rich materials.[1]

The question whether feeding is of practical importance has by now been clearly settled for some *Chironomus* species, at least; specimens that had fed on sucrose flew far longer than starved specimens, and starved females longer than starved males, which suggested they had eclosed with larger reserves of energy than the males. Some authors suggest the females and males apply the resources obtained in feeding differently. Males expend the extra energy on flight, while females use their food resources to achieve longer lifespans. The respective strategies should be compatible with maximal probability of successful mating and reproduction in those species that do not mate immediately after eclosion, and in particular in species that have more than one egg mass maturing, the less developed masses being oviposited after a delay. Such variables also would be relevant to species that exploit wind for dispersal, laying eggs at intervals. Chironomids that feed on nectar or pollen may well be of importance as pollinators, but current evidence on such points is largely anecdotal. However, the content of protein and other nutrients in pollen, in comparison to nectar, might well contribute to the females' reproductive capacities.[1]

Adults can be pests when they emerge in large numbers. They may cause difficulty during driving if they collide with the windshield, creating an opaque coating which obscures the driver's vision.[11] They can damage paint, brick, and other surfaces with their droppings. When large numbers of adults die, they can build up into malodorous piles. They can provoke allergic reactions in sensitive individuals.[12]

Ecology

Larvae and pupae are important food items for fish, such as trout, banded killifish, and sticklebacks, and for many other aquatic organisms as well such as newts. Many aquatic insects, such as various predatory hemipterans in the families Nepidae, Notonectidae, and Corixidae eat Chironomidae in their aquatic phases. So do predatory water beetles in families such as the Dytiscidae and Hydrophilidae. The flying midges are eaten by fish and insectivorous birds, such as swallows and martins. They are also thought to be an especially important food source for tufted duck chicks during their first few days of life. They also are preyed on by bats and flying predatory insects, such as Odonata and dance flies.

The Chironomidae are important as indicator organisms, i.e., the presence, absence, or quantities of various species in a body of water can indicate whether pollutants are present. Also, their fossils are widely used by palaeolimnologists as indicators of past environmental changes, including past climatic variability.[13] Contemporary specimens are used by forensic entomologists as medico-legal markers for the postmortem interval assessment.[14]

A number of chironomid species inhabit marine habitats. Midges of the genus *Clunio* are found in the intertidal zone, where they have adjusted their entire life cycle to the rhythm of the tides. This made the species *Clunio marinus* an important model species for research in the field of chronobiology.[15]

Anhydrobiosis and stress resistance

Anhydrobiosis is the ability of an organism to survive in the dry state. Anhydrobiotic larvae of the African chironomid *Polypedilum vanderplanki* can withstand prolonged complete desiccation (reviewed by Cornette and Kikawada[16]). These larvae can also withstand other external stresses including ionizing radiation.[17] The effects of anhydrobiosis, gamma ray and heavy-ion irradiation on the nuclear DNA and gene expression of these larvae were studied by Gusev et al.[17] They found that larval DNA becomes severely fragmented both upon anhydrobiosis and irradiation, and that these breaks are later repaired during rehydration or upon recovery from irradiation. An analysis of gene expression and antioxidant activity suggested the importance of removal of reactive oxygen species as well as the removal of DNA damages by repair enzymes. Expression of genes encoding DNA repair enzymes increased upon entering anhydrobiosis or upon exposure to radiation, and these increases indicated that when DNA damages occurred, they were subsequently repaired. In particular, expression of the *Rad51* gene was substantially up-regulated following irradiation and during rehydration.[17] The Rad51 protein plays a key role in homologous recombination, a process required for the accurate repair of DNA double-strand breaks.

Subfamilies and genera

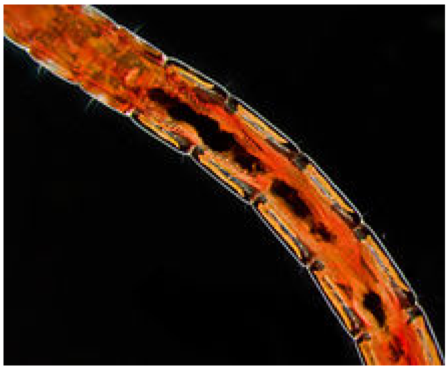
The family is divided into 11 subfamilies: Aphroteniinae, Buchonomyiinae, Chilenomyinae, Chironominae, Diamesinae, Orthocladiinae, Podonominae, Prodiamesinae, Tanypodinae, Telmatogetoninae, and Usambaromyiinae.[18][19] Most species belong to Chironominae, Orthocladiinae, and Tanypodinae. Diamesinae, Podonominae, Prodiamesinae, and Telmatogetoninae are medium-sized subfamilies with tens to hundreds of species. The remaining four subfamilies have fewer than five species each.

Chironomidae sp. female on flower of *Euryops* sp. damage caused by beetles in family Meloidae

- *Aagaardia* Sæther, 2000
- *Abiskomyia* Edwards, 1937
- *Ablabesmyia* Johannsen, 1905
- *Acalcarella*
- *Acamptocladius* Brundin, 1956
- *Acricotopus* Kieffer, 1921
- *Aedokritus*
- *Aenne*
- *Afrochlus*
- *Afrozavrelia* Harrison, 2004[20]
- *Allocladius*
- *Allometriocnemus*
- *Allotrissocladius*
- *Alotanypus* Roback, 1971

- *Amblycladius*
- *Amnihayesomyia*
- *Amphismittia*
- *Anaphrotenia*
- *Anatopynia* Johannsen, 1905
- *Ancylocladius*
- *Andamanus*
- *Antillocladius* Sæther, 1981
- *Anuncotendipes*
- *Apedilum* Townes, 1945
- *Aphrotenia*
- *Aphroteniella*
- *Apometriocnemus* Sæther, 1984
- *Apsectrotanypus* Fittkau, 1962
- *Archaeochlus*
- *Arctodiamesa* Makarchenko, 1983[21]
- *Arctopelopia* Fittkau, 1962
- *Arctosmittia*
- *Asachironomus*
- *Asclerina*
- *Asheum* Sublette & Sublette, 1983
- *Australopelopia*
- *Austrobrillia*
- *Austrochlus*
- *Austrocladius*
- *Axarus* Roback 1980
- *Baeoctenus*
- *Baeotendipes* Kieffer, 1913
- *Bavarismittia*
- *Beardius* Reiss & Sublette, 1985
- *Beckidia* Sæther 1979
- *Belgica*
- *Bernhardia*
- *Bethbilbeckia*
- *Biwatendipes*
- *Boreochlus* Edwards, 1938
- *Boreoheptagyia* Brundin 1966
- *Boreosmittia*
- *Botryocladius*
- *Brillia* Kieffer, 1913
- *Brundiniella*
- *Brunieria*
- *Bryophaenocladius* Thienemann, 1934
- *Buchonomyia* Fittkau, 1955
- *Caladomyia*


Chironomidae larva, about 1 cm long, the head is right: The magnified tail details are from other images of the same animal.


Chironomidae larva showing the characteristic red color, about 40× magnification: The head is towards the upper left, just out of view.

- *Camposimyia*
- *Camptocladius* van der Wulp, 1874
- *Cantopelopia*
- *Carbochironomus* Reiss & Kirschbaum 1990
- *Cardiocladius* Kieffer, 1912
- *Chaetocladius* Kieffer, 1911
- *Chasmatonotus*
- *Chernovskiia* Sæther 1977
- *Chilenomyia*
- *Chirocladius*
- *Chironomidae (genus)*
- *Chironominae*
- *Chironomini*
- *Chironomus* Meigen, 1803
- *Chrysopelopia*
- *Cladopelma* Kieffer, 1921
- *Cladotanytarsus* Kieffer, 1921
- *Clinotanypus* Kieffer, 1913
- *Clunio* Haliday, 1855
- *Coelopynia*
- *Coelotanypus*
- *Coffmania*
- *Collartomyia*
- *Colosmittia*
- *Compteromesa* Sæther 1981
- *Compterosmittia*
- *Conchapelopia* Fittkau, 1957
- *Conochironomus*
- *Constempellina* Brundin, 1947
- *Corynocera* Zetterstedt, 1838
- *Corynoneura* Winnertz, 1846
- *Corynoneurella* Brundin, 1949
- *Corytibacladius*
- *Cricotopus* van der Wulp, 1874
- *Cryptochironomus* Kieffer, 1918
- *Cryptotendipes* Lenz, 1941
- *Cyphomella* Sæther 1977
- *Dactylocladius*
- *Daitoyusurika*
- *Demeijerea* Kruseman, 1933
- *Demicryptochironomus* Lenz, 1941
- *Denopelopia*
- *Derotanypus*
- *Diamesa* Meigen in Gistl, 1835
- *Diamesinae*

- *Dicrotendipes* Kieffer, 1913
- *Diplocladius* Kieffer, 1908
- *Diplosmittia*
- *Djalmabatista* Fittkau, 1968
- *Doithrix*
- *Doloplastus*
- *Doncricotopus*
- *Dratnalia*
- *Echinocladius*
- *Edwardsidia*
- *Einfeldia* Kieffer, 1924
- *Endochironomus* Kieffer, 1918
- *Endotribelos*
- *Epoicocladius* Sulc & ZavÍel, 1924
- *Eretmoptera*
- *Eukiefferiella* Thienemann, 1926
- *Eurycnemus* van der Wulp, 1874
- *Euryhapsis* Oliver, 1981
- *Eusmittia*
- *Fissimentum*
- *Fittkauimyia*
- *Fleuria*
- *Freemaniella*
- *Friederia*
- *Georthocladius* Strenzke, 1941
- *Gillotia* Kieffer, 1921
- *Glushkovella*
- *Glyptotendipes* Kieffer, 1913
- *Goeldichironomus*
- *Graceus* Goetghebuer, 1928
- *Gravatamberus*
- *Gressittius*
- *Guassutanypus*
- *Guttipelopia* Fittkau, 1962
- *Gymnometriocnemus* Goetghebeur, 1932
- *Gynnidocladius*
- *Gynocladius* Mendes, Sæther & Andrade-Morraye, 2005
- *Hahayusurika*
- *Halirytus*
- *Halocladius* Hirvenoja, 1973
- *Hanochironomus*
- *Hanocladius*
- *Harnischia* Kieffer, 1921
- *Harrisius*
- *Harrisonina*

- *Hayesomyia* Murray & Fittkau, 1985
- *Heleniella* Gouin, 1943
- *Helopelopia* Roback, 1971
- *Henrardia*
- *Heptagyia*
- *Heterotanytarsus* Spärck, 1923
- *Heterotrissocladius* Spärck, 1923
- *Hevelius*
- *Himatendipes*
- *Hirosimayusurika*
- *Hudsonimyia* Roback, 1979[22]
- *Hydrobaenus*
- *Hydrosmittia*
- *Hyporhygma*
- *Ichthyocladius* Fittkau, 1974
- *Ikiprimus*
- *Ikisecundus*
- *Imparipecten*
- *Indoaxarus*
- *Indocladius*
- *Ionthosmittia*
- *Irisobrillia*
- *Kaluginia*
- *Kamelopelopia*
- *Kaniwhaniwhanus*
- *Kiefferophyes*
- *Kiefferulus* Goetghebuer, 1922
- *Knepperia*
- *Kloosia* Kruseman 1933
- *Krenopelopia* Fittkau, 1962
- *Krenopsectra*
- *Krenosmittia* Thienemann & Krüger, 1939
- *Kribiobius*
- *Kribiocosmus*
- *Kribiodosis*
- *Kribiopelma*
- *Kribiothauma*
- *Kribioxenus*
- *Kurobebrillia*
- *Kuschelius*
- *Labrundinia* Fittkau, 1962
- *Lappodiamesa* Serra-Tosio, 1968
- *Lappokiefferiella*
- *Lapposmittia*
- *Larsia* Fittkau, 1962

- *Lasiodiamesa* Kieffer, 1924
- *Laurotanypus*
- *Lauterborniella* Thienemann & Bause, 1913
- *Lepidopelopia*
- *Lepidopodus*
- *Lerheimia*
- *Limaya*
- *Limnophyes* Eaton, 1875
- *Lindebergia*
- *Linevitshia*
- *Lipiniella* Shilova 1961
- *Lipurometriocnemus*
- *Lithotanytarsus*
- *Litocladius* Andersen, Mendes & Sæther 2004
- *Ljungneria*
- *Lobodiamesa*
- *Lobomyia*
- *Lobosmittia*
- *Lopescladius*
- *Lunditendipes*
- *Lyrocladius* Mendes & Andersen, 2008
- *Macropelopia* Thienemann, 1916
- *Macropelopini*
- *Manoa*
- *Maoridiamesa*
- *Mapucheptagyia*
- *Maryella*
- *Mecaorus*
- *Megacentron*
- *Mesocricotopus*
- *Mesosmittia* Brundin, 1956
- *Metriocnemus* van der Wulp, 1874
- *Microchironomus* Kieffer, 1918
- *Micropsectra* Kieffer, 1909
- *Microtendipes* Kieffer, 1915
- *Microzetia*
- *Molleriella*
- *Mongolchironomus*
- *Mongolcladius*
- *Mongolyusurika*
- *Monodiamesa* Kieffer, 1922
- *Monopelopia* Fittkau, 1962
- *Murraycladius*
- *Nakataia*
- *Nandeca*

- *Nanocladius* Kieffer, 1913
- *Naonella*
- *Nasuticladius*
- *Natarsia* Fittkau, 1962
- *Neelamia*
- *Neobrillia*
- *Neopodonomus*
- *Neostempellina*
- *Neozavrelia* Goetghebuer, 1941
- *Nesiocladius*
- *Nilodorum*
- *Nilodosis*
- *Nilotanypus* Kieffer, 1923
- *Nilothauma* Kieffer, 1921
- *Nimbocera*
- *Notocladius*
- *Odontomesa* Pagast, 1947
- *Okayamayusurika*
- *Okinawayusurika*
- *Olecryptotendipes* Zorina, 2007[23]
- *Oleia*
- *Oliveridia* Sæther, 1980
- *Omisus* Townes, 1945
- *Onconeura*
- *Ophryophorus*
- *Oreadomyia*
- *Orthocladiinae*
- *Orthocladius* van der Wulp, 1874
- *Oryctochlus*
- *Oukuriella*
- *Pagastia* Oliver, 1959
- *Pagastiella* Brundin, 1949
- *Paraboreochlus* Thienemann, 1939
- *Parachaetocladius*
- *Parachironomus* Lenz, 1921
- *Paracladius* Hirvenoja, 1973
- *Paracladopelma* Harnisch, 1923
- *Paracricotopus* Thienemann & Harnisch, 1932
- *Parakiefferiella* Thienemann, 1936
- *Paralauterborniella* Lenz, 1941
- *Paralimnophyes* Brundin, 1956
- *Paramerina* Fittkau, 1962
- *Parametriocnemus* Goetghebuer, 1932
- *Pamirocesa*
- *Paraborniella*

- *Parachironominae*
- *Paradoxocladius*
- *Paraheptagyia*
- *Paranilothauma*
- *Parapentaneura*
- *Paraphaenocladius* Thienemann, 1924
- *Paraphrotenia*
- *Parapsectra* Reiss, 1969
- *Parapsectrocladius*
- *Parasmittia*
- *Paratanytarsus* Thienemann & Bause, 1913
- *Paratendipes* Kieffer, 1911
- *Paratrichocladius* Thienemann, 1942
- *Paratrissocladius* ZavÍel, 1937
- *Parochlus* Enderlein, 1912
- *Parorthocladius* Thienemann, 1935
- *Parvitergum*
- *Paucispinigera*
- *Pelomus*
- *Pentaneura*
- *Pentaneurella*
- *Pentaneurini*
- *Pentapedilum*
- *Petalocladius*
- *Phaenopsectra* Kieffer, 1921
- *Physoneura*
- *Pirara*
- *Platysmittia* Sæther, 1982
- *Plhudsonia*
- *Podochlus*
- *Podonomopsis*
- *Podonomus*
- *Polypedilum* Kieffer, 1912
- *Pontomyia*
- *Potthastia* Kieffer, 1922
- *Prochironomus*
- *Procladiini*
- *Procladius* Skuse, 1889
- *Prodiamesa* Kieffer, 1906
- *Propsilocerus*
- *Prosmittia*
- *Protanypus* Kieffer, 1906
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- *Psectrotanypus* Kieffer, 1909
- *Pseudobrillia*

- *Pseudochironomus* Malloch, 1915
- *Pseudodiamesa* Goetghebuer, 1939
- *Pseudohydrobaenus*
- *Pseudokiefferiella* Zavrel, 1941
- *Pseudorthocladius* Goetghebuer, 1932
- *Pseudosmittia* Goetghebuer, 1932
- *Psilochironomus*
- *Psilometriocnemus* Sæther, 1969
- *Pterosis*
- *Qiniella*
- *Reissmesa*
- *Rheochlus*
- *Rheocricotopus* Brundin, 1956
- *Rheomus*
- *Rheomyia*
- *Rheopelopia* Fittkau, 1962
- *Rheosmittia* Brundin, 1956
- *Rheotanytarsus* Thienemann & Bause, 1913
- *Rhinocladius*
- *Riethia*
- *Robackia* Sæther, 1977
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- *Setukoyusurika*
- *Seppia*
- *Sergentia* Kieffer, 1922
- *Shangomyia*
- *Shilovia*
- *Skusella*
- *Skutzia*
- *Smittia* Holmgren, 1869
- *Stackelbergina*
- *Stelechomyia*
- *Stempellina* Thienemann & Bause, 1913
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- *Stictocladius*

- *Stictotendipes*
- *Stilocladius* Rossaro, 1979
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- *Sumatendipes*
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- *Synendotendipes* Grodhaus, 1987
- *Synorthocladius* Thienemann, 1935
- *Tanypodinae*
- *Tanypus* Meigen, 1803
- *Tanytarsini*
- *Tanytarsus* van der Wulp, 1874
- *Tavastia*
- *Telmatogeton* Schiner, 1866
- *Telmatopelopia* Fittkau, 1962
- *Telopelopia*
- *Tempisquitoneura*
- *Tethymyia*
- *Thalassomya* Schiner, 1856
- *Thalassosmittia* Strenzke & Remmert, 1957
- *Thienemannia* Kieffer, 1909
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- *Thienemannimyia* Fittkau, 1957
- *Thienemanniola*
- *Tobachironomus*
- *Tokunagaia* Sæther, 1973
- *Tokunagayusurika*
- *Tokyobrillia*
- *Tosayusurika*
- *Townsia*
- *Toyamayusurika*
- *Tribelos* Townes, 1945
- *Trichochilus*
- *Trichosmittia*
- *Trichotanypus* Kieffer, 1906
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- *Vivacricotopus*
- *Wirthiella*
- *Xenochironomus* Kieffer, 1921
- *Xenopelopia* Fittkau, 1962
- *Xestochironomus*
- *Xestotendipes*
- *Xiaomyia*
- *Xylotopus*
- *Yaeprimus*
- *Yaequartus*
- *Yaequintus*
- *Yaesecundus*
- *Yaetanytarsus*
- *Yaetertius*
- *Yama*
- *Zalutschia* Lipina, 1939
- *Zavrelia* Kieffer, 1913
- *Zavreliella* Kieffer, 1920
- *Zavrelimyia* Fittkau, 1962
- *Zelandochlus*
- *Zhouomyia*
- *Zuluchironomus*

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External links

- The Chironomid Home Page (http://www.chironomidae.net/)
- Chironomidae and Water Beetles of Florida (http://johnepler.com)
- Chironomidae Research Group, University of Minnesota (https://web.archive.org/web/20060615085339/http://www.entomology.umn.edu/midge/index.htm)
- Family Chironomidae at Soil and Water Conservation Society of Metro Halifax (http://lakes.chebucto.org/ZOOBENTH/BENTHOS/xiii.html)
- Checklist of UK Recorded Chironomidae (https://web.archive.org/web/20060516165621/http://www.mapmate.co.uk/checklist/chironomidae.htm)
- Chironomidae at Nomina Insecta Nearctica (https://web.archive.org/web/20060506134605/http://www.nearctica.com/nomina/diptera/dipchiro.htm#anchor888580)
- Chironomid Palaeoecology @ UBC Okanagan (http://www.paleolab.ca)
- Chironomidae at Australian Faunal Directory (https://web.archive.org/web/20150213000027/http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/CHIRONOMIDAE)
- "Hydrilla tip mining midge" (http://entomology.ifas.ufl.edu/creatures/aquatic/hydrilla_tip_mining_midge.htm). *Featured Creatures*. University of Florida Institute of Food and Agricultural Sciences.
- Diptera.info (http://www.diptera.info/photogallery.php?album_id=71) Images