

**Atlas of the
Mayfly Larvae
(Class Insecta: Order Ephemeroptera)
Recorded at the
Old Woman Creek
National Estuarine Research Reserve
& State Nature Preserve, Ohio**

by

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February 2007

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Acknowledgments

The authors are grateful for the assistance of Dr. David Klarer, Old Woman Creek National Estuarine Research Reserve, for providing funding for this project and for his critical reviews of drafts. This work was funded under contract to Heidelberg College by the Ohio Department of Natural Resources, Division of Natural Areas and Preserves.

“This publication was supported [in part] by Grant Number H50/CCH524266 from the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of Centers for Disease Control and Prevention.”

“The Old Woman Creek National Estuarine Research Reserve in Ohio is part of the National Estuarine Research Reserve System (NERRS), established by Section 315 of the Coastal Zone Management Act, as amended. Additional information about the system can be obtained from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 1305 East West Highway – N/ORM5, Silver Spring, MD 20910.

Financial support for this publication was provided by a grant under the Federal Coastal Zone Management Act, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, Silver Spring, MD.”

Copies of this publication are available from the Ohio Department of Natural Resources-Division of Wildlife
2514 Cleveland Road East
Huron, Ohio 44839

Introduction

Both the formal biologist and the amateur naturalist often encounter lists of animals and plants when they read published scientific reports and visit nature centers. Rarely do they have ready access to photographs for each member of the list. The purpose of this chapter of the atlas is to provide a detailed pictorial record of the larval mayflies (Class Insecta: Order Ephemeroptera) within the Old Woman Creek coastal wetland system (OWC) along Lake Erie in Ohio.

Invertebrates occur in great abundance in freshwater ecosystems, including Great Lakes wetlands such as the marshes, swamps, and open water that make up OWC. A few of those invertebrates, such as freshwater mussels, grass shrimps, and giant water bugs, are readily visible once collected because of their large size. However, many others are so small that special attention must be given to seeing them. Most groups of invertebrates go unnoticed by casual visitors to aquatic habitats, and this is true of the aquatic larvae, or nymphs, of many kinds of mayflies. They range in length from less than 1 millimeter (1/16 inch) to more than 3 centimeters (1-1/4 inch), depending on kind and larval stage (instar).

The ability to distinguish one kind of mayfly larva from another often requires careful observation through a dissecting microscope. This chapter presents detailed photographs of critical diagnostic features that permit correct identification to the taxonomic level of genus (plural, genera) of the mayfly larvae found to date at OWC.



Female imago (adult) of *Hexagenia* sp., length (excluding tail filaments) about 3 cm (1.25 inches). Shed skin of subimago is partly visible at lower left.

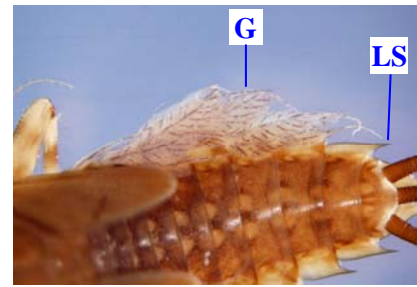
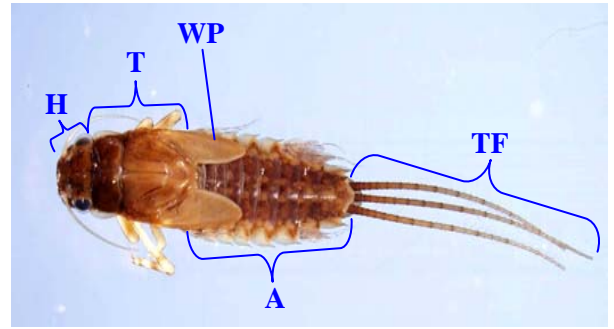
As a group, mayfly larvae live in a wide variety of aquatic habitats. Some kinds live in both standing and running water; other kinds live in only one or the other. Both their presence and abundance are excellent indicators of the quality, or “health”, of aquatic environments. Winged, nonbiting mayfly subadults (“duns” or subimagos) and adults (“spinners” or imagos) often congregate in large swarms near the shores of lakes and streams. Along the shore of Lake Erie, so many mayflies have sometimes accumulated under lights that dump trucks were required to remove them.

Mayflies fill a major role in aquatic ecosystems as a food source for fishes, other vertebrates, and predaceous invertebrates. Mayfly larvae generally feed by scraping or collecting their food, which consists primarily of detritus (remains of plants and animals), algae, and microorganisms. Adult mayflies do not eat or bite, as they lack functional mouthparts. Females deposit eggs at the water surface within minutes after mating.

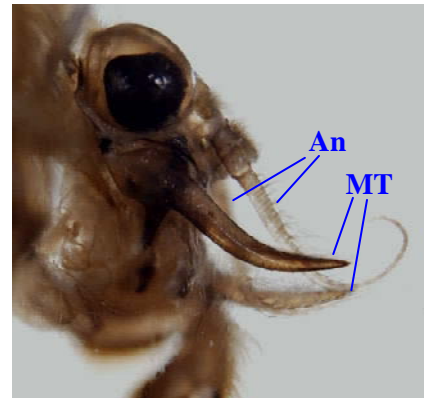
Characteristics of Ephemeroptera Larvae

As members of the Order Ephemeroptera, mayflies have four life stages: egg, larva, subimago, and imago (adult). The female lays eggs in the water, and most species of larvae hatch from a week to several months later. All larvae are aquatic and undergo more instars (periods between molts) than any other insect order. Larvae spend from 3 months to 2 or more years in the water before emerging from the water as subimagos. Mayflies are the only insects with a subimago instar, which possesses fully functional wings along with an immature reproductive system. Within approximately 24 hours, the subimago sheds its skin (molts) and becomes an imago.

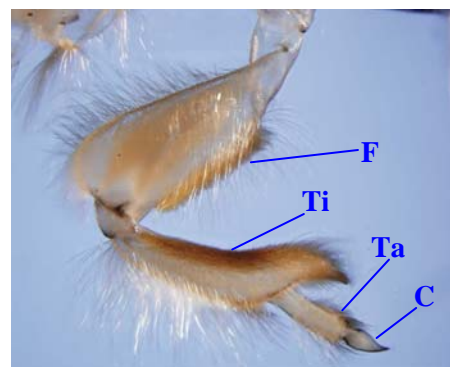
General features of a mayfly larva are shown in the photographs on this page. The body is divided into three regions: **head (H)**, **thorax (T)** and **abdomen (A)**. The head of some genera displays a pair of **mandibular tusks (MT)** arising below (ventral to) the **antennae (An)**. **Gills (G)** are attached to the sides of the **abdomen (A)**, which may feature **lateral spines (LS)**. **Wing pads (WP)** are present dorsally on the thorax of mature individuals but are absent on young larvae. Most mayfly larvae have three **tail filaments (TF)** attached to the end of the abdomen, although a few species have only two. Each leg is divided into five parts: the **coxa** (attached to the thorax, not shown), the **trochanter** (not shown), the **femur (F)**, the **tibia (Ti)**, and the **tarsus (Ta)**. A **claw (C)** is attached to each tarsus.



Leptophlebia sp., dorsal views



Hexagenia sp. head, lateral view



Hexagenia sp. hind leg, dorsal view

Layout of this Atlas

The following pages are organized alphabetically by family. The authors and other collectors have identified five genera of mayflies in four families (Baetidae, Caenidae, Ephemeridae, and Leptophlebiidae) within the OWC wetland system, which excludes the free-flowing upland reaches of Old Woman Creek.

This publication should not be used as the sole source to identify the families and genera of larval mayflies of OWC because it is likely that additional families and genera will be found in new collections. The references cited on this page should be used to obtain definitive identifications. The species within each genus are not included here, and the species of some genera cannot be identified.

Each genus of mayfly larva is illustrated and described on a single page of this atlas. Because the identifying features of the Order Ephemeroptera and the particular family are repeated on each page, the page for each genus can be used independently. Photographs are labeled with identifying letters and lines that indicate diagnostic structures. Some photographs show specimens collected within OWC; specimens from other ecosystems were used if they were of superior quality. The exact specimens photographed are recorded at the bottom of the page.

Beneath the descriptive features, each page lists where within OWC the genus has been found. It is likely that future collections will reveal some of the genera in additional habitats. The general ecology of the genus is briefly summarized, including its habit (such as swimmer or climber), its functional feeding group (such as collector-gatherer), and for some genera, special notes about its habitat or water quality requirements.

All information on each page was derived from three references, which are abbreviated as shown below followed by the page number(s):

E&W = Edmunds, Jr., G.F., and R.D. Waltz. 1996. Chapter 11. Ephemeroptera, pp. 126-163. *In*: Merritt, R.W., and K.W. Cummins (Eds.). *An Introduction to the Aquatic Insects of North America*. 3rd Ed. Kendall/Hunt Publishing Co., Dubuque, Iowa.

H = Hilsenhoff, W.L. 1982. *Aquatic Insects of Wisconsin*. Publication of the Natural History Council, University of Wisconsin-Madison, No. 2. Geological & Natural History Survey, Madison, Wisconsin.

V = Voshell, Jr., J.R. 2002. *A Guide to Common Freshwater Invertebrates of North America*. The McDonald and Woodward Publishing Co., Blacksburg, VA.

Checklist of Genera of Mayfly (Ephemeroptera)
Larvae Reported in the Old Woman Creek
Wetland System

Family Baetidae

Baetis

Callibaetis

Family Caenidae

Caenis

Family Ephemeridae

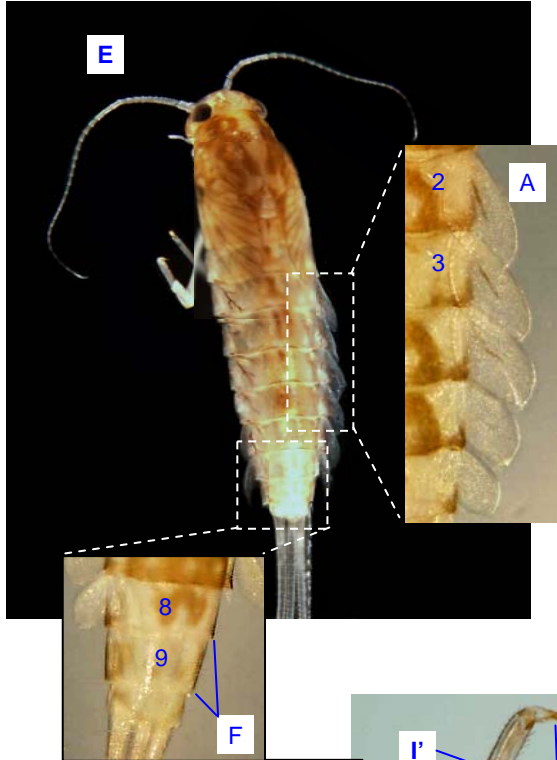
Hexagenia

Family Leptophlebiidae

Leptophlebia

Insecta: Ephemeroptera: Baetidae: *Baetis* sp. Small Minnow Mayflies

Dorsal views of *Baetis*



Features of Order Ephemeroptera

Three pairs of segmented legs on thorax
Wing pads developing or absent
Two or three terminal filaments on abdomen
Plate-like, leaf-like, or feather-like gills on sides of abdomen

Features of Family Baetidae

Abdominal gills consisting of one or two processes, exposed and present on abdominal segments 1 or 2 through 7; gills on abdominal segment 2 similar to those on succeeding segments (A)

Mandibular tusks absent (B)

Long, dense hair on forelegs absent (C)

Head not flattened dorso-ventrally (D)

Eyes and antennae lateral (not dorsal) (E)

Distinct lateral spines absent on abdominal segments 8 and 9 (F)

Features of Genus *Baetis*

Three terminal filaments present (G)

Gills present as single processes (A,G,H)

Claws on tarsus stout (I), shorter than half the length of tarsus (I')

Large teeth on tarsal claws (J)

Where Recorded at Old Woman Creek

Standing water in swamp forest

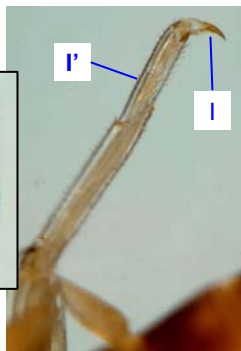
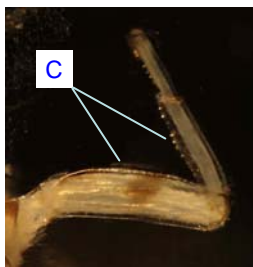
General Ecology

Habit: Swimmers, climbers, clingers

Functional feeding group: Scrapers,
Collectors-gatherers of detritus and diatoms

References: E&W 132-135, 159, 162; H 2, 9-12; V 144

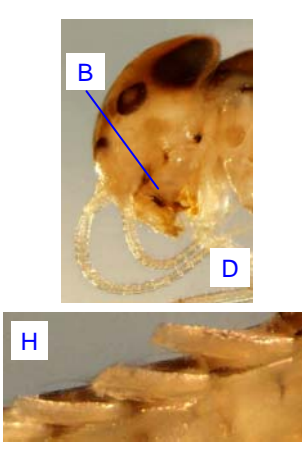
Photographs: St. Johns Dam MEX August 27, 2004;
St. Johns Dam CH 90 August 19, 2004



Ventral view of *Baetis*



Lateral views of *Baetis*

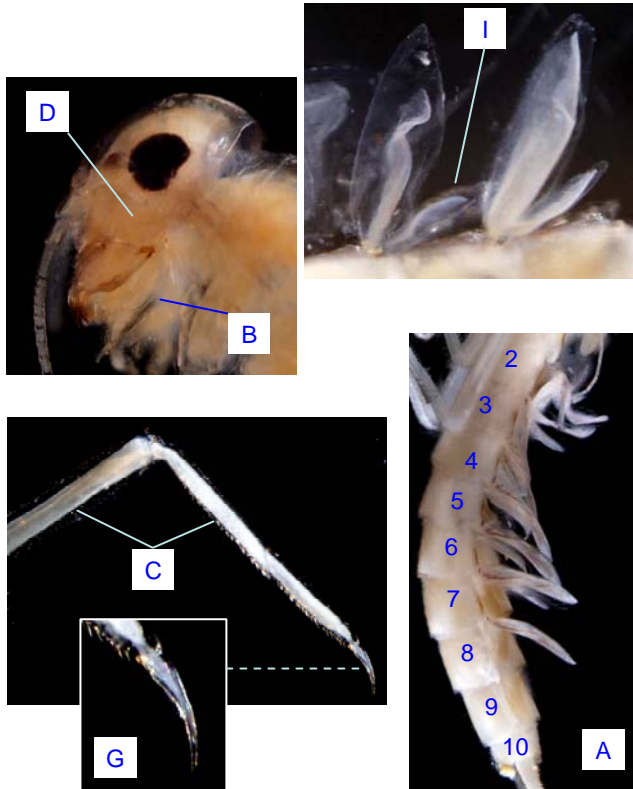


Insecta: Ephemeroptera: Baetidae: *Callibaetis* sp. Small Minnow Mayflies

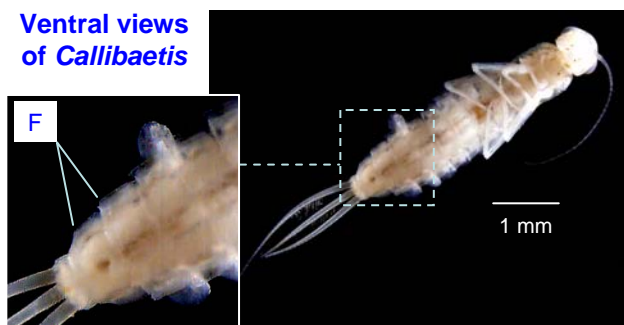
Dorsal view of *Callibaetis*



Lateral views of *Callibaetis*



Ventral views of *Callibaetis*



Features of Order Ephemeroptera

Three pairs of segmented legs on thorax
Wing pads developing or absent
Two or three terminal filaments on abdomen
Plate-like, leaf-like, or feather-like gills on sides of abdomen

Features of Family Baetidae

Abdominal gills consisting of one or two processes, exposed and present on abdominal segments 1 or 2 through 7; gills on abdominal segment 2 similar to those on succeeding segments (A)

Mandibular tusks absent (B)

Long, dense hair on forelegs absent (C)

Head not flattened dorso-ventrally (D)

Eyes and antennae lateral (not dorsal) (E)

Distinct lateral spines absent on abdominal segments 8 and 9 (F)

Features of Genus *Callibaetis*

Claws slender with sharp points (G)

Three terminal filaments present (H)

Gills with distinct ventral flaps (I)

Where Recorded at Old Woman Creek

Swamp forest; on filamentous algae

General Ecology

Habit: Swimmers, clingers

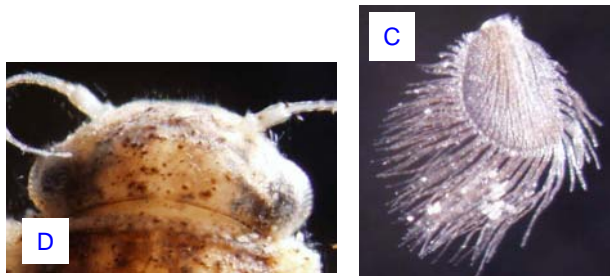
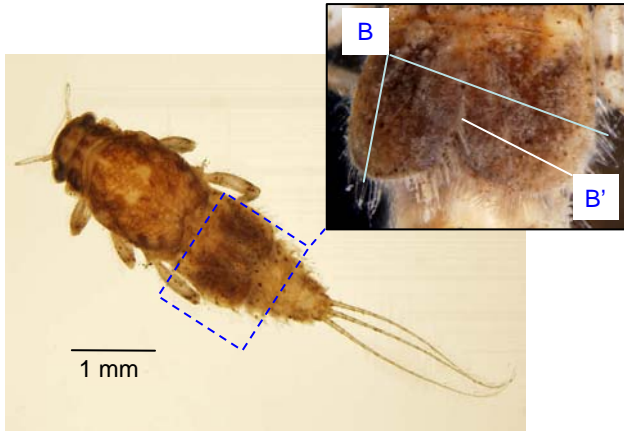
Functional feeding group: Collectors-gatherers of filamentous algae

References: E&W 132-135, 159; H 2, 9-12; V 144

Photographs: KK REF E3 July 31, 2002 OWCI; WQL REF BB3

Insecta: Ephemeroptera: Caenidae: *Caenis* sp. Small Squaregill Mayflies

Dorsal views of *Caenis*



Ventral view of
Caenis



Lateral view of
Caenis



Features of Order Ephemeroptera

Three pairs of segmented legs on thorax
Wing pads developing or absent
Two or three terminal filaments on abdomen
Plate-like, leaf-like, or feather-like gills on sides of abdomen

Features of Family Caenidae

Mandibular tusks absent (**A**)
Gills on abdominal segment 2 fringed with long setae on outer margin (**B**) and meeting or overlapping on dorsal surface of abdomen (**B'**), nearly square and covering the gills on segments 3-6
Gills on abdominal segments 3-6 fringed at margins (**C**)

Features of Genus *Caenis*

No tubercles on head (**D**)

Where Recorded at Old Woman Creek

In sediment at the following locations: lotus bed, near water lily bed, drowned OWC channel at upper end of wetland, upstream creek bed

General Ecology

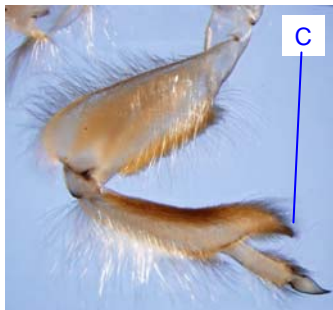
Habit: Swimmers, climbers
Functional feeding group: Collectors-gatherers, scrapers

References: E&W 130, 147, 162; H 2, 9; V 140

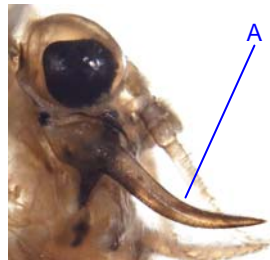
Photographs: REF E2 August 6, 2002 OWCI

Insecta: Ephemeroptera: Ephemeridae: *Hexagenia* sp. Common Burrower Mayflies

Dorsal views of *Hexagenia*



Lateral views of *Hexagenia*



Ventral views of *Hexagenia*



Features of Order Ephemeroptera

Three pairs of segmented legs on thorax
Wing pads developing or absent
Two or three terminal filaments on abdomen
Plate-like, leaf-like, or feather-like gills on sides of abdomen

Features of Family Ephemeridae

Mandibular tusks with upward curve (A)
Gills held dorsally (B)
Hind tibiae forming pronounced point at apex (C)
Front tibiae flattened and widened for burrowing (D)

Features of Genus *Hexagenia*

A rounded frontal process between the eyes (E)
Antennae with whorls of long setae (F)
Gills on segment one forked (G)

Where Recorded at Old Woman Creek

Sediment of lotus bed and upstream creek channel

General Ecology

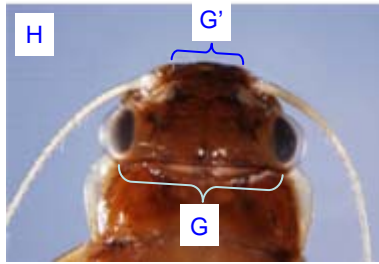
Habit: Burrowers
Functional feeding group: Collectors-gatherers

References: E&W 130-132, 147, 163; H 2, 9; V 137

Photographs: KK REF BB5 August 1, 1979 UHC 2B

Insecta: Ephemeroptera: Leptophlebiidae: *Leptophlebia* sp. Pronggilled Mayflies

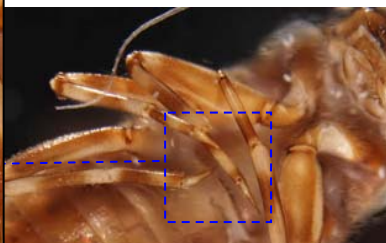
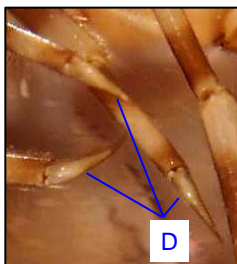
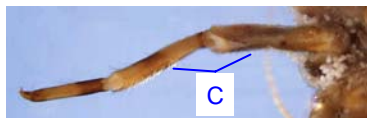
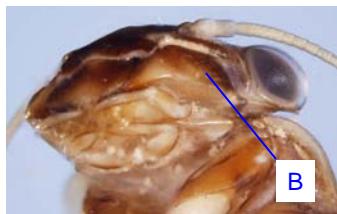
Dorsal views of *Leptophlebia*



Ventral views of *Leptophlebia*



Oblique views of *Leptophlebia*



Features of Order Ephemeroptera

Three pairs of segmented legs on thorax
Wing pads developing or absent
Two or three terminal filaments on abdomen
Plate-like, leaf-like, or feather-like gills on sides of abdomen

Features of Family Leptophlebiidae

Abdominal gills exposed on all segments (A)
Mandibular tusks absent (B)
Long, dense hair on forelegs absent (C)
Gills on abdominal segment 2 similar to those on succeeding segments (A, F)
Claws of all tarsi similar in structure and length (D)
Abdominal gills forked (segment 1)(E), present as clustered filaments, or consisting of two pointed leaf-like plates (F) (dorsal plate obscuring ventral plate in photo)

Features of Genus *Leptophlebia*

Head (G) wider than labrum (G')
Antennae and eyes lateral (not dorsal) (H)
Gills on abdominal segment 1 forked (E); succeeding gills each consist of two leaf-like plates (F)

Where Recorded at Old Woman Creek

Benthic in wetland, undesignated habitat

General Ecology

Habit: Swimmers, sprawlers, clingers
Functional feeding group: Collectors-gatherers

References: E&W 130-132, 139, 163; H 2, 9-12; V 143

Photographs: KK REF BB4 March 20, 1980 UHC1