

ENVS*3090 - Insect Diversity and Morphology

Trichoptera - Caddisflies

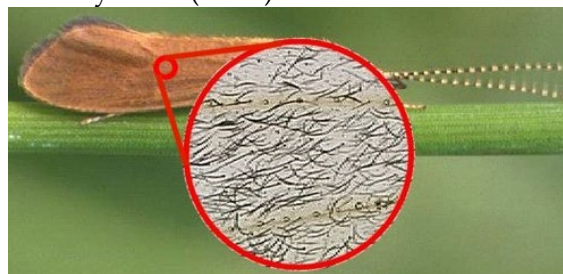
General Information

Greek Origins of Name: **Trichoptera**, derived from the Greek words “trichos” meaning hair and “ptera” meaning wings, refers to the long, silky hairs that cover most of the body and wings.

Origin of Common Name: From an old fisherman's term for the larvae of some **Trichoptera**; some families make cases out of bits of debris, similar to the way that cloth sellers called "caddis men" once peddled their wares (with bits and pieces pinned to their clothing).

Key Characteristics:

1. Wings held tent-like over the body
2. Wing membranes covered with tiny hairs (setae)



Trichoptera Facts:

- Relatively small order (~11,500 species).
- Many species of **Trichoptera** are very similar in appearance, both as larvae and as adults. It is often easier to identify a species by the structure of its case than by the features of its body.
- While still in their pupal case, caddisfly adults have sharp mandibles used for cutting through the pupal case. Once they emerge, their mandibles degenerate and become non-functional. From this time on they do not feed (or ingest food only in liquid form).

Classification and Distribution

Development: **Holometabolous**, i.e. complete metamorphosis (egg, larva, pupa, adult)

Distribution: Common worldwide. Larvae are aquatic and may be abundant in some cool, fresh water habitats. Adults are less conspicuous, usually nocturnal. Approximately 18 family and 1,261 species in North America and 43 family and >7,000 species worldwide.

Economic Importance

- **Trichoptera** larvae may serve as food for fish and other aquatic vertebrates. Fishermen often gather them for use as bait for trout and other game fish.
- Although a few species have been recorded as pests in rice paddies, most caddisflies have very little economic importance.

Life History and Ecology

- Adults are mostly nocturnal, weak-flying insects that are often attracted to lights.
- During the day, they hide in cool, moist environments such as the vegetation/foliage along river banks.
- The body and wings are clothed with long silky hairs (setae) — a distinctive characteristic of the order.
- In flight, the hind wings are coupled to the front wings by specially curved hairs.
 - At rest the wings are held tent-like over the abdomen.
- Many caddisflies have reduced or vestigial mouthparts.
 - Few species have been observed feeding, and most adults are relatively short-lived.
- Females usually lay gelatinous strings or masses of eggs on objects near or under water.
 - Some groups of **Trichoptera** will deposit their eggs in different ways:
 - Some go far beneath the surface to deposit their eggs.
 - Some lay their eggs far above the water, which their larvae will fall into when it hatches.
 - Some that develop in temporary pools lay their eggs in desiccation-resistant and freeze-resistant gelatinous matrixes, where their larvae will hatch and wait for the pool to be flooded in spring.
- All caddisfly larvae live in aquatic environments; they may be herbivores, scavengers, or predators.
 - In most cases, the predatory species are free-living or spin silken structures in the water (webs or tunnels) to entrap prey.
 - The scavengers and herbivores live within protective “cases” which they build from their own silk (produced in their salivary glands) and stones, twigs, leaf fragments, or other natural materials.
 - Case design and construction is distinctive for each family or genus of caddisfly.
 - The case is usually portable, dragged around like a snail shell as the insect moves, and held in place by a pair of hooked prolegs at the tip of the abdomen.
 - Most species have thread-like abdominal gills and get oxygen from water that circulates inside the case.
 - All larval growth and development (including pupation) occurs within the case.

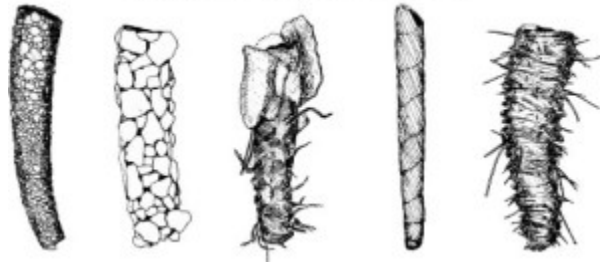
Physical Features

Appearance of Immatures:

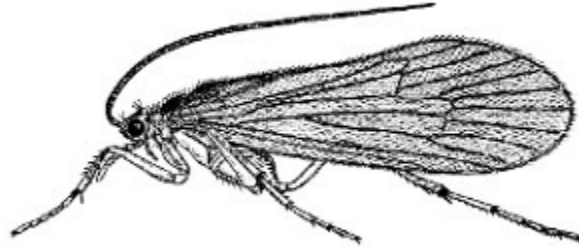


1. **Eruciform** (caterpillar-like) body; abdomen usually enclosed in a case made of stones, leaves, twigs, or other natural materials.
2. Head capsule well-developed with chewing mouthparts
3. Thread-like abdominal gills usually present in case-makers
4. One pair of hooked prolegs often present at tip of abdomen

Examples of Caddisfly Cases



Appearance of Adults:



1. Filiform antennae
2. Mouthparts reduced or vestigial
3. Two pairs of wings clothed with long hairs
4. Wings held tent-like over the abdomen

Major Families

Free-living Caddisflies and Related Families

Trichoptera

Rhyacophilidae (Free-living Caddisflies)

- Larvae do not construct a shelter, instead move around rock surfaces in running water.
- Most Rhyacophilid larvae are predators.

Rhyacophila

- The larvae use silk to prevent from being swept away by the current, and lay down a "thread trail" like some caterpillars.
- They hold onto the substrate with long, claw-like hooks on their anal prolegs as they feed on other larvae.
- Larvae encase themselves in a parchment-like silken cocoon, covered in silk and pebbles, and affix themselves to a rock when it comes time to pupate. The cocoon is tightly woven and separate from the case. The front of the pupa has blade-like mandibles, and the fringed back legs are free.
- The pupa's legs are operated like a puppet (more like a fursuit) by the adult within to swim to the surface when it is ready to emerge.

Glossomatidae (Saddle-case Making Caddisflies)

Glossoma

- Spin silken cocoon covered in irregular pebbles as a larval shelter.
- Both head and tail project from a flat-bottomed, oval-topped, saddle/turtle shell-like case.
- The larvae are heavily burdened by their case, and scrape food from rock surfaces.

Hydroptilidae (Purse-case Making Caddisflies)

- Larvae start out as free-living larvae, but later make open-ended, purse-like cases of silk, (often with small stones attached) to protect the larvae from predation.

Net-spinning Caddisflies and Other Fixed-retreat Makers

Trichoptera

Hydropsychidae (Net-spinning Caddisflies)

- Most larvae are filter feeders. They build silk nets in swift water to snare food particles. A few species are predatory.
 - The larva will stay within a silk and pebble shelter alongside the net, and will quickly advance on anything the current washes into its trap.
- The larvae have conspicuous tufts of gills under their abdomen.
- Present at rock riffles, very abundant. Most common net-spinning caddisfly.

Hydropsyche

- Common genus.

Cheumatopsyche

- Common genus; more likely to develop in polluted water than other related genera.

Parapsyche

- Rare genus.

Macrostemum

- 3 North American species.
- Very brightly coloured with long antennae.
- Develop in large, fast-moving rivers.

Philopotomidae (Finger-net Making Caddisflies)

- Finger-nets are long, narrow, and finely meshed (millions of mesh openings). They are often found distended on the underside of rocks.
- Larvae are usually bright orange.
- The larvae have a spatula-like labrum for scraping particulate from the bottom of their nets.
- Most caddisflies along rivers and streams are finger-net caddisflies.

Polycentropus

- Occur in both running and still waters
- Most common benthic caddisflies in the Great Lakes

Dolophilodes distinctus

- Wingless females emerge from late fall into early winter, with winged females emerging during the summer months.

Polycentropodidae (Trumpet-net and Tube-making Caddisflies)

- Less abundant than finger-net makers, but with more conspicuous nets.
- Most depend on running water to distend their nets and replenish food, as well as bring fresh, oxygen-rich water so they can breathe.

Neureclipsis

- Eat both algae and other arthropods.
- Spin enormous (~12cm) nets with a flared end (like a trumpet) facing upstream in broad, clean, relatively shallow rivers.

Polycentropus

- Predacious.
- Uses silken tubes as retreats and silken strands to detect the movement of prey.
- Some species use their silken tubes like pumps, bringing food into their tube using undulating motions.
 - This allows them to live in ponds and lakes, because they don't need running water to bring food.

Portable-case Making Caddisflies

- Has the greatest variety in caddisfly housing as a result of dealing with the current and predation.
- A lot of case morphology overlap in tube-making families.
- Larva make the cases by secreting a neat circle of silk onto the substrate in front of their head, and building the tube from that initial hoop.

Trichoptera

Limnephilidae (Northern Caddisflies)

- Huge, common, and diverse family. ~300 North American species.
- Widest variety of case morphologies.
- Larvae build tubular cases from a variety of natural materials.
 - Those in running water usually have heavy rock cases, and those in ponds are more likely to have lighter cases of leaves and roots.
- Found in a variety of habitats and includes some pond species that make portable tube-cases from criss-crossed pieces of debris (like a log cabin).

Limnephilus

- Large genus (~100 species).
- Found around ponds or marshes.

Pycnopsyche

- Cases made of leaves and sticks, feed on dead leaves.

Frenesia

- Emerge unusually late in the season, usually November.

Nemotaulius hostilus

- Has distinctly scalloped wings.

Platycentropus radiatus

- Uniquely patterned adult form.

Leptoceridae (Long-horned Caddisflies)

- Second widest variety of case morphologies.
- Larvae are quite small.
- Adult antennae are conspicuously long and slender, hence their name.
 - The larval antennae are also long relative to other caddisflies, but not as much (10x long as they are wide).
- Some construct flanged cases like molannids, some make stone cases like limnephilids, and a few make spiral cases like tiny phryganeids.
 - Some of the species that make spiral cases swim using fringed hind legs that stick out of the case. They swim from plant from plant to feed.

Mystacides sepulchralis

- Larvae less than 1cm long.
- Adults are distinctly shaped, shining blue-black caddisflies.

Ceraclea

- Small (1.2cm), stout-bodied larvae.
- Make wide, flanged cases from small sand grains.

Nectopsyche exquisita

- Adults are white with characteristic markings.
- Can be seen flying by the thousands above the surface of shallow lakes.
- Larvae make long and narrow cases, often with a twig or conifer needle extending beyond one end.

Triaenodes

- Adults gather in great numbers around lights at night.
- Larvae make distinctive tapered cases made of spirally arranged leaf fragments and can often be seen swimming (case and all) amongst vascular plants on the shallow edges of ponds, lakes, and rivers.

Oecetis

- Develop as predators in a variety of waters.

Thremmatidae

Neophylax

- Small genus
- Make heavy stone cases with large rock fragments on the side.
- Found in small, clear streams where they graze diatoms and other fine material from rock surfaces.
 - Case can withstand extreme conditions, so can be found in intermittent streams.
- Larvae develop during the winter, seal off their cases in spring, and wait until late summer or fall to develop into adults.
- (book typo pg. 244 - till?)

Apataniidae

- Used to be considered Limnephilidae.

Apatania

- Larvae live in cold lakes where they make tapered rock fragment cases.

Helicopsychidae (Snail-case Caddisflies)

- Builds a case out of small grains of sand that looks like a snail shell (so unexpected!).

Helicopsyche

- Small size (0.7cm) and are hard to see with their sandy case.
- Originally described as a snail.

Molannidae (Flat Caddisflies)

- Builds a case that is flat, flanged, and somewhat shield-shaped out of sand.

Odontoceridae (Strong-case or Mortarjoint Caddisflies)

- Small family.
- Cylindrical stone case.
- Larvae spend their larval stage hidden away in gravel or sand at the bottom of streams, but gather in masses to pupate on rocks.

Sericostomidae

- Small family.
- Cylindrical stone case.

Lepidostomidae

- Most make cylindrical stone cases.

Lepidostoma

- Common in seeps and springs
- Larvae look like Limnephilidae.

Brachycentridae

- Small family.
- Cylindrical stone case.
- Larvae have a distinctive crease across the protonum.

Brachycentrus

- Square-sided cases.

Micrasema

- Uncommon, but widely distributed genus.

Uenoidae

- Some make cylindrical stone cases.

Calamoceritidae

Heteroplectron

- Excavates the center of the right sized twig and lines the tube with silk.

Phryganeidae (Large Caddisflies)

- Larvae are large (often over 4cm long) and have yellow heads with black stripes.
- They construct smooth, tubular cases with plant fragments (leaves and bark) arranged in a spiral orientation or stacked in rings.
- Adults are usually 2cm.

Phryganea

- Large (4.3cm) larvae develop in lakes, marshes, and slow-moving rivers

Ptilostomis

- Adults are large (over 2cm), and are often seen at lights near temporary pools, ditches and ponds where their larvae develop.