

Fossil History and Evolution of Caddisfly

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Opinion Article

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ABOUT THE STUDY

A group of insects known as the caddisflies, or order *Trichoptera*, has both aquatic and terrestrial adult stages. There are over 14,500 species that have been described, and the majority of them fall into the suborders *Integripalpia* and *Annulipalpia* based on the adult mouthparts. While searching for food, *Integripalpi* larvae build a mobile shell to defend themselves, whereas *Annulipalpi* larvae build a permanent retreat where they wait for food to find them. The small third suborder *Spicpalpia*'s affinities are unknown, and molecular study indicates that it might not be monophyletic. The adults of rail flies, also known as sedge flies, are tiny moth-like insects with two pairs of hairy membrane wings. They belong to the superorder Amphiesmenoptera, which is closely linked to the Lepidoptera (moths and butterflies), which have scales on their wings.

In addition to streams, rivers, lakes, ponds, spring seeps, transitory waters (vernal pools), and even the ocean, aquatic larvae can be found in a wide range of habitats. Many kinds of larvae construct protective casings out of silk, which are then reinforced with pebbles, sand, twigs, bitten-off plant parts, or other waste. Different species of the larvae use varied feeding tactics, such as collecting particles from the water column and benthos or acting as predators, leaf-shredders, algal grazers, or collectors. Adults typically have brief lifetimes during which they do not eat.

Artificial flies are tied to resemble adults in fly fishing, and larvae and pupae are employed as bait. Caddisflies are referred to as "sedges" in the sport, and common and widespread genera like *Helicopsyche* and *Hydropsyche* are significant. Due to their sensitivity to water contamination and ability to be measured in the field, caddisflies are good bioindicators. Hubert Duprat, a French artist, has produced works of art by giving caddis larvae tiny grains of gold and precious stones to assemble into gorgeous containers.

The word "*Trichoptera*," which alludes to the bristly nature of these insects' wings, is derived from the Greek words "thrix," "hair," and "v," which stand for "wing" and "pteron," respectively. Uncertain of its earliest use, the term "caddis" first appears in Izaak Walton's 1653 book *The Complete Angler*, where "cod-worms or caddis" were

referenced as a type of bait. Although "cadice-men" were itinerant sellers of such materials and the term "cadys" was used for silk or cotton cloth in the fourteenth century, there is no evidence linking these terms to insects.

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Triassic-aged rocks have been found to contain fossil caddisflies. Larval cases, which are built of strong materials that keep well, contain the most fossilised remains. Caddisfly body fossils are relatively uncommon; the earliest date to the Early and Middle Triassic, or about 230 million years ago. Caddisfly wings are another potential source of fossils. At some point during the Triassic, the group appears to have evolved into one with entirely aquatic larvae. Fossils resembling caddisfly larval cases have been discovered in Brazilian marine deposits, which could date the order's beginnings to the Early Permian.

Caddisflies are almost universally terrestrial as adults, although they are aquatic as larvae and pupae. They share this trait with a number of distantly related species, including lacewings, dragonflies, mayflies, stoneflies, and alderflies. All of these groups' progenitors were terrestrial, had open tracheal systems, and convergently evolved various kinds of gills for their aquatic larvae as they submerged themselves in the water to avoid predators. Caddisflies are the only group of these insects to use silk in their daily lives, which has contributed to their success and made them the order of aquatic insects with the largest species diversity.

Worldwide, there are about 14,500 species of caddisflies in 45 families, although many more species still need to be identified. On the basis of adult mouthparts, the majority can be split into the suborders *Integripalpia* and *Annulipalpia*. The genitalia of both sexes, wing venation, and palps all affect an adult's appearance. The differences between the last two characters' suborders are unclear since they have experienced so great differentiation throughout the many superfamilies. The larvae of *Annulipalpians* are campodeiform, which are long-legged, free-living predators with well-sclerotized bodies that are dorso-ventrally flattened with protruding mouthparts. The larvae of *Integripalpians* are polypod (poorly sclerotized detritivores having abdominal prolegs in addition to thoracic legs, permanently residing in snug-fitting cases). Uncertain affinities exist for the third suborder, *Spicipalpia*; the larvae are free-living without cases and build net-like traps out of silk instead.