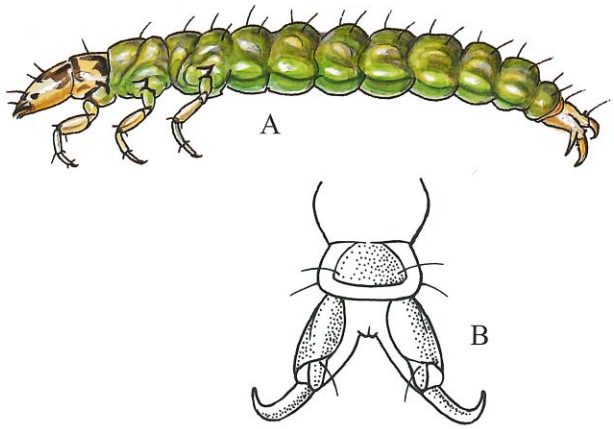
Plate 77

Freeliving Caddisflies

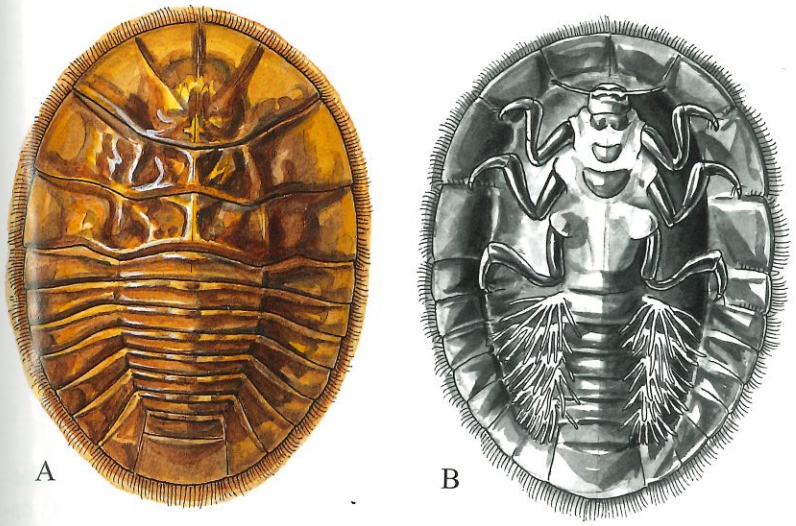


(A) Whole body, side view. **(B)** Last three segments on end of abdomen, rear/top view, enlarged. (Insecta: Trichoptera: Rhyacophilidae)

Distinguishing Features of Larvae — Body length usually 11–23 mm, range up to 32 mm (mature larvae). These roam freely and never reside in a case or retreat as larvae. The body is somewhat flattened, and the head projects forward. Many kinds are bright green while alive, but they quickly turn a purplish color when placed in alcohol. They are sometimes called "green caddisflies." The tops of the second and third thorax segments are completely soft and fleshy, without hardened plates. The abdomen is long and has deep constrictions at each segment (best seen in top view). Abdomen segment nine has a hardened plate on top. Almost the entire length of the prolegs at the end of the body is free from abdomen segment nine, so they are loose and movable (B). The claws on the prolegs are long, stout, curved, and sharply pointed. — Page 383

Plate 78

Water Pennies



(A) Whole body, top view. **(B)** Whole body, bottom view. (Insecta: Coleoptera: Psephenidae)

Distinguishing Features of Larvae — Body length 3–10 mm (mature larvae). Water pennies are very easy to recognize, and their common name gives a good description of their appearance. They have conspicuously flattened bodies that are oval to almost circular. Most of the thorax and abdomen segments have thin flat plates that extend away from the body, hiding the head and legs in top view (B). In some kinds of water pennies (not illustrated), there are spaces between the plates, giving the appearance of saw teeth on the outer edge. The legs have four segments (not counting the claws). There is one claw on the end of each leg. — Page 365

surface. Adult predaceous diving beetles live for 2 or 3 years.

Stress Tolerance — Mainly facultative, others somewhat tolerant.

Riffle Beetles

Family Elmidae; Plates 30, 81

Different Kinds in North America — Many; 24 genera, 97 species.

Distribution in North America — Throughout.

Habitat — Larvae and adults – primarily lotic-erosional, also lentic-littoral. Riffle beetles are common inhabitants of the swifter portions of streams and small rivers. They are most abundant and diverse in clear, cool waters. Stones, such as cobble, pebbles, and gravel, are the most common substrate for most species, but some species live in crevices or under the bark of decaying woody debris, in water moss, or on exposed roots. A few species of riffle beetles live in ponds and lakes on aquatic vegetation, and a few inhabit the sandy bottom of slow sections of streams.

Movement — Larvae and adults – primarily clingers, also climbers (lentic species). Riffle beetles are efficient clingers by virtue of their long, sharp claws at the end of the legs and their small, compact, hard bodies. When they do move, it is very slowly.

Feeding — Larvae and adults – scrapers, collector-gatherers. Most species of riffle beetles feed on periphyton, but some depend more on detritus.

Other Biology — Riffle beetle larvae breathe dissolved oxygen with gills that are on the end of their abdomen in a pocket with a door (Plate 81B). They protrude the gills out in the water and wave them to obtain dissolved oxygen. They withdraw the gills into the pocket in their abdomen and close the door to protect them from abrasion by sediment carried in the moving water. Adult riffle beetles breathe by means of a highly developed plastron, with microscopic-length hairs as dense as several million per square millimeter of body surface. This plastron is so efficient that most riffle beetle

adults never have to come to the surface for air again after they enter the water. Most riffle beetles require a lot of oxygen and are only found in waters with dissolved oxygen at or near the saturation point. Larvae are different from most other kinds of water beetles because riffle beetle larvae shed their skin six to eight times, instead of the usual three times. Most riffle beetles spend 1 or 2 years as larvae, but some species take up to 3 years to complete the larval stage. Newly emerged adult riffle beetles undergo a short flight period, but after they enter the water they lose the ability to fly. The unneeded hind wings progressively waste away by some unknown process. Adult life spans are not known, but riffle beetle adults are thought to be long lived. It is speculated that some species do not reach sexual maturity until their second year of adult life, and some may live on into a third year.

Stress Tolerance — Mostly facultative, others somewhat sensitive.

Water Pennies

Family Psephenidae; Plate 78

Different Kinds in North America — Few; 6 genera, 16 species.

Distribution in North America — The single most common and abundant species, *Psephenus herricki*, occurs only in the East (Georgia to Oklahoma and north into Canada), but other less common species of water pennies occur throughout the United States (especially the mountainous regions of the Southwest) and adjoining provinces of Canada.

Habitat — Larvae – lotic-erosional; adults – terrestrial (not included in this guide). Water penny larvae occur on stones in areas of riffles with moderate to fast current. Occasionally they are found on rocks along the wave-washed shores of lakes.

Movement — Larvae – clingers. Water pennies are very effective at holding on to rocks, because the thin, flat plates extending away from their body are flexible and collectively assume the

shape of whatever surface they are on. In addition, their grip on rock surfaces is made tighter by a dense fringe of short, fine hairs around the outer edge of the extended plates. Water pennies are seldom dislodged into a net merely by moving rocks. They have to be picked from the rocks with forceps or fingernails, and even then they are sometimes hard to remove.

Feeding — Larvae – scrapers. Water pennies are highly adapted for removing the thin layer of algae, especially diatoms, that occurs on stones in swift current. Their jaws have a thin, sharp inner edge, much like a paint scraper. The cupped shape of the jaws, along with hairs at the bases, help push the dislodged material into their mouths. Water pennies feed under the protection of the extended body plates, so the current does not wash their food away.

Other Biology — Water pennies obtain dissolved oxygen through gills on the underside of the abdomen (Plate 78B), as well as through the general body surface. During the day they reside underneath stones, then at night they move around to the top, where the most nutritious algae is located. Water pennies take 1 or 2 years to complete their life cycle. Mature larvae crawl out of the water a short distance to pupate in protected locations on rocks. The pupa is further protected under the last larval skin, which is tightly sealed to the rock surface. Little is known about the adults. They are thought to be short lived and probably do not feed. Adults of water pennies are usually observed on the sides and bottoms of rocks and logs just above the water surface in riffles, where they congregate for mating in summer. They appear to be attracted to protruding rocks in splashing water. Females enter the water to deposit their eggs in small patches (about 5 x 7 mm) on stones. Each patch contains 400–600 bright yellow eggs in a single layer.

Stress Tolerance — Facultative. Like most clingers, water pennies cannot persist in habitats where the rocks acquire a thick layer of algae, fungi, or inorganic sediment. However, they are somewhat tolerant of metal pollution.

Water Scavenger Beetles

Family Hydrophilidae; Plates 33, 83

Different Kinds in North America — Many; 20 genera, 192 species.

Distribution in North America — Throughout.

Habitat — Adults and larvae – primarily lentic-littoral, also lotic-depositional. Water scavenger beetles may be found in every still, shallow habitat, including ponds, margins of lakes, pools and other slow-moving sections of streams, puddles, and ditches. They are more common close to the shoreline where there is a lot of aquatic vegetation. Water scavenger beetles occur in the same habitats as predaceous diving beetles (Dytiscidae), and are often collected simultaneously. A few species in this family are terrestrial and occur in dung or decaying vegetation.

Movement — Larvae – climbers; adults – swimmers. Neither the larvae nor the adults of water scavenger beetles move as effectively as the predaceous diving beetles. Larvae tend to spend most of their time lying in wait for prey or crawling slowly. Adult water scavenger beetles swim by moving their legs alternately.

Feeding — Larvae – engulfer-predators; adults – collector-gatherers, engulfer-predators. Larvae of water scavenger beetles are almost exclusively predaceous. They are voracious and consume many kinds of aquatic organisms. Some kinds of larvae even crush and consume snails, shells and all (note their large jaws with teeth in Plate 83B). The common name for this family was probably conceived because the adults are often observed feeding on the bodies of decomposing vertebrates, especially fish. However, adult water scavenger beetles, like their larvae, also eat a considerable amount of live invertebrates.

Other Biology — Water scavenger beetles are the second largest family of water beetles, only exceeded by predaceous diving beetles (Dytiscidae) in the number of species. In standing-water habitats, the vast majority of water beetles collected will belong