

Oklahoma Riffle Beetles (Coleoptera: Dryopoidea).**IV. Ecology****HARLEY P. BROWN and CHARLES M. SHOEMAKE,****Zoology Department, University of Oklahoma, Norman¹**

"Riffle-beetles," as the name implies, refers to that group of aquatic beetles which live in riffles. A riffle may be described as a place where there is an obstruction in the stream, producing a ripple, or a stretch of shallow, rapid, or choppy water, typically providing a well-oxygenated habitat. Most members of this group occur in riffles. Others may be found along the sides of a stream, not really in the riffle area. Sanderson and Brown (1959) stated that a shallow, clear, fast-running stream is the typical habitat. We have found that certain genera commonly occur in quite turbid water, providing that the water is well-oxygenated and flowing.

The ecology of riffle beetles has been mentioned in the literature (e.g., Leech and Chandler, 1956; Sanderson and Brown, 1959; Wesenberg-Lund, 1943; Young, 1954), but the material presented is scanty and general. The purpose of this paper is to present a more detailed ecological description of those genera which occur in Oklahoma, based upon field observations. The genera are as follows:

SUPERFAMILY DRYOPOIDEA

Elmidae: *Ancyronyx*, *Dubiraphia*, *Heterelmis*, *Hexacylloepus*, *Macronychus*, *Microcyllloepus*, *Optioservus*, *Stenelmis*

Dryopidae: *Helichus*

Limnichidae: *Lutrochus*

Psephenidae: *Psephenus*, *Ectopria*

Instead of describing the ecology according to taxa, we shall treat the genera according to type of habitat.

- (1) Submerged aquatic plants and tiny roots in flowing water.

Most typically the genus *Dubiraphia* is found here, and often *Microcyllloepus*. Some *Stenelmis*, *Macronychus*, and *Helichus* are occasionally found in this habitat. We have collected specimens from rootlets and plants by "sweeping" with a delta dip net, by drying such material in Berlese funnels, and mainly by pulling up the vegetation and examining it a bit at a time.

- (2) Debris—sticks, leaves, and other materials which have been caught in an obstruction in flowing water.

Genera commonly found are *Microcyllloepus*, *Dubiraphia*, *Stenelmis*, *Heterelmis*, and *Helichus*. *Microcyllloepus* may be especially abundant among the layers of leaves which accumulate in such a situation.

- (3) Waterlogged wood in flowing water.

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Optimally, the wood must be old and water-soaked for a long time. Pieces of wood that have recently fallen into the water are not usually very productive. Most frequently we find *Helichus*, *Macronychus*, and *Ancyronyx*. The type of wood on which the latter two are found has small grooves or crevices and loose bark. *Heterelmis*, *Stenelmis*, and *Microcyloepus* may also be abundant on and beneath the bark of water-logged wood. A few *Dubiraphia*, *Hexacyloepus*, and larval psephenids may also occur on such wood.

Careful examination of suitable wood in bright light reveals most specimens, but additional ones may often be exposed by removing the wood from the water and placing it upside down, preferably in sunlight. Both larvae and adults tend to desert their crevices and creep downward over the surface of the wood. When in the water, the beetles are mostly on the underside of the wood, where there is less sediment.

Of the genera mentioned, *Microcyloepus*, *Dubiraphia*, *Hexacyloepus*, and the psephenids usually occur only in clear water, whereas the others are commonly found in either clear or turbid streams.

(4) Gravel (pebbles) in riffles.

Optioservus and certain species of *Stenelmis* occupy this highly oxygenated niche. Our best method for collecting from this habitat was holding a delta net on the bottom of the stream while shuffling the gravel about one foot upstream from the net. This dislodges the beetles, which are then swept by the current into the net (Musgrave, 1935). The "scrabble-basket" described by Bragg (1951) should be ideal for this situation.

(5) Beneath stones in riffles.

The underside of more or less flat stones in cool, clear streams is the preferred habitat for larval *Psephenus* ("water pennies") and *Ectopria* ("false water pennies"). *Ectopria* seems more inclined than *Psephenus* to occupy also the sides—and even the top—of such stones. *Microcyloepus*, *Optioservus*, *Lutrochus*, *Stenelmis*, and *Helichus* often share this sub-stone habitat, the latter two even in turbid water—especially near or at the stream margin.

(6) On or in travertine (calcareous deposit formed by certain algae).

An excellent example of this type of habitat is found in Honey Creek at Turner Falls (Murray County). The rough, porous deposit forms perfect hiding places on the underside of wood and rocks for both larval and adult *Lutrochus*, *Microcyloepus*, and *Hexacyloepus*. Some *Stenelmis* and *Dubiraphia* also occur in this habitat.

(7) On and under miscellaneous objects in flowing water.

Water-soaked paper ("The Tulsa World" seemed a favorite), cardboard, rusted metal, and even the tread of an old tire provide acceptable niches for *Helichus*, *Stenelmis*, and *Microcyloepus*.

(8) On objects above, beside, or near flowing streams.

On projecting sticks or stones in the shallows and along the margins of riffles, adults of *Lutrochus* and *Psephenus* are found either clustered or actively crawling. If disturbed, they fly rapidly, just above the water surface. A sweep net may be used for collecting, or a plastic bag may be held open just above the water downstream from an aggregation of specimens. The beetles obligingly fly into the bag when it is brought close to them.

(9) At lights near appropriate streams.

It is not surprising that the adult forms which readily take flight, such as *Psephenus* and *Ectopria*, may be taken at lights. We have also collected at lights such sluggish genera as *Helichus*, *Stenelmis*, and *Microcyloepus*, which never fly when exposed to air in daylight.

Within the superfamily Dryopoidea there are two major adaptations in the adults which reflect the general type of habitat in which members of this group may be found. The adaptations are (1) a tomentous plastron, and (2) long, curved, tarsal claws. The tomentous plastron, a specialized respiratory mechanism, allows the beetles to remain under water indefinitely. The plastron is a thin layer of gas spread over the body, giving it a silvery appearance when submerged. This layer is held in position by a clothing of hairs. Sufficient oxygen for respiration diffuses from the surrounding water into the gas layer, eliminating the necessity for the beetles to visit the water surface (Thorpe, 1950). The long, sharp, curved tarsal claws enable these beetles to cling to the substrate despite swift currents.

Since the larvae typically occupy approximately the same habitats as the adults, particularly among the elmids, they, too, exhibit appropriate adaptations. In addition to efficient claws for clinging, the elmids and limnichids have posteriorly-directed hairs and worm-like bodies well suited to tunneling or burrowing, while the psephenids are strikingly depressed (dorso-ventrally flattened), with body margins appressed to the substrate—offering very little resistance to the current. Nor do the gills offer appreciable resistance, those of *Psephenus* being completely beneath the shield-like body while those of all the others are completely retractile filaments.

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