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THE LIFE HISTORY AND HABITS OF A MAYFLY FROM UTAH.

BY JAMES G. NEEDHAM,
Cornell Univ. Ithaca, N. Y.

While collecting at Birch Glen in Logan Canon, Utah, on June 18th, 1926, I first came upon the nymph of the mayfly (*Rhithrogena mimus* Eat.) that is the subject of this article. I was gathering aquatic insects from among the larger stones in a swift portion of the river. Dipterous larvae of Simulium and Bibiocephala were common, and the nymphs of the big mayfly *Ephemerella doddsi* (locally called the "ginger quill") were appearing on my hand screen, when along with them appeared a few peculiar mayfly nymphs with broadly expanded gills of a bright rose-red color. I quickly got some of them into a rearing cage and in a few days had sub-imagos, and later adult reared specimens, of the species described below.

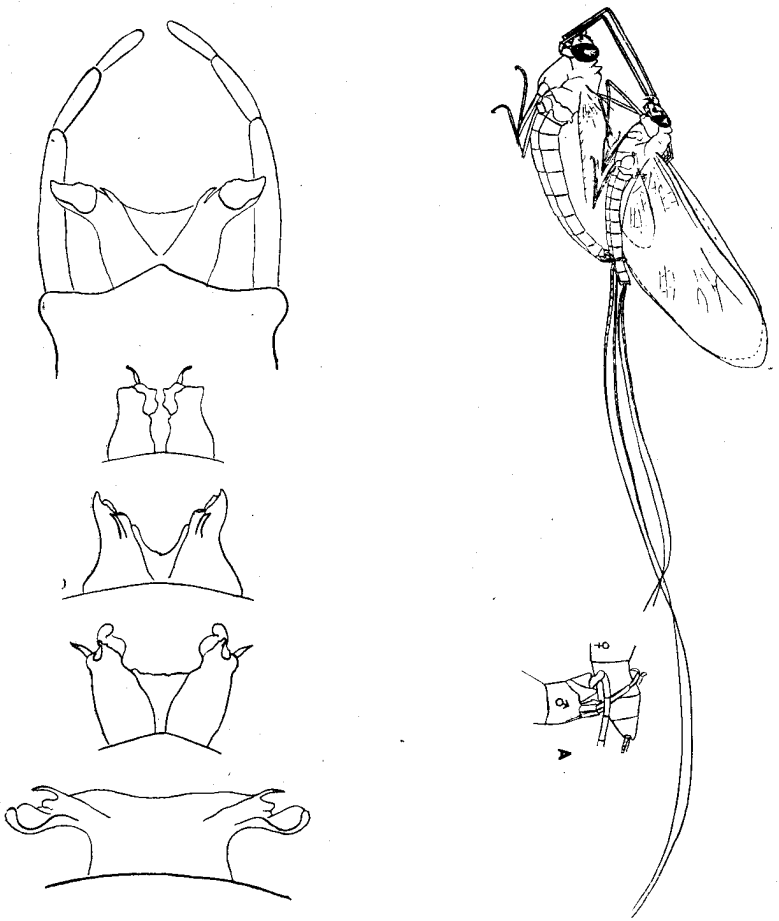
The first adults seen at large were flying over the river at nightfall on June 20th. They were then few. The next night there were more of them out, and two days later they were flying by thousands in an elongated swarm that extended up stream and down over the middle of the river. I could reach but few of them from the bank with an ordinary net, so I fastened my net to a long cane pole and, going to a narrows, found that I could then sweep them into it, a dozen or more at a stroke.

The swarm consisted of hovering males that flew about irregularly like midges or syrphus flies; not up and down with the regularity of so many other mayflies, but in and out, with their wings going when descending as well as when ascending. They kept to midstream, well down within the green lane formed by bordering trees.

Then I began looking for females. With thousands of males flying before me, a copulating pair (recognizable in the gathering dusk by larger size and slower flight) would be seen at intervals of a minute or two, and I would sweep it out of the swarm. These had to be taken quickly when seen for they soon would leave the swarm.

These pairs do not separate so quickly as do all other kinds of mayflies that I have taken when mating. Many of them were still attached when found in the net, and one pair was still attached when killed in the cyanide bottle. This pair I mounted so in balsam later. It is the basis of the accompanying figure. Thus

I have been able to settle to my satisfaction the hitherto doubtful question of the copulatory position of the male. The true position is as here shown.



Only in flight is copulation possible. The male flies up underneath the female, throws his elongated fore legs up over her thorax, flexing them at the swivel-like knee joint, and catching his claws somewhere on her back between the wing-roots. With the tip of his abdomen turned sharply forward, and the tip of the penes thus directed upward, he grasps the tip of the abdomen with his forceps somewhere behind the genital opening; and thus it is easy to see how the genital orifices of the pair are brought into apposition.*

Flying through these mayfly swarms were a number of other insects that were emerging from the river at nightfall, going shoreward. Commonest of

*—The position of a pair shown for *Chloeon dipterum* in Bernhard's figure 1 on page 468 of *Biologisches Centralblatt* for 1907 (Vol. 27) with the male inverted in position seems quite impossible; for in that position his forceps would clasp the abdomen of the female in front of the genital opening, compressing the oviducts and preventing ingress of the sperm mass. This figure is copied by Ulmer in Schultz's *Biologie der Thiere Deutschlands* Part 34, p. 9.

these were other larger mayflies (*Drunella grandis*), pale little stoneflies (*Alloperla pallidula*) and several species of midges (Chironomidae).

Large swarms continued to fly at nightfall until the 28th of June and smaller ones scatteringly well into the month of July. During all this time I was living by the river, collecting daily along its shores; yet outside these nightly swarms I saw only one specimen of this species at large. It was a male that I found in mid afternoon, sitting on a weed stem on the shore two feet from the edge of the water.

Nor did I find the nymphs in the stream in any such abundance as these swarms would lead one to expect. They were fairly common in the swifter waters only. Possessed of an admirable sucking disc they are able to cling to the smooth surface of current-swept stones. Doubtless they forage there upon the slime-coat algae that grow on such surfaces, and there meet with but few competitors.

The characters of the adult are set forth in the original description by Eaton (Monogr. Ephem. p. 249) and by McDunnough in the Canadian Entomologist 56: 13, 1924, Pl. 3 fig. 7. The form of the genitalia is as shown in the accompanying figures, from which it may be judged that the penes present remarkable differences in appearance according to the position of their parts. I am publishing figures of the nymph in a forthcoming bulletin of the Utah Agricultural Experiment station, but without description, owing to the nature of that bulletin.

The nymph measures in length of body 9 mm., with tails 7 or 8 mm. additional.

The body is very smooth, nearly concolorous greenish brown, only a little darker on the head, the mid-thorax, the wings, and the apex of the abdomen. The antennae are pale beyond the brown basal segment.

Prothorax pale greenish brown. Mesothorax darker, with a narrow blackish line across the front, an obscure paler median stripe, and some pale curved marking about the wing roots. Legs pale; femora darker on the dorsal side, the darker color divided by a pale V-mark opening outward (toward the knee). The carinate margins of all the leg segments are narrowly lined with brown, and the rear of the femora fringed with soft brown hairs.

The abdomen is darker dorsally toward the tip, pale beneath, and the tails are very pale. The gill plates are of a bright rose-pink tint in their thicker parts, with transparent margins. By the overlapping of their expanded margins they form the margin of a complete oval sucking disc beneath the abdomen. Those of the very large first pair meet together closely beneath the metathorax. Those of the last (7th) pair loosely overlap beneath the tip of the abdomen. Those of the five intermediate pairs have thin transparent outer margins, and, bear rounded, earlike, erect lobes singly on the thicker inner margin. The filamentous gills arise in pedicellate tufts on the dorsal side at the base of the gill plate.

This is a remarkably beautiful mayfly nymph, by reason of its rose-tinted gills. It is still more remarkable for the perfection of its attachment disc, produced by adaptations of the gills.

No satisfactory characters for distinguishing *Cinygma* from *Rhithrogena*

have ever been proposed. The nymph is so nearly identical with the typical *Rhithrogena* that I propose to abandon the name *Cinygma* altogether!