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THE NYMPH OF EPHEMERA GUTTULATA PICTET WITH NOTES ON THE SPECIES.

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While on a trip into the mountains of Eastern Tennessee during May, 1923, the writer had the fortune to observe the very interesting Mayfly, *Ephemera guttulata*, and to collect its nymphal skin which appears to be undescribed. This was taken on a small mountain stream on the west slope of Chilhowee Mountain just back of Montvale Springs Hotel.

This striking mayfly with its almost black wings and thorax, set off by the snow white abdomen, lives in the smaller perennial, spring-fed torrents that flow down the higher of the Eastern Tennessee mountains. On Chilhowee Mountain these streams pour down deep V-shaped gorges over beds of small stones and coarse grit, in a succession of minature water falls, for they descend at the rate of several hundred feet to the mile. These mountains are covered with pines on their high dry ridges but the deep ravines between these ribs of pine woods are filled with a dense growth of deciduous timber so that these torrents are heavily shaded by tall trees in their whole course.

The species of Ephemera are usually found in large rivers or open lakes where an extensive surface is open to the light sky. These eastern Tennessee streams were completely shaded so that the reaction of this species to light were quite different from the reactions of the common *Ephemera simulans* of Lake Erie. In *simulans* the nymph burrows in the mud of the lake bottom, being obviously negatively phototropic. At the time of emergence it becomes positively phototropic and rises to the light of the sky. At Put-in-Bay this emergence takes place between 8 and 10 p.m. It sheds its skin as it rises through the water and bursts out at the surface fully winged, when it becomes less positively phototropic and flies towards the dark land. It rests on the shore vegetation until the following evening when it sheds its subimago skin, becomes sexually mature and at twilight flutters up and down in a mating dance. At this stage it is evidently becoming positively phototropic again. In this twilight dance it leaves the dark foliage for the more open lighter spaces. The males grasp the females and release them after a few seconds. The female becomes at once completely, positively phototropic and flies out toward the light surface of the lake to deposit her eggs.

If we compare this series of reactions with those of *guttulata* of the shaded mountain streams, we find that two of the series of reactions of *guttulata* are reversed. *Guttulata* is negatively phototropic as a nymph, is positive as it emerges, but *remains positively phototropic after emergence* as it flies from the heavily shaded creek to the lighter areas above the shade. Further, *after copulation it becomes negatively phototropic* and flies down to the densely shaded torrent to oviposit. *Simulans* or any of the other open stream species of Ephemera would react themselves away from a shaded stream when they started to oviposit. So by these reversed reactions *guttulata* is able to occupy a habitat that normal members of the genus Ephemera are not able to occupy, one that is ecologically outside the general habitat of the genus.

The bizarre coloration of black thorax and wings with snow white ab-

domen is also interesting in its relation to the habitat. Except for the white abdomen, the mayflies, at the time of the twilight flights were practically invisible to the observer. These white abdomens, as the *guttulata* females dodged about in the gathering darkness reminded one of the streaks of light of a flight of fireflies. It is possible that this white abdomen is useful to *guttulata* in the mating flights in the deep shade of the mountain gorges as its visibility is very obviously increased by this pattern. A snuffcolored, lowland Ephemera would be practically invisible under the same conditions. The reactions of this species have been discussed more fully elsewhere (Biol. Bull, 48, pp. 390-401, 1925).

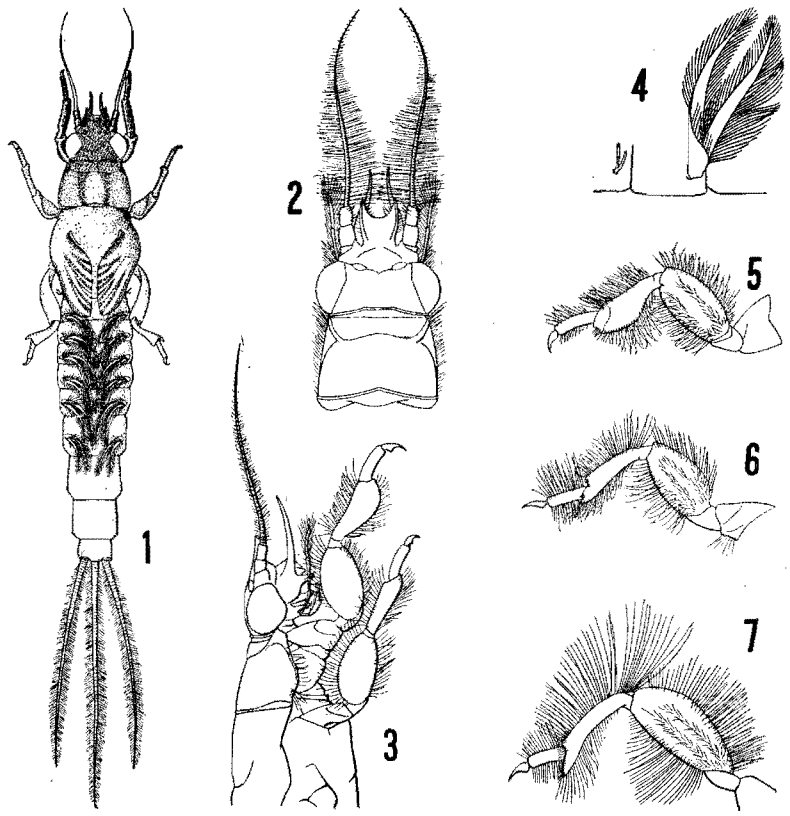

Fig. 1. Dorsal view. Fig. 2. Head and pronotum. Fig. 3. Lateral view of head and prothorax. Fig. 4. First and second gills. Fig. 5. Fore leg. Fig. 6. Middle leg. Fig. 7. Hind leg.

The burrowing larva of *guttulata* lives in the meager areas of coarse sand and muck found in the little basins below the water falls. The sub-imagoes the writer observed to emerge came out on dull cloudy days. These fly out of the shade over the stream up to the better lighted areas of the hillside where they rest in the full light. No mating dances were seen. These probably took place among the tree tops just before the egglaying began at twilight.

The following description of the nymph parallels that of Needham for *Ephemera varia* (Bull. U. S. Bureau of Fisheries 36, p. 285, 1920.). See figures 1-7.

Length, full grown (exuvia) 20 mm.; tails 11 mm. additional; antennae 5 mm.

Color dark brown, lighter on abdomen which in the exuvia shows no marked color pattern. Head, thorax and wing pads dark brown with two parallel dark stripes on the dorsum of the prothorax. The wing pads with alternate light and dark lines radiating along the main veins fanwise.

Antennae slender, three times the length of the madibular tusks. Basal half with widely spreading horizontal hairs, the outer half more nearly naked. The frontal prominence ends in a sharp tooth at either side, the two separated by a regularly rounded notch in front. (In *varia* the bottom of this notch is squared off). Mandibular tusks long, slender, upcurved. Viewed from above they project the length of the frontal prominence in front of that organ. (In *varia* half again as far.). From above their outer curve is visible between the antenna and the frontal prominence. (In *varia* it is visible outside the antenna). Maxillary palp very slender reaching to beyond the middle of the mandibular tusk.

All legs short and twisted, clothed with long hairs on their edges. Femora of each broadly oval. Tibia of fore leg spatulate with no apical tooth, of middle and hind leg cylindrical slightly curved and terminating in a large digging tooth. Tarsus a single segment more than half as long as the tibia with a single movable claw.

Gills yellowish, those on segment 1 bifurcated rudiments; on segments 2-7, large, bushy, the two divisions of equal size. Tails thinly margined with horizontal hairs. Middle tail longer and slenderer than the outer ones.

The figures are from an exuvium of *Ephemera guttulata* Pict. from Chilhowee Mountain, Blount County, Tennessee, now in Collection Kennedy.