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On Life Conditions in Torrential Streams

by

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Mr. BENT LAUGE MADSEN recently published in this journal (vol. 31: 345—347), a strong criticism of some theories on adaptations to torrential life put forward by me (1950) and corroborated by JOHNSON (1959). The discrepancies chiefly are due to the fact that we speak of entirely different things. Whereas MADSEN speaks of slow-flowing water in which “the stones . . . are well cemented in the sandy or gravelly substrate”, JOHNSON and I speak of torrential streams. (Such habitats actually do exist in a low-lying country as Denmark, though of course only in very few places and for short reaches of the streams). In the torrential stream the stones are not embedded in sand or gravel, but those which are too large and too heavy for the current to move lie loose on the bottom. A great many torrential Trichoptera pupate on the lower side of stones.

In my paper I mentioned the fact that the current is somewhat reduced in the layers near the bottom, as “is described in every textbook of hydrodynamics”. Nevertheless animals living on the upper surface of stones in torrential streams are subjected to the full impact of a very strong current, of which I have been able to convince myself by direct observation. Several nymphs and larvae in this habitat, e.g. that of the caddisfly *Oligoplectrum maculatum* FOURCR., are dependent on this fact for their nutrition. Said Trichopteron pupates on the upper surface of stones. Before pupation the larva has to build an elaborate structure in order to enable the emergence of the adult against the current. There is an appreciable current also on the lower side of the stones; to the filter-feeding caddisfly larva *Wormaldia* this is a necessity of life.

MADSEN apparently has not understood the term torrential, though

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I believe to have defined it rather clearly in the paper mentioned. (Conditions in his stream tanks are extremely far from those in torrential streams). He occupies himself with nymphs of the mayfly genus *Heptagenia*. These nymphs, however, do not live in torrential streams at all, but are of common occurrence in not too fast flowing water and especially in lakes. The peculiar shape of their heads is not, as MADSEN thinks, a means of withstanding the current (which is negligible where the nymphs live), but an adaptation to their highly specialized mode of feeding, as shown by FROEHLICH (1964) in the related *Arthroplea*. MADSEN mentions *Leuctra* nymphs as a typical example of adaptation to life beneath stones in torrential streams, but nor do these nymphs live in torrential streams; they are especially characteristic of small slow-flowing forest brooks.

By the way, when MADSEN hints that my paper (1950) is a duplicate of that of DODDS & HISAW (1924), he is not entirely correct.

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