The Mayfly3 Subimagos: A Possible Explanation

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Adult insects reproduce and disperse. Indeed, adulthood is recognized by the possession of functional genitalia and, in insects, by the presence of wings. These adult structures are attained simultaneously, at eclosion, in all living insect species except the mayflies. In the mayflies functional wings occur first, in a subimagos that can fly but cannot mate; after the subimaginal molt, the genitalia are functional. There seems no adaptive basis for this double molt to maturity, and I suggest there may indeed be none.

Simultaneity of maturity of genitalia and wings presumably depends upon these organs responding at the same time to the hormonal balance in the insect, the balance between ecdysterone and ophycosine. It seems unlikely that two such different target organs should always—from the start—have responded at the same time to the hormones; it seems more likely that simultaneity would have evolved from a system in which one organ achieves maturity before the other. Simultaneity could only be selected for in insects which live long enough for its advantages to be translated into increased reproductive potential. Insects which live only briefly might well be immune to such selective pressures, that is, exempt from them. Such insects are the mayflies, which emerge in a crowd, so need not travel to find mates. Remaining congregated and existing so briefly, they can scamp out predators long enough to undergo the second molt, mate, and lay eggs. Primitive mayflies may not have emerged so synchronously as modern ones (G. F. Edmonds, letter, 1974), but early conditions may have lacked the intensity of aerial predation with which mayflies today cope. More recent mayflies tend to emerge synchronously and their adult lives, already relatively brief, are shortened further (Edmonds, ibid.). These relatively recent adaptations seem to protect mayflies effectively from predation. Thus, in the long history of these insects, the need was never felt for a single molt to dispersing and reproducing maturity, and the ancient double molt remains, a relic.

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1 Ephemerisida. Note that "Ephemerisida" means "subimaginal insects" "Ephemerisidae" means "subimaginal wings," a term first used by Imitz (1934) and for which I am grateful. The subimaginal molt in Ephemerisidae occurs at the first time the inner wing blade is evident. See Imitz (1934) and Kukalová-Peck (1974).

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