THE CLASSIFICATION OF EPHEMEROPTERA IN RELATION TO THE
EVOLUTIONARY GRADE OF NYMPHAL AND ADULT STAGES

G. F. EDMUNDS

University of Utah, Salt Lake City, U.S.A.

Ephemeroptera imagoes have been subject to natural selection associated primarily with
reproduction. Nymphal features have evolved for life in a diversity of aquatic habitats.
Most of the structures evolve semi-independently in the two stages. Inferences concerning
phylogeny which are drawn from the adults thus may be tested by comparison with inferences
drawn from the nymphs. Groups that are separated from their nearest relatives by extremely
wide gaps in one stage may show only slight differentiation in the other stage; no rule may be
formulated as to which stage evolves more rapidly.

Any classification that is based on one life history stage is at times inconvenient for con-
considering the other stage because the size and position of the character gaps employed in
hierarchic categorization are different in the adult and nymphal stages. Following are some
of the outstanding examples from the Ephemeroptera.

In the Tricorythidae, such unique and specialized nymphs as Diceromyzon and Machadory-
thus might well be placed as the sole members of monotypic families, except that the known
adult structures appear to be rather typical of the Tricorythidae. A more striking case is seen
in the Neocloeopteridae and Caenidae. These two families are almost indistinguishable in the
nymphal stage, being virtually impossible to separate except on size and the presence or
absence of the developing hind wings. But the families are so completely different in the
adults that as yet no characters have been found in the exoskeleton that will serve to charac-
terize the group. Thus, although the nymphal evidence suggests that there is no justification
for two families, the immense character gap between the adults of the two groups favors the
separation into two families.

In the family Siphlonuridae (including Isonychiidae) the nymphs have evolved more
rapidly than have the adults. Such subfamilies as Ameletopsinae, Oniscagastriinae and
Coloburiscinae each have many unique nymphal characters and would seemingly be more
convenient to regard as distinct families, except that the adult characters appear to be few even
for their segregation as subfamilies. Another type of problem arises in the Siphlonuridae
because it appears highly probable that the nymphal traits of most other families of
Heptagenioidea can be traced into the Siphlonuridae. Thus some of the nymphs now placed
in the Siphlonuridae would be best considered as primitive members of other families except
for the fact that the adults largely retain Siphlonurid characters.

The phylogenetic interrelationships of most genera of Ephemeroptera are now reaching
fairly reliable levels of probability. This has been possible because of the wide range of
characters studied by various investigators, the extensive geographic areas represented, and
the fact that about 80% of the named genera are known in the nymphal stage by one or more
described species. The probable phylogenetic sequence is best represented by means of a
phylogenetic tree diagram, but the classification must consider not only phylogeny but
historical stability, utility, and the conceptual value of the generalization expressed by the
hierarchic arrangement as it applies to both nymphal and adult stages.

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