

## REVISIONARY NOTES ON PREDACEOUS HEPTAGENIIDAE BASED ON LARVAL AND ADULT ASSOCIATIONS (EPHEMEROPTERA)

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### ABSTRACT

New data indicate that larvae previously described as *Spinadis* Edmunds and Jensen and *Spinadis wallacei* Edmunds and Jensen are the larval stage of the prior named adults of *Anepeorus simplex* (Walsh) and are therefore synonymized. It is highly probable that larvae described as *Acanthomola pubescens* Whiting and Lehmkuhl represent the larval stage of *Anepeorus rusticus* McDunnough, but they remain to be reared. *Anepeorus sensu novum* and *Pseudiron* are placed in the subfamily Anepeorinae, and *Raptoheptagenia* (= recently associated *Heptagenia cruentata* Walsh adults and larvae previously thought to be *Anepeorus*) is placed in the subfamily Heptageniinae.

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Recent studies by McCafferty and Provonsha (1984, 1985, 1986) dealt with the predaceous heptageniid mayflies that have been traditionally placed in the genera *Anepeorus* McDunnough, *Pseudiron* McDunnough, and *Spinadis* Edmunds and Jensen. Questions were raised with regard to certain larval associations and application of generic nomenclature to the larval stage. The nomenclatural propriety of *Pseudiron*, which was recently revised by Pescador (1985), is not in doubt. The larva first assigned to *Anepeorus* by Burks (1953) was clearly stated to be questionable and provisional, but by the appearance of the treatment of North American mayflies by Edmunds et al. (1976), this form had been generally accepted without question as correct, although such larvae had never been reared, and McCafferty and Provonsha (1985, 1986) were highly suspect of the association. The genus *Spinadis* was based on a very distinctive larval form (Edmunds and Jensen 1974), but the fact that only a female adult has been reared from such larvae has not clearly resolved the question of whether its adult stage had been previously described under a different name (McCafferty and Provonsha 1984).

Two recent findings lead us to now suppress the name *Spinadis*. Reexamination of the female adult (McCafferty and Provonsha 1984) reared from a larva referable to *Spinadis* indicates that it is similar to adult females tentatively assigned to *Anepeorus* that were taken in series with male adults of *Anepeorus simplex* (Walsh). Similarities include wing venation, shape of the costal projection of the hindwing, hind tarsus to tibia ratio, ventral margin of the frontal shelf of the head, margination of the eyes dorsally, and elongation and posterior margin of the pronotum. These morphological traits (see McCafferty and Provonsha [1984] for details) are not only strikingly similar in these females but also very similar in males that are without doubt *Anepeorus*.

In addition, larvae referable to *Anepeorus* were very recently reared in Saskatchewan to adults of *Heptagenia cruentata* Walsh by Whiting and Lehmkuhl (1987a), who erected a new genus, *Raptoheptagenia*, for that species. Thus, with the accurate placement of those larvae, there remains no contradiction that larvae originally named *Spinadis* are the

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larvae of *Anepeorus simplex*. Also, known distributional and large-river habitat data for larvae known as *Spinadis* and adults of *A. simplex* in eastern North America are similar.

In consideration of the above we designate *Spinadis* Edmunds and Jensen as a NEW JUNIOR SYNONYM of *Anepeorus* McDunnough, and *Spinadis wallacei* Edmunds and Jensen as a NEW JUNIOR SYNONYM of *Anepeorus simplex* (Walsh). The genus *Anepeorus* is very distinctive in both the adult stage (McCafferty and Provonsha 1985) and larval stage (described as *Spinadis* [Edmunds et al. 1976, McCafferty and Provonsha 1986]).

The larval stage of *Anepeorus rusticus* McDunnough, the western North American species, remains unknown. Adults of this species are clearly congeneric with, but distinguishable from, those of *A. simplex* (McCafferty and Provonsha 1985), but it is problematic as to how similar the larvae of the two species will prove to be. We predict that *A. rusticus* larvae will be a two-tailed predaceous form (with reduced mouthpart setation and reduced molar region) with gill structure similar to *A. simplex*. The presence of spines, or tubercles, dorsally on the body of *A. simplex* may be of generic significance. The head shape of *A. rusticus* larvae could be somewhat different than that of *A. simplex* since there are distinctive differences in the frontal shelf of the adults of the two species (McCafferty and Provonsha 1985).

In consideration of all of the above, it appears extremely probable that the larvae recently described as *Acanthomola pubescens* Whiting and Lehmkuhl (1987b) from Saskatchewan is actually the larval stage of *Anepeorus rusticus*. The similarity in characteristics to those of larval *A. simplex* is comparable in degree to the similarities between the adults of the two *Anepeorus* species. The range and general habitat for *A. rusticus* adults include that of the newly described larvae. Although it is our opinion that *Acanthomola pubescens* is synonymous with *Anepeorus rusticus*, it would appear prudent to defer formal synonymy until verified by rearing, especially in light of the recent history of misassociations within the predaceous Heptageniidae. Unfortunately, Whiting and Lehmkuhl (1987b) stated that because of its rarity and threats to its habitat the larvae probably would never be reared.

*Spinadis* and *Pseudiron* were found to be closely related based on larval mouthparts (McCafferty and Provonsha 1986). We now consider *Anepeorus* sensu novum and *Pseudiron* to be sister genera for the same reasons, and because of additional adult synapomorphies. We therefore place *Pseudiron* and *Anepeorus* (including nominal *Acanthomola*) together in the subfamily Anepeorinae rather than in separate subfamilies as has been done in the past.

*Raptoheptagenia* is more plesiomorphic than *Anepeorus* and *Pseudiron*, and it appears to be either independently derived or intermediate between the more generalized heptageniid genera traditionally placed in the subfamily Heptageniinae and the specialized *Anepeorus* and *Pseudiron*. The larvae of *Raptoheptagenia*, although predaceous and with a highly modified gill structure, have a body form more typical of Heptageniinae. They also possess a number of autapomorphies, such as raptorial labial palps (McCafferty and Provonsha 1986). The adult of *Raptoheptagenia* has remained a more generalized form typical of many Heptageniinae. McDunnough (1931), however, noted certain similarities between the adults of *Pseudiron* and *Raptoheptagenia* (as *Heptagenia cruentata*). We prefer to include *Raptoheptagenia* in the subfamily Heptageniinae until its relationships can be more fully elucidated.

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