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The taxonomic impediment of unrecognised flight polymorphism in Notonectidae (Hemiptera: Heteroptera)

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Abstract

Foundation revisions of four genera within the Notonectidae (Hemiptera: Heteroptera: Nepomorpha) were reviewed to determine how the existence of previously unrecognised polymorphism of the wings or flight musculature might have led to confusion in the description of species. Specimens of the flightless morph may appear very different from flight capable ones. They are generally less pigmented and may be both smaller and less robust. In species descriptions the flightless morph can usually be readily diagnosed through the reduced pigmentation of the mesoscutellum. Flight-muscle and wing polymorphisms were found to be common in these genera. In *Notonecta* only one of the possible flying or flightless morphs was described in 51 of 60 species (85%), in *Anisops* in 64 of 80 species (80%), in *Buenoa* 26 of 35 species (74%), and in *Enithares* 11 of 33 species (33%).

A greater recognition of the existence of flight polymorphism in this family can lead to more robust species descriptions and selection of type specimens. Within the four genera considered here alternative morphs are yet to be described in many species.

Key words: *Notonecta*, *Anisops*, *Buenoa*, *Enithares*, flight polymorphism

Introduction

Polymorphisms of the flight apparatus, involving either the flight musculature alone or both the wings and musculature (Roff 1994; Zera & Denno 1997), is common in the Hemiptera and ubiquitous within the aquatic Heteroptera (Larsén 1950; Parsons 1960). Within the Nepomorpha it is present in all 11 families recognised by Štys &Jansson (1988) and Hebsgaard *et al*. (2004). It has broadly two forms. Wing polymorphism, in which there are macropterous and brachypterous morphs, is usually easily recognised. Less obvious is the flight-muscle polymorphism in the Corixidae and Notonectidae in which the indirect flight musculature fails to develop fully during the teneral period, or regresses later, even though the wings are fully developed (Young 1961, 1962, 1965a). Flight-muscle polymorphism is not as easily identified as wing polymorphism, but Young (1962, 1965a) showed that it can be common. In the New Zealand notonectids examined by Young (1962), for example, 57 of 564 (10%) of macropterous *A. wakefieldi* were flightless as were 1236 of 2577 (48%) of macropterous *A. assimilis*, and in the most stable ponds and lakes almost the entire population was flightless. Although there have been no recent publications on flight-muscle polymorphism of Notonectidae, there have been several on the Corixidae. The most significant have been those of Acton and Scudder (1969) on the ultrastructure of the flight muscles of *Cenocorixa bifida*, Scudder (1971) on the postembryonic development, and Scudder (1975) and Dodson (1975) on the ecology of flight-muscle polymorphic populations of *Cenocorixa.*

There has, however, been sustained and intensive research on flight polymorphism generally in insects. With the beginnings of understanding of the control of metamorphosis and development by Wigglesworth (summarised, 1954) it began to be realised that short wingedness was a juvenile character and that this polymorphism, as in metamorphosis generally, was a consequence of the interaction of juvenile and ecdysone hormones. This construct of Wigglesworth (1954, 1961), elaborated further by Southwood (1961), has

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