

THE TERMINOLOGY OF FEMALE POLYMORPHS OF *ISCHNURA* (ZYGOPTERA: COENAGRIONIDAE)

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This paper is dedicated to Philip S. Corbet on the occasion of his 70th birthday.

Received 06 April 1999; accepted 18 April 1999

Key words: Odonata, *Ischnura*, polymorphism, terminology.

Abstract

It is suggested that the current range of terminology employed to name the polymorphs of *Ischnura elegans* (Vander Linden) should be simplified and standardised in order to avoid confusion. It is proposed that the adult female forms be known as *andromorph*, *infuscans* and *rufescens-obsolata*.

Introduction

Ischnura females are well known to exhibit a number of colour forms and phases, which can appear to be bewilderingly complex. Askew (1988) states with reference to *Ischnura*, "Females are polymorphic". One of the best known and understood species in this context is *I. elegans*. However, although the various forms of this and closely related species such as *I. graellsii* are now well known and can be recognised easily, the terminology used to describe and designate them is confusing, and at worst, misleading. This is, therefore, an attempt to clarify the situation with specific reference to *I. elegans*, and maybe, these suggestions will help in connexion with other *Ischnura* species.

Polymorphism

Polymorphism has been defined as "The existence of three or more distinctly different forms within a plant or animal species" (Concise Dictionary of Biology, 1985). Such a definition includes *environmental polymorphism* (e.g. the caste systems of social insects) and *genetic polymorphisms* which are inherited through a mendelian mechanism (e.g. human blood groups, sickle-cell anaemia). Ford (1940) defined a genetic polymorphism as "The occurrence together in the same locality of two or more discontinuous (i.e. *distinct*) forms of a species in such proportions that the rarest of them cannot be maintained merely by recurrent mutation". A genetic polymorphism arises when alternative forms (allelomorphs) of major genes are common in a population (Sheppard, 1967).

While the details of female polymorphism in *I. elegans* have yet to be unravelled, it seems certain that we are witnessing a true genetic polymorphism. This was satisfactorily demonstrated by Johnson (1964, 1966) for *I. damula* and *I. demorsa*, although both of these species have dimorphic females which are andromorphic (like the male) or heteromorphic (dissimilar to the male). Hinnekint (1985) and Parr (1969) have both speculated on the genetic systems involved in the polymorphism of *L. elegans* and have proposed possible modes of inheritance. Cordero (1990) has investigated the inheritance of female polymorphism in the very similar *I. graellsii* (Rambur). As *L. graellsii* appears to be closely allied to *L. elegans* it would seem likely that the genetic mechanism determining female polymorphism may be the same in both species. Cordero's work suggests the existence of three alleles at one autosomal locus, with a dominance relationship of the type $p_1 > p_2 > p_3$.

A genetic polymorphism, if it exists for long periods of time is regarded as 'balanced', and this usually indicates a situation of special genetic and evolutionary interest. If two or more distinct forms are present in the population it means that there is a balance of selective forces resulting in all of them being maintained. It is important to recognise that a genetic polymorphism can be structural (as in flowers of primroses, *Primulus* sp.), or involve colour, pattern, physiology (e.g. blood groups), vision (e.g. red-green colour blindness), etc. That is to say, the term polymorphism does not imply that only strictly morphological (i.e. macrostructural) characters are involved. Polymorphism means the presence of multiple forms or types, not necessarily structural differences. Thus Hilton's (1987) rejection of the suffix -morphic, which he says implies a morphological (i.e. structural) difference is unacceptable.

The Females of *Ischnura elegans*

There are three clearly defined female polymorphs of *I. elegans*, each with a range of age related colour variants, which makes the polymorphism in this species appear to be very complex. The colour forms and aging have been described by Lord (1961), Parr & Palmer (1971) and Parr (1973). In order to accurately designate colour to any of these forms or stages, one should refer to a standard colour reference, such as Kornerup & Wanscher (1967).

Current Terminology

Unfortunately, in recent years the number of descriptive terms applied to the various polymorphs and age-phases of *Ischnura* species has multiplied to the point where it can be difficult to be certain to which form is being referred.

The *andromorph* (called the 'type' by Killington (1924)) is referred to as 'typica' by Askew (1988). The use of either of the two latter terms suggests that the andromorph is the typical female. However, various studies (e.g. Lord, 1961. Parr, 1965. Parr & Palmer, 1971; Askew, 1988. Gorb, *in press*) have shown that the frequencies of the three morphs vary greatly in different populations, with the *andromorph* not necessarily being the commonest. Thus it is not justifiable to label *andromorphs* as 'typica' or 'type'. Huxley (1942) comments on a similar situation in the lepidopteran *Argynnis paphia* L. Certain populations

of this butterfly have a morph called *valezina*, which is very rare in English colonies except in the central southern areas where it may comprise 5 - 15% of females. In China, almost all female *A. paphia* are *valezina*, which illustrates the relativity of the term 'normal' or 'typica'.

The use of *heteromorph* for female forms which are unlike the male can be useful when the species in question is dimorphic for females, and the other morph is termed *andromorph*. For example, several North American species of *Ischnura* have dimorphic females, with the *heteromorph* differing in colour and usually stripe pattern from the other, male-like female form (Johnson, 1972). In polymorphic species with more than two female forms the term *heteromorph* can obscure the fact that two genetically dissimilar morphs may exist in addition to the *andromorph*. Hilton (1987) makes the point that the prefixes homo- and hetero- mean similar and different, but fail to specify similar to, or different from what. In these cases it is better to use a specific term to designate each morph.

The terms *homeochrome* and *heterochrome* are of very dubious value in connexion with *I. elegans* and it is not clear why they are in fact used. Askew (1988) groups *infuscans*, 'typica' (*andromorph*) and their immature stage, *violacea* under *homeochrome*; he places *rufescens* and *infuscans-obsolata* under *heterochrome*. Using *homeochrome* and *heterochrome* does not add any useful information for this species and, therefore, these terms are best avoided.

Other terms which are currently in use include *androchrome* and *androchromatypic*; as well as *gynochrome* and *gynochromatypic*. The first pair are alternatives for *andromorph* and the second pair represent *heteromorphs* (non male-like forms). However, *androchrome* and *gynochrome* are no better than *homeochrome* and *heterochrome*, discussed earlier. Furthermore, *androchromatypic* (and *gynochromatypic*) (Hilton, 1987) suggest that these are typically coloured as males or as females, because the suffix -typic is from the latin *typus* or greek -*typos* or -*tupos* meaning 'type', that is, a kind, class or category, from which the term 'typical' is derived. It can clearly be misleading to refer to 'typical' or 'normal' female colouring in a species such as *I. elegans* which is trimorphic and in which the proportion of different morphs can vary greatly in different colonies. This situation is further complicated by the use in a recently refereed manuscript of *androchrome* to include both *andromorphs* and *infuscans* in *I. elegans*, despite the fact that *infuscans* is male-like only in pattern, not colour.

The Naming of Female Polymorphs in *Ischnura* species

The immature stages of female *I. elegans* known as *rufescens* and *violacea* are very distinct and should be referred to whenever young females of this species are discussed. Of the adult forms, the labels *andromorph* and *infuscans* are descriptive and well named. Prior to 1924, the forms presently known as *infuscans* and *infuscans-obsolata* were both known as *infuscans* (Lord, 1961). However, Killington (1924) proposed that the two similar forms, one with humeral stripes and the other lacking them, should be given different names, even though he considered them to show close affinity. He called the latter form *infuscans-obsolata* to indicate the close relationship he believed existed with *infuscans*. In fact it is *infuscans* and the *andromorph* which have a closer affinity: they

have indistinguishable immature stages (*violacea*) and both possess black humeral stripes.

Lord (loc.cit.) points out that the name *infuscans-obsolata* is inappropriate and misleading. 'Obsolata' primarily means old, outdated, disused; less usually it can mean wornout, vestigial or rudimentary. If the primary meaning of 'obsolata' is implied, Lord suggests that the name *rufescens-obsolata* is more appropriate, because it is not *infuscans* which is "old", but *rufescens* when it becomes mature. The name *rufescens-obsolata* has the advantage of being similar to the one it replaces, and would avoid the confusion which might arise should a completely new name be applied.

Summary

It is proposed that the plethora of inaccurate, complex and confusing names for female polymorphs of *I. elegans* should be reduced in accordance with the following:

Adult forms: *andromorph*, *infuscans* and *rufescens-obsolata* (previously *infuscans-obsolata*). Immature stages: *violacea* and *rufescens*.

Rejected names and terms used to describe polymorphs of *I. elegans* and closely related species include: *type*, *typica*, *androchrome*, *androchromatypic*, *homeochrome*, *heterochrome*, *heteromorphic*, *gynochrome*, *gynochromatypic*, *infuscans-obsolata*, *usual*, *normal*.

Acknowledgement

I thank Prof Philip S. Corbet for assistance with the literature.

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