

Phylogeny of *Libellula* Linnaeus (Odonata: Insecta)

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Abstract

Phylogenetic analysis was performed on a set of 242 morphological characters. The taxon sample included 31 *Libellula*, and representative species from selected libelluline tribes, from all libellulid subfamilies, from all libelluloid families, from all anisopteran superfamilies, and *Epiophlebia*. *Corduliinae* was shown to be paraphyletic even among genera characterized by a well developed anal loop bisector. Sympetrini was found to be polyphyletic with *Crocothemis* the sister group to Libellulini. The traditional placement of Trameini, far from Libellulini is in doubt, because it is here placed as the sister group to *Crocothemis* + Libellulini. Kennedy's phylogeny of *Libellula* was largely corroborated, with the following exceptions: the subgenera *Libellula*, *Eolibellula*, and *Syntetrum* form a monophyletic group which is the sister group to a clade including *Belonia*, *Holotania*, *Neotetrum*, and *Eotainia* subgenus nov. [type species *Mesothemis composita* Hagen]; and *Eurothemis* is determined to be the sister group of *Ladona* instead of *Neotetrum*. In addition we confirm *Belonia* to be monophyletic, and find *Platetrum* + *Plathemis* to form a monophyletic group, sister to *Ladona* + *Eurothemis*; these four subgenera together form the sister group to *Libellula sensu stricto* (s.s.).

Key words: Libellulidae, *Libellula*, *Eotainia* subgenus nov., phylogeny

Introduction

Libellula Linnaeus was established in 1758 to include all known Odonata, and has been redefined both through removal of species into newly established genera, and by addition of newly described *Libellula*. At present approximately 33 species are recognized within *Libellula s. l.* (Bridges 1994), and all but *L. melli* Schmidt and *L. nipponica* Kobayashi of China are included in this study (Fig. 1). Several subgenera have been established within *Libellula* and include: *Platetrum* Newman, *Plathemis* Hagen, *Ladona* Needham, *Eurothemis* Kennedy, *Libellula* Linnaeus, *Eolibellula* Kennedy, *Syntetrum* Kennedy, *Belonia* Kirby, *Holotania* Kirby, and *Neotetrum* Kennedy. In addition, our phylogenetic analysis