Studies on phylogeny and biogeography of damselflies (Odonata) with emphasis on the Argiolestidae

Kalkman, V.J.

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5. REDEFINING THE DAMSELFLY FAMILIES: A COMPREHENSIVE MOLECULAR PHYLOGENY OF ZYGOPTERA (ODONATA)

Klaas-Douwe B. Dijkstra, Vincent J. Kalkman, Rory A. Dow, Frank Stokvis and Jan van Tol

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**An extensive molecular phylogenetic reconstruction of the suborder Zygoptera of the Odonata is presented, based on mitochondrial (16S, COI) and nuclear (28S) data of 59% of the 310 genera recognized and all (suspected) families except the monotypic Hemiphlebiidae. A partial reclassification is proposed, incorporating morphological characters. Many traditional families are recovered as monophyletic, but reorganization of the superfamily Coenagrionoidea into three families is proposed: Isostictidae, Platycnemididae and Coenagrionidae. *Archboldargia* Lieftinck, *Hylaeargia* Lieftinck, *Palaiargia* Förster, *Papuargia* Lieftinck and *Onychargia* Selys are transferred from Coenagrionidae to Platycnemididae, and *Leptocnemis* Selys, *Oreocnemis* Pinhey and *Thaumatagrion* Lieftinck from Platycnemididae to Coenagrionidae. Each geographically well-defined clade of Platycnemididae is recognized as a subfamily, and thus Disparoneurinae (i.e. Old World 'Protoneuridae') is incorporated, Calicnemiinae is restricted, and Allocnemidinae (type genus: *Allocnemis* Selys) subfam.n., Idiocnemidinae (type genus: *Idiocnemis* Selys) subfam.n. and Onychargiinae (type genus: *Onychargia* Selys) subfam.n. and Coperini trib.n. (type genus: *Copera* Kirby) are described. Half of Coenagrionidae belongs to a well-supported clade incorporating *Coenagrion* Kirby and the potential subfamilies Agriocnemidinae, Ischnurinae and Pseudagrioninae. The remainder is less well defined, but includes the Pseudostigmatidae and New World Protoneuridae that, with Argiinae and Teinobasinae, may prove valid subfamilies with further evidence. Ninety-two per cent of the genera formerly included in the polyphyletic Amphipterygidae and Megapodagrionidae were studied. Pentaphlebiidae, Rimanellidae and Devadattidae fam.n. (type genus: *Devadatta* Kirby) are separated from Amphipterygidae, and Argiolestidae, Heteragrionidae, Hypolestidae, Philogeniidae, Philosinidae and Thaumatoneuridae from Megapodagrionidae. Eight further groups formerly placed in the latter are identified, but are retained as *incertae sedis*; the validity of Lestoideidae, Philogangidae and Pseudolestidae is confirmed. For some families (e.g. Calopterygidae, Chlorocyphidae) a further subdivision is possible; Protostictinae subfam.n. (type genus: *Protosticta* Selys) is introduced in Platystictidae. Numerous new combinations are proposed in the Supporting Information. Many long-established families lack strong morphological apomorphies.
In particular, venation is incongruent with molecular results, stressing the need to review fossil Odonata taxonomy: once defined by the reduction of the anal vein, Protoneuridae dissolves completely into six clades from five families.**

INTRODUCTION

Odonata are among the most ancient of winged insects, dating from the Permian (Grimaldi & Engel 2005). Extant Odonata are considered monophyletic (e.g. Davis et al. 2011) and include two suborders of almost 3000 species each, the Zygoptera or damselflies and the Anisoptera or true dragonflies, and a third suborder, the Anisozygoptera or damseldragons with only four species (Kalkman et al. 2008, Dijkstra et al. 2013). Although wing venation guided classification of Odonata, rampant homoplasy (convergence) obscures relationships, as has been demonstrated in Anisoptera (e.g. Dijkstra & Vick 2006, Ware et al. 2007, Pilgrim & von Dohlen 2008, Fleck et al. 2008a, Blanke et al. 2013). The same applies, perhaps more so, in Zygoptera (O'Grady & May 2003, Carle et al. 2008, Pessacq 2008), in which systematic challenges remain in groups with the most simplified venation (mostly Coenagrionoidea) and those characterized by the potentially highly homoplasious insertion of supplementary longitudinal veins (mostly Megapodagrionidae).

Although the phylogeny of the Anisoptera has been reasonably well studied and its classification is fairly settled (e.g. Ware et al. 2007, Fleck et al. 2008b), recent studies of Zygoptera rely on rather incomplete molecular datasets (Bybee et al. 2008, Carle et al. 2008, Dumont et al. 2010) and one extensive morphological study (Rehn 2003), although the family Calopterygidae has been studied in detail (Dumont et al. 2005, 2007). Our taxon sampling is the most extensive thus far in Zygoptera, including members of 59% of the 310 genera currently recognized and all (suspected) families, except for the monotypic Hemiphlebiidae. To optimize sampling breadth versus phylogenetic depth, our approach targeted two variable mitochondrial markers [16S, cytochrome c oxidase I (COI)] and a more conserved nuclear one (28S) for many species, rather than more markers for a limited selection. These are among the most commonly applied markers in Odonata and generally provide well resolved and supported trees, at least from species to family level (Hasegawa & Kasuya 2006, Ballare & Ware 2011). Moreover, a relatively long section of 28S was sequenced and the combined total extent of 28S+16S is comparable (84-145%) to several studies with three or more markers (Ware et al. 2007, Bybee et al. 2008, Pilgrim & von Dohlen 2008, Fleck et al. 2008a, b) and 75% of two studies using four nuclear markers only (Dumont et al. 2005, 2010). For 83% of the studied taxa, COI was sequenced and available sequences surpass previous studies (121-210% and 108%). We focus on the phylogenetic and taxonomic implications of the newly available data (cf. Dijkstra & Kalkman 2012), particularly for the definition of the families, using Silsby (2001) as the basis of the 'traditional' classification (Dijkstra et al. 2013).

METHODS

Specimen acquisition

The study relies on collections assembled in recent years at the Naturalis Biodiversity Center, Leiden, the Netherlands (formerly the National Museum of Natural History and the Netherlands Centre for Biodiversity Naturalis), by the authors, supplemented with donations from our international network (see the Acknowledgements section). Specimens included in the analysis were collected from 43 countries and from all continents, excluding Antarctica. In 34% of cases, one or two legs were removed from a live sample and preserved in 96% ethanol; the specimen was retained as an acetone-dried voucher. In the remaining cases, legs were removed from a specimen previously preserved either in 96% ethanol or by drying with acetone.

DNA extraction and amplification

Genomic DNA was extracted from legs using the Qiagen DNeasy Blood & Tissue Kit (Qiagen, Venlo, The Netherlands). Elution was performed in 100 µL elution buffer. Fragments of the nuclear 28S rRNA gene (1346-1532 bp) and the mitochondrial 16S rRNA (522-542 bp) and COI genes

(658 bp) were amplified using primer combinations developed with Primer3 (Rozen & Skaletsky 2000) (Table S1). Twenty-five microlitres of PCR reaction mixes for 16S and COI contained 2.5 µL of 10× CoralLoad PCR Buffer (Qiagen), 1 µL of each primer (10 pM), 1.25U of Taq DNA Polymerase (Qiagen), 0.5 µL of dNTPs and 1 µL of DNA template. Five microlitres of Qsolution (Qiagen) were added to the reaction mix for 28S. The amplification protocol consisted of 3 min at 94°C followed by 40-50 cycles of 15 s at 94°C, 30 s at 60°C to 35°C and 40 s at 72°C, and a final 5min at 72°C. Direct sequencing was performed at Macrogen Europe on an ABI 3730XL sequencer (Applied Biosystems, Carlsbad, CA).

Data analysis

Sequences were edited with sequencher 4.10.1 (Gene Codes Corporation, Ann Arbor, MI) and assembled using bioedit 7.0.9.0 (Hall 1999), geneious pro 5.6.4 (Biomatters Ltd, Auckland, New Zealand) (Drummond et al. 2011) was used to check for stop codons. All sequence data and additional geographic and ecological data as well as photographs of the specimens were uploaded to the Barcode of Life Data System (BOLD; Ratnasingham & Hebert 2007). Sequences were also deposited in GenBank. Barcode index numbers (BINs) and GenBank accession numbers are provided in Table S2. The number of unique site patterns was 635 for 28S, 452 for 16S and 359 for COI.

Phylogenetic analyses

Multiple sequence alignments were performed using mafft (Katoh et al. 2009) under default parameters. After exploration of all molecular data with neighbour joining analysis using mafft, a selection was made for in-depth analysis of specimens for which both 16S and 28S sequences were available. As a rule, we included two individuals per genus, preferably representing distant species, or two for each distinct clade if the genus appeared not to be monophyletic. The subset included 356 specimens, representing at least 322 species placed in 184 genera. For 295 of these specimens, COI sequences are available as well. Maximum parsimony (MP), maximum likelihood (ML) and Bayesian inference (BI) analyses were performed on the individual datasets of 28S (additional taxa: *Amazoneura*, *Dolonagrion*, *Megapodagrion*) and 16S (adding *Coeliccia dinoceras* Laidlaw, *Xiphiagrion*), as well as the combined 28S+16S and 28S+16S+COI datasets. MP analyses were performed in tnt (Goloboff et al. 2008) by heuristic search with 10 000 random-taxonaddition replicates, TBR branch swapping, maxtrees set to 1000 with autoincrease. All characters were treated as equal and unordered. Gaps were treated as missing data. Node support was established with a bootstrap analysis of 500 replicates. ML analyses were run with raxml (Stamatakis et al. 2008) using a Gamma model of rate heterogeneity, with each fragment treated as a separate partition. For the BI, the best-fitting nucleotide substitution model for each of the individual fragments was assessed using hierarchical likelihood ratio tests in mrmodeltest 2.3 (Nylander 2004). For 28S and 16S, a general time reversal (GTR + I + G) model (nst=6) was selected, whereas for COI the Hasegawa-Kishino-Yano model (nst=2) was used, all with a proportion of invariable sites and a gamma distribution for rates across sites (rates = invgamma). For each dataset, two independent Monte Carlo Markov Chain simulations were run in mrbayes 3.2.1 (Huelsenbeck & Ronquist 2001) with four chains, for 4 000 000 generations and a sample frequency of 2000 at a temperature of 0.05, providing >10 000 trees for the consensus after an average standard deviation of split frequencies <0.01 had been reached. Several anisopterans were tested as outgroup, leading to similar topologies, and thus only results using *Aeshna juncea* (Linnaeus) of Aeshnidae are shown.

Morphology

Specimens in the Naturalis Biodiversity Center (Leiden) and University Museum of Zoology (Cambridge) and numerous publications (e.g. Bechly 1996, O'Grady & May 2003, Rehn 2003, Gassmann 2005, Bybee et al. 2008, Pessacq 2008, van Tol et al. 2009, Garrison et al. 2010, Yu & Bu 2011b) were examined for morphological characters of the lineages identified by molecular analysis.

RESULTS

The phylogenies reconstructed on the 28S+16S and 28S+ 16S+COI datasets are presented in figures 1-3. Support for important clades is summarized in Table S3 and, where relevant, is discussed for separate partitions in the following sections. Of the generally accepted families, many were recovered as monophyletic with good support in (almost) all analyses: Calopterygidae, Chlorocyphidae, Euphaeidae, Isostictidae, Lestidae, Lestoideidae, Platystictidae and Polythoridae. Coenagrionidae was monophyletic if the Pseudostigmatidae and New World Protoneuridae were included, as was Platycnemididae if the Old World Protoneuridae were included, although seven genera had to be moved between the two families (see Discussion for details). Amphipterygidae and Megapodagrionidae were found to be highly polyphyletic, although the latter revealed several large and sometimes wellsupported groups of genera.
The remaining families are either monogeneric (Philogangidae, Pseudolestidae) or nearly so with only one taxon sampled (Dicteriadidae). Perilestidae and Synlestidae were paraphyletic in many analyses but in BI/ML 28S+16S+COI, the two combined were monophyletic with low support and a well-supported monophyletic Perilestidae was embedded in Synlestidae.

Although family-level clades often were well supported and the internal topology of these clades was frequently resolved, generally limited support was found for family interrelationships. However, the clade combining Coenagrionidae, Platycnemididae, Pseudostigmatidae and the entire Protoneuridae was well supported. BI/ML 28S+16S recovered Isostictidae as their sister group, but with low support. Lestoidea (including Lestidae, Perilestidae and Synlestidae) was well supported consistently as the sister group of all remaining Zygoptera, as was Platystictidae as the sister group of the remainder. No nearest relatives could be identified for the families Calopterygidae, Chlorocyphidae, Philogangidae, Polythoridae and Pseudolestidae, as well as for the clades that formerly constituted Amphipterygidae and Megapodagrionidae. Only Euphaeidae and Lestoideidae appeared consistently as sister groups with good support, but their further relationships remained unclear. The results and their implications are detailed in the following section for each family and/or well-supported clade.

DISCUSSION

Molecular and morphological studies indicate that Zygoptera are monophyletic (Bechly 1996, Rehn 2003, Bybee et al. 2008, Carle et al. 2008, Dumont et al. 2010), although Trueman (1996, 2007) questioned this based on an analysis of wing venation. Given our focus on that suborder and the often low support of higher-level relationships found within it, our dataset is unsuited for this issue. Our analyses supported the prevailing family classification for 72% of all genera and 80% of all species of Zygoptera. Therefore recognition at the family level of equally well-supported but previously unrecognized clades, particularly within the 'family' Megapodagrionidae, should be considered. Proposed taxonomic consequences are discussed in the following sections, starting with the relatively well defined smaller sister groups of remaining Zygoptera (the superfamilies Lestoidea and Platystictoidea), followed by the 'crown' radiation of the Coenagrionoidea, which encompasses three-fifths of all damselfly species. The discussion concludes with the problematic remainder, grouped strictly for convenience in the probably paraphyletic 'Calopterygoidea'.

The suggested reclassification of Zygoptera based on this discussion is provided in Appendix 1, including the authorities for all genus- and family-group names. Diagnoses of new or revised family groups are given in Appendix 2 and a summary of proposed taxonomic changes, including new combinations, is given in Table S4.

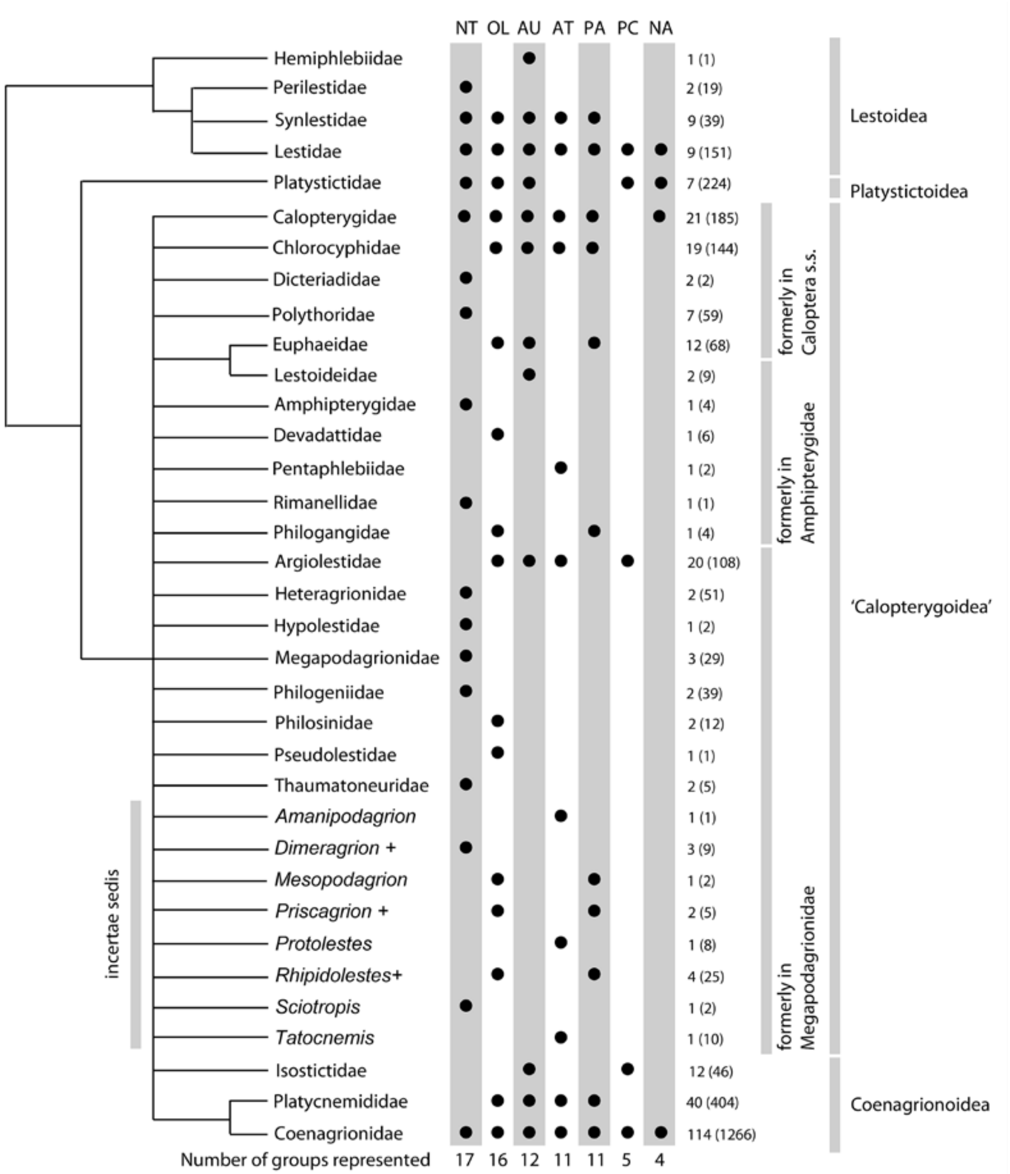


Figure 1. Summary of Zygoptera phylogeny, based on figures 2, 3 and the Discussion section. Only reasonably supported dichotomies are shown. The classification follows Appendix 1 (see for other genera placed near *Dimeragrion*, *Priscagrion* and *Rhipidolestes*) and the fate of some traditional taxa is indicated. For each recognized damselfly lineage, the known numbers of genera and species (in brackets) are shown, as is their occurrence in the Afrotropical (AT), Australasian (AU), Nearctic (NA), Neotropical (NT), Oriental (OL), Pacific (PC) and Palaearctic (PA) regions.

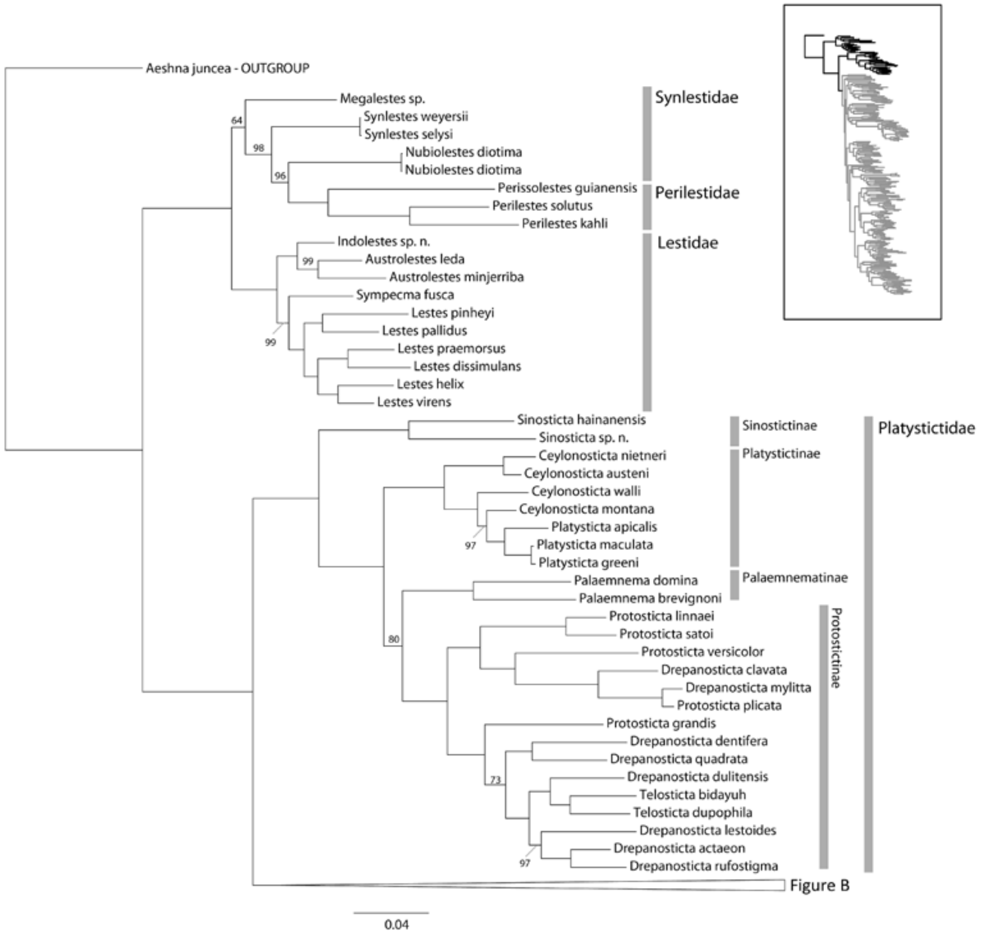


Figure 2a. Phylogenetic reconstruction for 295 specimens from the combined Bayesian analysis of 28S, 16S and COI. Posterior probabilities are shown (as percentages) only if below 100%. Species names and classification as proposed are shown. (a) Lestoidea and Platystictoidea; (b, c) various groups; (d) Platycnemididae; (e) Coenagrionidae.

Superfamily Lestoidea

All analyses confirmed that the over 200 species of Lestoidea (not to be confused with the unrelated genus *Lestoidea*) form the sister group of all the other 93% of damselflies (cf. Bybee et al. 2008, Carle et al. 2008, Dumont et al. 2010, Davis et al. 2011). Contrary to Rehn (2003), the position of the superfamily Lestoidea suggests that the narrowed external edge of the labial palp is an apomophy of remaining Zygoptera, rather than that the expanded edge arose convergently in Lestoidea and Anisoptera. With the exception of *Hemiphlebia*, Lestoidea possesses distinctly modified secondary genitalia with a reduced apex of the genital ligula (the functional penis) and triangular anterior hamules (Rehn 2003, Garrison et al. 2010).

The monotypic Hemiphlebiidae from southeastern Australia and Tasmania was not studied, but is the sister group of remaining Lestoidea according to previous studies (Rehn 2003, Dumont et al. 2010, Davis et al. 2011).

Just over a quarter of the Lestoidea species are placed currently in the Perilestidae and Synlestidae.

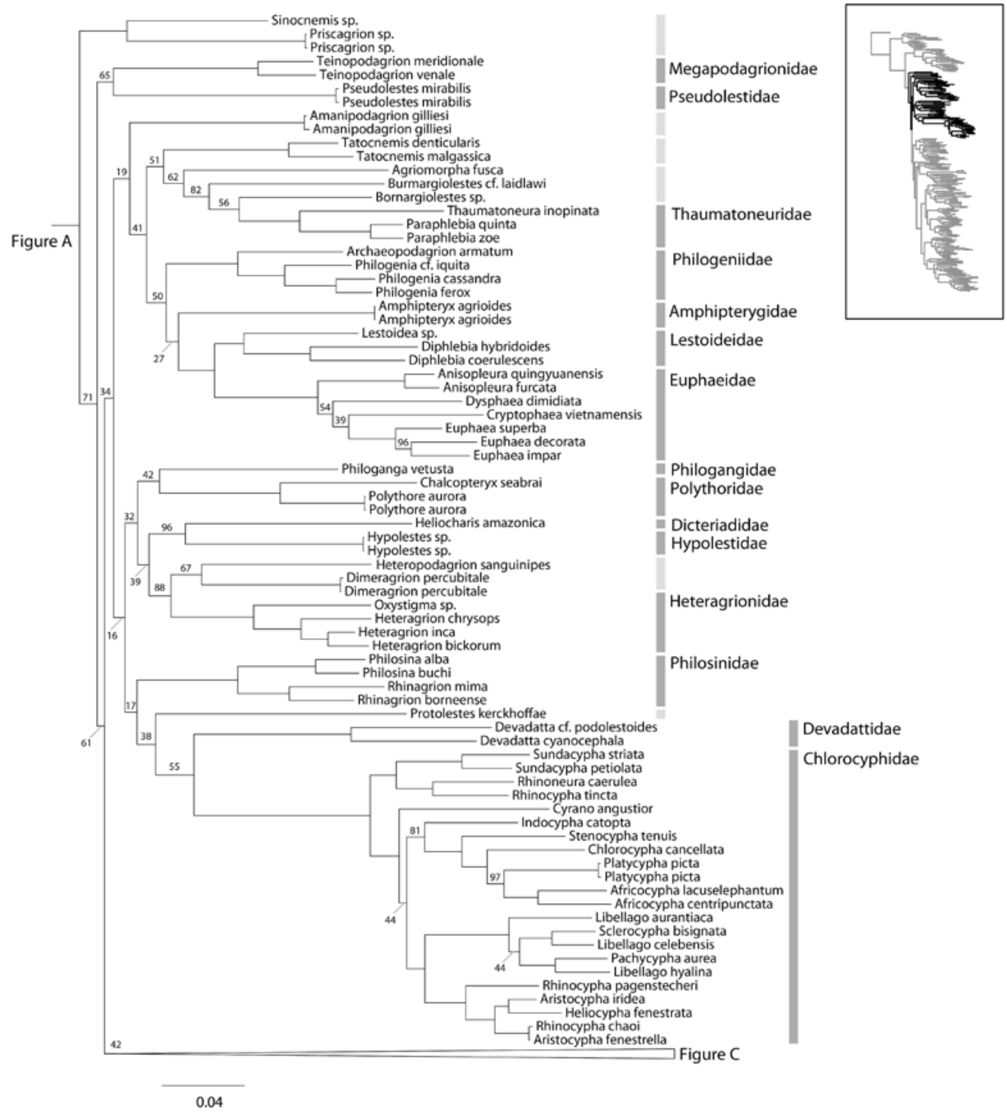


Figure 2b. Continued.

We found no support for the monophyly of the latter family, but in BI/ML 28S+16S+COI the two combined were monophyletic with low support, as was Perilestidae with high support. The last is expected given the morphological similarity of the Neotropical *Perilestes* and *Perissolestes*. The monotypic *Nubiolestes* from central Africa has been considered the only non-American perilestid, but formed the sister group of the American genera only in BI/ML 28S+16S+COI, although with low support. However, we had difficulty amplifying COI for many synlestids and BI, ML and MP of 28S and 28S+16S recovered *Nubiolestes* as the sister group of the southern African *Chlorolestes*. Neotropical Perilestidae share mid-dorsal spines on the larval abdomen, a two-toothed ovipositor,

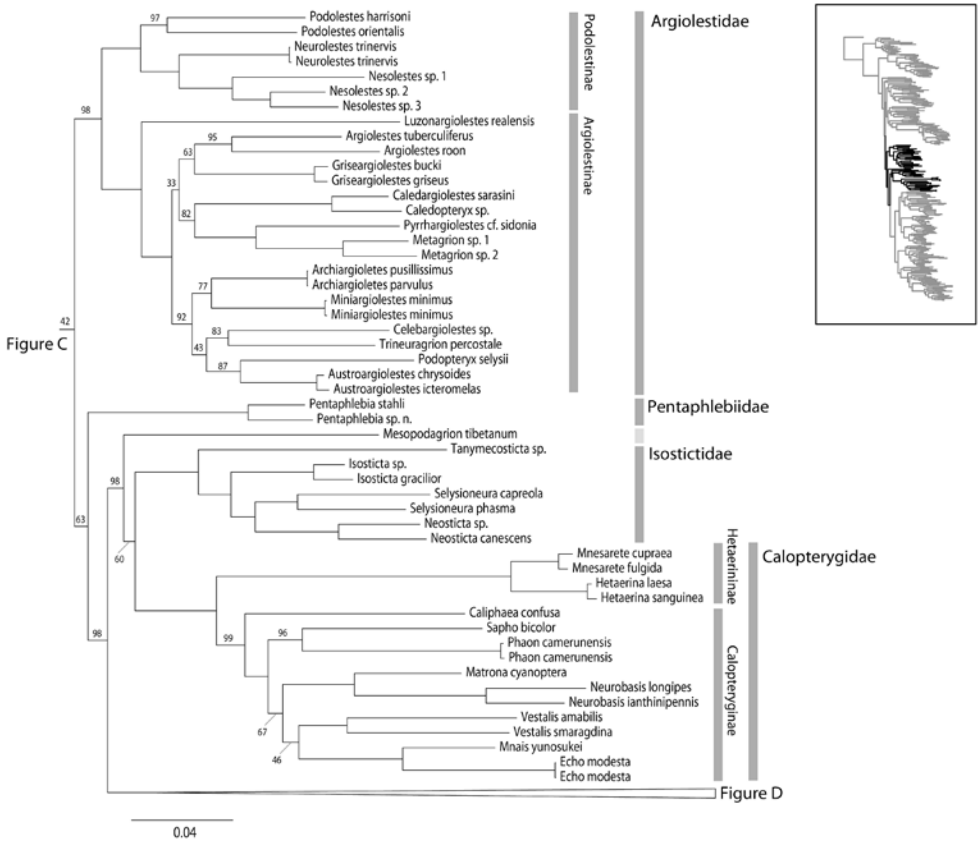


Figure 2c. Continued.

very short pterostigmata, anal veins reduced basally (or shifted distally) allowing the quadrilateral cells to reach the wing margins, and a distinctive layout of markings and appendages (Garrison et al. 2010). The anal vein and ovipositor dentition of *Nubiolestes* are intermediate to *Chlorolestes* and other features are closer to the latter. Interestingly, the Synlestidae from South Africa (*Chlorolestes*, *Ecchlorolestes*) never grouped together, nor did those from Australia (*Episynlestes*, *Synlestes*). We did not sample the problematic genera *Phylolestes* from Hispaniola, *Sinolestes* from China and *Chorismagrion* from Australia. The last, sometimes placed in the Chorismagrionidae (Bechly 1996), was recovered within Synlestidae by Bybee et al. (2008) and Dumont et al. (2010). May et al. (unpublished data in Dijkstra et al. 2013) found Synlestidae to be monophyletic if *Nubiolestes* was included, but morphological apomorphies for the group remain to be identified. Given the discussed problems, we retain Perilestidae and Synlestidae as currently recognized, only transferring *Nubiolestes*, although Synlestidae may still prove not be monophyletic and the two families might eventually be merged or divided. Lestidae was monophyletic in all analyses (cf. Rehn 2003, Bybee et al. 2008, Dumont et al. 2010). *Austrolestes* and *Indolestes* are sister groups, but were never monophyletic with *Sympecma*, which also closes its wings at rest, and thus no support for the subfamily Sympecmatinae was found. *Sympecma* was recovered in *Lestes* in ML 28S+16S: over half the species of Lestidae are

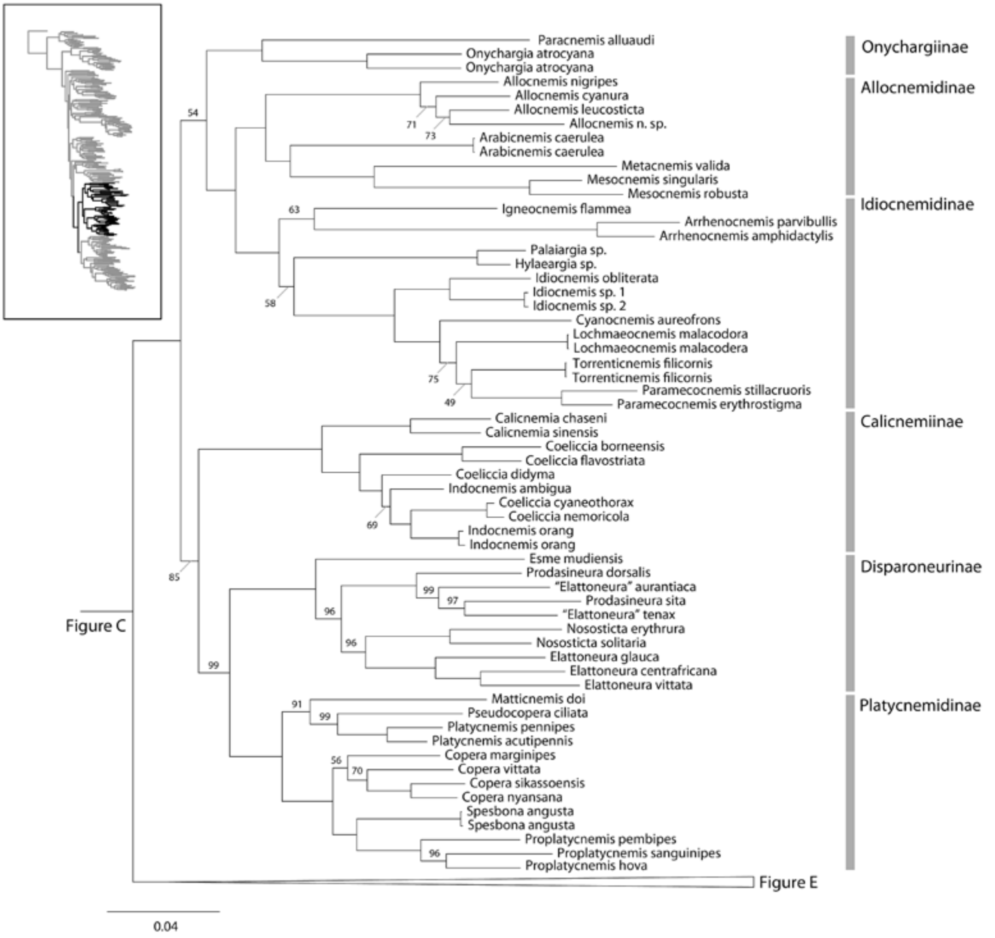


Figure 2d. Continued.

currently placed in *Lestes* and this heterogeneous and cosmopolitan genus is likely to be subdivided in the future.

Superfamily Platystictoidea and family Platystictidae

Platystictidae is monophyletic in all analyses and the sister group of all Zygoptera, excluding Lestoidea, in BI and ML of 28S+16S and 28S+16S+COI (cf. Bybee et al. 2008, van Tol et al. 2009, Dumont et al. 2010, Davis et al. 2011). The group possesses a peculiar combination of venation characters, including a reduced anal vein abutting (when present) the quadrilateral cell, a supplementary basal cross-vein and a very basally positioned node, and is also characterized by the ridges on the occiput and postgenae (Rehn 2003, Garrison et al. 2010). Currently the over 220 species are placed in just seven genera, a higher ratio than in any other family. This is due to the highly polyphyletic nature of the Oriental genera *Protosticta* and *Drepanosticta* (van Tol et al. 2009). The recently described genus *Telosticta* is monophyletic, but further generic revision is required (Dow & Orr 2012). Wilson (1997) erected the subfamily Sinostictinae for the distinct genus *Sinosticta* from

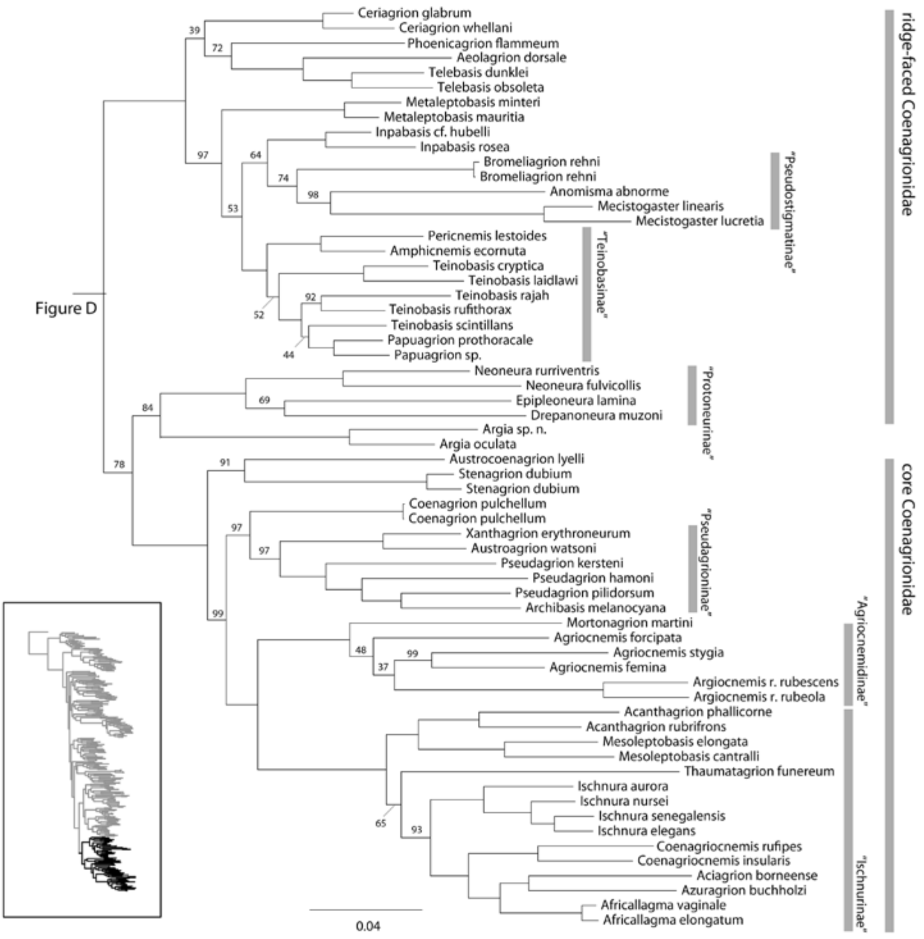


Figure 2e. Continued.

southern China, which was the sister group of remaining Platystictidae with high support. The Sri Lankan Platystictidae were found to be the sister group of all platysticids except *Sinosticta* in BI 28S+16S and BI/ML 28S+16S+COI, and of the Neotropical genus *Palaemnema* (sole member of the subfamily Palaemnematinae) in BI/ML 28S and ML 28S+16S, making the Oriental Platystictinae paraphyletic. Therefore we limit Platystictinae to the Sri Lankan group and erect Protostictinae subfam.n. for the remaining Asian Platystictidae. The genus *Ceylonosticta* is reinstated for the Sri Lankan species placed in the mainland genus *Drepanosticta*, although this genus appears paraphyletic relative to the endemic *Platysticta* and must be revised (Table S4).

Superfamily Coenagrionoidea

A monophyletic group including Coenagrionidae, Platycnemididae, Protoneuridae and Pseudostigmatidae *sensu* Silsby (2001), was well supported by BI/ML 28S+16S/ 28S+16S+COI (cf. Bybee et al. 2008, Carle et al. 2008). Isostictidae is the sister group of this assemblage according to Bybee et al. (2008), a relationship we recovered only with low support in BI/ML 28S+16S. All aforementioned

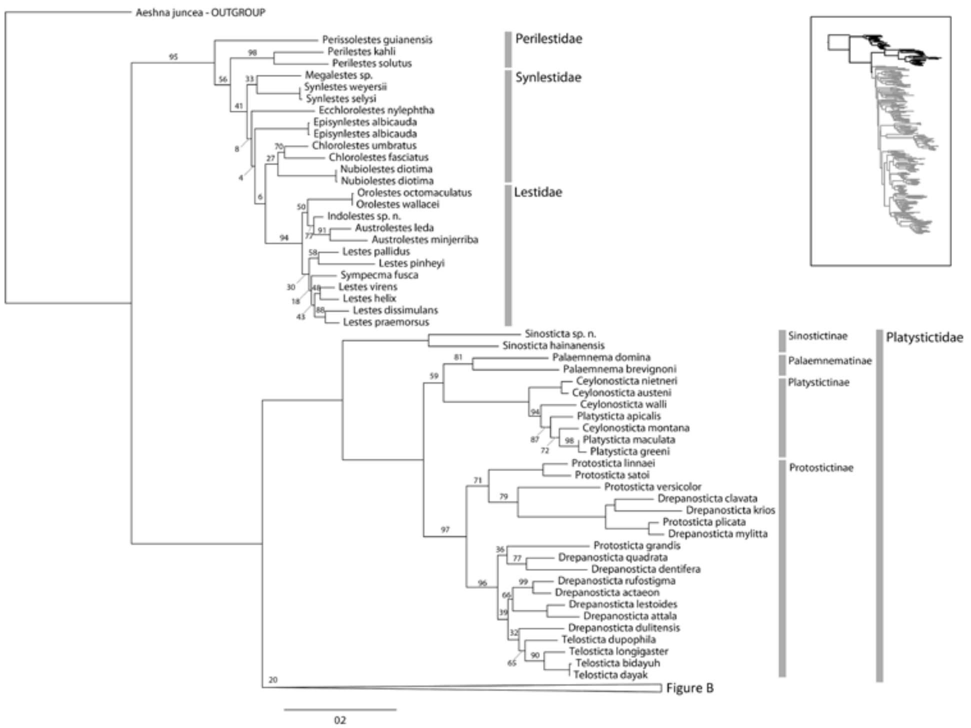
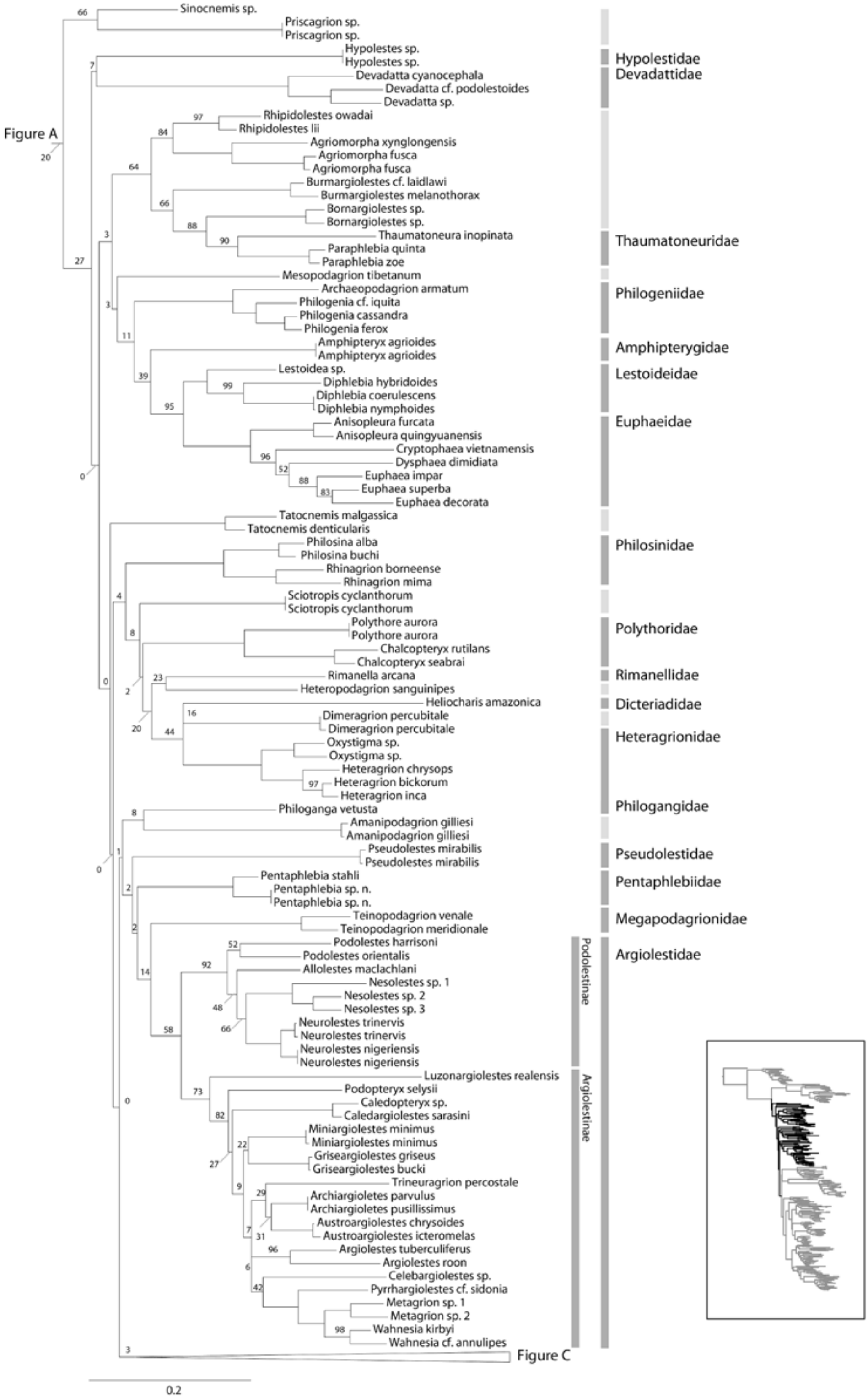
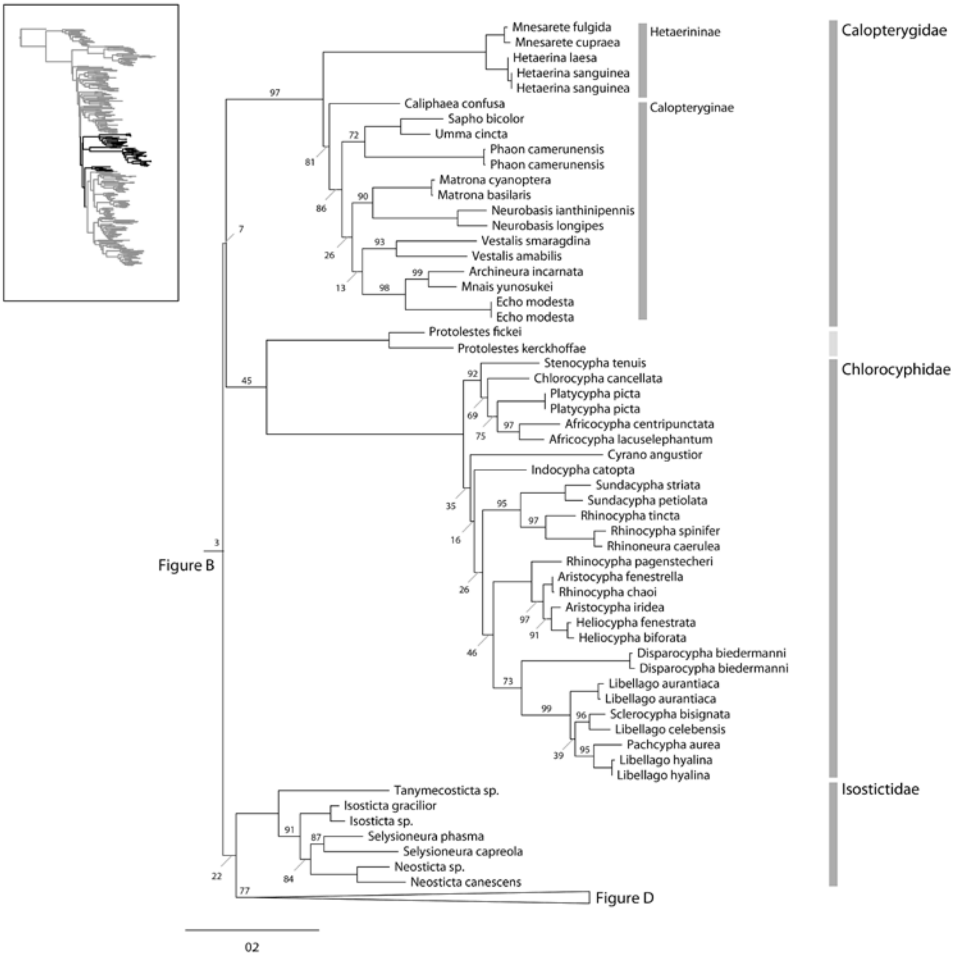


Figure 3a. Phylogenetic reconstruction for 356 specimens from the combined maximum likelihood analysis of 28S and 16S. Bootstrap values are shown only if below 100. Species names and classification as proposed are shown. (a) Lestoidea and Platystictoidea; (b, c) various groups; (d) Platycnemididae; (e) Coenagrionidae.

families are retained in the superfamily Coenagrionoidea, including almost three-fifths of all damselfly species. They are characterized by the larval prementum, which has an (almost) entire anterior border and palps bearing setae, although palpal setae also occur in the Lestidae (Bechly 1996, Rehn 2003).

Coenagrionoid classification has been unsettled by the discovery of non-monophyly of its long-recognized families. As detailed in the following, our extensive sampling allows reconfiguration of the superfamily into three families, of which Isostictidae includes less than 3% of species and Platycnemididae 24%. The Old World 'protoneurids' (Disparoneuridae in Kalkman & Orr 2012) are not closely related to the true New World Protoneuridae (Pessacq 2008), being either the sister group of Platycnemididae (Bybee et al. 2008, van Tol et al. 2009, Dumont et al. 2010) or falling within that family (Rehn 2003, Carle et al. 2008). In BI/ML 16S/28S+16S/28S+16S+COI, Platycnemididae forms the sister group of remaining Coenagrionoidea (excluding Isostictidae) and Disparoneuridae is the sister group of its subfamily Platycnemidinae. The remaining Platycnemididae (previously considered as subfamily Calicnemiinae) are paraphyletic, as demonstrated previously based on morphology (Gassmann 2005). Our analyses show that they form several geographically well-defined clades. Stability is served by expanding the family to incorporate the Disparoneuridae and recognizing each of these clades as a subfamily. The latter family-group name is favoured over


Sinocnemis sp.
Priscagrion sp.
Priscagrion sp.
Hypolestes sp.
Hypolestes sp.
Devadatta cyanocephala
Devadatta cf. podolestoides
Devadatta sp.
Figure A
Rhipidolestes owadai
Rhipidolestes lii
Agriomorpha xynglongensis
Agriomorpha fusca
Agriomorpha fusca
Burmargiolestes cf. laidlawi
Burmargiolestes melanothorax
Bornargiolestes sp.
Bornargiolestes sp.
Thaumatoneura inopinata
Paraphlebia quinta
Paraphlebia zoe
Mesopodagrion tibetanum
Archaeopodagrion armatum
Philogenia cf. iquita
Philogenia cassandra
Philogenia ferox
Amphipteryx agrioides
Amphipteryx agrioides
Lestoidea sp.
Diphlebia hybridoides
Diphlebia coerulescens
Diphlebia nymphoides
Anisopleura furcata
Anisopleura quingyuanensis
Cryptophaea vietnamensis
Dysphaea dimidiata
Euphaea impar
Euphaea superba
Euphaea decorata
Tatocnemis malgassica
Tatocnemis denticularis
Philosina alba
Philosina buchi
Rhinagrion borneense
Rhinagrion mima
Sciotropis cyclanthorum
Sciotropis cyclanthorum
Polythore aurora
Polythore aurora
Chalcopteryx rutilans
Chalcopteryx seabrai
Rimanella arcana
Heteropodagrion sanguinipes
Heliocharis amazonica
Dimeragrion percubitale
Dimeragrion percubitale
Oxystigma sp.
Oxystigma sp.
Heteragrion chrysops
Heteragrion bickorum
Heteragrion inca
Philoganga vetusta
Amanipodagrion gilliesi
Amanipodagrion gilliesi
Pseudolestes mirabilis
Pseudolestes mirabilis
Pentaphlebia stahli
Pentaphlebia sp. n.
Pentaphlebia sp. n.
Teinopodagrion venale
Teinopodagrion meridionale
Podolestes harrisoni
Podolestes orientalis
Allolestes maclachlani
Nesolestes sp. 1
Nesolestes sp. 2
Nesolestes sp. 3
Neurolestes trinervis
Neurolestes trinervis
Neurolestes nigeriensis
Neurolestes nigeriensis
Luzonargiolestes realensis
Podopteryx selysii
Caledopteryx sp.
Caledargiolestes sarasini
Miniargiolestes minimus
Miniargiolestes minimus
Griseargiolestes griseus
Griseargiolestes bucki
Trineuragrion percostale
Archiargioletes parvulus
Archiargioletes pusillissimus
Austroargiolestes chrysoides
Austroargiolestes icteromelas
Argiolestes tuberculiferus
Argiolestes roon
Celebargiolestes sp.
Pyrrhargiolestes cf. sidonia
Metagrion sp. 1
Metagrion sp. 2
Wahnesia kirbyi
Wahnesia cf. annulipes
Figure C
0.2
Podolestinae
Argiolestinae
Hypolestidae
Devadattidae
Thaumatoneuridae
Philogeniidae
Amphipterygidae
Lestoideidae
Euphaeidae
Philosinidae
Polythoridae
Rimanellidae
Dicteriadidae
Heteragrionidae
Philogangidae
Pseudolestidae
Pentaphlebiidae
Megapodagrionidae
Argiolestidae



▲ Figure 3c. Continued.
◀ Figure 3b. Continued.

Caconeuridae, introduced simultaneously (Fraser 1957), because *Caconeura* belongs to a distinctive southern Indian radiation, while *Disparoneura* has more in common with the widespread elements of this group. The complex systematics of the remaining 73% of Coenagrionoidea is discussed under Coenagrionidae.

Family Isostictidae

All analyses confirmed that Isostictidae is monophyletic, although its position is problematic and it may not belong in Coenagrionoidea (cf. Bybee et al. 2008, Carle et al. 2008). The family incorporates less than 50 damselfly species confined to Australia, New Guinea, New Caledonia and neighbouring islands. Larvae have unique gills that are strongly constricted medially and somewhat swollen basally in most genera. Adults are peculiar with laterally compressed heads, recalling some Coenagrionidae such as *Amphicnemis*, *Ceriagrion* and *Neoneura*, with wide and deep labial clefts, and have rather forcipate and often toothed or serrate cerci, lack bright colours and are generally very slender.

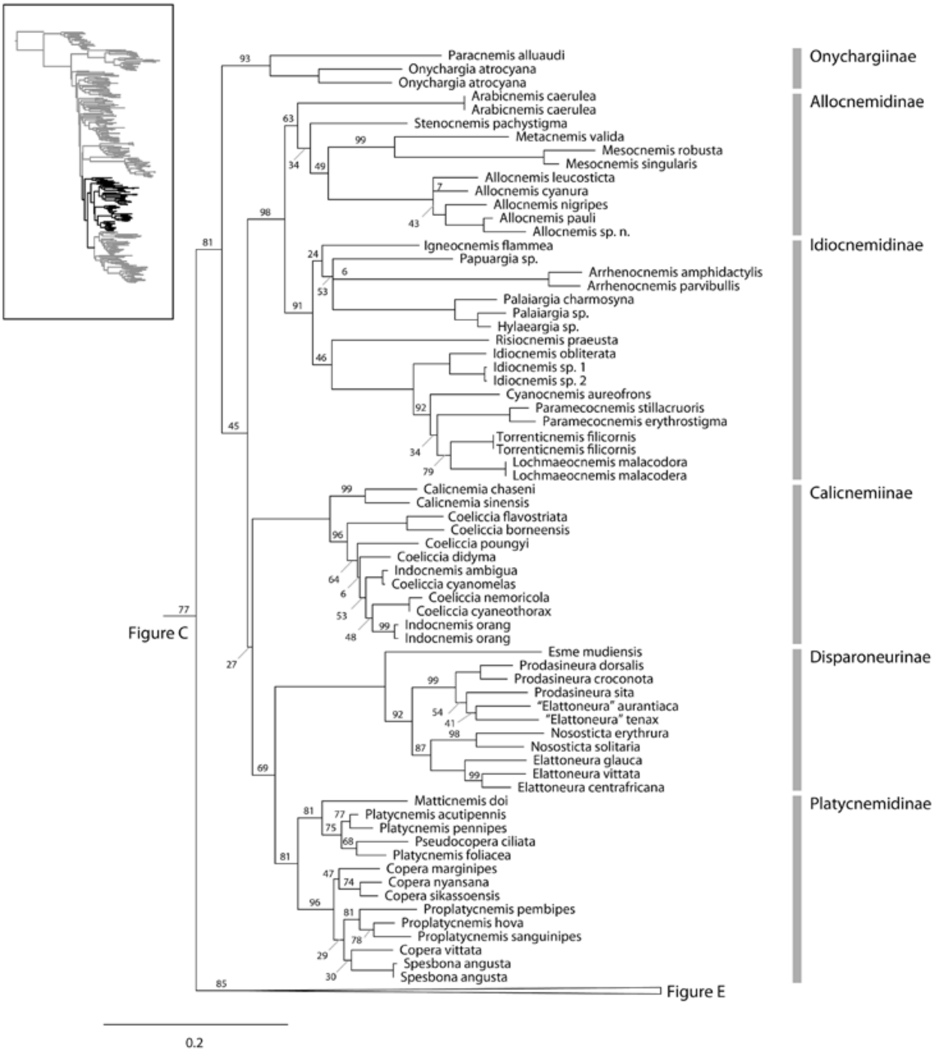


Figure 3d. Continued.

Family Platycnemididae
Incorporating Disparoneuridae, this family includes over 400 species confined to the Old World, mostly to tropical streams and rivers. Despite being long recognized as a family and genetically well defined, no clear morphological apomorphies are known, although the species always lack spines on the genital ligula shaft (Pessacq 2008, Kalkman et al. 2010), while these are present in at least 53% of 103 examined coenagrionid genera. Adults often have laterally expanded heads (with usually shallow labial cleft and no trace of postfrontal suture) and tibiae with dense long spines (Rehn 2003, Carle et al. 2008). A consistently recovered clade comprised the small Oriental genus *Onychargia* and the Madagascan *Paracnemis*: we consider this as the subfamily Onychargiinae subfam.n.
It was the sister group of remaining Platycnemididae in ML 28S+16S/28S+16S+COI, but of the combined African and Papuan clades (see later) in

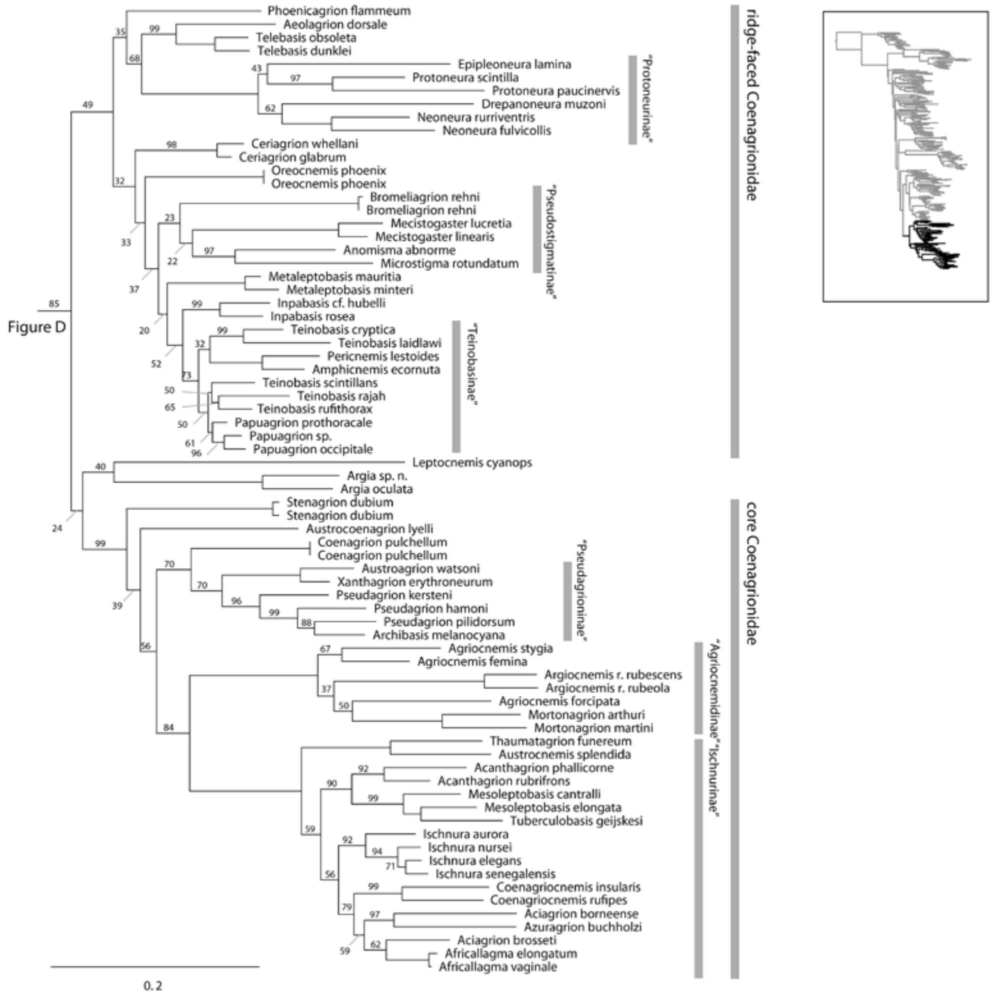


Figure 3e. Continued.

BI 28S+16S/28S+16S+COI. *Onychargia* was placed previously in Coenagrionidae, but its spineless genital ligula, long leg spines, markings (most notably the transverse pale band across vertex) and cerci with long internal tooth (concealed in tenth tergite) fit Platycnemididae better. The two genera have quite similar markings and share notably short cerci, as well as their swampy habitats (K. Schütte, *in litt.*), which is unusual for the family. *Paracnemis* is monotypic, although '*Metacnemis*' *secundaris* Aguesse (known only from the holotype from Madagascar) is unlike that South African genus and closer to *Paracnemis*, most notably by markings, and is placed there until its rediscovery allows a better assessment (Table S4).

Another clade represents almost 30 species restricted to tropical mainland Africa (*Allocnemis*, *Mesocnemis*, *Metacnemis*, *Stenocnemis*) plus the endemic monotypic genus from adjacent Arabia *Arabicnemis*, which we consider as the subfamily Allocnemidinae subfam.n. Although this group is well defined geographically, their morphology is heterogeneous, the robust *Mesocnemis* and

Metacnemis having been previously associated with 'argiine' Coenagrionidae. Distinguished only by the relative length of the anal vein, the genera *Allocnemis*, *Chlorocnemis* Selys and *Isomecocnemis* Cowley (the latter two were formerly in Protoneuridae for this reason) are intermixed and all species should be treated under the first name (Table S4). *Metacnemis* should be restricted to *M. valida* (Hagen in Selys), as both species added to that genus later appear not to be related (see discussion both earlier and later in this paper). This African clade is the sister group of one of about 100 platycnemidid species occurring east of Huxley's Line. The studied New Guinean genera with crenulated wingtip margins (*Cyanocnemis*, *Idiocnemis*, *Lochmaeocnemis*, *Paramecocnemis*, *Torrenticnemis*) form a well-supported monophyletic subgroup. Based on this and other morphology, *Rhyacocnemis* from New Guinea and *Lieftinckia* and *Salomocnemis* from the Solomon Islands belong here too (Gassmann 2005). This subfamily, to be called Idiocnemidinae subfam.n., also includes New Guinean genera with absent or reduced wingtip crenulation: *Arrhenocnemis* was placed previously in Megapodagrionidae but shown to belong here by Gassmann (2005) and Orr & Kalkman (2010). *Palaiargia* and *Papuargia* (as well as presumably *Archboldargia*) were considered previously as 'argiine' Coenagrionidae, based on their venation and lacking the lateral expansion of the head (Lieftinck 1949). *Hylaeargia* was found to fall within *Palaiargia* although the male appendages are rather different; better taxon sampling is needed before a decision can be made on its status. The Philippine genus *Risiocnemis* was recovered here consistently. The positions of the morphologically well-defined subgenera (cf. Gassmann & Hämäläinen 2002) varied by analysis, but they were never recovered as sister groups and this warrants recognizing *Igneocnemis* as a genus (Table S4). The gills of *Hylaeargia*, *Lieftinckia* and *Palaiargia* larvae form a unique three-dimensional ruff (Lieftinck 1957, Corbet 1999). Whether this is an apomorphy of Idiocnemidinae is unclear, as no other larvae have been described.

Calicnemiinae is limited to the Oriental genera *Calicnemia*, *Coeliccia* and *Indocnemis* in our analyses, which together have about 85 species. Within the family, these genera are notable for possessing distinct elongate pale spots on the posterior border of the postocular lobes (Gassmann 2005). *Indocnemis* makes *Coeliccia* paraphyletic. That genus probably requires further subdivision and more species may be placed in *Indocnemis*, so synonymizing it now would be confusing. Moreover, the sister group of remaining *Coeliccia*, Dow's (2010) *borneensis* group from Borneo, shares some characters with *Coeliccia lieftincki* Laidlaw from Java and *Coeliccia* species from the Philippine islands Mindoro, Mindanao and Palawan. The Philippine species are especially close to the Palawan genus *Asthenocnemis*, 16S data groups *Coeliccia dinoceras* from Mindanao firmly with the *borneensis* group. *Asthenocnemis* may make *Coeliccia* paraphyletic and major generic reclassification of the subfamily is needed.

Disparoneurinae includes distinct African, Asian and Papua- Australian clades (representing over 25, 45 and 55 species, respectively) that together form the largest platycnemidid radiation. This includes all platycnemidids with a largely or entirely reduced anal vein, except some *Allocnemis*, and typically rather short and high male appendages. The Papua- Australian clade conforms to the genus *Nososticta*, but species currently assigned to *Elattoneura* and *Prodasineura* are mixed in both the African and Asian clades. The slightly less reduced anal vein that supposedly separates *Elattoneura* from *Prodasineura* is obviously not reliable. Nonetheless, most species can be assigned to the correct continent by their combination of coloration (e.g. blue is frequent in Asia, but absent in Africa), venation (complete reduction anal vein only in Asia) and paraproct shape, the distal border of which is rather vertical in Africa, but tends to slope in Asia (Dijkstra 2007). As the type-species of *Elattoneura* is African and that of *Prodasineura* is Asian, all African species should be placed in *Elattoneura* (Table S4). The situation in Asia is more complicated, as the species now placed in *Elattoneura* may not be closely related to the type of *Prodasineura* and the entire group requires revision. The Arabian *Arabineura* and Indian *Disparoneura* presumably belong to this clade too, as both have appendages nearest *Prodasineura*. Ten 'caconeurine' species are endemic to southern India, but although morphologically very distinctive as a group, the four genera (*Caconeura*, *Esme*, *Melanoneura*, *Phylloneura*) are almost identical. We retrieved *Esme* as the sister group of all other Disparoneurinae sampled, but Dumont et al. (2010) retrieved *Caconeura* within *Prodasineura*. The latter study had a narrow taxon-sampling, and while Bybee et al. (2008) confirmed that *Phylloneura* is disparoneurine, they only had *Nososticta* to compare. As with the Allocnemidinae and Idiocnemidinae, the African *Elattoneura* and Papua-Australian *Nososticta* were retrieved mostly as sister groups of each other, rather than of the Oriental *Prodasineura*, a pattern worthy of closer investigation and supported by the generally vertical profile of their paraprocts.

The subfamily Platycnemidinae as previously known, defined by feather-like tibiae (expanded, coloured) in males, is a monophyletic assemblage of nearly 40 species, including the family's only notable Malagasy and Palaearctic radiations. It consists of two well-supported clades, both of which contain species presently classified in *Platycnemis* and *Copera*. The clade with the generotypic *Copera marginipes* (Rambur), which we recognize as the tribe Coperini trib.n., has a unique larval character (gills with frilled borders) and adult males often have barred eyes, colourful legs (white, yellow, orange, red, blue) and an internal tooth on the cerci. Aside from the true Oriental *Copera* species, it includes all Afrotropical species until now placed in *Platycnemis*. The name *Proplatycnemis* is available for the Malagasy species (Table S4), which have a distinctive genital ligula shape; *Proplatycnemis pembipes* (Dijkstra et al.) from the Tanzanian island Pemba belongs here (Dijkstra et al. 2007). The continental African species group with the morphologically similar true *Copera*, and are best transferred accordingly (Table S4). The South African genus *Spesbona* is the sister group of *Proplatycnemis*; its sole species *Spesbona angusta* (Selys) was previously placed in *Metacnemis* but is distantly related to the type of the genus, *M. valida* (Dijkstra 2013). The species' markings, genital ligula and appendages are close to those of *Proplatycnemis*. Its tibiae, however, are black and not widened, which prevented an earlier association with its true relatives. This and the bulging postocular lobes, pointed pterostigmata and deep blue colour are unique within the subfamily (Dijkstra 2013). The tribe Platycnemidini has smooth-bordered gills and males always have white legs and no cercal tooth. It consists of the Palaearctic *Platycnemis* species (including the generotype) and the black-and-white species placed formerly in *Copera*, which extend from Japan to Java. The genus *Platycnemis* should be limited to the Palaearctic species, and for its probable sister group of 'false' *Copera* species the name *Pseudocopera* is available (Table S4). The recently described *Matticnemis doi* (Hämäläinen) is the sister group of these two genera (Hämäläinen 2012, Dijkstra 2013).

Family Coenagrionidae

Encompassing almost 1300 species, remaining Coenagrionoidea represents the greatest damselfly radiation. Earlier subdivisions are generally unsupported by morphology (O'Grady & May 2003), but molecular studies are revealing some notable groups. We sampled 45 of 115 genera and, and with data published for another 17, these groups are becoming increasingly well supported. As detailed in the following, two major groups can be distinguished, both of which are cosmopolitan and contain over 600 species, but only the group including *Coenagrion* is unquestionably monophyletic. This group is generally defined by well-developed postocular spots and dominates in the Holarctic and Palaeotropics, representing over 80% of species diversity in the Palaearctic and Afrotropics and just 30% (ischnurines only) in the Neotropics. The remainder rarely possesses postocular spots, but is characterized by a ridged frons in most species, although the large genus

Argia is the notable exception for both characters. This half is richest in the Neotropics with 70% of species, including Pseudostigmatidae and true Protoneuridae. It also has a notable Palaeotropical presence, e.g. teinobasines and *Ceriagrion*, representing over 40% of species in the Oriental, Australian and Pacific regions.

We treat all this diversity within a massively expanded Coenagrionidae. Such an inclusive approach serves stability, although given the size of this group (about 30% larger than any other odonate family), applying the family rank to more manageable units might seem appropriate when better phylogenetic support is obtained. The oldest name available for the non-core genera is Pseudostigmatidae Kirby 1890, applied for over 120 years to just a score of peculiar species. It seems counterintuitive to apply that name to about 30 times as many generally 'ordinary' damselflies. Given its long history in a polyphyletic sense, using Protoneuridae Yakobson & Bianchi 1905 for almost 500 species never known by that name may also cause confusion. Both 'families' as currently known are apophyletic groups (i.e. their distinctness resulted in an exaggerated taxonomic rank; see O'Grady & May 2003), defined by the extreme expansion and reduction of their venation, respectively. Although taxonomic names are governed by rules, they are applied by consensus. We expect these names will continue to signify only these damselflies for most users, even if only in a colloquial sense, as they have for over a century. The family-group name Teinobasidae Tillyard 1917 has been applied for most of the former Coenagrionidae in the ridge-faced group (De Marmels 2007), yet is sufficiently unfamiliar to most users to be neutral. *Teinobasis* and other 'Teinobasinae' are characterized by all features defining the group. We believe that if the monophyly of the whole group is resolved and a name for it is required, this one would be carried best by the odonatological community. Prioritizing it would, however, require a ruling of the International Commission on Zoological Nomenclature. The data suggest that Agriocnemidinae, Ischnurinae and Pseudagrioninae constitute distinct groups within core Coenagrionidae, as may Argiinae, Protoneurinae, Pseudostigmatinae and Teinobasinae among the remainder. Thus a taxonomic solution in which most familiar names can be conserved as subfamilies is conceivable and therefore perhaps preferable. However, sampling and support are still insufficient for a comprehensive subdivision and thus, for now, we apply these names only in a vernacular sense.

Core Coenagrionidae

The monophyly of this group representing over 650 species is well supported in our and all previous molecular analyses (Bybee et al. 2008, Carle et al. 2008, Dumont et al. 2010). Three well-supported clades conforming to previously named subfamilies are recovered within it, which together appear to contain almost nine-tenths of the species. The largest clade represents just over half and conforms to the cosmopolitan Ischnurinae, including all genera that possess a vulvar spine in the female, although it is occasionally absent: *Acanthagrion*, *Aciagrion*, *Africallagma*, *Austrocnemis*, *Azuragrion*, *Coenagriocnemis*, *Dolonagrion* (based on 28S only), *Ischnura*, *Mesoleptobasis* (with *Tuberculobasis* within it) and *Xiphiagrion* (16S only). The formerly 'platycnemidid' *Thaumatagrion* is closely related to *Austrocnemis*, also a dark-bronzy long-legged Papua-Australian genus, which is supported by its spiny genital ligula (Gassmann 2005). Hovmöller (2006) previously investigated the group's monophyly, adding *Amphiallagma*, *Cyanallagma*, *Homeoura* and *Oxyagrion*, while *Amphiagrion*, *Enallagma*, *Hesperagrion* and *Proischnura* belong here as well (Carle et al. 2008, Dumont et al. 2010), all possessing the vulvar spine. Based on this character and/or similarity to other ischnurines, the genera *Acanthallagma*, *Andinagrion*, *Argentagrion*, *Austroallagma*, *Denticulobasis* (denticulate vulvar plate is assumed homologous), *Enacantha*, *Leptobasis*, *Leucobasis*, *Mesamphiagrion*, *Millotagrion*, *Oreagrion*, *Oreiallagma*, *Oxyallagma*, *Pinheyagrion*, *Protallagma*, *Tigriagrion* and *Zoniagrion* can be added. *Amorphostigma* Fraser, *Boninagrion* Asahina, *Rhodischnura* Laidlaw and probably *Pacificagrion* must be subsumed into *Ischnura* (O'Grady & May 2003, Hovmöller 2006, Karube et al. 2012). *Anisagrion*, *Apanisagrion* and *Calvertagrion* lack the vulvar spine, but form a largely Central American, probably monophyletic, group with the spined *Hesperagrion* (De Marmels 2002a).

The clade incorporating *Agriocnemis*, *Argiocnemis* and *Mortonagrion* conforms to the Palaeotropical Agriocnemidinae of about 55 species. The first appears paraphyletic, but all three genera require redefinition (Dow 2011). It is the only coenagrionid subfamily supported by the morphological analysis of O'Grady & May (2003), the arculus being shifted considerably distal to the second antenodal cross-vein. The clade of *Archibasis*, *Austroagrion*, *Pseudagrion* and *Xanthagrion* conforms to the mostly Palaeotropical Pseudagrioninae, including almost 200 species. The Asian *Pseudagrion* species sampled was closer to the Asian *Archibasis* than to the two African species studied. As the type of *Pseudagrion* is African, this indicates that the Asian taxa may have to be reclassified. Earlier results suggest that the Palaearctic *Erythromma* and Oriental *Paracercion* and *Stenagrion* are related (Carle et al. 2008, Dumont et al. 2010), as may be the Antipodean *Caliagrion* and *Xanthocnemis*, but we found no clear relationship for *Stenagrion*. Also the Australian *Austrocoenagrion* and Holarctic *Coenagrion* were not recovered with any specific subgroup, although their genetic distinctiveness confirms their separation as genera (Dijkstra & Kalkman 2012). Jordan et al. (2003) could not resolve the origin of the Hawaiian *Megalagrion* radiation; Dumont et al. (2010) recovered it between agriocnemidines and ischnurines.

An apomorphy of all genera discussed earlier is the usual presence of well-developed postocular spots (cf. De Marmels 1984). Although variable in their extent and development, the spots are typically positioned centrally on the postocular lobes and enclosed by dark coloration. In *Austrocnemis*, *Thaumatagrion*, most *Amphiagrion* and occasional species of other genera (e.g. *Erythromma*), the head is so dark to have obliterated them, while in *Andinagrion* and *Oxyallagma*, the head and thorax are uniformly reddish, and in *Tigriagrion* the spots are partially obliterated by a dark pattern. Postocular spots are absent in 89% of the remaining coenagrionoid genera, discussed later. Where markings occur, these usually differ in their shape and position, e.g. a pale occipital bar may expand laterally and/or posteriorly onto the postocular lobes. None of the core Coenagrionidae members have an angularly ridged frons, which is present in 75% of remaining genera. Although extremely plastic, the male appendages of core Coenagrionidae often show typical features, with notably swollen paraproct bases and terminally branched cerci, both branches often being hooked and bearing a soft pad between them. The distal segment of the genital ligula often has a well-developed pair of median lobes. The discussed characters suggest that *Himalagrion* and *Neoerythromma* are core Coenagrionidae too.

Remaining Coenagrionidae

The relationships of the remaining genera are much less resolved than for the core Coenagrionidae. Generally we retrieved them as the monophyletic sister group of core Coenagrionidae, but with weak support and different groups (sometimes combined) excluded in certain analyses: *Argia* and *Leptocnemis* in ML 28S+16S, *Argia* and Protoneuridae in BI 28S+16S+COI, and *Argia* only in ML 28S+16S+COI, probably because COI was unavailable for *Leptocnemis*. *Argia* and *Leptocnemis* together were the sister group of all other Coenagrionidae in BI 28S+16S. Carle et al. (2008) retrieved them as monophyletic, including *Argia* and the protoneurid *Neoneura*, although their taxon sampling was limited and excluded *Leptocnemis*. Separate ML 28S+16S of a wider coenagrionid sampling (outgroup: *Platycnemis*) recovered all non-core genera together, except for *Leptocnemis*, which was the sister group of all other Coenagrionidae. Although the entire group may yet prove to be monophyletic, further analysis is needed, especially of the monotypic genus *Leptocnemis* from the Seychelles and the American genus *Argia*. The latter is the only remaining genus of Argiinae, now that all Old World 'argiines' (*Mesocnemis*, *Onychargia*, *Palaiargia* and relatives) have been confirmed as Platycnemididae. It is probably the largest odonate genus, with at least 130 species, and differs from most taxa discussed in the following (but is similar to core coenagrionids) in having a rounded frons and prominent postocular spots (Garrison et al. 2010). *Leptocnemis* was regarded as platycnemidid but lacks features of that family, possessing a spiny genital ligula (Gassmann 2005). It also has a rounded frons and peculiar postocular spots shifted towards the vertex.

As in core Coenagrionidae, three notable clades are apparent in the remaining assemblage, although we estimate that together these represent less than half of over 600 species involved. All investigated genera of true Protoneuridae form a well-supported clade (*Amazoneura* based on 28S only, *Drepanoneura*, *Epipleoneura*, *Neoneura*, *Protoneura*, *Psaironeura*) in all analyses. Its position varied, being recovered with reasonable support with *Aeolagrion* and *Telebasis* within the complex of remaining genera in BI/ML 28S+16S, but forming the sister group of all those genera in ML 28S+16S+COI or falling outside the complex together with *Argia* in BI 28S+16S+COI with only moderate support. However, as discussed in the following, 'protoneurid' morphology is very consistent with non-core Coenagrionidae and its position well inside that family is certain.

Earlier molecular studies focused exclusively on the charismatic but small 'family' Pseudostigmatidae (Groeneveld et al. 2007, Ingley et al. 2012). Adults are substantially larger than other damselflies, have highly modified venation and pterostigmata (from which their name derives), a genital ligula with distal segment modified to form a very long single flagellum, feed mostly on orb-weaving spiders and their prey, and breed in phytotelmata. We found only moderate support for the group's monophyly. It was represented by *Anomisma*, *Mecistogaster* and *Microstigma*, but also includes *Megaloprepus*, *Pseudostigma* and possibly the eastern African *Coryphagrion*, which would be the only non-Neotropical representative and lacks the flagellum. Our study and earlier molecular work suggest that the smaller-bodied American genera *Bromeliagrion*, *Diceratobasis* and *Leptagrion* are close or should be included too (Groeneveld et al. 2007, Carle et al. 2008, Ingley et al. 2012). The latter genera lack modified wings, although they are still comparatively large-bodied and also breed in phytotelmata. This reproductive habitat is not unique to the group, however, also occurring occasionally in the third wellsupported clade, represented in our dataset by the (principally) Malesian genera *Amphicnemis*, *Papuagrion*, *Pericnemis* and *Teinobasis*. De Marmels (2007) considered these four genera as Teinobasinae (subfamily of Coenagrionidae) with a cercal spur, an articulated ventral process at the appendage base that is typically directed posteriorly.

De Marmels (2007) also treated *Bromeliagrion*, *Chromagrion*, *Melanesobasis*, *Nehalennia*, *Plagulibasis*, *Pyrrhosoma* and *Tepuibasis* as Teinobasinae with a cercal spur, to which *Aceratobasis* and *Diceratobasis* can be added (Garrison et al. 2010). Such a structure is not found in any core Coenagrionidae, but a potentially homologous (but seldom articulated) basal process occurs in about half the remaining genera, including the 'pseudostigmatid' *Microstigma* (near which the spurred *Bromeliagrion* and *Diceratobasis* have been recovered) and many 'protoneurids', e.g. *Epipleoneura*, *Forcepsioneura*, *Idioneura*, *Microneura*, *Neoneura*, *Peristicta*, *Phasmoneura*, *Protoneura* and *Psaironeura*. Given its plasticity, we doubt this structure (also when articulated) defines a monophyletic group and hence no strict delimitation of the subgroup nearest *Teinobasis* can presently be made. We suspect it is an Indo-Pacific complex, including also *Melanesobasis* and *Plagulibasis*, which have a cercal spur, and *Nesobasis* and *Vanuatubasis*, which do not, but it is apparent from the paraphyly of *Teinobasis* and the recent separation of *Luzonobasis*, *Pandanobasis* and *Sangabasis* from Philippine *Amphicnemis* (Villanueva 2012) that generic revision is needed. The precise positions of genera listed by De Marmels (2007) as Teinobasinae lacking the spur (*Aeolagrion*, *Ceriagrion*, *Inpabasis*, *Metaleptobasis*, *Phoenicagrion* and *Telebasis*; only *Hylaeonympha*, *Leptagrion* and *Minagrion* were unavailable for our study) varied by analysis, but were always recovered near the 'protoneurid', 'pseudostigmatid' and 'teinobasine' clades (cf. Bybee et al. 2008, Carle et al. 2008, Dumont et al. 2010), as was the monotypic genus *Oreocnemis* from Mt Mulanje in Malawi. Although described in Platycnemididae, the last lacks all features associated with that family and possesses a spiny genital ligula. Carle et al. (2008) and Dumont et al. (2010) retrieved *Chromagrion*, *Nehalennia* and *Pyrrhosoma* here as well (cf. De Marmels 2007).

Aside from the general lack of postocular spots and the frequently present cercal spur, 83% of the non-core coenagrionid genera for which there is molecular evidence possess an angularly ridged frons. Other ridge-faced coenagrionids are *Aceratobasis*, *Angelagrion*, *Antiagrion*, *Leptagrion*, *Melanesobasis* and *Minagrion*. The ridge is variably present in species of *Tepuibasis*, as in the sampled genus *Phoenicagrion*. Of the Protoneuridae not sampled only *Junix*, *Phasmoneura* and *Proneura* lack the ridge, although *Amazoneura* and some *Protoneura* species also lack it. Another potentially informative character is the female's deeply or entirely divided 10th tergite (O'Grady & May 2003, Garrison et al. 2010) in *Aeolagrion*, *Amphicnemis*, *Antiagrion*, *Argia*, *Ceriagrion*, *Chromagrion*, *Hylaeonympha*, *Leptocnemis*, *Minagrion*, *Nehalennia*, *Papuagrion*, *Pyrrhosoma*, *Teinobasis* and *Telebasis*, although it sometimes occurs in the core coenagrionid *Pseudagrion*. Extensive metallic coloration in genera as disparate as *Amphicnemis*, *Epipleoneura* and *Nehalennia*, as well as a prominently modified epiproct, also appears to occur in this group but not in core Coenagrionidae. Although *Schistolobos* and *Telagrion* have a rounded frons and somewhat spot-like postocular markings, their appendages and setose genital ligula suggest a relationship to *Aceratobasis*. The metallic coloration and genital ligula of *Tukanobasis* imply it also belongs near the ridge-faced genera despite a rounded frons. The mysterious monotypic genera *Argiagrion* Selys and *Moroagrion* Needham & Gyger also have features of the group, but have been found to be synonyms of *Leptagrion* and *Pyrrhosoma*, respectively (Dijkstra & Kalkman 2013).

Superfamily 'Calopterygoidea'

With the superfamilies Lestoidea, Platystictoidea and Coenagrionoidea reasonably defined, the position of the remaining 27% of damselfly diversity (almost 800 species) is left uncertain. Thus far, the superfamily name 'Calopterygoidea' and the more colloquial 'Caloptera' have been used for about threefifths of this diverse assemblage. Rehn (2003) limited it to the most densely veined families Calopterygidae, Chlorocyphidae, Dicteriadidae, Euphaeidae and Polythoridae, whereas Bechly (1996) included Amphipterygidae and the genera *Diphlebia*, *Philoganga*, *Pseudolestes* and *Thaumatoneura* as well. This leaves only the genus *Lestoidea* (not to be confused with the unrelated superfamily) and heterogeneous Megapodagrionidae 'in limbo'. There is no convincing evidence for the combined monophyly of all (or any combination) of these groups, although Bybee et al. (2008) found weak support in some analyses, as did Carle et al. (2008) if Isostictidae was included, although that was also unstable. 'Calopterygoidea', by almost any definition, may ultimately prove paraphyletic, requiring the creation of further superfamilies. In the following sections we discuss all well-supported groups within this complex.

Family Calopterygidae

With almost a quarter of the species, Calopterygidae is the largest and most widespread family in the complex. Despite their distinctive appearance, good morphological apomorphies are unclear, although they probably exist in the shape of the larval prementum and antennae. Our results are broadly congruent with those of Dumont et al. (2005, 2007, 2010) based on a different set of (exclusively nuclear) markers. The strictly American Hetaerininae (including *Mnesarete* and presumably *Bryoplathanon* and *Ormenophlebia*; see Garrison et al. 2010), with about a third of the species, is confirmed as the sister group of the remaining Calopterygidae. Dumont et al. (2010) prefer to treat this group as a family, but as Calopterygidae is monophyletic (cf. Rehn 2003, Bybee et al. 2008) stability is served by retaining the present ranks and separating the distinct clades within Calopteryginae as tribes. The distinctness of ranks is subjective: classifying all lineages as one family best communicates their common ancestry. Three tribes are largely Oriental: Vestalini (*Vestalaria*, *Vestalis*), Calopterygini (*Atrocalopteryx*, *Matrona*, *Matronoides*, *Neurobasis*, with only *Calopteryx* extending across the Holarctic) and Mnaisini (*Archineura*, *Echo*, *Mnais*, *Psolodesmus*). Dumont et al. (2010) recovered the last clade but retained the genera in Calopterygini. However, Vestalini variably form the sister group of Calopterygini s.s. or Mnaisini in our and Dumont's analyses, and Mnaisini can thus best be separated. Saphoini is strictly Afrotropical (*Phaon*, *Sapho*, *Umma*). The distinctive Oriental genera *Caliphaea* and *Noguchiphaea* each represents a monogeneric tribe, as does the only South American calopterygine, *Iridictyon* (Dumont et al. 2010).

Family Chlorocyphidae

The more than 140 Palaeotropical species are unique by the adult's expanded eyes and clypeus, short abdomen, and the larva's spike-like paraprocts and reduced epiproct (Bechly 1996). Our results confirm their monophyly (cf. Rehn 2003, Bybee et al. 2008, Dumont et al. 2010) and show reasonable congruence with Bechly's (1996) classification. Subfamilies could be recognized, but because two of the available names (Disparocyphinae and Libellagininae) are older than the family name in prevailing use, we refrain from applying them formally until the nomenclatory conundrum is resolved (see Dijkstra et al. 2013). Four Afrotropical genera form the monophyletic 'Chlorocyphinae'. The analyses indicate that '*C.*' *centripunctata* Gambles, which also shares details of markings and extended paraprocts with *A. lacuselephantum* (Karsch), should be transferred to *Africocypha* (Table S4). *Stenocypha* is the sister group of the remaining African genera and formerly made up the *gracilis* group of *Chlorocypha*, making that genus paraphyletic (Dijkstra 2013). Only BI/ML 28S and ML 28S+16S suggest that the clear-winged Africans are the sister group of the entire Asian radiation, in which marked wings predominate. Two consistently well-supported clades include *Rhinocypha* species and would constitute Bechly's (1996) 'Rhinocyphinae', but their combined monophyly was not recovered. One clade is predominantly continental and also includes *Aristocypha* and *Heliocypha* (often treated as subgenera of *Rhinocypha*) and all species with a brightly coloured mid-dorsal wedge on the thorax and/or wing markings with clear fields within the dark pattern. The second clade is largely insular and includes the type species of *Rhinocypha*, *Rhinoneura* and *Sundacypha*. Major generic revision is required, including the probably related genera *Calocypha*, *Heterocypha* and *Paracypha*. 'Libellagininae' is well supported and its main constituent genus *Libellago* also consists of two clades differing in wing markings: those with dark tips (including *Sclerocypha* and presumably *Melanocypha* and *Watuwila*) and those without, including *Pachycypha*. Wing markings are thus unexpectedly informative about relationships within the group: the clear-winged genera *Cyrano* (Philippines) and *Indocypha* (south Asia), and the Sulawesi *Disparocypha*, with its narrow wings and a distally broadened pterostigmata, stand apart from the major Asian radiations in all analyses, probably representing monogeneric subfamilies.

Families Euphaeidae and Lestoideidae

All analyses recovered the Asian family Euphaeidae of almost 70 species as monophyletic with good support (cf. Rehn 2003, Bybee et al. 2008, Dumont et al. 2010), and identified *Diphlebia* plus *Lestoidea* as its sister group (cf. Bybee et al. 2008, Carle et al. 2008). The most notable apomorphy of Euphaeidae is that the larvae possess lateral gills on the eighth abdominal segment as well as on the six preceding segments (Bechly 1996). The close relation of the superficially dissimilar Australian genera *Diphlebia* and *Lestoidea* was suggested by Novelo-Gutiérrez (1995), based on their similar larvae and venation ground plan, although no shared apomorphies are known: the genera differ only in venation density, *Lestoidea* lacking numerous cross-veins and most of the anal vein. As family-group names are available, each of these distinctive genera could also be treated as a family. However, as genus- and family-group names that refer to the same group of species seem rather redundant, and distinctiveness is subjective, classifying these lineages together in the family Lestoideidae to communicate their common ancestry is preferred.

Family Polythoridae

Our limited sampling shows this Neotropical family to be monophyletic (cf. Rehn 2003, Bybee et al. 2008, Dumont et al. 2010). The almost 60 species share several notable larval characters, such as lateral gills on the second to seventh abdominal segments, dorsal abdominal spines or knobs (shared with *Teinopodagrion* in Megapodagrionidae) and swollen gills with angular or finger-like projections (Garrison et al. 2010). The apical projection of the genital ligula is also distinctive. The family has been considered close to the Euphaeidae, because the larvae share lateral abdominal gills (e.g. Bechly 1996), but no support has been found in any molecular studies.

Family Megapodagrionidae

The greatest systematic challenge in Zygoptera is classifying the over 300 species currently or formerly associated with Amphipterygidae and Megapodagrionidae. Their heterogeneity has long been recognized, as is apparent from the fact that many family-group names reinstated below are over half a century old. Previous studies showed that so-called 'megapods' are not monophyletic, containing at least five or six lineages that are richest in tropical America, Madagascar, South-east Asia, New Guinea and Australia (Rehn 2003, Bybee et al. 2008, van Tol et al. 2009, Dumont et al. 2010, Kalkman et al. 2010). Until now, however, no comparative phylogenetic data were available for the majority of genera. We obtained molecular data for 92% of the 51 genera involved, most of which are morphologically well defined (e.g. Garrison et al. 2010, Kalkman & Theischinger 2013), and the results indicate that Megapodagrionidae includes between eight and 15 distinct (potentially family-level) clades and Amphipterygidae includes four. No 16S data were available for the family's type genus, the monotypic Amazonian *Megapodagrion*. In BI/ML 28S it was the sister group of the Andean *Teinopodagrion*, represented by two species with complete sequences in our dataset. These two genera, together with the southern Brazilian *Allopodagrion*, were already recognized to be a monophyletic group by De Marmels (2001). In comparison to other formerly 'megapod' genera, both the adults and larvae have very long legs. The latter have long triquetral paraprocts and long antennae with an elongated first segment (De Marmels 2001, Kalkman et al. 2010, Neiss et al. 2011, Fleck et al. 2012). Fleck et al. (2012) noted a close resemblance between *Allopodagrion*, *Megapodagrion* and *Teinopodagrion* larvae and those of Calopterygidae and Dicteriadidae, but our dataset provides no support for a relationship with these groups. *Megapodagrion* and *Teinopodagrion* were not recovered close to any other 'megapods', and as they possess distinct morphology, Megapodagrionidae should be restricted to just these three genera.

Family Argiolestidae

Over 100 'megapod' species form a well-supported clade confined to the Old World tropics in all analyses. Separated as the family Argiolestidae, it comprises two subfamilies divided by Huxley's Line (Kalkman & Theischinger 2013). This group includes all 'megapod' genera entirely lacking spines on the shaft of the genital ligula (Kalkman et al. 2010) except for *Amanipodagrion* and *Protolestes*, which do not seem to be closely related (see later). They differ from all other Zygoptera by the larval gills forming a horizontal fan (Kalkman et al. 2010). The only other damselflies described as having such gills are the Madagascan *Protolestes* and South American *Dimeragrion*. Our analyses implied these are not related to Argiolestidae, which is supported by other details of the larval gills and adult morphology (Tennessen 2010, Pérez-Gutiérrez & Montes-Fontalvo 2011, Kalkman & Theischinger 2013). Another apomorphy is a central ridge of tubercles on the male cerci, which is present in all genera and absent only secondarily in a few species. It seems absent from all other Zygoptera, although *Heteragrion*, *Oxystigma* and *Heteropodagrion* possess something similar. The subfamily Argiolestinae makes up almost three-quarters of the family's species diversity, restricted largely to Australia, New Guinea and New Caledonia, with some isolated species in Sulawesi and the Philippines. Podolestinae includes *Podolestes* in South-east Asia, *Allolestes* in the Seychelles, *Nesolestes* in Madagascar and the Comores, and *Neurolestes* in Central Africa.

Family Philosinidae

The Oriental *Philosina* and *Rhinagrion* are similar in morphology both in the adult stage, sharing the general shape of the genital ligula with notably long and dense setae on its shaft, and in the larval stage, with the larval paraprocts forming a unique tube around the epiproct (Kalkman & Villanueva 2011, Zhang et al. 2011). Their sister group relationship is highly supported in all analyses and together they are recognized as Philosinidae, encompassing only 12 known species, but no near relatives were identified.

Family Thaumatoneuridae

The Central American *Paraphlebia* and *Thaumatoneura* were recovered consistently as sister genera, sharing details of genital ligula, venation and larval morphology. They are also the only 'megapod' genera with dimorphic males in some species, the wings being either distinctly marked or completely clear (Garrison et al. 2010). All analyses except BI/ML 28S retrieved these two combined with the Asian genera *Agriomorpha*, *Bornargiolestes*, *Burmargiolestes* and *Rhipidolestes* as monophyletic, with *Bornargiolestes* as the Americans' sister group, but while support was good in BI/ML 28S+16S it was poor in BI/ML 28S+16S+COI. The Oriental genera are similar in general morphology, but no apomorphies are known for them or for this possible subtropical group as a whole. They include some of the few 'megapods' with distinct wing markings or that perch with closed wings. *Agriomorpha* and *Paraphlebia* share very hairy larval gills and all genera have notably dense venation towards the wing margins, but all these tendencies require further study. We combine the two American genera into the family Thaumatoneuridae, but leave the rest as *incertae sedis*. *Burmargiolestes xinglongensis* Wilson & Reels is nearer to *Agriomorpha* than to the other *Burmargiolestes* and is transferred to that genus (Table S4).

Remaining Neotropical 'megapods' and family Dicteriadidae

The status of the remaining Neotropical 'megapods' is only partly resolved, but we retrieved three notable groups. Firstly, a well-supported relationship was found between *Philogenia* (35 species) and the small Ecuadorian genus *Archaeopodagrion* in all analyses. These genera are rather distinct morphologically, but share the presence of very long coiled flagella on the genital ligula. Secondly, the large genus *Heteragrion* (over 50 species) and smaller *Oxystigma* were recovered together with high support in all analyses. These genera resemble each other closely in the shape of the male appendages, genital ligula and markings. A probable apomorphy is the inflated larval gills, which bear rows of strongly curved spines (Geijskes 1943, De Marmels 2004). Thirdly, the localized *Dimeragrion* (Guiana Shield) and *Heteropodagrion* (northern Andes) were sister groups in MP 28S+16S and BI/ML 28S+16S+COI. Based on their closed wings at rest (except *Dimeragrion*), angulate frons (found also in *Heteragrion*) and especially the adult female's uniquely divided eighth tergite (Garrison et al. 2010), we assume the monotypic Colombian *Mesagrion* belongs here too.

Heliocharis and *Hypolestes* were recovered as sister groups with moderate support in all analyses except BI/ML 28S/28S+16S. *Heliocharis* forms the Amazonian family Dicteriadidae with the also monotypic *Dicterias*, while *Hypolestes* is endemic with three species to the Greater Antilles.

Dicteriadid adults are peculiar among Zygoptera for their anteriorly widened postclypeus, drawn-out palpal hooks and almost bare legs. *Hypolestes* differs considerably from other 'megapods' by venation, genital ligula and appendages, but the two groups bear no obvious morphological resemblance, making this result rather inexplicable (Garrison et al. 2010). The Venezuelan *Sciotropis* shares the presence of several basal cross-veins with Polythoridae, but not with other 'megapod' genera except for the occasional *Dimeragrion* (N. von Ellenrieder, *in litt.*), and a general similarity of the male appendages and genital ligula can be seen (cf. Garrison et al. 2010). However, this genus was resolved as the sister group of Polythoridae, with negligible support only in MP 28S+16S (COI unavailable).

Although some of these groups grouped together in some analyses – sometimes also with other Neotropical taxa such as *Rimanella* and Polythoridae – good support for further relationships was not found. Therefore the complex taxonomy cannot be resolved definitively at present, also because the oldest name available (Hypolestidae) is connected to one of the more disparate taxa. However, considering the results and keeping nomenclatorial stability in mind, we tentatively propose to divide this group. Such a solution at least progresses from the previous situation, in which most genera were included in a clearly polyphyletic Megapodagrionidae. Dicteriadidae should be retained for *Dicterias* and *Heliocharis*, while the family-group name Philogeniidae is available for *Archaeopodagrion* and *Philogenia*, Heteragrionidae for *Heteragrion* and *Oxystigma*, and Hypolestidae for *Hypolestes*. While *Dimeragrion*, *Heteropodagrion* and *Mesagrion* may form another group, no name is available and these genera are considered *incertae sedis*, as is *Sciotropis*.

Families Philogangidae, Pseudolestidae and the 'amphipterygid' complex

Novelo-Gutiérrez (1995) removed the Papua-Australian *Diphlebia* and Oriental *Philoganga* from Amphipterygidae, restricting the family to four small and geographically disjunct genera with larvae possessing gill tufts: *Amphipteryx* in Central America and *Devadatta* in South-east Asia forming the subfamily Amphipteryginae, and *Pentaphlebia* in central Africa and *Rimanella* in northern South America constituting Rimanellinae. Rehn's (2003) morphological analysis confirmed this classification, but molecular studies recovered the group as polyphyletic (Bybee et al. 2008, Dumont et al. 2010). The larva of *Pseudolestes mirabilis* Kirby from the Chinese island Hainan also possess tufts (Yu & Bu 2011a), but with sufficiently distinct morphology to consider Pseudolestidae a monotypic family. As discussed earlier, the affinities of *Diphlebia* are with the genus *Lestoidea* and Euphaeidae, whereas no support for relationships of *Amphipteryx*, *Devadatta*, *Philoganga*, *Pentaphlebia*, *Pseudolestes* and *Rimanella* with each other or with any damselfly genera could be found. Although the molecular evidence cannot disprove the relationship, the morphological grounds to retain any except *Amphipteryx* in Amphipterygidae are weak. For example, *Pseudolestes* has gill tufts but was never placed in that family, while *Philoganga* and *Diphlebia* do not have gill tufts but were long considered amphipterygids. Other larval features, especially of the paraprocts and epiproct, differ strongly between the genera. While the genera were grouped for possessing numerous postnodal cross-veins that are not aligned with adjacent veins, they differ in number and alignment of the antenodal crossveins, the position of the radial sectors and the shape of the quadrangles, but all these characters are probably homoplasious (Rehn 2003). As each genus has distinctive adult and larval morphology (see Appendix 2) and family-group names are available (except for Devadattidae fam.n.), all can be considered best as monogeneric families. Even if any of these genera were sister groups, the phylogenetic and geographic distance between them is great and recognizing them as highly localized families seems the most convenient and stable solution.

Remaining Palaeotropical 'megapods'

After the reclassification of most 'megapod' genera, six from tropical Asia, Madagascar and Africa remain unassigned. The Chinese *Priscagrion* and *Sinocnemis* are recovered as sister groups in all analyses with reasonable support. Based on morphology, both De Marmels (2002b) and Yu & Bu (2011b) suggested *Priscagrion* was close to Argiolestidae, but molecular data indicate this is unlikely. *Sinocnemis* has a more simplified venation, but these characters are highly homoplasious. The two genera appear similar, most strikingly in the shape of the genital ligula and the modification of its internal fold. This is long and tapering in at least one *Sinocnemis* species and even drawn out and filamentlike in one *Priscagrion* species (Yu & Bu 2011b). The similar appearance of *Sinocnemis* to the sympatric genus *Mesopodagrion* was noted by Kalkman (2008), but their very different genital ligulae and our molecular data imply there is no close relationship. Both *Mesopodagrion* species have the terminal rim of the 10th tergite distinctively extended between the cerci (Yu & Bu 2009), although something similar occurs in the coenagrionid genus *Inpabasis*.

No close relatives could be identified for the monotypic *Amanipodagrion* from the East Usambara Mountains in Tanzania, or for *Protolestes* and *Tatocnemis* from Madagascar. Each possesses a combination of adult characters that fits none of the recognized groups. *Amanipodagrion* has a hanging resting posture and banded wings, creating a superficial resemblance to the unrelated *Chlorolestes*, and lacks spines on the genital ligula shaft. *Tatocnemis* has crenulated wingtips, shared with idiocnemidine Platycnemididae, but is not close otherwise. *Protolestes* has a broadened head recalling many Platycnemididae, but supposedly has fan-like larval gills found otherwise only in Argiolestidae and possibly *Dimeragrion* (Kalkman et al. 2010). None of these genera appears to have close relatives and future work is likely to show that they constitute five separate families, assuming a close relation between *Priscagrion* and *Sinocnemis*. Study of the unknown and poorly known (*Tatocnemis* and *Protolestes*) larvae is likely to confirm these groups' isolated positions. Pending further study these genera are regarded as *incertae sedis*.

OUTLOOK

Altogether, our phylogenetic reconstruction is largely congruent with the traditional classification of Zygoptera. Nonetheless, we reinstate, raise and create 11 damselfly families, bringing the total to 27, with at least another seven likely to be separated in the near future. While this seems radical, most changes are in smaller groups and the family affiliation of only one in five damselfly species changes. Also, we believe the revised classification will prove to be stable: further splits are considered more likely than the remerging of groups. Furthermore, we have refrained from subjectively recognizing 'distinctive' families (e.g. Diphlebiidae, Disparoneuridae, Hetaerinidae, Sinostictidae) for which there was no phylogenetic imperative. Most of the 'new' names have existed for over half a century, constituting taxonomic 'hunches' for which no decisive evidence was available (or accepted) at the time of introduction.

Consensus for the suggested reclassification must be found, as attained for the better-known Anisoptera (Dijkstra et al. 2013), but we feel separating well-supported groups is more consistent than retaining unsupported groups for tradition's sake. All 11 (re-)instated families come from only two former families composed mostly of geographically isolated groups. These families were 'waste baskets' for equally unusual taxa, which persisted in stable but isolated areas, with no or only very distant relatives surviving elsewhere. Although better support for relationships between families may be obtained with more sequence data and morphological evidence (especially of larvae and genitalia), our expectations are modest, as the most challenging groups are so isolated phylogenetically, and morphologically so simplified, that comparable groups may not be identifiable with the available methods.

Finally, two general observations about the phylogeny and taxonomy of damselflies must be made. First, almost all larger genera for which multiple species were sampled (e.g. *Drepanosticta*, *Libellago*, *Rhinocypha*, *Coeliccia*, *Agriocnemis*, *Pseudagrion*, *Teinobasis*) are not monophyletic and thus extensive revision of the suborder must take place. Secondly, many identified clades lack strong morphological apomorphies, and this also applies to many long-established families, such as Calopterygidae, Euphaeidae and Platycnemididae, even prior to molecular investigations. Characters of venation, in particular, show little congruence with our molecular results. The most poignant example is Protoneuridae, characterized by the absence or reduction of the anal vein. The family dissolves completely and in its broadest historic definition is seen to include six clades from five families: all Platystictidae, *Lestoidea* in Lestoideidae, all Isostictidae, most *Allocnemis* species and all Disparoneurinae in Platycnemididae, and true 'Protoneurinae' in Coenagrionidae. This result challenges the current taxonomy for fossil Odonata which is based almost entirely on venation, and stresses the importance of a review of fossil data in the light of molecular results.

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APPENDIX I:

CLASSIFICATION OF THE SUBORDER ZYGOPTERA

The proposed classification follows Dijkstra et al. (2013). Superfamilies and families are provided for all genera, subfamilies and tribes for selected ones (see text). For convenience, groups of (presumably) related genera within Coenagrionidae also are indicated (see text). The order of superfamilies and families is phylogenetic (smallest sister group first), while that of lower ranks and 'calopterygoid' families is alphabetical. Sampled genera are indicated with an asterisk. Three widely accepted family names are outdated by older names, although these have, at most, 15% of usage (Google search): Libellaginidae Yakobson & Bianchi, 1905 and Disparocyphidae Munz, 1919 for Chlorocyphidae, Heliocharitidae Tillyard & Fraser, 1939 for Dicteriadidae, and Epallagidae Needham, 1903 for Euphaeidae. An application to the International Commission on Zoological Nomenclature for the suppression of the older names will be prepared (Dijkstra et al. 2013). Because of this problem, groups within Chlorocyphidae are listed informally.

SUPERFAMILY LESTOIDEA CALVERT, 1901

Family Hemiphlebiidae Kennedy, 1920 (*Hemiphlebia* Selys, 1869)

Family Perilestidae Kennedy, 1920 (**Perilestes* Hagen, 1862, **Perissolestes* Kennedy, 1941)

Family Synlestidae Tillyard, 1917 (**Chlorolestes* Selys, 1862, *Chorismagrion* Morton, 1914, **Ecchlorolestes* Barnard, 1937, **Episynlestes* Kennedy, 1920, **Megalestes* Selys, 1862, **Nubiolestes* Fraser, 1945, *Phylolestes* Christiansen, 1948, *Sinolestes* Needham 1930, **Synlestes* Selys, 1868)

Family Lestidae Calvert, 1901 (*Archilestes* Selys, 1862, **Austrolestes* Tillyard, 1913, *Chalcolestes* Kennedy, 1920, **Indolestes* Fraser, 1922, **Lestes* Leach, 1815, **Orolestes* McLachlan, 1895, *Platylestes* Selys, 1862, *Sinhalestes* Fraser, 1951, **Sympecma* Burmeister, 1839)

SUPERFAMILY PLATYSTICTOIDEA KENNEDY, 1920

Family Platystictidae Kennedy, 1920

Subfamily Palaemnematinae Tillyard & Fraser, 1938 (**Palaemnema* Selys, 1860)

Subfamily Platystictinae Kennedy, 1920 (**Ceylonosticta* Fraser, 1931, **Platysticta* Selys, 1860) Subfamily Protostictinae subfam.n. (**Drepanosticta* Laidlaw, 1917, **Protosticta* Selys, 1885, *Sulcosticta* van Tol, 2005, **Telosticta* Dow & Orr, 2012)

Subfamily Sinostictinae Wilson, 1997 (**Sinosticta* Wilson, 1997)

SUPERFAMILY 'CALOPTERYGOIDEA' SELYS, 1850

Family Amphipterygidae Tillyard, 1917 (**Amphipteryx* Selys, 1853)

Family Argiolestidae Fraser, 1957

Subfamily Argiolestinae Fraser, 1957 (**Archiargiolestes* Kennedy, 1925, **Argiolestes* Selys, 1862, **Austroargiolestes* Kennedy, 1925, **Caledargiolestes* Kennedy, 1925, **Caledopteryx* Kennedy, 1925, **Celebargiolestes* Kennedy, 1925, *Eoargiolestes* Kalkman & Theischinger, 2013, **Griseargiolestes* Theischinger, 1998, **Luzonargiolestes* Kalkman & Theischinger, 2013, **Metagrion* Calvert, 1913, **Miniargiolestes* Theischinger, 1998, **Podopteryx* Selys, 1871, **Pyrrhargiolestes* Kalkman & Theischinger, 2013, *Solomonargiolestes* Kalkman & Theischinger, 2013, **Trineuragrion* Ris, 1915, **Wahnesia* Förster, 1900)

Subfamily Podolestinae Kalkman & Theischinger, 2013 (**Allolestes* Selys, 1869, **Nesolestes* Selys, 1891, **Neurolestes* Selys, 1882, **Podolestes* Selys, 1862)

Family Calopterygidae Selys, 1850

Subfamily Calopteryginae Selys, 1850

Tribe Caliphaeini Fraser, 1929 (**Caliphaea* Hagen, 1859)

Tribe Calopterygini Selys, 1850 (_Atrocalopteryx_ Dumont et al. 2005, *_Calopteryx_ Leach, 1815, *_Matrona_ Selys, 1853, _Matronoides_ Foerster, 1897, *_Neurobasis_ Selys, 1853)

Tribe Iridictyonini Dumont et al. 2005 (_Iridictyon_ Needham & Fisher, 1940)

Tribe Mnaisini Ishida, 1996 (*_Archineura_ Kirby, 1894, *_Echo_ Selys, 1853, *_Mnais_ Selys, 1853, _Psolodesmus_ McLachlan, 1870)

Tribe Noguchiphaeini Dumont et al. 2005 (_Noguchiphaea_ Asahina, 1976)

Tribe Saphoini Dumont et al. 2005 (*_Phaon_ Selys, 1853, *_Sapho_ Selys, 1853, *_Umma_ Kirby, 1890)

Tribe Vestalini Needham, 1903 (_Vestalaria_ May, 1935, *_Vestalis_ Selys, 1853)

Subfamily Hetaerininae Tillyard & Fraser, 1939 (_Bryoplathanon_ Garrison, 2006, *_Hetaerina_ Hagen, 1853, *_Mnesarete_ Cowley, 1934, _Ormenophlebia_ Garrison, 2006)

Family Chlorocyphidae Cowley, 1937

'Chlorocyphinae' (*_Africocypha_ Pinhey, 1961, *_Chlorocypha_ Fraser, 1928, *_Platycypha_ Fraser, 1949, *_Stenocypha_ Dijkstra, 2013)

'Disparocyphinae' (*_Disparocypha_ Ris, 1916)

'Libellagininae' (*_Libellago_ Selys, 1840, _Melanocypha_ Fraser, 1949, *_Pachycypha_ Lieftinck, 1950, *_Sclerocypha_ Fraser, 1949, _Watuwila_ van Tol, 1998)

'Rhinocyphinae' (*_Aristocypha_ Laidlaw, 1950, _Calocypha_ Fraser, 1928, *_Heliocypha_ Fraser, 1949, _Heterocypha_ Laidlaw, 1950, _Paracypha_ Fraser, 1949, *_Rhinocypha_ Rambur, 1842, *_Rhinoneura_ Laidlaw, 1915, *_Sundacypha_ Laidlaw, 1950)

Incertae sedis (*_Cyrano_ Needham & Gyger, 1939, *_Indocypha_ Fraser, 1949)

Family Devadattidae fam.n. (*_Devadatta_ Kirby, 1890)

Family Dicteriadidae Montgomery, 1959 (_Dicterias_ Selys, 1853, *_Heliocharis_ Selys, 1853)

Family Euphaeidae Yakobson & Bianchi, 1905 (*_Anisopleura_ Selys, 1853, _Bayadera_ Selys, 1853, *_Cryptophaea_ Hämäläinen, 2002, _Cyclophaea_ Ris, 1930, *_Dysphaea_ Selys, 1853, _Epallage_ Charpentier, 1840, *_Euphaea_ Selys, 1840, _Heterophaea_ Cowley, 1934, _Schmidtiphaea_ Asahina, 1978)

Family Heteragrionidae Rácenis, 1959 (*_Heteragrion_ Selys, 1862, *_Oxystigma_ Selys, 1862)

Family Hypolestidae Fraser, 1938 (*_Hypolestes_ Gundlach, 1888)

Family Lestoideidae Munz, 1919

Subfamily Diphlebiinae Heymer, 1975 (*_Diphlebia_ Selys, 1869)

Subfamily Lestoideinae Munz, 1919 (*_Lestoidea_ Tillyard, 1913)

Family Megapodagrionidae Calvert, 1913 (_Allopodagrion_ Förster, 1910, *_Megapodagrion_ Selys, 1885, *_Teinopodagrion_ De Marmels, 2001)

Family Pentaphlebiidae Novelo-Gutiérrez, 1995 (*_Pentaphlebia_ Förster, 1909)

Family Philogangidae Kennedy, 1920 (*_Philoganga_ Kirby, 1890)

Family Philogeniidae Rácenis, 1959 (*_Archaeopodagrion_ Kennedy, 1939, *_Philogenia_ Selys, 1862)

Family Philosinidae Kennedy, 1925 (*_Philosina_ Ris, 1917, *_Rhinagrion_ Calvert, 1913)

Family Polythoridae Munz, 1919 (*_Chalcopteryx_ Selys, 1853, _Chalcothore_ De Marmels, 1985, _Cora_ Selys, 1853, _Euthore_ Selys, 1869, _Miocora_ Calvert, 1917, *_Polythore_ Calvert, 1917, _Stenocora_ Kennedy, 1940)

Family Pseudolestidae Fraser, 1957 (*_Pseudolestes_ Kirby, 1900)

Family Rimanellidae Davies & Tobin, 1984 (*_Rimanella_ Needham, 1934)

Family Thaumatoneuridae Fraser, 1938 (*_Paraphlebia_ Selys, 1861, *_Thaumatoneura_ McLachlan, 1897)

Incertae sedis group 1: *_Agriomorpha_ May, 1933, *_Bornargiolestes_ Kimmins, 1936, *_Burmargiolestes_ Kennedy, 1925, *_Rhipidolestes_ Ris, 1912; **group 2**: *_Amanipodagrion_ Pinhey, 1962; **group 3**: *_Dimeragrion_ Calvert, 1913, *_Heteropodagrion_ Selys, 1885, _Mesagrion_ Selys, 1885; **group 4**: *_Mesopodagrion_ McLachlan, 1897; **group 5**: *_Priscagrion_ Zhou & Wilson, 2001, *_Sinocnemis_ Wilson & Zhou, 2000;

group 6: **Protolestes* Förster, 1897; **group 7** (= 'Tatocnemidinae Rácenis, 1959'): **Tatocnemis* Kirby, 1889; group 8: **Sciotropis* Rácenis, 1959

SUPERFAMILY COENAGRIONOIDEA KIRBY, 1890

Family Isostictidae Fraser, 1955 (*Austrosticta* Tillyard, 1908, *Cnemisticta* Donnelly, 1993, *Eurysticta* Watson, 1969, **Isosticta* Selys, 1885, *Labidiosticta* Watson, 1991, *Lithosticta* Watson, 1991, **Neosticta* Tillyard, 1913, *Oristicta* Tillyard, 1913, *Rhadinosticta* Watson, 1991, **Selysioneura* Förster, 1900, **Tanymecosticta* Lieftinck, 1935, *Titanosticta* Donnelly, 1993)

Family Platycnemididae Yakobson & Bianchi, 1905

Subfamily Allocnemidinae subfam.n. (**Allocnemis* Selys, 1863, **Arabicnemis* Waterston, 1984, **Mesocnemis* Karsch, 1891, **Metacnemis* Hagen, 1863, **Stenocnemis* Karsch, 1899)

Subfamily Calicnemiinae Fraser, 1957 (*Asthenocnemis* Lieftinck, 1949, **Calicnemia* Strand, 1928, **Coeliccia* Kirby, 1890, **Indocnemis* Laidlaw, 1917)

Subfamily Disparoneurinae Fraser, 1957 (*Arabineura* Schneider & Dumont, 1995, *Caconeura* Kirby, 1890, *Disparoneura* Selys, 1860, **Elattoneura* Cowley, 1935, **Esme* Fraser, 1922, *Melanoneura* Fraser, 1922, **Nososticta* Hagen, 1860, *Phylloneura* Fraser, 1922, **Prodasineura* Cowley, 1934)

Subfamily Idiocnemidinae subfam.n. (*Archboldargia* Lieftinck, 1949, **Arrhenocnemis* Lieftinck, 1933, **Cyanocnemis* Lieftinck, 1949, **Hylaeargia* Lieftinck, 1949, **Idiocnemis* Selys, 1878, **Igneocnemis* Hämäläinen, 1991, *Lieftinckia* Kimmins, 1957, **Lochmaeocnemis* Lieftinck, 1949, **Palaiargia* Förster, 1903, **Papuargia* Lieftinck, 1938, **Paramecocnemis* Lieftinck, 1932, *Rhyacocnemis* Lieftinck, 1956, **Risiocnemis* Cowley, 1934, *Salomocnemis* Lieftinck, 1987, **Torrenticnemis* Lieftinck, 1949)

Subfamily Onychargiinae subfam.n. (**Onychargia* Selys, 1865, **Paracnemis* Martin, 1902) Subfamily Platycnemidinae Yakobson & Bianchi, 1905

Tribe Coperini trib.n. (**Copera* Kirby, 1890, **Proplatycnemis* Kennedy, 1920, **Spesbona* Dijkstra, 2013)

Tribe Platycnemidini Yakobson & Bianchi, 1905 (**Matticnemis* Dijkstra, 2013, **Platycnemis* Burmeister, 1839, **Pseudocopera* Fraser, 1922)

Family Coenagrionidae Kirby, 1890

Core Coenagrionidae [genera associated with *Agriocnemis* ('Agriocnemidinae Fraser, 1957'): **Agriocnemis* Selys, 1877, **Argiocnemis* Selys, 1877, **Mortonagrion* Fraser, 1920; genera associated with *Ischnura* ('Ischnurinae Fraser, 1957'): **Acanthagrion* Selys, 1976, *Acanthallagma* Williamson & Williamson, 1924, **Aciagrion* Selys, 1891, **Africallagma* Kennedy, 1920, *Amphiagrion* Selys, 1876, *Amphiallagma* Kennedy, 1920, *Andinagrion* Bulla, 1973, *Anisagrion* Selys, 1876, *Apanisagrion* Kennedy, 1920, *Argentagrion* Fraser, 1948, *Austroallagma* Lieftinck, 1953, **Austrocnemis* Tillyard, 1913, **Azuragrion* May, 2002, *Calvertagrion* St Quentin, 1960, **Coenagriocnemis* Fraser, 1949, *Cyanallagma* Kennedy, 1920, *Denticulobasis* Machado, 2009, **Dolonagrion* Garrison & von Ellenrieder, 2008, *Enacantha* Donnelly & Alayo, 1966, *Enallagma* Charpentier, 1840, *Hesperagrion* Calvert, 1902, *Homeoura* Kennedy, 1920, **Ischnura* Charpentier, 1840, *Leptobasis* Selys, 1877, *Leucobasis* Rácenis, 1959, *Mesamphiagrion* Kennedy, 1920, **Mesoleptobasis* Sjöstedt, 1918, *Millotagrion* Fraser, 1953, *Oreagrion* Ris, 1913, *Oreiallagma* von Ellenrieder & Garrison, 2008, *Oxyagrion* Selys, 1876, *Oxyallagma* Kennedy, 1920, *Pacificagrion* Fraser, 1926, *Pinheyagrion* May, 2002, *Proischnura* Kennedy, 1920, *Protallagma* Kennedy, 1920, **Thaumatagrion* Lieftinck, 1932, *Tigriagrion* Calvert, 1909, **Tuberculobasis* Machado, 2009, **Xiphiagrion* Selys, 1876, *Zoniagrion* Kennedy, 1917;

genera associated with *Pseudagrion* ('Pseudagrioninae Tillyard, 1917'): **Archibasis* Kirby, 1890, **Austroagrion* Tillyard, 1913, *Caliagrion* Tillyard, 1913, *Erythromma* Charpentier, 1840, *Paracercion* Weekers & Dumont, 2004, **Pseudagrion* Selys, 1876, **Xanthagrion* Selys, 1876, *Xanthocnemis* Tillyard, 1913; remaining genera: **Austrocoenagrion* Kennedy, 1920, **Coenagrion* Kirby, 1890, *Himalagrion* Fraser, 1920, *Megalagrion* McLachlan, 1883, *Neoerythromma* Kennedy, 1920, **Stenagrion* Laidlaw, 1915]

Ridge-faced complex [genera associated with *Protoneura* ('Protoneurinae Yakobson & Bianchi, 1905'): **Amazoneura* Machado, 2004, **Drepanoneura* von Ellenrieder & Garrison, 2008, **Epipleoneura* Williamson, 1915, *Epipotoneura* Williamson, 1915, *Forcepsioneura* Lencioni, 1999, *Idioneura* Selys, 1860, *Junix* Rácenis, 1968, *Lamproneura* De Marmels, 2003, *Microneura* Hagen, 1886, **Neoneura* Selys, 1860, *Peristicta* Hagen, 1860, *Phasmoneura* Williamson, 1916, *Proneura* Selys, 1889, **Protoneura* Selys, 1857, **Psaironeura* Williamson, 1915, *Roppaneura* Santos, 1966; genera associated with *Pseudostigma* ('Pseudostigmatinae Kirby, 1890'): **Anomisma* McLachlan, 1877, **Bromeliagrion* De Marmels, 2005, *Coryphagrion* Morton, 1924, *Diceratobasis* Kennedy, 1920, *Leptagrion* Selys, 1876, **Mecistogaster* Rambur, 1842, *Megaloprepus* Rambur, 1842, **Microstigma* Rambur, 1842, *Pseudostigma* Selys, 1860; genera associated with *Teinobasis* ('Teinobasinae Tillyard, 1917'): **Amphicnemis* Selys, 1863, *Luzonobasis* Villanueva, 2012, *Melanesobasis* Donnelly, 1984, *Nesobasis* Selys, 1891, *Pandanobasis* Villanueva, 2012, **Papuagrion* Ris, 1913, **Pericnemis* Selys, 1863, *Plagulibasis* Lieftinck, 1949, *Sangabasis* Villanueva, 2012, **Teinobasis* Kirby, 1890, *Vanuatubasis* Ober & Staniczek, 2009; remaining genera: *Aceratobasis* Kennedy, 1920, **Aeolagrion* Williamson, 1917, *Angelagrion* Lencioni, 2008, *Antiagrion* Ris, 1904, **Ceriagrion* Selys, 1876, *Chromagrion* Needham, 1903, *Hylaeonympha* Rácenis, 1968, **Inpabasis* Santos, 1961, **Metaleptobasis* Calvert, 1907, *Minagrion* Dos Santos, 1965, *Nehalennia* Selys, 1850, **Oreocnemis* Pinhey, 1971, **Phoenicagrion* von Ellenrieder, 2008, *Pyrrhosoma* Charpentier, 1840, *Schistolobos* von Ellenrieder & Garrison, 2008, *Telagrion* Selys, 1876, **Telebasis* Selys, 1865, *Tepuibasis* De Marmels, 2007, *Tukanobasis* Machado, 2009]

Undetermined [**Argia* Rambur, 1842 (= 'Argiinae Tillyard, 1917'), **Leptocnemis* Selys, 1886]

APPENDIX 2:

DIAGNOSES OF NEW AND REVISED FAMILY-GROUP NAMES

Allocnemidinae subfam.n. (type genus: *Allocnemis* Selys, 1863 by present designation) – small damselflies separated within range (Africa and Arabia) from other genera with two antenodal cross-veins (Ax), no spines on shaft of genital ligula, long leg spines, rounded frons and no postocular spots by combination of arculus clearly proximal to Ax2, which often converges posteriorly with Ax1; cubital cross-vein distal to origin of anal vein by about three times its length (by about its length in *Stenocnemis*); often more than three cells between quadrilateral and subnode (two in *Arabicnemis* and *Stenocnemis*). *Allocnemis* differs from similar genera in range by combination of R4 originating closer to subnode than IR3 (Tillyard & Fraser terminology); cubital cross-vein at origin of anal vein; wings often stained yellow. Male cerci in all genera are triangular (broad base and pointed tip) and usually with ventral process near base; paraprocts simple, often rather pointed or elongate.

Amphipterygidae (type genus: *Amphipteryx* Selys, 1853) – large damselflies with seven to eight Ax, two to three in subcostal space; arculus near Ax3; quadrangle without cross-veins; IR3 (Tillyard & Fraser terminology) originating at level of quadrangle, much closer to arculus than to nodus. Wings clear and closed at rest. Thorax and abdomen black with blue pattern on thorax and tip of abdomen but without metallic shine. Shaft of genital ligula with setae. Larvae with epiproct and paraprocts roundish in cross-section but not balloon-shaped, broadest at approximately one-fifth of their base from where they gradually taper to a single point, as well as two filamentous gills tufts located beneath them.

Argiolestidae (type genus: *Argiolestes* Selys, 1862) – mediumsized to large damselflies with two (rarely three) Ax and several intercalated veins distally in radial fields; IR3 originating near the subnodus, clearly closer to nodus than to arculus. Wings clear and held open at rest. Most species largely brown to black, often with blue, orange or red pattern on face, thorax, legs and/or tip of abdomen. Shaft of genital ligula without setae. Larvae with epiproct and paraprocts broad and flat, lying in a horizontal plane.

Coperini trib.n. (type genus: *Copera* Kirby, 1890 by present designation) – small damselflies featuring typical characters of subfamily Platycnemidinae, characterized by feather-like tibiae, which are dilated and bright white, yellow, orange, red or blue, and used in display; only entirely black and not widened in *Spesbona angusta* (Selys). Differs from tribe Platycnemidini by: caudal lamellae of larvae with frilled border (unique character among Odonata); inner side of the male cerci with a tooth- or branch-like process, but tiny in *C. sikassoensis* (Martin) and *C. vittata* (Selys), and reduced completely in *C. marginipes* (Rambur); male tibiae often not white.

Devadattidae fam.n. (type genus: *Devadatta* Kirby, 1890 by present designation) – large damselflies with seven to 12 Ax, four to five in subcostal space; arculus between Ax4 and Ax6; quadrangle with two to three cross-veins; IR3 originating at level of quadrangle, much closer to arculus than to nodus. Wings clear except for brown spot at the tips; closed at rest. Thorax and abdomen dull, without metallic shine or bright colours. Shaft of genital ligula with setae. Larvae with epiproct and paraprocts sturdy and pyramidal, widest subbasally and terminating in single (paraprocts) or triple (epiproct) points, as well as two filamentous gills tufts located beneath them.

Heteragrionidae (type genus: *Heteragrion* Selys, 1862) – medium-sized to large damselflies with two Ax and several intercalated veins distally in radial fields; IR3 originating near the subnodus, clearly closer to nodus than to arculus. Wings clear and held open at rest. Body of many species marked with bright orange or red. Genital ligula with setae on shaft and distal segment with paired laterally directed apical flagella. Larvae with epiproct and paraprocts inflated and triangular in cross-section, bearing a filament at tip; basal part with dorsal rib carrying a row of strongly curved spines.

Hypolestidae (type genus: *Hypolestes* Gundlach, 1888) – medium-sized damselflies with two Ax and several intercalated veins distally in radial fields; IR3 originating somewhat distal to quadrangle, much closer to arculus than to nodus. Wings clear and held open at rest. Body dark brown or black with pale yellow pattern; mature males with extensive light grey pruinosity on head, thorax and ninth and 10th abdominal segments. Genital ligula with setae on shaft and distal segment with paired lateral and apical flagella. Larvae with epiproct and paraprocts inflated, constricted in the middle and ending in a long and sharply pointed filament.

Idiocnemidinae subfam.n. (type genus: *Idiocnemis* Selys, 1878 by present designation) – small to medium-sized damselflies with two Ax; the arculus at Ax2; pterostigma with costal side subequal to distal side; anal vein terminates in distal half of wing; shaft of genital ligula without spines; spines on legs long. Margins of wing tips crenulated (not in *Archboldargia*, *Hylaeargia*, *Palaiargia*, *Papuargia*, and weakly developed in *Rhyacocnemis*; similar character state acquired independently, but weakly developed, in *Tatocnemis*). Larvae with epiproct and paraprocts forming a unique three-dimensional ruff (described only for *Hylaeargia*, *Lieftinckia* and *Palaiargia*).

Megapodagrionidae (type genus: *Megapodagrion* Selys, 1885) – small to medium-sized damselflies with two Ax and several intercalated veins distally in radial fields; IR3 originating near the subnodus, clearly closer to nodus than to arculus. Wings clear and held open at rest. Shaft of genital ligula with setae. First antennal segment in both larvae and adults long, usually similar to slender second segment; legs also very long, with hind femur reaching anterior margin of third abdominal segment or beyond. Larvae with paraprocts long and thickened, each with a median outer ridge along their length, and foliaceous, wider and shorter epiproct.

Onychargiinae subfam.n. (type genus: *Onychargia* Selys, 1865 by present designation) – small damselflies with two Ax; arculus at Ax2; pterostigma with costal side subequal to its distal side; anal vein terminates in distal half of wing; shaft of genital ligula without spines; spines on legs long. Head not laterally expanded, frons not angulate, dorsum black and lacking postocular spots but often with a pale line running from eye to eye across the lateral ocelli (sometimes partly broken). Margins of wing tips not crenulated. Male cerci distinctly shorter than 10th abdominal segment and subequal to paraprocts.

Pentaphlebiidae (type genus: *Pentaphlebia* Förster, 1909) – large damselflies with four to six Ax, two in subcostal space; arculus close to Ax2; quadrangle without cross-veins; IR3 originating at level of quadrangle, much closer to arculus than to nodus. Wings clear to smoky with darkened falcate tips and very long pterostigmata; closed at rest.
Adult male is rather dark and plain, with reddish to black thorax and abdomen. Shaft of genital ligula with setae. Second antennal segment distinctly elongated, thin in adults and swollen in larvae. Larvae with blade-like paraprocts, expanded laterally near base and shorter than abdomen, short trifid epiproct, as well as two filamentous gills tufts located beneath them.

Philogangidae (type genus: *Philoganga* Kirby, 1890) – very large damselflies with 11-13 Ax, 14-17 in subcostal space; arculus close to Ax2; quadrangle without cross-veins; IR3 originating distal to quadrangle, closer to arculus than to nodus. Wings clear with long pterostigmata; held open at rest. Thorax and abdomen black, boldly marked with yellow or orange. Shaft of genital ligula without or with a few setae. Larvae with epiproct and paraprocts similar, inflated at base and tapering to finely pointed tips, without filamentous gills tufts.

Philogeniidae (type genus: *Philogenia* Selys, 1862) – mediumsized to large damselflies with 2 Ax and s everal intercalated veins distally in radial fields; IR3 originating near the subnodus, clearly closer to nodus than to arculus. Wings clear or with brownish tips; held open at rest. Body dark brown to black with yellow, blue or green pattern and blue pruinosity on dorsum of abdomen in males. Genital ligula with setae on shaft; distal segment with paired long and slender spiral-shaped apical flagella. Larvae with epiproct and paraprocts inflated, constricted in the middle and ending in a filament.

Philosinidae (type genus: *Philosina* Ris, 1917) – mediumsized to large damselflies with two Ax and several intercalated veins distally in radial fields; IR3 originating near the subnodus, clearly closer to nodus than to arculus. Wings clear (except for diffuse dark spot at tips in *Philosina buchi* Ris) and held open at rest. Head, thorax and abdomen in most species with bold pattern of yellow, orange, red or blue; partly covered with pruinosity in *Philosina*; dorsum of tip of abdomen weakly sclerotized in males allowing them to expand their abdomen. Shaft of genital ligula with dense long setae. Larvae with paraprocts thick and undulating, longer than thinner and foliaceous epiproct; in life the paraprocts form a tube folded around the epiproct.

Protostictinae subfam.n. (type genus: *Protosticta* Selys, 1885 by present designation) – small to moderately large damselflies, with venation characteristic of family, i.e. node at about one-quarter of wing length from base, and a cross-vein in the postcubital space closer to wing base than to the level of the proximal Ax. Distinctive combination of characters: IR3 arising distal to subnode (typically at level of subnode in other genera of family); CuP vein meeting hind margin of forewing at level of R3, or even proximal to it; anal bridge vein present ('*Drepanosticta*') or absent ('*Protosticta*'); R4+5 at or distal to subnode (as in Platystictinae s.s.). Male appendages very diverse in form; genital ligula with squarish cleft (rather than triangular as in *Sinosticta* and *Palaemnema*) and long horns (short in *Platysticta*).

Pseudolestidae (type genus: *Pseudolestes* Kirby, 1900) – medium-sized damselflies with two Ax and several intercalated veins distally in radial fields; IR3 originating near the subnodus, clearly closer to nodus than to arculus. Wings held open at rest, forewing clear; hind wing shorter than forewing, broadened in apical half and slightly falcate at tip, dark with bright orange patches (male) or clear with a broad iridescent subapical black band (female). Adult male has blue face and a black body with yellow lines on thorax. Shaft of genital ligula with setae. Larvae with epiproct and paraprocts inflated and sack-like, each as broad as the abdomen itself and ending a short nipple-like filament, as well as two filamentous gills tufts located beneath them.

Rimanellidae (type genus: *Rimanella* Needham, 1934) – large damselflies with two Ax; arculus at Ax2; quadrangle without cross-veins; IR3 originating somewhat distal to quadrangle, much closer to arculus than to nodus. Wings clear with long pterostigmata; closed at rest. Adult male is colourful with blue pattern on head, yellowish green thorax with dark stripes and red to reddish brown abdomen. Sternum of 10th abdominal segment in both sexes forms a concave semicircular plate, delimited by lateral carinae from tergum. Shaft of genital ligula with setae. Larvae with whip-like paraprocts that are jointed near base and longer than abdomen, short trifid epiproct, as well as two filamentous gills tufts located beneath them.

Thaumatoneuridae (type genus: *Thaumatoneura* McLachlan, 1897) – medium-sized to large damselflies with two to four Ax (only two in subcostal space) and several intercalated veins distally in radial fields; IR3 originating near the subnodus, clearly closer to nodus than to arculus. Wings broad, with numerous intercalated veins in posterior portion and one to two accessory cross-veins distal to the cubital cross-vein, posterior to quadrangle. Several species with dimorphic males, i.e. wings either clear or with broad black band; wings closed at rest. Shaft of genital ligula with setae; distal segment with pair of broad lateral lobes. Larvae with epiproct and paraprocts inflated, strongly constricted in middle and ending in a filament, both inflated base and filament covered with stout stiff setae.

SUPPORTING INFORMATION (SI)

Supporting Information Table S1. Primers used.
Primer name Target Direction Sequence (5’ to 3’)

ODO_28S_f2_2	28S	F	CCCGGCCGGGTCCCCGACGGT
ODO_28S_r2_p3	28S	R	TTACACACTCCTTAGCGGATTC
ODO_28S_f3	28S	F	ACCATGAAAGGTGTTGGTTG
ODO_28S_r3_p3	28S	R	ATCTCCCTGCGAGAGGATTC
ODO_12852F	16S	F	AGAAACCGACCTGGCTTAAA
ODO_13393R	16S	R	CGCCTGTTTATCAAAAACAT
ODO_LCOI490d	COI	F	TTTCTACWAACCAYAAAGATATTGG
ODO_HCO2198d	COI	R	TAAACTTCWGGRTGTCCAAARAATCA

Supporting Information Table S2*. List of analysed samples. GenBank Accession numbers are provided for 16S, 28S and COI: a blank space thus indicates the marker was not available for analysis.

Family	Species	Authority	Year	Collector	Repository
Aeshnidae	*Aeshna juncea*	(Linnaeus)	1758		RMNH
Amphipterygidae	*Amphipteryx agrioides*	Selys	1853	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Amphipterygidae	*Amphipteryx agrioides*	Selys	1853	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Argiolestidae	*Allolestes maclachlani*	Selys	1869	Gerlach, J.	RMNH
Argiolestidae	*Archiargiolestes parvulus*	(Watson)	1977	Taylor, J.	RMNH
Argiolestidae	*Archiargiolestes pusillissimus*	(Kennedy)	1925	Taylor, J.	RMNH
Argiolestidae	*Argiolestes roon*	Kalkman, Richards & Polhemus	2010	Polhemus, D.A.	BPBM
Argiolestidae	*Argiolestes tuberculiferus*	Michalski & Oppel	2010	Kalkman, V.J.	RMNH
Argiolestidae	*Austroargiolestes chrysoides*	(Tillyard)	1913	Kalkman, V.J.	RMNH
Argiolestidae	*Austroargiolestes icteromelas*	(Selys)	1862	Kalkman, V.J.	RMNH
Argiolestidae	*Caledopteryx sarasini*	(Ris)	1915	Marinov, M. & Richards, S.	RMNH
Argiolestidae	*Caledopteryx* sp.			Marinov, M.	RMNH
Argiolestidae	*Celebargiolestes* sp.			Gunther, A. & Randow, F.	RMNH
Argiolestidae	*Griseargiolestes bucki*	Theischinger	1998	Kalkman, V.J.	RMNH
Argiolestidae	*Griseargiolestes griseus*	(Selys)	1862	Kalkman, V.J.	RMNH
Argiolestidae	*Luzonargiolestes baltazarae*	(Gapud & Recuenco)	2001	Nazareno, C.M.	RMNH
Argiolestidae	*Metagrion* sp.			Kaize, J.	RMNH
Argiolestidae	*Metagrion* sp.			Kalkman, V.J.	RMNH
Argiolestidae	*Miniargiolestes minimus*	(Tillyard)	1908	Taylor, J.	RMNH
Argiolestidae	*Miniargiolestes minimus*	(Tillyard)	1908	Taylor, J.	RMNH
Argiolestidae	*Nesolestes nigeriensis*	Gambles	1970	Parr, M.J.	RMNH
Argiolestidae	*Nesolestes nigeriensis*	Gambles	1970	Parr, M.J.	RMNH
Argiolestidae	*Nesolestes* sp.			Schütte, K.	RMNH
Argiolestidae	*Nesolestes* sp.			Schütte, K.	RMNH
Argiolestidae	*Neurolestes trinervis*	(Selys)	1885	Dijkstra, K.-D.B., Mézière, N. & Vanappelghem, C.	RMNH
Argiolestidae	*Podolestes harrissoni*	Lieftinck	1953	Dow, R.A.	RMNH
Argiolestidae	*Podolestes orientalis*	Selys	1862	Dow, R.A.	RMNH
Argiolestidae	*Podopteryx selysi*	(Förster)	1899	Richards, S.	RMNH
Argiolestidae	*Pyrrhargiolestes* cf *sidonia*	(Martin)	1909	Richards, S.	RMNH
Argiolestidae	*Trineuragrion percostale*	Ris	1915	Marinov, M.	RMNH
Argiolestidae	*Wahnesia* cf *annulipes*	(Lieftinck)	1956	Polhemus, D.A.	BPBM
Argiolestidae	*Wahnesia kirbyi*	(Lieftinck)	1935	Gassmann, D.	RMNH
Calopterygidae	*Archineura incarnata*	(Karsch)	1891	Kalkman, V.J.	RMNH
Calopterygidae	*Caliphaea confusa*	Hagen in Selys	1859	Hämäläinen, M.	RMNH
Calopterygidae	*Echo modesta*	Laidlaw	1902	Dow, R.A.	RMNH
Calopterygidae	*Echo modesta*	Laidlaw	1902	Dow, R.A.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
The Netherlands		228912	25925401	KF369596	KF369992	KF369278	ODOPH001-13
Mexico	Oaxaca State	504314	30104157	KF369616	KF370014	KF369296	ODOPH002-13
Mexico	Oaxaca State	504313	25919417	KF369615	KF370013	KF369295	ODOPH003-13
Seychelles	Mahe	500397	25925674	KF369611	KF370007		ODOPH004-13
Australia	Western Australia	502085	25924878	KF369623	KF370021	KF369303	ODOPH005-13
Australia	Western Australia	502082	25924781	KF369624	KF370022	KF369304	ODOPH006-13
Indonesia	West Papua Province, Roon Island	500848	25925591	KF369631	KF370029	KF369310	ODOPH007-13
Papua New Guinea		501972	25924702	KF369632	KF370030	KF369311	ODOPH008-13
Australia	Queensland	505271	30102316	KF369638	KF370036	KF369317	ODOPH009-13
Australia	New South Wales	504912	30102330	KF369639	KF370037	KF369318	ODOPH010-13
New Caledonia	Grand Terre	503406	25924883	KF369651	KF370049	KF369328	ODOPH011-13
New Caledonia		500855	25925671	KF369652	KF370050	KF369329	ODOPH012-13
Indonesia	Sulawesi	500856	25925448	KF369656	KF370054	KF369333	ODOPH013-13
Australia	New South Wales	504888	30102304	KF369723	KF370122	KF369390	ODOPH014-13
Australia	New South Wales	504927	30102334	KF369724	KF370123	KF369391	ODOPH015-13
Philippines	Luzon	502091	25924671	KF369769	KF370168	KF369431	ODOPH016-13
Indonesia	Papua Barat	502075	25924734	KF369783	KF370182	KF369445	ODOPH017-13
Indonesia	Papua	500542	25924698	KF369782	KF370181	KF369444	ODOPH018-13
Australia	Western Australia	502080	25924879	KF369787	KF370186	KF369448	ODOPH019-13
Australia	Western Australia	502078	25924904	KF369788	KF370187	KF369449	ODOPH020-13
Nigeria	Obudu Plateau	229198	25925528	KF369800	KF370199		ODOPH021-13
Nigeria	Obudu Plateau	229199	25925540	KF369799	KF370198		ODOPH022-13
Madagascar	Apasy	228875	25925463	KF369801	KF370200	KF369458	ODOPH023-13
Madagascar	Sainte Luce	228871	25925439	KF369802	KF370201	KF369459	ODOPH024-13
Gabon	Haut-Ogooué	502482	25924903	KF369805	KF370204	KF369462	ODOPH025-13
Malaysia	Sarawak	501278	25924193	KF369855	KF370254	KF369504	ODOPH026-13
Malaysia	Sarawak	503423	25924229	KF369856	KF370255	KF369505	ODOPH027-13
Papua New Guinea		504973	30102343	KF369857	KF370256	KF369506	ODOPH028-13
Papua New Guinea		543750	30102337	KF369883	KF370282	KF369530	ODOPH029-13
New Caledonia		500854	25925588	KF369936	KF370335	KF369575	ODOPH030-13
Papua New Guinea	Milne Bay Province	500852	25925446	KF369941	KF370340		ODOPH031-13
Papua New Guinea	Morobe Province	500857	25925400	KF369942	KF370341		ODOPH032-13
China	Guăngxī	500707	30104131	KF369626	KF370024		ODOPH033-13
Vietnam	Lao Cai	502054	25924866	KF369655	KF370053	KF369332	ODOPH034-13
Malaysia	Terengganu	503924	30102260	KF369709	KF370108	KF369378	ODOPH035-13
Malaysia	Terengganu	503928	30102262	KF369710	KF370109	KF369379	ODOPH036-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Calopterygidae	*Hetaerina laesa*	Hagen in Selys	1853	Wasscher, M.	RMNH
Calopterygidae	*Hetaerina sanguinea*	Selys	1853	Faasen, T.	RMNH
Calopterygidae	*Hetaerina sanguinea*	Selys	1853	Faasen, T.	RMNH
Calopterygidae	*Matrona basilaris*	(Selys)	1853	Kalkman, V.J.	RMNH
Calopterygidae	*Matrona cyanoptera*	Hämäläinen & Yeh	2000	Yeh, C.	RMNH
Calopterygidae	*Mnais yunosukei*	Asahina	1990	Hämäläinen, M.	RMNH
Calopterygidae	*Mnesarete cupraea*	(Selys)	1853	Wasscher, M.	RMNH
Calopterygidae	*Mnesarete fulgida*	(Selys)	1879	Faasen, T.	RMNH
Calopterygidae	*Neurobasis ianthinipennis*	Lieftinck	1849	Kalkman, V.J.	RMNH
Calopterygidae	*Neurobasis longipes*	Hagen	1887	Dow, R.A.	RMNH
Calopterygidae	*Phaon camerunensis*	Sjöstedt	1899	Dijkstra, K.-D.B.	RMNH
Calopterygidae	*Phaon camerunensis*	Sjöstedt	1899	Dijkstra, K.-D.B., Kipping, J. & Schütte, K.	RMNH
Calopterygidae	*Sapho bicolor*	(Selys)	1853	Dijkstra, K.-D.B., Mézière, N. & Vanappelghem, C.	RMNH
Calopterygidae	*Umma cincta*	(Hagen in Selys)	1853	Dijkstra, K.-D.B.	RMNH
Calopterygidae	*Vestalis amabilis*	Lieftinck	1965	Teo, J.	RMNH
Calopterygidae	*Vestalis smaragdina*	Selys	1879	Hämäläinen, M.	RMNH
Chlorocyphidae	*Africocypha lacuselephantum*	(Karsch)	1899	Dijkstra, K.-D.B. & Schütte, K.	RMNH
Chlorocyphidae	*Aristocypha fenestrella*	(Rambur)	1842	Dow, R.A.	RMNH
Chlorocyphidae	*Aristocypha iridea*	(Selys)	1891	Hämäläinen, M.	RMNH
Chlorocyphidae	*Chlorocypha cancellata*	(Selys)	1879	Dijkstra, K.-D.B., Kipping, J. & Schütte, K.	RMNH
Chlorocyphidae	*Chlorocypha centripunctata*	Gambles	1975	Dijkstra, K.-D.B. & Schütte, K.	RMNH
Chlorocyphidae	*Cyrano angustior*	Hämäläinen	1989	Villanueva, R.J.T.	RMNH
Chlorocyphidae	*Disparocypha biedermanni*	Ris	1916	Günther, Andre	RMNH
Chlorocyphidae	*Disparocypha biedermanni*	Ris	1916	Günther, Andre	RMNH
Chlorocyphidae	*Heliocypha biforata*	(Selys)	1859	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Chlorocyphidae	*Heliocypha fenestrata cornelli*	(Lieftinck)	1947	Günther, Andre	RMNH
Chlorocyphidae	*Indocypha catopta*	Zhang, Hämäläinen & Tong	2010	Zhang, H.	RMNH
Chlorocyphidae	*Libellago aurantiaca*	Selys	1859	Dow, R.A.	RMNH
Chlorocyphidae	*Libellago aurantiaca*	Selys	1859	Kalkman, V.J., Dijkstra, K.-D.B., Dingermanse, N.J. & Goudsmits, K.	RMNH
Chlorocyphidae	*Libellago celebensis orientalis*	van Tol	2007	Günther, Andre	RMNH
Chlorocyphidae	*Libellago hyalina*	Selys	1859	Hämäläinen, M.	RMNH
Chlorocyphidae	*Libellago hyalina*	Selys	1859	Dow, R.A.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
Suriname	Sipaliwini	504753	30102348	KF369728	KF370127	KF369394	ODOPH037-13
Peru	Tamshiyacu-Tahuayo Reserve	501933	30104122	KF369730	KF370129	KF369395	ODOPH038-13
Peru	Tamshiyacu-Tahuayo Reserve	501872	25924874	KF369729	KF370128		ODOPH039-13
China	Guǎngxī	500702	30104130	KF369770	KF370169	KF369432	ODOPH040-13
Taiwan	Taipei County	505773	30104141	KF369771	KF370170	KF369433	ODOPH041-13
Thailand	Chiang Mai	505746	30104134	KF369789	KF370188	KF369450	ODOPH042-13
Suriname	Sipaliwini	505200	30102289	KF369790	KF370189	KF369451	ODOPH043-13
Peru	Tamshiyacu-Tahuayo Reserve	501910	30104121	KF369791	KF370190	KF369452	ODOPH044-13
Indonesia	Papua	500612	30104124	KF369803	KF370202	KF369460	ODOPH045-13
Malaysia	Pahang	501097	25925908	KF369804	KF370203	KF369461	ODOPH046-13
Democratic Republic of Congo	Province Orientale	502115	25924828	KF369838	KF370237	KF369488	ODOPH047-13
Cameroon	Centre Province	500146	25924787	KF369839	KF370238	KF369489	ODOPH048-13
Gabon	Haut-Ogooué	502474	25924246	KF369896	KF370295	KF369539	ODOPH049-13
Democratic Republic of Congo	Province Orientale	502320	25924259	KF369938	KF370337		ODOPH050-13
Malaysia	Sarawak	503483	25924707	KF369939	KF370338	KF369576	ODOPH051-13
Thailand	Chiang Mai	505747	30104135	KF369940	KF370339	KF369577	ODOPH052-13
Cameroon	Southwest Province	229119	25925362	KF369600	KF369996	KF369282	ODOPH053-13
Malaysia	Terengganu	503911	30102258	KF369633	KF370031	KF369312	ODOPH054-13
Thailand	Chiang Mai	505756	25919438	KF369634	KF370032	KF369313	ODOPH055-13
Cameroon	South Province	229139	25925636	KF369665	KF370063	KF369341	ODOPH056-13
Cameroon	Northwest Province	229140	25925374	KF369599	KF369995	KF369281	ODOPH057-13
Philippines	Luzon	500682	25919436	KF369684	KF370082	KF369356	ODOPH058-13
Indonesia	Sulawesi	505705	30104112	KF369693	KF370091		ODOPH059-13
Indonesia	Sulawesi	505708	30104114	KF369694	KF370092		ODOPH060-13
Thailand	Nakhon Ratchasima	229185	25925413	KF369726	KF370125		ODOPH061-13
Indonesia	Bali	505711	30104116	KF369727	KF370126	KF369393	ODOPH062-13
China	Guizhou	502066	30104142	KF369745	KF370144	KF369410	ODOPH063-13
Malaysia	Sarawak	503497	25924149	KF369762	KF370161	KF369426	ODOPH064-13
Brunei Darussalam	Belait	500799	25924715	KF369763	KF370162		ODOPH065-13
Indonesia	Sulawesi	505707	30104113	KF369764	KF370163	KF369427	ODOPH066-13
Thailand	Phangnga	505697	30104105	KF369765	KF370164	KF369428	ODOPH067-13
Malaysia	Sarawak	228958	25925275	KF369766	KF370165		ODOPH068-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Chlorocyphidae	*Pachycypha aurea* cf	Lieftinck	1950	Dow, R.A.	RMNH
Chlorocyphidae	*Platycypha picta*	(Pinhey)	1962	Mézière, N.	RMNH
Chlorocyphidae	*Platycypha picta*	(Pinhey)	1962	Mézière, N.	RMNH
Chlorocyphidae	*Rhinocypha chaoi*	Wilson	2004	Dijkstra, K.-D.B.	RMNH
Chlorocyphidae	*Rhinocypha pagenstecheri*	Förster	1897	Günther, Andre	RMNH
Chlorocyphidae	*Rhinocypha spinifer*	Laidlaw	1931	Dow, R.A.	RMNH
Chlorocyphidae	*Rhinocypha tincta*	Rambur	1842	Kalkman, V.J.	RMNH
Chlorocyphidae	*Rhinoneura caerulea*	Kimmins	1936	Reels, G.T.	RMNH
Chlorocyphidae	*Sclerocypha bisignata*	(McLachlan)	1870	Günther, Andre	RMNH
Chlorocyphidae	*Stenocypha tenuis*	(Longfield)	1936	Apodaca, C.	RMNH
Chlorocyphidae	*Sundacypha petiolata*	(Selys)	1859	Dow, R.A.	RMNH
Chlorocyphidae	*Sundacypha striata*	Orr	1999	Dijkstra K.-D.B. & Kalkman, V.J.	RMNH
Coenagrionidae	*Acanthagrion phallicorne*	Leonard	1977	Faasen, T.	RMNH
Coenagrionidae	*Acanthagrion rubrifrons*	Leonard	1977	Wasscher, M.	RMNH
Coenagrionidae	*Aciagrion borneense*	Ris	1911	Dow, R.A.	RMNH
Coenagrionidae	*Aciagrion brosseti*	Legrand	1982	Dijkstra, K.-D.B.	RMNH
Coenagrionidae	*Aeolagrion dorsale*	(Burmeister)	1839	Faasen, T.	RMNH
Coenagrionidae	*Africallagma elongatum*	(Martin)	1907	Dijkstra, K.-D.B.	RMNH
Coenagrionidae	*Africallagma vaginale*	(Sjöstedt)	1917	Dijkstra, K.-D.B., Mézière, N. & Vanappelghem, C.	RMNH
Coenagrionidae	*Agriocnemis femina*	(Brauer)	1868	Dow, R.A.	RMNH
Coenagrionidae	*Agriocnemis forcipata*	Le Roi	1915	Dijkstra, K.-D.B., Mézière, N. & Vanappelghem, C.	RMNH
Coenagrionidae	*Agriocnemis stygia*	(Fraser)	1954	Dijkstra, K.-D.B.	RMNH
Coenagrionidae	*Amphicnemis ecornuta*	Selys	1889	Dow, R.A.	RMNH
Coenagrionidae	*Anomisma abnorme*	McLachlan	1877	Faasen, T.	RMNH
Coenagrionidae	*Archibasis melanocyana*	(Selys)	1877	Dow, R.A.	RMNH
Coenagrionidae	*Argia oculata*	Hagen in Selys	1865	Wasscher, M.	RMNH
Coenagrionidae	*Argia* sp.			Wasscher, M.	RMNH
Coenagrionidae	*Argiocnemis rubescens rubeola*	Selys	1877	Dow, R.A.	RMNH
Coenagrionidae	*Argiocnemis rubescens rubescens*	Selys	1877	Kalkman, V.J.	RMNH
Coenagrionidae	*Austroagrion watsoni*	Lieftinck	1982	Kalkman, V.J.	RMNH
Coenagrionidae	*Austrocnemis splendida*	(Martin)	1901	Kalkman, V.J.	RMNH
Coenagrionidae	*Austrocoenagrion lyelli*	(Tillyard)	1913	Kalkman, V.J.	RMNH
Coenagrionidae	*Azuragrion buchholzi*	(Pinhey)	1971	Mézière, N.	RMNH
Coenagrionidae	*Bromeliagrion rehni*	Garrison	2005	Faasen, T.	RMNH
Coenagrionidae	*Bromeliagrion rehni*	Garrison	2005	Faasen, T.	RMNH

Country	**Location**	**Voucher**	**Extract**	**16S**	**28S**	**COI**	**Barcode Index**
Malaysia	Sarawak	501002	25925799	KF369818	KF370217	KF369471	ODOPH069-13
Gabon	Haut-Ogooué	502649	25924907	KF369850	KF370249	KF369499	ODOPH070-13
Gabon	Haut-Ogooué	502610	25924861	KF369851	KF370250	KF369500	ODOPH071-13
China	Guangdong	229240	25925437	KF369886	KF370285	KF369533	ODOPH072-13
Indonesia	Lombok	505712	30104117	KF369887	KF370286	KF369534	ODOPH073-13
Malaysia	Sarawak	503488	30104097	KF369888	KF370287	KF369535	ODOPH074-13
Indonesia	Papua	500674	30104128	KF369889	KF370288	KF369536	ODOPH075-13
Malaysia	Sarawak	503485	25919425	KF369890	KF370289	KF369537	ODOPH076-13
Indonesia	Sulawesi	505706	25919429	KF369899	KF370298	KF369540	ODOPH077-13
Uganda	Kibale NP	229154	25918278	KF369910	KF370309	KF369550	ODOPH078-13
Malaysia	Sarawak	504000	30102270	KF369911	KF370310	KF369551	ODOPH079-13
Brunei Darussalam	Belait	229245	25919414	KF369912	KF370311	KF369552	ODOPH080-13
Peru	Tamshiyacu-Tahuayo Reserve	501719	25924109	KF369591	KF369987	KF369273	ODOPH081-13
Suriname	Sipaliwini	504755	30102347	KF369592	KF369988	KF369274	ODOPH082-13
Malaysia	Sarawak	503596	25918240	KF369593	KF369989	KF369275	ODOPH083-13
Democratic Republic of Congo	Province Orientale	502280	25924062	KF369594	KF369990	KF369276	ODOPH084-13
Peru	Tamshiyacu-Tahuayo Reserve	501723	25924051	KF369595	KF369991	KF369277	ODOPH085-13
Tanzania	Tanga Region	504230	30104082	KF369597	KF369993	KF369279	ODOPH086-13
Gabon	Haut-Ogooué	502448	25924075	KF369598	KF369994	KF369280	ODOPH087-13
Malaysia	Sarawak	501242	25924204	KF369601	KF369997	KF369283	ODOPH088-13
Gabon	Haut-Ogooué	502585	30104123	KF369602	KF369998	KF369284	ODOPH089-13
Democratic Republic of Congo	Province Orientale	502179	25924112	KF369794	KF370193	KF369454	ODOPH090-13
Malaysia	Sarawak	503580	30104100	KF369614	KF370012	KF369294	ODOPH091-13
Peru	Tamshiyacu-Tahuayo Reserve	501709	25924846	KF369619	KF370017	KF369299	ODOPH092-13
Malaysia	Sarawak	228996	25925353	KF369625	KF370023	KF369305	ODOPH093-13
Suriname	Sipaliwini	504761	30102282	KF369627	KF370025	KF369306	ODOPH094-13
Suriname	Sipaliwini	504749	30102278	KF369628	KF370026	KF369307	ODOPH095-13
Malaysia	Selangor	500068	25925624	KF369629	KF370027	KF369308	ODOPH096-13
Indonesia	Papua, Japen	500599	25924625	KF369630	KF370028	KF369309	ODOPH097-13
Australia	Queensland	505304	30102326	KF369637	KF370035	KF369316	ODOPH098-13
Australia	Queensland	505255	30102321	KF369640	KF370038		ODOPH099-13
Australia	New South Wales	504852	30102308	KF369641	KF370039	KF369319	ODOPH100-13
Gabon	Haut-Ogooué	502620	30104143	KF369644	KF370042	KF369322	ODOPH101-13
Peru	Tamshiyacu-Tahuayo Reserve	501856	25924868	KF369648	KF370046	KF369326	ODOPH102-13
Peru	Tamshiyacu-Tahuayo Reserve	501718	25924849	KF369647	KF370045	KF369325	ODOPH103-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Coenagrionidae	*Ceriagrion glabrum*	(Burmeister)	1839	Dijkstra, K.-D.B., Mézière, N. & Vanappelghem, C.	RMNH
Coenagrionidae	*Ceriagrion whellani*	Longfield	1952	Dijkstra, K.-D.B.	RMNH
Coenagrionidae	*Coenagriocnemis insularis*	(Selys)	1872	Skinner, A.	RMNH
Coenagrionidae	*Coenagriocnemis rufipes*	(Rambur)	1842	Skinner, A.	RMNH
Coenagrionidae	*Coenagrion pulchellum*	(Vander Linden)	1825	Dijkstra, K.-D.B.	RMNH
Coenagrionidae	*Coenagrion pulchellum*	(Vander Linden)	1825	Smit, J.	RMNH
Coenagrionidae	*Dolonagrion fulvellum*	(Selys)	1876	Wasscher, M.	RMNH
Coenagrionidae	*Drepanoneura muzoni*	von Ellenrieder & Garrison	2008	Faasen, T.	RMNH
Coenagrionidae	*Epipleoneura lamina*	Williamson	1915	Faasen, T.	RMNH
Coenagrionidae	*Episynlestes albicauda*	(Tillyard)	1913	Kalkman, V.J.	RMNH
Coenagrionidae	*Episynlestes albicauda*	(Tillyard)	1913	Kalkman, V.J.	RMNH
Coenagrionidae	*Inpabasis hubelli* cf	Santos	1961	Faasen, T.	RMNH
Coenagrionidae	*Inpabasis rosea*	(Selys)	1877	Wasscher, M.	RMNH
Coenagrionidae	*Ischnura aurora*	(Brauer)	1865	Kalkman, V.J.	RMNH
Coenagrionidae	*Ischnura elegans*	(Vander Linden)	1820	Van Tol, J.	RMNH
Coenagrionidae	*Ischnura nursei*	Morton	1907	Dijkstra, K.-D.B.	RMNH
Coenagrionidae	*Ischnura senegalensis*	(Rambur)	1842	Dow, R.A.	RMNH
Coenagrionidae	*Leptocnemis cyanops*	(Selys)	1869	Gerlach, J.	RMNH
Coenagrionidae	*Mecistogaster linearis*	(Fabricius)	1777	Faasen, T.	RMNH
Coenagrionidae	*Mecistogaster lucretia*	(Drury)	1773	Faasen, T.	RMNH
Coenagrionidae	*Mesoleptobasis cantralli*	Santos	1961	Faasen, T.	RMNH
Coenagrionidae	*Mesoleptobasis elongata*	Garrison & von Ellenrieder	2009	Wasscher, M.	RMNH
Coenagrionidae	*Metaleptobasis mauritia*	Williamson	1915	Wasscher, M.	RMNH
Coenagrionidae	*Metaleptobasis minteri*	Daigle	2003	Faasen, T.	RMNH
Coenagrionidae	*Microstigma rotundatum*	(Selys)	1860	Faasen, T.	RMNH
Coenagrionidae	*Mortonagrion arthuri*	Fraser	1942	Dow, R.A.	RMNH
Coenagrionidae	*Mortonagrion martini*	(Ris)	1900	Richards, S.	RMNH
Coenagrionidae	*Neoneura fulvicollis*	Selys	1886	Wasscher, M.	RMNH
Coenagrionidae	*Neoneura rurriventris*	(Selys)	1860	Faasen, T.	RMNH
Coenagrionidae	*Oreocnemis phoenix*	Pinhey	1971	Dijkstra, K.-D.B.	RMNH
Coenagrionidae	*Oreocnemis phoenix*	Pinhey	1971	Dijkstra, K.-D.B.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
Gabon	Haut-Ogooué	502549	25924844	KF369657	KF370055	KF369334	ODOPH104-13
Democratic Republic of Congo	Katanga	505470	30104088	KF369658	KF370056	KF369335	ODOPH105-13
Mauritius		504477	30102297	KF369675	KF370073	KF369347	ODOPH106-13
Mauritius		504475	30102295	KF369676	KF370074	KF369348	ODOPH107-13
Nederland	Leiden	504320	25919418	KF369678	KF370076	KF369350	ODOPH108-13
Ukraine		504321	30104158	KF369677	KF370075	KF369349	ODOPH109-13
Suriname	Tapatosso	505024	30102285		KF370093	KF369364	ODOPH110-13
Peru	Tamshiyacu-Tahuayo Reserve	501759	30104165	KF369695	KF370094	KF369365	ODOPH111-13
Peru	Tamshiyacu-Tahuayo Reserve	501870	25924899	KF369716	KF370115	KF369385	ODOPH112-13
Australia	Queensland	505246	30102319	KF369717	KF370116		ODOPH113-13
Australia	Queensland	505303	30102324	KF369718	KF370117		ODOPH114-13
Peru	Tamshiyacu-Tahuayo Reserve	501754	25924106	KF369747	KF370146	KF369412	ODOPH115-13
Suriname	Sipaliwini	504751	30102279	KF369748	KF370147	KF369413	ODOPH116-13
Australia	New South Wales	504855	30102310	KF369749	KF370148	KF369414	ODOPH117-13
Netherlands		228277	25925473	KF369750	KF370149	KF369415	ODOPH118-13
India	Maharashtra	500482	30104145	KF369893	KF370292	KF369538	ODOPH119-13
Malaysia	Sarawak	501241	25924216	KF369751	KF370150	KF369416	ODOPH120-13
Seychelles	Mahe	500398	25925618	KF369754	KF370153		ODOPH121-13
Peru	Tamshiyacu-Tahuayo Reserve	501850	25924887	KF369773	KF370172	KF369435	ODOPH122-13
Peru	Tamshiyacu-Tahuayo Reserve	501805	30104167	KF369774	KF370173	KF369436	ODOPH123-13
Peru	Tamshiyacu-Tahuayo Reserve	501848	30104168	KF369778	KF370177	KF369440	ODOPH124-13
Suriname	Sipaliwini	505203	30102290	KF369779	KF370178	KF369441	ODOPH125-13
Suriname	Sipaliwini	504747	30102277	KF369784	KF370183	KF369446	ODOPH126-13
Peru	Tamshiyacu-Tahuayo Reserve	501701	25924083	KF369785	KF370184	KF369447	ODOPH127-13
Peru	Tamshiyacu-Tahuayo Reserve	501735	25924860	KF369786	KF370185		ODOPH128-13
Singapore	Pulau Ubin	503516	25924169	KF369792	KF370191		ODOPH129-13
Papua New Guinea		504969	30104080	KF369793	KF370192	KF369453	ODOPH130-13
Suriname	Marowijne	504744	30102275	KF369795	KF370194	KF369455	ODOPH131-13
Peru	Tamshiyacu-Tahuayo Reserve	501845	25924862	KF369796	KF370195	KF369456	ODOPH132-13
Malawi	Southern Region	229209	25925435	KF369812	KF370211		ODOPH133-13
Malawi	Southern Region	229208	25925459	KF369813	KF370212		ODOPH134-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Coenagrionidae	*Papuagrion occipitale*	(Selys)	1877	Kalkman, V.J.	RMNH
Coenagrionidae	*Papuagrion prothoracale*	Lieftinck	1935	Kalkman, V.J.	RMNH
Coenagrionidae	*Pericnemis lestoides*	(Brauer)	1868	Villanueva, R.J.T.	RMNH
Coenagrionidae	*Phoenicagrion flammeum*	(Selys)	1876	Faasen, T.	RMNH
Coenagrionidae	*Protoneura paucinervis*	Selys	1886	Faasen, T.	RMNH
Coenagrionidae	*Protoneura scintilla*	Gloyd	1939	Faasen, T.	RMNH
Coenagrionidae	*Pseudagrion hamoni*	Fraser	1955	Tarboton, W.	RMNH
Coenagrionidae	*Pseudagrion kersteni*	Gerstaecker	1869	Dijkstra, K.-D.B.	RMNH
Coenagrionidae	*Pseudagrion pilidorsum*	(Brauer)	1868	Dow, R.A.	RMNH
Coenagrionidae	*Stenagrion dubium*	(Laidlaw)	1912	Dow, R.A.	RMNH
Coenagrionidae	*Stenagrion dubium*	(Laidlaw)	1912	Hämäläinen, M.	RMNH
Coenagrionidae	*Teinobasis cryptica*	Dow	2010	Megan, N.	RMNH
Coenagrionidae	*Teinobasis laidlawi*	Kimmins	1936	Kebing, W.	RMNH
Coenagrionidae	*Teinobasis rajah*	Laidlaw	1912	Kalkman, V.J., Dijkstra, K.-D.B., Dingermanse, N.J. & Goudsmits, K.	RMNH
Coenagrionidae	*Teinobasis rufithorax*	(Selys)	1877	Smit, H.	RMNH
Coenagrionidae	*Teinobasis scintillans*	Lieftinck	1932	Kalkman, V.J.	RMNH
Coenagrionidae	*Telebasis dunklei*	Bick & Bick	1995	Faasen, T.	RMNH
Coenagrionidae	*Telebasis obsoleta*	(Selys)	1876	Faasen, T.	RMNH
Coenagrionidae	*Thaumatagrion funereum*	Lieftinck	1932	Richards, S.	RMNH
Coenagrionidae	*Tuberculobasis geijskesi*	Machado	2009	Wasscher, M.	RMNH
Coenagrionidae	*Xanthagrion erythroneurum*	(Selys)	1876	Kalkman, V.J.	RMNH
Coenagrionidae	*Xiphiagrion cyanomelas*	Selys	1876	Reels, G.T.	RMNH
Coenagrionidae	*Xiphiagrion cyanomelas*	Selys	1876	Dow, R.A.	RMNH
Devadattidae	*Devadatta cyanocephala*	Hämäläinen, Sasamota & Karube	2006		RMNH
Devadattidae	*Devadatta* sp.			Dow, R.A.	RMNH
Devadattidae	*Devadatta* sp.			Kalkman, V.J., Dijkstra, K.-D.B., Dingermanse, N.J. & Goudsmits, K.	RMNH
Dicteriadidae	*Heliocharis amazonica*	Selys	1853	Wasscher, M.	RMNH
Euphaeidae	*Anisopleura furcata*	Selys	1891	Hämäläinen, M.	RMNH
Euphaeidae	*Anisopleura quingyuanensis*	Zhou	1982	Kalkman, V.J.	RMNH
Euphaeidae	*Cryptophaea vietnamensis*	(van Tol & Rozendaal)	1995	Hämäläinen, M.	RMNH
Euphaeidae	*Dysphaea dimidiata*	(Selys)	1853	Dijkstra K.-D.B. & Kalkman, V.J.	RMNH
Euphaeidae	*Euphaea decorata*	Hagen in Selys	1853	Dijkstra, K.-D.B.	RMNH
Euphaeidae	*Euphaea impar*	Selys	1859	Dow, R.A.	RMNH
Euphaeidae	*Euphaea superba*	Kimmins	1936	Kalkman, V.J.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
Indonesia	Papua, Japen	500554	25924649	KF369824	KF370223		ODOPH135-13
Indonesia	Papua, Japen	229213	25925280	KF369825	KF370224	KF369476	ODOPH136-13
Philippines	Mindanao	500872	25925449	KF369834	KF370233	KF369484	ODOPH137-13
Peru	Tamshiyacu-Tahuayo Reserve	501728	25923076	KF369846	KF370245	KF369496	ODOPH138-13
Peru	Tamshiyacu-Tahuayo Reserve	501963	30104153	KF369871	KF370270	KF369519	ODOPH139-13
Peru	Tamshiyacu-Tahuayo Reserve	501961	25924850	KF369872	KF370271		ODOPH140-13
South Africa	Limpopo	500376	25924848	KF369877	KF370276	KF369524	ODOPH141-13
Liberia	Nimba County	503080	25923008	KF369878	KF370277	KF369525	ODOPH142-13
Malaysia	Sarawak	228961	25925205	KF369879	KF370278	KF369526	ODOPH143-13
Malaysia	Sarawak	228951	25925217	KF369908	KF370307	KF369549	ODOPH144-13
Malaysia	Sabah	505760	30104137	KF369907	KF370306	KF369548	ODOPH145-13
Malaysia	Sarawak	503885	30104090	KF369919	KF370318	KF369559	ODOPH146-13
Malaysia	Sarawak	503565	30104101	KF369920	KF370319	KF369560	ODOPH147-13
Brunei Darussalam	Belait	500747	25924668	KF369921	KF370320	KF369561	ODOPH148-13
Indonesia	Papua	504970	30104081	KF369922	KF370321	KF369562	ODOPH149-13
Indonesia	Papua	229289	25925342	KF369923	KF370322	KF369563	ODOPH150-13
Peru	Tamshiyacu-Tahuayo Reserve	501793	25923001	KF369926	KF370325	KF369566	ODOPH151-13
Peru	Tamshiyacu-Tahuayo Reserve	501855	30104144	KF369927	KF370326	KF369567	ODOPH152-13
Papua New Guinea		501979	25924818	KF369932	KF370331	KF369571	ODOPH153-13
Suriname	Para	505022	30102286	KF369937	KF370336		ODOPH154-13
Australia	New South Wales	504854	30102309	KF369943	KF370342	KF369578	ODOPH155-13
Malaysia	Sarawak	228954				KF369579	ODOPH156-13
Malaysia	Sarawak	228983				KF369580	ODOPH157-13
Vietnam	Central Vietnam	229256	25925508	KF369685	KF370083	KF369357	ODOPH158-13
Malaysia	Sarawak	503484	25924203	KF369686	KF370084	KF369358	ODOPH159-13
Brunei Darussalam	Temburong	500720	25924633	KF369687	KF370085	KF369359	ODOPH160-13
Suriname	Sipaliwini	505205	30102291	KF369725	KF370124	KF369392	ODOPH161-13
Thailand	Chiang Mai	505757	30104136	KF369617	KF370015	KF369297	ODOPH162-13
China	Guǎngxī	229123	25925575	KF369618	KF370016	KF369298	ODOPH163-13
Vietnam	Northern Vietnam	229255	25925505	KF369682	KF370080	KF369354	ODOPH164-13
Brunei Darussalam	Temburong	229164	25925442	KF369707	KF370106	KF369377	ODOPH165-13
China	Hong Kong	229182	25925526	KF369720	KF370119	KF369387	ODOPH166-13
Malaysia	Sarawak	504004	30102272	KF369721	KF370120	KF369388	ODOPH167-13
China	Guǎngxī	229184	25925270	KF369722	KF370121	KF369389	ODOPH168-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Heteragrionidae	*Heteragrion bickorum*	Daigle	2005	Garrison, R.W. & Ellenrieder, N. von	RMNH
Heteragrionidae	*Heteragrion chrysops*	Hagen in Selys	1862	Demarmels, J.	RMNH
Heteragrionidae	*Heteragrion inca*	Calvert	1909	Faasen, T.	RMNH
Heteragrionidae	*Oxystigma* sp.				RMNH
Heteragrionidae	*Oxystigma* sp.			Dijkstra, K.-D.B.	RMNH
Hypolestidae	*Hypolestes* sp.			Veurink, G.	RMNH
Hypolestidae	*Hypolestes* sp.			Veurink, G.	RMNH
Incertae sedis	*Agriomorpha fusca*	May	1933	Van Tol, J.	RMNH
Incertae sedis	*Agriomorpha fusca*	May	1933	Reels, G.T.	RMNH
Incertae sedis	*Agriomorpha xynglongensis*	Wilson & Reels	2001	Reels, G.T.	RMNH
Incertae sedis	*Amanipodagrion gilliesi*	Pinhey	1962	Clausnitzer, V.	RMNH
Incertae sedis	*Amanipodagrion gilliesi*	Pinhey	1962	Clausnitzer, V.	RMNH
Incertae sedis	*Bornargiolestes* sp.			Reels, G.T.	RMNH
Incertae sedis	*Bornargiolestes* sp.			Dow, R.A.	RMNH
Incertae sedis	*Burmargiolestes laidlawi* cf	Lieftinck	1960	Hämäläinen, M.	RMNH
Incertae sedis	*Burmargiolestes melanothorax*	(Selys)	1891	Hämäläinen, M.	RMNH
Incertae sedis	*Dimeragrion percubitale*	Calvert	1913	Demarmels, J.	RMNH
Incertae sedis	*Dimeragrion percubitale*	Calvert	1913	Demarmels, J.	RMNH
Incertae sedis	*Heteropodagrion sanguinipes*	Selys	1885	Tennessen, K.	RMNH
Incertae sedis	*Mesopodagrion tibetanum*	McLachlan	1896	Hämäläinen, M.	RMNH
Incertae sedis	*Priscagrion* sp.			Bowen-Jones, E.	RMNH
Incertae sedis	*Priscagrion* sp.			Bowen-Jones, E.	RMNH
Incertae sedis	*Protolestes fickei*	Förster	1899	Schütte, K.	RMNH
Incertae sedis	*Protolestes kerckhoffae*	Schmidt in Fraser	1949	Schütte, K.	RMNH
Incertae sedis	*Rhipidolestes lii*	Zhou	2003	Zhang, H.	RMNH
Incertae sedis	*Rhipidolestes owadai*	Asahina	1997	Hämäläinen, M.	RMNH
Incertae sedis	*Sciotropis cyclanthorum*	Racenis	1959	Demarmels, J.	RMNH
Incertae sedis	*Sciotropis cyclanthorum*	Racenis	1959	Demarmels, J.	RMNH
Incertae sedis	*Sinocnemis* sp.			Zhang, H.	RMNH
Incertae sedis	*Tatocnemis denticularis*	Aguesse	1968	Schütte, K.	RMNH
Incertae sedis	*Tatocnemis malgassica*	Kirby	1889	Schütte, K.	RMNH
Isostictidae	*Isosticta gracilior*	Lieftinck	1975	Marinov, M.	RMNH
Isostictidae	*Isosticta* sp.			Marinov, M.	RMNH
Isostictidae	*Neosticta canescens*	Tillyard	1913	Kalkman, V.J.	RMNH
Isostictidae	*Neosticta* sp.			Kalkman, V.J.	RMNH
Isostictidae	*Selysioneura capreola*	Lieftinck	1932	Kalkman, V.J.	RMNH
Isostictidae	*Selysioneura phasma*	Lieftinck	1932	Kalkman, V.J.	RMNH
Isostictidae	*Tanymecosticta* sp.			Kalkman, V.J.	RMNH
Lestidae	*Austrolestes leda*	(Selys)	1862	Kalkman, V.J.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
Ecuador	Orenella	502100	25924759	KF369731	KF370130	KF369396	ODOPH169-13
Venezuela	Aragua	502036	25924806	KF369732	KF370131	KF369397	ODOPH170-13
Peru	Tamshiyacu-Tahuayo Reserve	501859	25924723	KF369733	KF370132	KF369398	ODOPH171-13
Suriname		500842	25924655	KF369816	KF370215	KF369469	ODOPH172-13
Suriname	Paramaribo	228855	25925560	KF369817	KF370216	KF369470	ODOPH173-13
Dominican Republic		503672	30104091	KF369736	KF370135	KF369401	ODOPH174-13
Dominican Republic		503671	25919415	KF369737	KF370136	KF369402	ODOPH175-13
Vietnam	Vinh Phu	228706	25918280	KF369603	KF369999	KF369285	ODOPH348-13
China	Hainan	228938	25925519	KF369604	KF370000		ODOPH349-13
China	Hainan	228941	25925496	KF369605	KF370001		ODOPH350-13
Tanzania	Usumbara Mountains	229121	25925555	KF369612	KF370008	KF369290	ODOPH189-13
Tanzania	Usumbara Mountains	229120	25925543	KF369613	KF370009	KF369291	ODOPH190-13
Malaysia	Sarawak	500005	25924765	KF369646	KF370044	KF369324	ODOPH351-13
Malaysia	Sarawak	501245	25924209	KF369645	KF370043	KF369323	ODOPH352-13
Vietnam	Thua Thien Hue	502086	25924789	KF369649	KF370047	KF369327	ODOPH353-13
Thailand	Chiang Mai	228104	25925579	KF369650	KF370048		ODOPH354-13
Venezuela	Pijianaus-BO	502032	25924693	KF369689	KF370087	KF369361	ODOPH176-13
Venezuela	Pijianaus-BO	502033	25924705	KF369688	KF370086	KF369360	ODOPH177-13
Ecuador	Santo Domingo de los Tsachilas	501970	25924894	KF369734	KF370133	KF369399	ODOPH178-13
Vietnam	Lao Cai	502079	25924783	KF369780	KF370179	KF369442	ODOPH179-13
China	Fuijan	501994	25924760	KF369860	KF370259	KF369509	ODOPH180-13
China	Fuijan	504323	25919416	KF369861	KF370260	KF369510	ODOPH181-13
Madagascar	Apasy	228865	25925568	KF369869	KF370268	KF369517	ODOPH182-13
Madagascar	Malio	228866	25925580	KF369870	KF370269	KF369518	ODOPH183-13
China	Guizhou	502063	25924784	KF369891	KF370290		ODOPH357-13
Laos	Bolikhamsai	502089	25924718	KF369892	KF370291		ODOPH358-13
Venezuela	Aragua	502029	25924725	KF369898	KF370297		ODOPH184-13
Venezuela	Aragua	502028	25924808	KF369897	KF370296		ODOPH185-13
China	Guizhou	502059	25924696	KF369902	KF370301	KF369543	ODOPH186-13
Madagascar	Tolongoina	228858	25925545	KF369917	KF370316	KF369557	ODOPH187-13
Madagascar	Amboavola	228861	25925569	KF369918	KF370317	KF369558	ODOPH188-13
New Caledonia		503408	25924826	KF369752	KF370151	KF369417	ODOPH193-13
New Caledonia		503409	25924822	KF369753	KF370152	KF369418	ODOPH194-13
Australia	Queensland	505269	30102327	KF369797	KF370196	KF369457	ODOPH191-13
Australia		502016	25924689	KF369798	KF370197		ODOPH192-13
Indonesia	Papua	500515	25924685	KF369900	KF370299	KF369541	ODOPH195-13
Indonesia	Papua	229242	25925292	KF369901	KF370300	KF369542	ODOPH196-13
Indonesia	Papua	500651	25924799	KF369916	KF370315	KF369556	ODOPH197-13
Australia	New South Wales	504856	30102311	KF369642	KF370040	KF369320	ODOPH198-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Lestidae	*Austrolestes minjerriba*	Watson	1979	Kalkman, V.J.	RMNH
Lestidae	*Indolestes* sp.			Kalkman, V.J.	RMNH
Lestidae	*Lestes dissimulans*	Fraser	1955	Dijkstra, K.-D.B.	RMNH
Lestidae	*Lestes helix*	Ris	1918	Faasen, T.	RMNH
Lestidae	*Lestes pallidus*	Rambur	1842	Dijkstra, K.-D.B.	RMNH
Lestidae	*Lestes pinheyi*	Fraser	1955	Dijkstra, K.-D.B.	RMNH
Lestidae	*Lestes praemorsus decipiens*	Kirby	1894	Dow, R.A.	RMNH
Lestidae	*Lestes virens*	(Charpentier)	1825		RMNH
Lestidae	*Orolestes octomaculatus*	Martin	1902	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Lestidae	*Orolestes wallacei*	(Kirby)	1889	Dow, R.A.	RMNH
Lestidae	*Sympecma fusca*	(Vander Linden)	1820	Dijkstra, K.-D.B.	RMNH
Lestoideidae	*Diphlebia coerulescens*	Tillyard	1913	Kalkman, V.J.	RMNH
Lestoideidae	*Diphlebia hybridoides*	Tillyard	1912	Kalkman, V.J.	RMNH
Lestoideidae	*Diphlebia nymphoides*	Tillyard	1912	Kalkman, V.J.	RMNH
Lestoideidae	*Lestoidea* sp.			Kalkman, V.J.	RMNH
Megapodagrionidae	*Teinopodagrion meridionale*	De Marmels	2001	Ellenrieder, N. von & Lozano, F.	RMNH
Megapodagrionidae	*Teinopodagrion venale*	(Hagen in Selys)	1862	Demarmels, J.	RMNH
Pentaphlebiidae	*Pentaphlebia* n. sp.			Dijkstra, K.-D.B. & Vanappelghem, C.	RMNH
Pentaphlebiidae	*Pentaphlebia* n. sp.			Dijkstra, K.-D.B. & Vanappelghem, C.	RMNH
Pentaphlebiidae	*Pentaphlebia stahli*	Förster	1909	Dijkstra, K.-D.B. & Schütte, K.	RMNH
Perilestidae	*Perilestes kahli*	Williamson & Williamson	1924	Wasscher, M.	RMNH
Perilestidae	*Perilestes solutus*	Williamson & Williamson	1924	Wasscher, M.	RMNH
Perilestidae	*Perissolestes guianensis*	Williamson & Williamson	1924	Wasscher, M.	RMNH
Philogangidae	*Philoganga vetusta*	Ris	1912	Van Tol, J.	RMNH
Philogeniidae	*Archaeopodagrion armatum*	Tennesen & Johnson	2009	Tennessen, K. & Johnson, J.T.	RMNH
Philogeniidae	*Philogenia cassandra*	Hagen in Selys	1862	Demarmels, J.	RMNH
Philogeniidae	*Philogenia ferox*	Racenis	1959	Demarmels, J.	RMNH
Philogeniidae	*Philogenia iquita* cf	Dunkle	1990	Faasen, T.	RMNH
Philosinidae	*Philosina alba*	Wilson	1999	Zhang, H.	RMNH
Philosinidae	*Philosina buchi*	Ris	1917	Kalkman, V.J.	RMNH
Philosinidae	*Rhinagrion borneense*	(Selys)	1886	Stone, S.	RMNH
Philosinidae	*Rhinagrion mima*	(Karsch)	1891	Hämäläinen, M.	RMNH
Platycnemididae	*"Elattoneura" aurantiaca*	(Selys)	1886	Dow, R.A.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
Australia	Queensland	505287	30102350	KF369643	KF370041	KF369321	ODOPH199-13
Indonesia	Papua	500625	30104094	KF369746	KF370145	KF369411	ODOPH200-13
Ghana	Eastern Region	500228	25924697	KF369755	KF370154	KF369419	ODOPH201-13
Peru	Tamshiyacu-Tahuayo Reserve	501919	25924896	KF369756	KF370155	KF369420	ODOPH202-13
Democratic Republic of Congo	Katanga	505583	30104087	KF369757	KF370156	KF369421	ODOPH203-13
Democratic Republic of Congo	Katanga	505433	30104084	KF369758	KF370157	KF369422	ODOPH204-13
Malaysia	Sarawak	503590	25924185	KF369759	KF370158	KF369423	ODOPH205-13
Europe		228913	25925414	KF369760	KF370159	KF369424	ODOPH206-13
Thailand	Krabi	229210	25925426	KF369814	KF370213		ODOPH207-13
Malaysia	Pahang	500060	25924811	KF369815	KF370214		ODOPH208-13
Nederland	Leiden	504319	25919419	KF369913	KF370312	KF369553	ODOPH209-13
Australia	Queensland	505268	30102322	KF369690	KF370088	KF369362	ODOPH210-13
Australia		501976	25924630	KF369691	KF370089	KF369363	ODOPH211-13
Australia	New South Wales	504876	30102313	KF369692	KF370090		ODOPH212-13
Australia		502014	25924642	KF369761	KF370160	KF369425	ODOPH213-13
Argentina	Salta	502087	25924675	KF369924	KF370323	KF369564	ODOPH214-13
Venezuela	Aragua	502035	25924761	KF369925	KF370324	KF369565	ODOPH215-13
Gabon	Haut-Ogooué	502559	25924867	KF369831	KF370230	KF369482	ODOPH216-13
Gabon	Haut-Ogooué	502562	25924891	KF369832	KF370231		ODOPH217-13
Cameroon	Southwest Province	500108	25924812	KF369833	KF370232	KF369483	ODOPH218-13
Suriname	Brokopondo	505207	30102293	KF369835	KF370234	KF369485	ODOPH219-13
Suriname	Sipaliwini	504759	30102281	KF369836	KF370235	KF369486	ODOPH220-13
Suriname	Sipaliwini	504762	30102346	KF369837	KF370236	KF369487	ODOPH221-13
Vietnam	Dak Lak	228428	25925572	KF369840	KF370239	KF369490	ODOPH222-13
Ecuador	Zamora Chinchipe	501971	25924741	KF369622	KF370020	KF369302	ODOPH223-13
Venezuela	Aragua	502038	25924795	KF369841	KF370240	KF369491	ODOPH224-13
Venezuela	Cumbre de Choroni	502040	25924892	KF369842	KF370241	KF369492	ODOPH225-13
Peru	Tamshiyacu-Tahuayo Reserve	501714	25924890	KF369843	KF370242	KF369493	ODOPH226-13
China	Hainan	502061	25924724	KF369844	KF370243	KF369494	ODOPH227-13
China	Guǎngxī	229215	25925552	KF369845	KF370244	KF369495	ODOPH228-13
Malaysia	Sarawak	500942	25925690	KF369884	KF370283	KF369531	ODOPH229-13
Thailand	Ranong	502101	25924772	KF369885	KF370284	KF369532	ODOPH230-13
Malaysia	Pahang	503648	25924910	KF369711	KF370110	KF369380	ODOPH231-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Platycnemididae	*"Elattoneura" tenax*	(Hagen in Selys)	1860	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Allocnemis cyanura*	(Förster)	1909	Dijkstra, K.-D.B., Mézière, N. & Vanappelghem, C.	RMNH
Platycnemididae	*Allocnemis leucosticta*	(Selys)	1863	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Allocnemis* n. sp. *near pauli*			Dijkstra, K.-D.B., & K. Schütte	RMNH
Platycnemididae	*Allocnemis nigripes*	(Selys)	1886	Mézière, N.	RMNH
Platycnemididae	*Allocnemis pauli*	(Longfield)	1936	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Amazoneura ephippigera*	(Selys)	1886	Faasen, T.	RMNH
Platycnemididae	*Amazoneura ephippigera*	(Selys)	1886	Faasen, T.	RMNH
Platycnemididae	*Arabicnemis caerulea*	Waterston	1984	Schneider, W.	RMNH
Platycnemididae	*Arabicnemis caerulea*	Waterston	1984	Schneider, W.	RMNH
Platycnemididae	*Arrhenocnemis amphidactylis*	Lieftinck	1949	Kalkman, V.J.	RMNH
Platycnemididae	*Arrhenocnemis parvibullis*	Orr & Kalkman	2010	Kalkman, V.J.	RMNH
Platycnemididae	*Calicnemia chaseni*	(Laidlaw in Campion & Laidlaw)	1928	Dow, R.A.	RMNH
Platycnemididae	*Calicnemia sinensis*	Lieftinck	1984	Kalkman, V.J.	RMNH
Platycnemididae	*Coeliccia borneensis*	(Selys)	1886	Southwell, L.	RMNH
Platycnemididae	*Coeliccia cyaneothorax*	Kimmins	1936	Dow, R.A.	RMNH
Platycnemididae	*Coeliccia cyanomelas*	Ris	1912	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Coeliccia didyma*	(Selys)	1863	Dow, R.A.	RMNH
Platycnemididae	*Coeliccia dinoceras*	Laidlaw	1925	Van Tol, J.	RMNH
Platycnemididae	*Coeliccia flavostriata*	Laidlaw	1918	Dow, R.A.	RMNH
Platycnemididae	*Coeliccia nemoricola*	Laidlaw	1912	Dow, R.A.	RMNH
Platycnemididae	*Coeliccia poungyi*	Fraser	1924	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Platycnemididae	*Copera marginipes*	(Rambur)	1842	Dow, R.A.	RMNH
Platycnemididae	*Copera nyansana*	(Förster)	1916	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Copera sikassoensis*	(Martin)	1912	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Copera vittata*	(Selys)	1863	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Platycnemididae	*Cyanocnemis aureofrons*	Lieftinck	1949	Richards, S.	RMNH
Platycnemididae	*Elattoneura centrafricana*	Lindley	1976	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Elattoneura glauca*	(Selys)	1860	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Elattoneura vittata*	(Selys)	1886	Dijkstra, K.-D.B., Kipping, J. & Schütte, K.	RMNH
Platycnemididae	*Esme mudiensis*	Fraser	1931	Bedjanič, M.	RMNH
Platycnemididae	*Hylaeargia* sp.			Richards, S.	RMNH
Platycnemididae	*Idiocnemis obliterata*	Lieftinck	1932	Kalkman, V.J.	RMNH
Platycnemididae	*Idiocnemis* sp.			Kalkman, V.J.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
Sri Lanka	Kitulgala	229264	25925262	KF369714	KF370113	KF369383	ODOPH232-13
Gabon	Haut-Ogooué	502478	25924876	KF369606	KF370002	KF369286	ODOPH233-13
South Africa	Prince Albert	228210	25925498	KF369607	KF370003	KF369287	ODOPH234-13
Cameroon	Northwest Province	229129	25925616	KF369609	KF370005	KF369289	ODOPH235-13
Gabon	Haut-Ogooué	502653	25924809	KF369608	KF370004	KF369288	ODOPH236-13
DR Congo	Orientale	229133	25925422	KF369610	KF370006		ODOPH237-13
Peru	Tamshiyacu-Tahuayo Reserve	501694	25924829		KF370011	KF369293	ODOPH238-13
Peru	Tamshiyacu-Tahuayo Reserve	501967	25924870		KF370010	KF369292	ODOPH239-13
Yemen	Wadi Dau'an System	505846	30104156	KF369620	KF370018	KF369300	ODOPH240-13
Yemen	Wadi Dau'an System	505845	30104155	KF369621	KF370019	KF369301	ODOPH241-13
Indonesia	Papua	229253	25925675	KF369635	KF370033	KF369314	ODOPH242-13
Papua New Guinea		501977	25924785	KF369636	KF370034	KF369315	ODOPH243-13
Malaysia	Pahang	500057	25924754	KF369653	KF370051	KF369330	ODOPH244-13
China	Hong Kong	229127	25925564	KF369654	KF370052	KF369331	ODOPH245-13
Malaysia	Sarawak	503469	25924164	KF369668	KF370066	KF369342	ODOPH246-13
Malaysia	Sarawak	501314	25924158	KF369669	KF370067	KF369343	ODOPH247-13
China	Guangdong	228208	25925491	KF369670	KF370068		ODOPH248-13
Malaysia	Terengganu	503926	30102261	KF369671	KF370069	KF369344	ODOPH249-13
Philippines	Mindanao	226847					ODOPH250-13
Malaysia	Sarawak	501225	25925484	KF369672	KF370070	KF369345	ODOPH251-13
Malaysia	Sarawak	503632	30104095	KF369673	KF370071	KF369346	ODOPH252-13
Thailand	Chiang Mai	229162	25925570	KF369674	KF370072		ODOPH253-13
Malaysia	Pahang	501092	25925932	KF369679	KF370077	KF369351	ODOPH254-13
Democratic Republic of Congo	Province Orientale	502195	25924877	KF369680	KF370078	KF369352	ODOPH255-13
Liberia	Nimba County	503091	25924819	KF369681	KF370079	KF369353	ODOPH256-13
Thailand	Khao Yai National Park	229163	25925511	KF369715	KF370114	KF369384	ODOPH257-13
Papua New Guinea		501995	25924750	KF369683	KF370081	KF369355	ODOPH258-13
Democratic Republic of Congo	Orientale	229169	25919412	KF369712	KF370111	KF369381	ODOPH259-13
South Africa	Mpumalanga/ KwaZulu Natal	229171	25925514	KF369713	KF370112	KF369382	ODOPH260-13
Cameroon	South Province	229233	25925613	KF369865	KF370264	KF369513	ODOPH261-13
India		502041	30104083	KF369719	KF370118	KF369386	ODOPH262-13
Papua New Guinea		502071	25924855	KF369735	KF370134	KF369400	ODOPH263-13
Indonesia	Papua	500639	25924791	KF369738	KF370137	KF369403	ODOPH264-13
Papua New Guinea		502018	25924762	KF369740	KF370139	KF369405	ODOPH265-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Platycnemididae	*Idiocnemis* sp.			Kalkman, V.J.	RMNH
Platycnemididae	*Igneocnemis flammea*	(Selys)	1882	Kalkman, V.J. & J. van Tol	RMNH
Platycnemididae	*Indocnemis ambigua*	(Asahina)	1997	Van Tol, J.	RMNH
Platycnemididae	*Indocnemis orang*	(Förster in Förster & Laidlaw)	1907	Dow, R.A.	RMNH
Platycnemididae	*Indocnemis orang*	(Förster in Förster & Laidlaw)	1907	Van Tol, J.	RMNH
Platycnemididae	*Lochmaeocnemis malacodora*	Lieftinck	1949	Kalkman, V.J.	RMNH
Platycnemididae	*Lochmaeocnemis malacodora*	Lieftinck	1949	Kalkman, V.J.	RMNH
Platycnemididae	*Matticnemis doi*	(Hämäläinen)	2012	Hämäläinen, M.	RMNH
Platycnemididae	*Mesocnemis robusta*	(Selys)	1886	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Mesocnemis singularis*	Karsch	1891	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Metacnemis valida*	(Hagen in Selys)	1863	Tarboton, W.	RMNH
Platycnemididae	*Nososticta erythrura*	(Lieftinck)	1932	Kalkman, V.J.	RMNH
Platycnemididae	*Nososticta solitaris*	(Tillyard)	1906	Kalkman, V.J.	RMNH
Platycnemididae	*Onychargia atrocyana*	(Selys)	1865	Dow, R.A.	RMNH
Platycnemididae	*Onychargia atrocyana*	(Selys)	1865	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Palaiargia charmosyna*	Lieftinck	1932	Kalkman, V.J.	RMNH
Platycnemididae	*Palaiargia* sp.			Kalkman, V.J.	RMNH
Platycnemididae	*Palaiargia* sp.			Richards, S.	RMNH
Platycnemididae	*Paracnemis alluaudi*	Martin	1902	Schütte, K.	RMNH
Platycnemididae	*Paramecocnemis erythrostigma*	Lieftinck	1932	Kalkman, V.J.	RMNH
Platycnemididae	*Paramecocnemis stillacruoris*	Lieftinck	1956	Kalkman, V.J.	RMNH
Platycnemididae	*Platycnemis acutipennis*	Selys	1841	Mostert, Kees	RMNH
Platycnemididae	*Platycnemis foliacea*	Selys	1886	Karube, H.	RMNH
Platycnemididae	*Platycnemis pennipes*	(Pallas)	1771	Tol, J, Van	RMNH
Platycnemididae	*Prodasineura croconota*	(Ris)	1916	Dijkstra, K.-D.B.	RMNH
Platycnemididae	*Prodasineura dorsalis*	(Selys)	1860	Dow, R.A.	RMNH
Platycnemididae	*Prodasineura sita*	(Kirby)	1894	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Platycnemididae	*Proplatycnemis hova*	(Selys in Martin)	1908	Schütte, K.	RMNH
Platycnemididae	*Proplatycnemis pembipes*	(Dijkstra, Clausnitzer & Martens)	2007	Clausnitzer, V.	RMNH
Platycnemididae	*Proplatycnemis sanguinipes*	(Schmidt)	1951	Schütte, K.	RMNH
Platycnemididae	*Pseudocopera ciliata*	(Selys)	1863	Ng, Y.F.	RMNH
Platycnemididae	*Risiocnemis praeusta*	Hämäläinen	1991	Villanueva, R.J.T.	RMNH
Platycnemididae	*Spesbona angusta*	(Selys)	1863	Simaika, J.	RMNH
Platycnemididae	*Spesbona angusta*	(Selys)	1863	Simaika, J.	RMNH
Platycnemididae	*Stenocnemis pachystigma*	(Selys)	1886	Dijkstra, K.-D.B. & Schütte, K.	RMNH
Platycnemididae	*Torrenticnemis filicornis*	Lieftinck	1949	Kalkman, V.J.	RMNH
Platycnemididae	*Torrenticnemis filicornis*	Lieftinck	1949	Kalkman, V.J.	RMNH
Platystictidae	*Ceylonosticta austeni*	Lieftinck	1940	Bedjanič, M.	RMNH
Platystictidae	*Ceylonosticta montana*	(Hagen in Selys)	1860	Bedjanič, M.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
Papua New Guinea		502020	25924774	KF369739	KF370138	KF369404	ODOPH266-13
Philippines	Mindanao	500686	25924629	KF369741	KF370140	KF369406	ODOPH267-13
Vietnam	Vinh Phu	228684	25925561	KF369742	KF370141	KF369407	ODOPH268-13
Malaysia	Pahang	501077	25925956	KF369744	KF370143	KF369409	ODOPH269-13
Vietnam	Dak Lak	228399	25925573	KF369743	KF370142	KF369408	ODOPH270-13
Indonesia	Papua	229271	25925630	KF369767	KF370166	KF369429	ODOPH271-13
Indonesia	Papua	229193	25925539	KF369768	KF370167	KF369430	ODOPH272-13
Vietnam	Lang Son	506232	30104160	KF369772	KF370171	KF369434	ODOPH273-13
Egypt	Nile Valley	500908	25925600	KF369776	KF370175	KF369438	ODOPH274-13
South Africa	Dhlumudhlumu Mountains	228202	25925516	KF369777	KF370176	KF369439	ODOPH275-13
South Africa	Eastern Cape	500866	25925551	KF369781	KF370180	KF369443	ODOPH276-13
Indonesia	Papua, Japen	229202	25925538	KF369806	KF370205	KF369463	ODOPH277-13
Australia		502015	30104103	KF369807	KF370206	KF369464	ODOPH278-13
Malaysia	Sarawak	500022	25924624	KF369811	KF370210	KF369468	ODOPH279-13
China	Hong Kong	229207	25925563	KF369810	KF370209	KF369467	ODOPH280-13
Indonesia	Papua	500580	25924652	KF369821	KF370220	KF369474	ODOPH281-13
Indonesia	Papua	500627	25924636	KF369823	KF370222	KF369475	ODOPH282-13
Papua New Guinea		502070	25924901	KF369822	KF370221		ODOPH283-13
Madagascar		229282	25925559	KF369826	KF370225	KF369477	ODOPH284-13
Indonesia	Papua	229283	25925654	KF369827	KF370226	KF369478	ODOPH285-13
Indonesia	Papua	500610	25924664	KF369828	KF370227	KF369479	ODOPH286-13
France		228906	25925571	KF369847	KF370246	KF369497	ODOPH287-13
Japan		228191	25925477	KF369848	KF370247		ODOPH288-13
Netherlands	Drentsche Aa	228274	25925393	KF369849	KF370248	KF369498	ODOPH289-13
China	Hong Kong	229235	25925281	KF369862	KF370261		ODOPH290-13
Malaysia	Sarawak	501332	25924184	KF369863	KF370262	KF369511	ODOPH291-13
Sri Lanka	Colombo	229286	25925215	KF369864	KF370263	KF369512	ODOPH292-13
Madagascar		228196	25925440	KF369866	KF370265	KF369514	ODOPH293-13
Tanzania	Pemba Island	228169	25925465	KF369867	KF370266	KF369515	ODOPH294-13
Madagascar		228197	25925429	KF369868	KF370267	KF369516	ODOPH295-13
Malaysia	Pahang	501165	25925872	KF369880	KF370279	KF369527	ODOPH296-13
Philippines	Dinagat Island	500878	25925418	KF369895	KF370294		ODOPH297-13
South Africa		229272	25925523	KF369906	KF370305	KF369547	ODOPH298-13
South Africa		229273	25925535	KF369905	KF370304	KF369546	ODOPH299-13
Cameroon	Southwest Province	229244	25925666	KF369909	KF370308		ODOPH300-13
Indonesia	Papua	500622	25924660	KF369935	KF370334	KF369574	ODOPH301-13
Indonesia	Papua	229291	25925678	KF369934	KF370333	KF369573	ODOPH302-13
Sri Lanka	Uva	229757	25925644	KF369659	KF370057	KF369336	ODOPH303-13
Sri Lanka	Uva Province	229778	25925609	KF369660	KF370058	KF369337	ODOPH304-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Platystictidae	*Ceylonosticta nietneri*	Fraser	1931	Bedjanič, M.	RMNH
Platystictidae	*Ceylonosticta walli*	(Fraser)	1931	Bedjanič, M.	RMNH
Platystictidae	*Drepanosticta actaeon*	Laidlaw	1934	Kebing, W.	RMNH
Platystictidae	*Drepanosticta attala*	Lieftinck	1934	Dow, R.A.	RMNH
Platystictidae	*Drepanosticta clavata*	Lieftinck	1932	Kalkman, V.J.	RMNH
Platystictidae	*Drepanosticta dentifera*	Kimmins	1936	Tateh, O.	RMNH
Platystictidae	*Drepanosticta dulitensis*	Kimmins	1936	Dow, R.A.	RMNH
Platystictidae	*Drepanosticta krios*	van Tol	2005	Van Tol, J. & Kalkman, V.J.	RMNH
Platystictidae	*Drepanosticta lestoides*	(Brauer)	1868	Van Tol, J. & Kalkman, V.J.	RMNH
Platystictidae	*Drepanosticta mylitta*	Cowley	1936	Villanueva, R.J.T.	RMNH
Platystictidae	*Drepanosticta quadrata*	(Selys)	1860	Dow, R.A.	RMNH
Platystictidae	*Drepanosticta rufostigma*	(Selys)	1886	Kalkman, V.J., Dijkstra, K.-D.B., Dingermanse, N.J. & Goudsmits, K.	RMNH
Platystictidae	*Palaemnema brevignoni*	Machet	1990	Wasscher, M.	RMNH
Platystictidae	*Palaemnema domina*	Calvert	1903	Gonzalez-Soriano, E.	RMNH
Platystictidae	*Platysticta apicalis*	Kirby	1894	Bedjanič, M.	RMNH
Platystictidae	*Platysticta greeni*	Kirby	1891	Bedjanič, M.	RMNH
Platystictidae	*Platysticta maculata*	Selys	1860	Bedjanič, M.	RMNH
Platystictidae	*Protosticta grandis*	Asahina	1985	Van Tol, J.	RMNH
Platystictidae	*Protosticta linnaei*	van Tol	2008	Van Tol, J.	RMNH
Platystictidae	*Protosticta plicata*	van Tol	2005		RMNH
Platystictidae	*Protosticta satoi*	Asahina	1997	Van Tol, J.	RMNH
Platystictidae	*Protosticta versicolor*	Laidlaw	1913	Dow, R.A.	RMNH
Platystictidae	*Sinosticta hainanense*	Wilson & Reels	2001		RMNH
Platystictidae	*Sinosticta* sp.				RMNH
Platystictidae	*Telosticta bidayuh*	Dow & Orr	2012	Dow, R.A.	RMNH
Platystictidae	*Telosticta dayak*	Dow & Orr	2012	Dow, R.A.	RMNH
Platystictidae	*Telosticta dupophila*	Lieftinck	1933	Dow, R.A.	RMNH
Platystictidae	*Telosticta longigaster*	Dow & Orr	2012	Dow, R.A.	RMNH
Polythoridae	*Chalcopteryx rutilans*	(Rambur)	1842	Smit, J.	RMNH
Polythoridae	*Chalcopteryx seabrai*	Santos & Machado	1961	Wasscher, M.	RMNH
Polythoridae	*Polythore aurora*	(Selys)	1879	Faasen, T.	RMNH
Polythoridae	*Polythore aurora*	(Selys)	1879	Faasen, T.	RMNH
Pseudolestidae	*Pseudolestes mirabilis*	Kirby	1900	Reels, G.T.	RMNH
Pseudolestidae	*Pseudolestes mirabilis*	Kirby	1900	Reels, G.T.	RMNH
Rimanellidae	*Rimanella arcana*	(Needham)	1933	Demarmels, J.	
Synlestidae	*Chlorolestes fasciatus*	(Burmeister)	1839	Dijkstra, K.-D.B.	RMNH
Synlestidae	*Chlorolestes umbratus*	Hagen in Selys	1862	Dijkstra, K.-D.B.	RMNH

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
Sri Lanka	Sabaragamuwa Province	229772	25925633	KF369661	KF370059	KF369338	ODOPH305-13
Sri Lanka	Central Province	503239	25925646	KF369662	KF370060	KF369339	ODOPH306-13
Malaysia	Sarawak	503455	25924230	KF369696	KF370095	KF369366	ODOPH307-13
Malaysia	Sarawak	503447	25924200	KF369697	KF370096	KF369367	ODOPH308-13
Indonesia	Papua, Japen	228097	25925517	KF369698	KF370097	KF369368	ODOPH309-13
Malaysia	Sarawak	501317	25924159	KF369699	KF370098	KF369369	ODOPH310-13
Malaysia	Sarawak	500011	25924764	KF369700	KF370099	KF369370	ODOPH311-13
Philippines	Mindanao	226901	25925506	KF369701	KF370100	KF369371	ODOPH312-13
Philippines	Mindanao	228849	25925518	KF369702	KF370101	KF369372	ODOPH313-13
Philippines	Dinagat Island	228843	25925530	KF369703	KF370102	KF369373	ODOPH314-13
Singapore	Nee Soon	501013	25925785	KF369704	KF370103	KF369374	ODOPH315-13
Brunei Darussalam	Belait	500823	25924680	KF369705	KF370104	KF369375	ODOPH316-13
Suriname	Brokopondo	505198	30102288	KF369819	KF370218	KF369472	ODOPH317-13
Mexico		228084	25924701	KF369820	KF370219	KF369473	ODOPH318-13
Sri Lanka	Uva Province	229762	25925596	KF369852	KF370251	KF369501	ODOPH319-13
Sri Lanka	Central Province	229765	25925670	KF369853	KF370252	KF369502	ODOPH320-13
Sri Lanka	Central Province	229760	25925611	KF369854	KF370253	KF369503	ODOPH321-13
Vietnam	Dak Lak	228386	25925631	KF369873	KF370272	KF369520	ODOPH322-13
Vietnam	Dak Lak	228353	25925500	KF369874	KF370273	KF369521	ODOPH323-13
Philippines	Cebu	228842	25925578	KF369875	KF370274	KF369522	ODOPH324-13
Vietnam	Vinh Phu	228714	25925536	KF369876	KF370275	KF369523	ODOPH325-13
Malaysia	Sarawak	501032	25925789	KF369706	KF370105	KF369376	ODOPH326-13
China	Hainan	228939	25925541	KF369903	KF370302	KF369544	ODOPH327-13
China	Hainan	228935	25925553	KF369904	KF370303	KF369545	ODOPH328-13
Malaysia	Sarawak	503627	25924160	KF369928	KF370327	KF369568	ODOPH329-13
Malaysia	Sarawak	503637	25924213	KF369929	KF370328	KF369569	ODOPH330-13
Malaysia	Sarawak	504051	30102273	KF369930	KF370329	KF369570	ODOPH331-13
Malaysia	Sarawak	503509	25924225	KF369931	KF370330		ODOPH332-13
Peru	Tamshiyacu-Tahuayo Reserve	505717	30104154	KF369663	KF370061		ODOPH333-13
Suriname	Sipaliwini	505197	30102287	KF369664	KF370062	KF369340	ODOPH334-13
Peru	Tamshiyacu-Tahuayo Reserve	501729	25924842	KF369859	KF370258	KF369508	ODOPH335-13
Peru	Tamshiyacu-Tahuayo Reserve	501969	25924885	KF369858	KF370257	KF369507	ODOPH336-13
China	Hainan	228942	25925509	KF369882	KF370281	KF369529	ODOPH337-13
China	Hainan	228943	25925521	KF369881	KF370280	KF369528	ODOPH338-13
Venezuela	Sierra De Lema		r_1023_R	KF369894	KF370293		ODOPH339-13
South Africa	border of Mpumalanga and KwaZulu Natal	229156	25925293	KF369666	KF370064		ODOPH340-13
South Africa	border of Western and Eastern Cape	229158	25925210	KF369667	KF370065		ODOPH341-13

Table S2 - Continued

Family	Species	Authority	Year	Collector	Repository
Synlestidae	*Ecchlorolestes nylephtha*	(Barnard)	1937	Dijkstra, K.-D.B.	RMNH
Synlestidae	*Megalestes* sp.			Kalkman, V.J.	RMNH
Synlestidae	*Nubiolestes diotima*	(Fraser)	1944	Dijkstra, K.-D.B. & Schütte, K.	RMNH
Synlestidae	*Nubiolestes diotima*	(Fraser)	1944	Dijkstra, K.-D.B. & Schütte, K.	RMNH
Synlestidae	*Synlestes selysi*	Tillyard	1917	Kalkman, V.J.	RMNH
Synlestidae	*Synlestes weyersii*	Selys	1869	Kalkman, V.J.	RMNH
Thaumatoneuridae	*Paraphlebia quinta*	Calvert	1901	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Thaumatoneuridae	*Paraphlebia zoe*	Hagen	1861	Dijkstra, K.-D.B. & Kalkman, V.J.	RMNH
Thaumatoneuridae	*Thaumatoneura inopinata*	McLachlan	1897	Esquivel, C.	RMNH

Supplementary Information Table S3. Support in analyses for proposed classification of Zygoptera. Support for each group presented in the classification is provided for the maximum likelihood (ML) and Bayesian inference (BI) analyses for the combined 28S and 16S (and COI) datasets, as bootstrap values (ML) and percentages of posterior probabilities (BI). Support values are not applicable (n.a.) for groups for which no or only one species was available.

Group	ML 28S+16S	BI 28S+16S	ML 28S+ 16S+COI	BI 28S+ 16S+COI	Support for monophyly and classification
Superfamily Lestoidea Calvert, 1901	95	100	98	100	very high support
Family Hemiphlebiidae Kennedy, 1920	n.a.	n.a.	n.a.	n.a.	monotypic; see Davis et al. (2011) and others
Family Perilestidae Kennedy, 1920	0	0	84	100	high support for 28S+16S+COI
Family Synlestidae Tillyard, 1917	0	0	0	0	no support, convenience; see May et al. (pers. comm.) in Dijkstra et al. (2013)
Family Lestidae Calvert, 1901	94	100	99	100	very high support
Superfamily Platystictoidea Kennedy, 1920	100	100	100	100	complete support
Family Platystictidae Kennedy, 1920	100	100	100	100	complete support
Subfamily Palaemnematinae Tillyard & Fraser, 1938	81	100	100	100	very high support
Subfamily Platystictinae Kennedy, 1920	100	100	100	100	complete support
Subfamily Protostictinae subfam. nov.	97	100	100	100	very high support
Subfamily Sinostictinae Wilson, 1997	100	100	100	100	complete support
Superfamily 'Calopterygoidea' Selys, 1850	0	0	0	0	no support, convenience; see Bybee et al. (2008)
Family Amphipterygidae Tillyard, 1917	n.a.	n.a.	n.a.	n.a.	monogeneric, name available, no near relatives
Family Argiolestidae Fraser, 1957	58	100	85	98	good support
Subfamily Argiolestinae Fraser, 1957	73	99	98	100	high support
Subfamily Podolestinae Kalkman & Theischinger, 2013	92	100	94	100	very high support

Country	Location	Voucher	Extract	16S	28S	COI	Barcode Index
South Africa	Eastern Cape	229165	25925502	KF369708	KF370107		ODOPH342-13
China	Guăngxī	229194	25925492	KF369775	KF370174	KF369437	ODOPH343-13
Cameroon	Southwest Province	500110	25924728	KF369809	KF370208	KF369466	ODOPH344-13
Cameroon	Southwest Province	229206	25925249	KF369808	KF370207	KF369465	ODOPH345-13
Australia	Queensland	505293	30102325	KF369914	KF370313	KF369554	ODOPH346-13
Australia	New South Wales	504868	30102312	KF369915	KF370314	KF369555	ODOPH347-13
Mexico	Oaxaca State	504317	25919420	KF369829	KF370228	KF369480	ODOPH355-13
Mexico	Veracruz State	504309	25919421	KF369830	KF370229	KF369481	ODOPH356-13
Costa Rica	San José	501982	25924773	KF369933	KF370332	KF369572	ODOPH359-13

Table S3 - Continued

Group	ML 28S+16S	BI 28S+16S	ML 28S+ 16S+COI	BI 28S+ 16S+COI	Support for monophyly and classification
Family Calopterygidae Selys, 1850	97	100	96	100	very high support
Subfamily Calopteryginae Selys, 1850	81	58	93	99	good support
Tribe Caliphaeini Fraser, 1929	n.a.	n.a.	n.a.	n.a.	monogeneric; see Dumont et al. (2010)
Tribe Calopterygini Selys, 1850	90	100	99	100	very high support
Tribe Iridictyonini Dumont et al., 2005	n.a.	n.a.	n.a.	n.a.	monogeneric; see Dumont et al. (2010)
Tribe Mnaisini Ishida, 1996	98	100	100	100	complete support
Tribe Noguchiphaeini Dumont et al., 2005	n.a.	n.a.	n.a.	n.a.	monogeneric; see Dumont et al. (2010)
Tribe Saphoini Dumont et al., 2005	72	95	64	96	good support
Tribe Vestalini Needham, 1903	93	100	81	100	high support
Subfamily Hetaerininae Tillyard & Fraser, 1939	100	100	100	100	complete support
Family Chlorocyphidae Cowley, 1937	100	100	100	100	complete support
possible subfamily Chlorocyphinae	92	100	98	100	very high support
possible subfamily Disparocyphinae	n.a.	n.a.	n.a.	n.a.	monogeneric
possible subfamily Libellagininae	99	100	100	100	complete support
possible subfamily Rhinocyphinae	0	0	0	0	no support
Family Devadattidae fam. nov.	n.a.	n.a.	n.a.	n.a.	monogeneric, no near relatives
Family Dicteriadidae Montgomery, 1959	n.a.	n.a.	n.a.	n.a.	two very close genera, no near relatives
Family Euphaeidae Yakobson & Bianchi, 1905	100	100	100	100	complete support
Family Heteragrionidae Rácenis, 1959	100	100	100	100	complete support
Family Hypolestidae Fraser, 1938	n.a.	n.a.	n.a.	n.a.	monogeneric, name available, no near relatives
Family Lestoideidae Munz, 1919	100	100	100	100	complete support
Subfamily Diphlebiinae Heymer, 1975	n.a.	n.a.	n.a.	n.a.	monogeneric, name available

Table S3 - Continued

Group	ML 28S+16S	BI 28S+16S	ML 28S+ 16S+COI	BI 28S+ 16S+COI	Support for monophyly and classification
Subfamily Lestoideinae Munz, 1919	n.a.	n.a.	n.a.	n.a.	monogeneric, name available
Family Megapodagrionidae Calvert, 1913	100	100	100	100	complete support
Family Pentaphlebiidae Novelo-Gutiérrez, 1995	n.a.	n.a.	n.a.	n.a.	monogeneric, name available, no near relatives
Family Philogangidae Kennedy, 1920	n.a.	n.a.	n.a.	n.a.	monogeneric, name available, no near relatives
Family Philogeniidae Rácenis, 1959	100	100	100	100	complete support
Family Philosinidae Kennedy, 1925	100	100	100	100	complete support
Family Polythoridae Munz, 1919	100	100	100	100	complete support
Family Pseudolestidae Fraser, 1957	n.a.	n.a.	n.a.	n.a.	monogeneric, name available, no near relatives
Family Rimanellidae Davies & Tobin, 1984	n.a.	n.a.	n.a.	n.a.	monogeneric, name available, no near relatives
Family Thaumatoneuridae Fraser, 1938	90	100	96	100	very high support
group 1 (*Rhipidolestes* + related genera) + Thaumatoneuridae	64	100	28	62	some support
group 2: *Amanipodagrion*	n.a.	n.a.	n.a.	n.a.	no near relatives
group 3: *Dimeragrion* + *Heteropodagrion*	0	0	48	67	some support in 28S+16S+COI
group 4: *Mesopodagrion*	n.a.	n.a.	n.a.	n.a.	no near relatives
group 5: *Priscagrion* + *Sinocnemis*	66	100	86	100	good support
group 6: *Protolestes*	n.a.	n.a.	n.a.	n.a.	no near relatives
group 7: *Tatocnemis*	n.a.	n.a.	n.a.	n.a.	no near relatives
group 8: *Sciotropis*	n.a.	n.a.	n.a.	n.a.	no near relatives
Superfamily Coenagrionoidea Kirby, 1890	22	57	0	0	low support in 28S+16S; see Bybee et al. (2008)
Family Isostictidae Fraser, 1955	100	100	99	100	complete support
Family Platycnemididae Yakobson & Bianchi, 1905	81	100	82	100	high support
Subfamily Allocnemidinae subfam. nov.	63	59	91	100	good support
Subfamily Calicnemiinae Fraser, 1957	100	100	100	100	complete support
Subfamily Disparoneurinae Fraser, 1957	100	100	100	100	complete support
Subfamily Idiocnemidinae subfam. nov.	91	100	100	100	very high support
Subfamily Onychargiinae subfam. nov.	93	100	83	100	high support
Subfamily Platycnemidinae Yakobson & Bianchi, 1905	81	97	96	100	high support
Tribe Coperini trib. nov.	96	100	98	100	very high support
Tribe Platycnemidini Yakobson & Bianchi, 1905	81	98	91	91	high support
Family Coenagrionidae Kirby, 1890	85	100	77	100	high support
Core Coenagrionidae	99	100	100	100	complete support
possible subfamily Agriocnemidinae	100	100	100	100	complete support
possible subfamily Ischnurinae	100	100	100	100	complete support

Table S3 - Continued

Group	ML 28S+16S	BI 28S+16S	ML 28S+ 16S+COI	BI 28S+ 16S+COI	Support for monophyly and classification
possible subfamily Pseudagrioninae	70	90	61	97	good support
Ridge-faced complex	49	55	43	0	low support
possible subfamily Protoneurinae	100	100	100	100	complete support
possible subfamily Pseudostigmatinae (incl. *Bromeliagrion*)	23	79	27	74	some support
possible subfamily Teinobasinae	73	100	66	100	good support

Supplementary Information Table S4. Summary of proposed taxonomic changes, including new combinations.

Genera *incertae sedis* not listed, see Classification in main text.

Genus	Former family*	Proposed family
Nubiolestes Fraser, 1945	Perilestidae	Synlestidae*
Devadatta Kirby, 1890	Amphipterygidae	Devadattidae
Pentaphlebia Förster, 1909	Amphipterygidae	Pentaphlebiidae
Rimanella Needham, 1934	Amphipterygidae	Rimanellidae
Heteragrion Selys, 1862	Megapodagrionidae	Heteragrionidae
Oxystigma Selys, 1862	Megapodagrionidae	Heteragrionidae
Hypolestes Gundlach, 1888	Megapodagrionidae	Hypolestidae
Archaeopodagrion Kennedy, 1939	Megapodagrionidae	Philogeniidae
Philogenia Selys, 1862	Megapodagrionidae	Philogeniidae
Philosina Ris, 1917	Megapodagrionidae	Philosinidae
Rhinagrion Calvert, 1913	Megapodagrionidae	Philosinidae
Paraphlebia Selys, 1861	Megapodagrionidae	Thaumatoneuridae
Thaumatoneura McLachlan, 1897	Megapodagrionidae	Thaumatoneuridae
Archboldargia Lieftinck, 1949	Coenagrionidae	Platycnemididae
Hylaeargia Lieftinck, 1949	Coenagrionidae	Platycnemididae
Onychargia Selys, 1865	Coenagrionidae	Platycnemididae
Palaiargia Förster, 1903	Coenagrionidae	Platycnemididae
Papuargia Lieftinck, 1938	Coenagrionidae	Platycnemididae
Leptocnemis Selys, 1886	Platycnemididae	Coenagrionidae
Oreocnemis Pinhey, 1971	Platycnemididae	Coenagrionidae
Thaumatagrion Lieftinck, 1932	Platycnemididae	Coenagrionidae

* following Dijkstra et al. (2013)

Platystictidae

The Sri Lankan Platystictidae is either the sister-group of all platysticids except *Sinosticta* or of the Neotropical subfamily Palaemnematinae, making the Oriental Platystictinae *s.l.* paraphyletic. We limit Platystictinae to the Sri Lankan group and reinstate the genus *Ceylonosticta* for the Sri Lankan species placed in the mainland genus *Drepanosticta*. These species agree with Platystictinae *s.s.* in the vein CuP meeting the hind margin of the fore wing at the origin of R3, rather than proximal to it.

Table S4 - Continued

Family / Former combination	**Proposed new combination**
Drepanosticta adami (Fraser, 1933)	*Ceylonosticta adami* Fraser, 1933
Drepanosticta anamia Bedjanič, 2010	*Ceylonosticta anamia* (Bedjanič, 2010)
Drepanosticta austeni Lieftinck, 1940	*Ceylonosticta austeni* (Lieftinck, 1940)
Drepanosticta bine Bedjanič, 2010	*Ceylonosticta bine* (Bedjanič, 2010)
Drepanosticta brincki Lieftinck, 1971	*Ceylonosticta brincki* (Lieftinck, 1971)
Drepanosticta digna (Hagen in Selys, 1860)	*Ceylonosticta digna* (Hagen in Selys, 1860)
Drepanosticta hilaris (Hagen in Selys, 1860)	*Ceylonosticta hilaris* (Hagen in Selys, 1860)
Drepanosticta lankanensis (Fraser, 1931)	*Ceylonosticta lankanensis* Fraser, 1931
Drepanosticta mojca Bedjanič, 2010	*Ceylonosticta mojca* (Bedjanič, 2010)
Drepanosticta montana (Hagen in Selys, 1860)	*Ceylonosticta montana* (Hagen in Selys, 1860)
Drepanosticta nietneri (Fraser, 1931)	*Ceylonosticta nietneri* Fraser, 1931
Drepanosticta submontana (Fraser, 1933)	*Ceylonosticta submontana* Fraser, 1933
Drepanosticta subtropica (Fraser, 1933)	*Ceylonosticta subtropica* Fraser, 1933
Drepanosticta tropica (Hagen in Selys, 1860)	*Ceylonosticta tropica* (Hagen in Selys, 1860)
Drepanosticta walli (Fraser, 1931)	*Ceylonosticta walli* Fraser, 1931

incertae sedis

Genetically *B. xinglongensis* is nearer *Agriomorpha fusca* May, 1933 than to the other *Burmargiolestes*. Its general coloration and markings, including the dorsally pale eighth to tenth abdominal segments, and the nearly straight CuA reaching halfway the nodus and pterostigma are also shared with that species but not with any *Burmargiolestes*.

Burmargiolestes xinglongensis Wilson & Reels, 2001	*Agriomorpha xinglongensis* (Wilson & Reels, 2001)

Chlorocyphidae

C. centripunctata is genetically closer to *Africocypha lacuselephantum* (Karsch, 1899) than to *Chlorocypha*: its extended paraprocts, black tenth tergite and other details of markings are also shared with that species but not with any *Chlorocypha*.

Chlorocypha centripunctata Gambles, 1975	*Africocypha centripunctata* (Gambles, 1975)

Platycnemididae

Chlorocnemis and *Isomecocnemis* were separated from *Allocnemis* and placed in a separate family (Protoneuridae) only for the reduction of the anal vein, and distinguished from each other by the degree of that reduction. This character is not congruent with the genetic data. All species in Africa that combine R4 originating closer to subnode than IR3, Cux at origin of anal vein and often yellow-stained wings are considered congeneric.

Chlorocnemis abbotti (Calvert, 1892)	*Allocnemis abbotti* (Calvert, 1892)
Chlorocnemis contraria Schmidt, 1951	*Allocnemis contraria* (Schmidt, 1951)
Isomecocnemis cyanura (Förster, 1909)	*Allocnemis cyanura* (Förster, 1909)
Chlorocnemis eisentrauti Pinhey, 1974	*Allocnemis eisentrauti* (Pinhey, 1974)
Chlorocnemis elongata Hagen in Selys, 1863	*Allocnemis elongata* (Hagen in Selys, 1863)
Chlorocnemis flavipennis Selys, 1863	*Allocnemis flavipennis* (Selys, 1863)
Chlorocnemis interrupta Legrand, 1984	*Allocnemis interrupta* (Legrand, 1984)

Table S4 - Continued

Family / Former combination	Proposed new combination
Chlorocnemis maccleeryi Pinhey, 1969	*Allocnemis maccleeryi* (Pinhey, 1969)
Chlorocnemis marshalli Ris, 1921	*Allocnemis marshalli* (Ris, 1921)
Chlorocnemis montana St. Quentin, 1942	*Allocnemis montana* (St. Quentin, 1942)
Chlorocnemis nigripes Selys, 1886	*Allocnemis nigripes* (Selys, 1886)
Chlorocnemis pauli Longfield, 1936	*Allocnemis pauli* (Longfield, 1936)
Isomecocnemis subnodalis (Selys, 1886)	*Allocnemis subnodalis* (Selys, 1886)
Chlorocnemis superba Schmidt, 1951	*Allocnemis superba* (Schmidt, 1951)
Chlorocnemis wittei Fraser, 1955	*Allocnemis wittei* (Fraser, 1955)

All continental African species placed formerly in *Platycnemis* have features typical of the tribe Coperini (caudal lamellae of larvae with frilled borders, male cerci with tooth- or branchlike inner process; male tibiae not white). They share with Asian *Copera* – type species *C. marginipes* (Rambur, 1842) – a genital ligula that is unique in the subfamily by its rounded apex without branches.

Platycnemis congolensis Martin, 1908	*Copera congolensis* (Martin, 1908)
Platycnemis guttifera Fraser, 1950	*Copera guttifera* (Fraser, 1950)
Platycnemis nyansana Förster, 1916	*Copera nyansana* (Förster, 1916)
Platycnemis rufipes (Selys, 1886)	*Copera rufipes* (Selys, 1886)
Platycnemis sikassoensis (Martin, 1912)	*Copera sikassoensis* (Martin, 1912)

The slightly less reduced anal vein is not reliable to separate *Elattoneura* from *Prodasineura*. All African species placed in *Prodasineura* are closer to the type species *Elattoneura glauca* (Selys, 1860) than to true *Prodasineura* by coloration (e.g. never blue, often pruinose), venation (anal vein never completely lost) and rather vertical distal border of the paraproct.

Prodasineura flavifacies Pinhey, 1981	*Elattoneura flavifacies* (Pinhey, 1981)
Prodasineura incerta Pinhey, 1962	*Elattoneura incerta* (Pinhey, 1962)
Prodasineura odzalae (Aguesse, 1966)	*Elattoneura odzalae* (Aguesse, 1966)
Prodasineura perisi Compte Sart, 1964	*Elattoneura perisi* (Compte Sart, 1964)
Prodasineura villiersi Fraser, 1948	*Elattoneura villiersi* (Fraser, 1948)
Prodasineura vittata (Selys, 1886)	*Elattoneura vittata* (Selys, 1886)

The morphologically well-defined subgenera *Igneocnemis* and *Risiocnemis* were never recovered as sister-groups. All species listed below possess the characters of *Igneocnemis*: arculus at Ax2, wing tips only smoothly crenulated, pedicel of antenna subequal to scape, male postclypeus distinctly angulate, and female pronotal hindlobe not divided into three lobes (Gassmann & Hämäläinen, 2002).

Risiocnemis antoniae Gassmann & Hämäläinen, 2002	*Igneocnemis antoniae* (Gassmann & Hämäläinen, 2002)
Risiocnemis atripes (Needham & Gyger, 1941)	*Igneocnemis atripes* (Needham & Gyger, 1941)
Risiocnemis atropurpurea (Brauer, 1868)	*Igneocnemis atropurpurea* (Brauer, 1868)
Risiocnemis calceata Hämäläinen, 1991	*Igneocnemis calceata* (Hämäläinen, 1991)
Risiocnemis flammea (Selys, 1882)	*Igneocnemis flammea* (Selys, 1882)
Risiocnemis fuligifrons Hämäläinen, 1991	*Igneocnemis fuligifrons* (Hämäläinen, 1991)

Table S4 - Continued

Family / Former combination	Proposed new combination
Risiocnemis haematopus (Selys, 1882)	*Igneocnemis haematopus* (Selys, 1882)
Risiocnemis ignea (Brauer, 1868)	*Igneocnemis ignea* (Brauer, 1868)
Risiocnemis incisa Kimmins, 1936	*Igneocnemis incisa* (Kimmins, 1936)
Risiocnemis kaiseri Gassmann & Hämäläinen, 2002	*Igneocnemis kaiseri* (Gassmann & Hämäläinen, 2002)
Risiocnemis melanops Hämäläinen, 1991	*Igneocnemis melanops* (Hämäläinen, 1991)
Risiocnemis nigra Gassmann & Hämäläinen, 2002	*Igneocnemis nigra* (Gassmann & Hämäläinen, 2002)
Risiocnemis odobeni Hämäläinen, 1991	*Igneocnemis odobeni* (Hämäläinen, 1991)
Risiocnemis pistor Gassmann & Hämäläinen, 2002	*Igneocnemis pistor* (Gassmann & Hämäläinen, 2002)
Risiocnemis plebeja Hämäläinen, 1991	*Igneocnemis plebeja* (Hämäläinen, 1991)
Risiocnemis polilloensis Hämäläinen, 1991	*Igneocnemis polilloensis* (Hämäläinen, 1991)
Risiocnemis rubricercus Gassmann & Hämäläinen, 2002	*Igneocnemis rubricercus* (Gassmann & Hämäläinen, 2002)
Risiocnemis rubripes (Needham & Gyger, 1939)	*Igneocnemis rubripes* (Needham & Gyger, 1939)
Risiocnemis siniae Hämäläinen, 1991	*Igneocnemis siniae* (Hämäläinen, 1991)
Risiocnemis tendipes (Needham & Gyger, 1941)	*Igneocnemis tendipes* (Needham & Gyger, 1941)

M. secundaris is known only from the holotype from Madagascar. It is closer to *Paracnemis*, most notably by markings and distribution, than to the South African generotype *M. valida* (Hagen in Selys, 1863).

Metacnemis secundaris Aguesse, 1968	*Paracnemis secundaris* (Aguesse, 1968)

All Malagasy and Comoro species placed formerly in *Platycnemis* have features typical of the tribe Coperini (caudal lamellae of larvae with frilled borders, male cerci with tooth- or branchlike inner process; male tibiae often not white) and a genital ligula with a pair of lobe-like apical branches, creating a marked apical notch between them, and a more basal pair of slender lateral branches. The latter pair is unique in the subfamily, but reduced in *P. sanguinipes*. *P. hova* (Martin, 1908) is the type species of *Proplatycnemis* Kennedy, 1920. *P. pembipes* from Pemba also belongs here (Dijkstra et al., 2007).

Platycnemis agrioides Ris, 1915	*Proplatycnemis agrioides* (Ris, 1915)
Platycnemis alatipes (McLachlan, 1872)	*Proplatycnemis alatipes* (McLachlan, 1872)
Platycnemis aurantipes Lieftinck, 1965	*Proplatycnemis aurantipes* (Lieftinck, 1965)
Platycnemis hova Martin, 1908	*Proplatycnemis hova* (Martin, 1908)
Platycnemis longiventris Schmidt, 1951	*Proplatycnemis longiventris* (Schmidt, 1951)
Platycnemis malgassica Schmidt, 1951	*Proplatycnemis malgassica* (Schmidt, 1951)
Platycnemis melana Aguesse, 1968	*Proplatycnemis melana* (Aguesse, 1968)
Platycnemis pembipes Dijkstra et al., 2007	*Proplatycnemis pembipes* (Dijkstra et al., 2007)
Platycnemis protostictoides Fraser, 1953	*Proplatycnemis protostictoides* (Fraser, 1953)
Platycnemis pseudalatipes Schmidt, 1951	*Proplatycnemis pseudalatipes* (Schmidt, 1951)
Platycnemis sanguinipes Schmidt, 1951	*Proplatycnemis sanguinipes* (Schmidt, 1951)

Table S4 - Continued

Family / Former combination	Proposed new combination
All black-and-white species placed formerly in *Copera* have features typical of the tribe Platycnemidini (caudal lamellae of larvae with smooth borders, male cerci without tooth- or branchlike process; male tibiae always white) and a genital ligula with short and lobe-like apical branches. The name *Pseudocopera* Fraser, 1922 is available for these 'false' *Copera* (type species *P. arachnoides* Fraser, 1922 is a synonym of *C. ciliata*). *C. superplatypes* is tentatively placed here due to similarities with *P. ciliata*, but its penis is unknown and it may belong to *Platycnemis*.	
Copera annulata (Selys, 1863)	*Pseudocopera annulata* (Selys, 1863)
Copera ciliata (Selys, 1863)	*Pseudocopera ciliata* (Selys, 1863)
Copera superplatypes Fraser, 1927	*Pseudocopera superplatypes* (Fraser, 1927)
Copera tokyoensis Asahina, 1948	*Pseudocopera tokyoensis* (Asahina, 1948)