

A review of the taxonomy of African Odonata - finding ways to better identification and biogeographic insight

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The taxonomy of the approximately 850 species of sub-Saharan African Odonata is relatively well-known, probably due to the impoverished nature of the fauna as compared to that of other tropical regions. The need for revisions, study of higher classification, comprehension of (often clinal, environmentally induced) variability and knowledge of larvae, phylogeny and biogeography are stressed. Taxonomic priorities are discussed for each family. Supportive activities include the production of identification manuals for a broader public, the accumulation of supplementary material and the conservation of existing collections. A list of genera with estimated numbers of species, taxonomic status and references is provided, as well as a list of important regional works.

INTRODUCTION

Although not as well studied as the Holarctic and Australasian Region's faunas, knowledge of the taxonomy of African Odonata is well ahead of those of the Oriental and Neotropic Regions. The main reason is that the African fauna is relatively impoverished, harbouring only about 60% of the number of species found in each of the two other tropical regions. The writer here defines the African fauna as that occurring south of the Sahara, with the inclusion of the Indian Ocean islands (Comoros, Madagascar, Mascarenes and Seychelles). It numbers around 850 species, placed in 125 genera. The former figure is about 15% of the World total. Around 95% of species are not found beyond the region. Despite the fact that the African Odonata are relatively well-known, numerous taxonomic issues remain uncertain, or at least unsettlingly hazy. Elucidating the relationships between species, and finding ways to distinguish them, is perhaps the primary challenge of African odonatology. This knowledge is required as a fundament for future research, particularly for the almost untouched field of African odonate

biogeography. The first priority for the taxonomy of African Odonata is, therefore, revisions.

REVISIONS & REVIEWS

It is hardly an exaggeration to say that all genera require at least some study. Elliot Pinhey tackled many problems, as can be seen from the numerous referrals to his work in the Appendix. Due to their size, large genera generally have the greatest problems. *Pseudagrion* is by far the largest genus with almost a hundred species. *Phyllomacromia* and *Tribemis* both number around forty species, *Chlorocypha*, *Paragomphus* and *Orthetrum* nearly thirty, and *Ceragrion*, *Platycnemis*, *Gynacantha*, *Notogomphus* and *Phyllogomphus* about twenty. Other larger genera are *Lestes*, *Nesolestes*, *Agriocnemis*, *Elatoneura* and *Zygonyx*. Subtraction of the well-studied genera from the largest genera creates an idea of revision priority (*vide* Appendix). Besides full-scale revisions, many smaller issues of suspected synonyms, nomenclature, mix-ups, identification problems and species limits require attention. Some of the larger genera that appear fairly well sorted could be reviewed to straighten out the identification of the

species. The problems are reviewed for each family below.

HIGHER CLASSIFICATION

Next to taxonomic work with a species-group (most often genus) approach, there are numerous problems in higher classification that require to be addressed. These are often relative to the fauna of the Oriental Region, with which the African fauna has most in common. It is a lucky coincidence that when Elliot Pinhey's 'trailblazer' Frederic Fraser began studying the African fauna intensively in the 1940s, he had about twenty years of experience of the oriental fauna. Many of the higher level problems are worldwide issues, and the knowledge of the African fauna shall profit from research in this field. The phylogeny of the Odonata is still much debated (e.g. Bechly 1995; Lohmann 1996; Trueman 1996). Especially the use of molecular techniques, which are used increasingly to study Odonata, holds the promise of new phylogenetic insights.

THE PROBLEM OF VARIABILITY

One of the greatest practical problems in African Odonata taxonomy is that of variability, particularly in size and melanisation (intensity of black pigmentation). Much of this variation is related to environmental conditions. The African Continent forms a vast, rather continuous landmass, and many of the species are wide-ranging. Numerous gradients in humidity and temperature lie across the continent, with the seasons adding another dimension of environmental variation. Specimens have been collected only fragmentarily along these clines in space and time, which may result in the false perception of discreteness in forms. The status of countless subspecies, as well as species, may be re-assessed with these recurrent variation trends in mind. Particularly sensitive to this problem are genera in which structural characters are of little taxonomic value (*Chlorocypha*) and groups that are difficult to collect (Gomphidae). In cases where discrete forms exist, one must ask why these are not worthy of species status, and if they are forms, what the ecological or behavioural

backgrounds of them might be. Examples are the forms of *Palpopleura lucia* (Drury, 1773) (e.g. O'Neill & Paulson 2001) and *Eleuthemis buettikoferi* Ris, 1910 (Lempert 1988) and the subspecies of *Atoc-neura biordinata* (Karsch, 1899) (Longfield 1953).

LARVAE

Most of what has been published on African Odonata (and most of what is written in this review) is about adults, but perhaps the greatest taxonomic frontier lies in the field of the larval stages. Although their study has (logically) lapsed behind, the larvae or exuviae of many genera have been described. Numerous genera and species are still awaiting such descriptions. The study of larvae shall offer a whole new set of characters for phylogenetic study. Many species are much easier to collect as larva than as adult (e.g. corduliids and gomphids) and, therefore, larvae also hold promise for biogeographic and ecological research. The rearing of larvae to adults must be especially stimulated, as it is the most reliable means to establish their specific identity.

PHYLOGENY & BIOGEOGRAPHY

Taxonomic research can be taken beyond the level of nomenclature and identification. With the aid of phylogenetic analysis and molecular techniques, hypotheses of the evolutionary history of African Odonata may be created. Combined with distribution data, this may serve to understand more about the climatology and geography of Africa and the origins and dispersive capacity of its dragonflies. Odonata have a number of biological advantages in this regard. Their strong relation with freshwater and different types of vegetation (particularly the forest-savanna contrast) make dragonflies sensitive to the environmental vicissitudes which characterise the continent's history. The species range from extremely good to very poor dispersers, which offer insight in different degrees of vicariance and dispersal. The Odonata are also a relatively ancient group, giving it a deep grasp in time. It of course remains to be seen (from the biogeographic and phylogenetic analyses advocated) if the present-day representatives are descendants of such ancient faunas. This combination of advantages

is distinct from that of other well-studied groups, such as vertebrates, butterflies and plants. Therefore, what may be learnt from Odonata about African biogeography may be not only of affirmative, but even of supplementary value.

REVIEWS OF THE FAMILIES

The Appendix lists genera of African Odonata. For each genus the number of species, and the need for revision and biogeographic valuation, are estimated. An attempt is also made to provide the most recent, comprehensive or relevant references, i.e. those treating all species known (at the time of writing), a large proportion thereof, or that provide a good overall impression of the genus. In the following paragraphs the taxonomic status of each family is briefly outlined. These reviews are not exhaustive, but do stipulate the most urgent cases.

AMPHIPTERYGIDAE & CALOPTERYGIDAE

Due to the small numbers of species in these families and their conspicuous nature, they are well-known. The generic distinction between *Sapho* and *Umma* requires some attention, especially in relation to the species *puella* Sjöstedt, 1917, that is variably placed in either genus (G.S. Vick pers. comm.).

CHLOROCYPHIDAE

This family was treated in its totality by Pinhey (1967a). Nevertheless, the taxonomy is still unsound as a result of the lack of structural characters in this group (Figure 1). As a result, the morphological basis of the genera is rather slim. Problems are greatest in the red-bodied *Chlorocypha* species, particularly the *dispar*- and *rubida*-groups. These range throughout Africa's equatorial forests and demonstrate strong variation in markings (related to age and environment), which is at the same time the sole foundation of the many species and subspecies that are currently recognised. A possible source of new characters, though not easily quantified, are the agonistic and courtship displays of males (e.g. Robertson 1982).

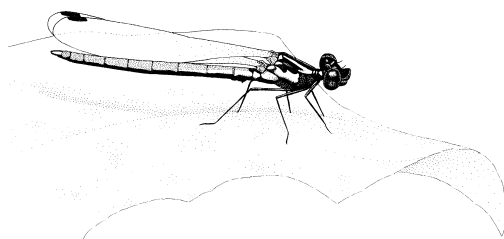


Figure 1. Male of *Chlorocypha tenuis* Longfield. “It has been realized for many years that some of the confusion is due to maturation changes in colour and markings” writes Pinhey (1967a) in his revision of the African Chlorocyphidae. This variability still cripples the taxonomy of the group, which is poor in morphological characters, today.

LESTIDAE, PERILESTIDAE & SYNLESTIDAE

These families are small and taxonomically well-known. *Lestes* has been split into several (sub-) genera, six of which are recognised in Africa (Pinhey 1980b). The value of these can only be assessed after a complete phylogenetic treatment of this cosmopolitan group. Most of the African synlestids have limited ranges and knowledge of their phylogeny would yield insight into the biogeography of the Cape Region.

MEGAPODAGRIONIDAE

Coryphagrion grandis exhibits a strong ecological and morphological resemblance to the neotropical giant damselflies (Pseudostigmatidae). Thorough investigations should reveal whether these are mere analogies, or if the two are actually related (Clausnitzer & Lindeboom 2002). In the latter case it would provide a neotropical link at the ‘wrong’ side of Africa. The other genera seem more typically megapodagrionid, and their geographically isolated positions warrant biogeographic investigation relative to neotropical, oriental and australasian genera. The limits between *Allolestes*, *Nesolestes* and *Neurolestes* may require re-evaluation. Reviews of the three Malagasy genera also seem timely.

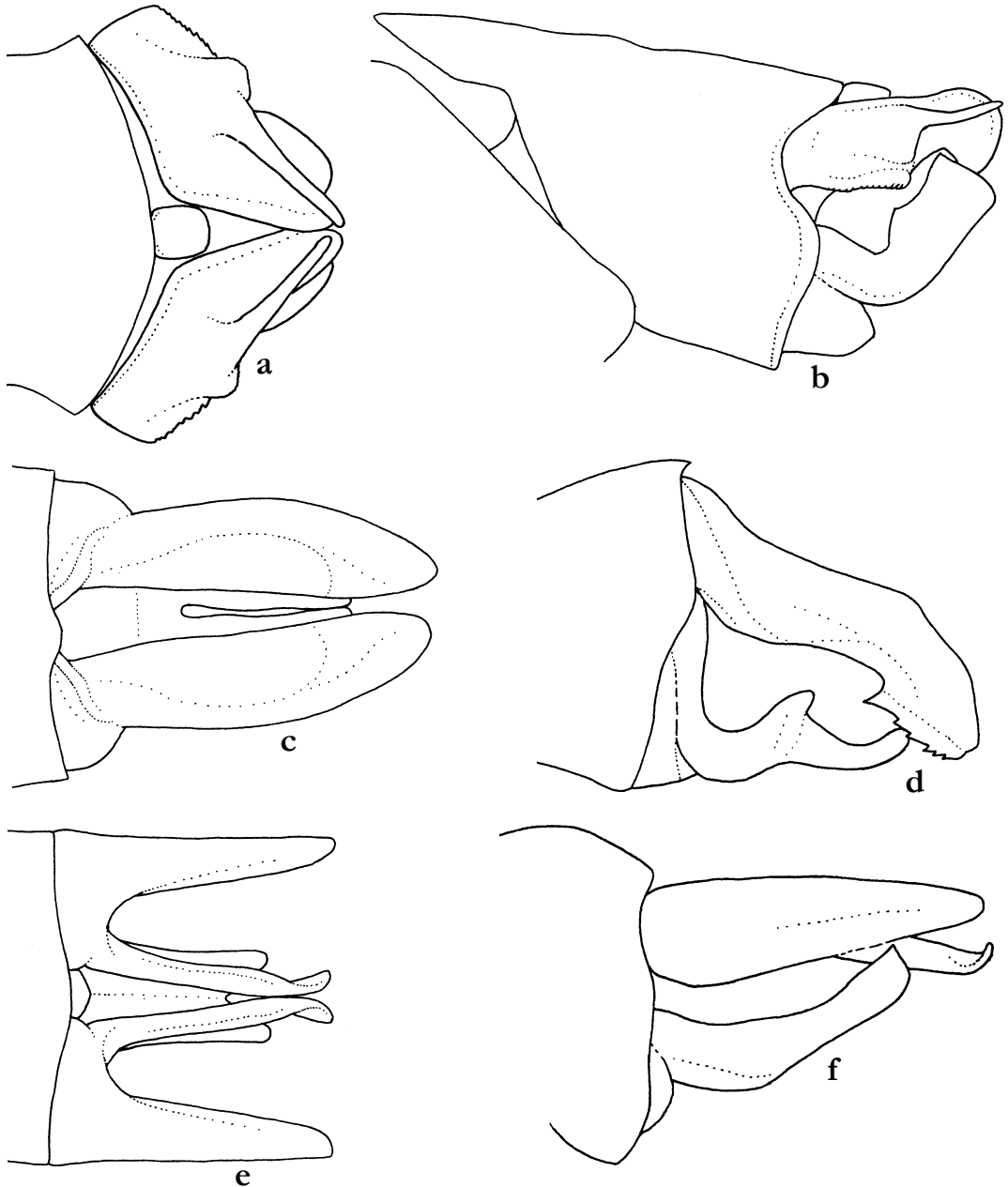


Figure 2. Male appendages of African Gomphidae. **a**, *Ceratogomphus pictus* Hagen (dorsal aspect); **b**, *Ceratogomphus pictus* Hagen (lateral aspect); **c**, *Crenigomphus renei* Fraser (dorsal aspect); **d**, *Crenigomphus renei* Fraser (lateral aspect); **e**, *Microgomphus camerunensis* Longfield (dorsal aspect); **f**, *Microgomphus camerunensis* Longfield (lateral aspect). “The main emphasis is on the Gomphidae since their appendages are far more diverse than other anisopterous families” writes Pinhey (1969c) in what is still the most thorough investigation of odonate tandem linkage. Despite the morphological richness, no family requires more taxonomic attention than this one.

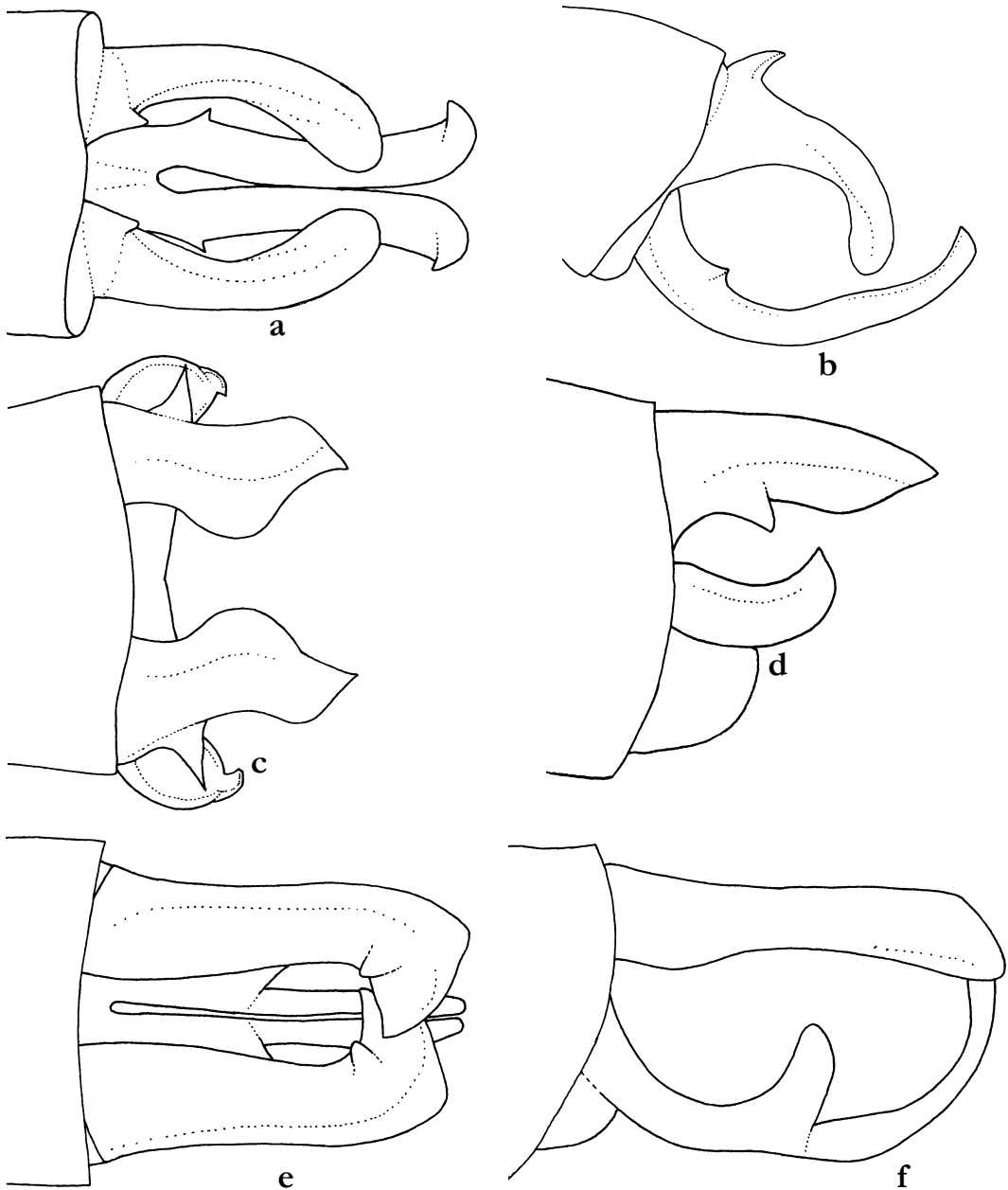


Figure 3. Male appendages of African Gomphidae. **a**, *Nepogomphoides stuhlmanni* (Karsch) (dorsal aspect); **b**, *Nepogomphoides stuhlmanni* (Karsch) (lateral aspect); **c**, *Notogomphus lecythus* Campion (dorsal aspect); **d**, *Notogomphus lecythus* Campion (lateral aspect); **e**, *Onychogomphus styx* Pinhey (dorsal aspect); **f**, *Onychogomphus styx* Pinhey (lateral aspect). “The main emphasis is on the Gomphidae since their appendages are far more diverse than other anisopterous families” writes Pinhey (1969c) in what is still the most thorough investigation of odonate tandem linkage. Despite the morphological richness, no family requires more taxonomic attention than this one.

COENAGRIONIDAE

This is a large and problematic family. The status of a host of small or monotypic genera require study. Two species assigned to the oriental genus *Argiocnemis*, one from Cameroon and the one from the Indian Ocean island Rodriguez, are only known from the holotypes (Pinhey 1966b, 1970b). The anomalous *Argiagrion leoninum* is known only from the type female from Sierra Leone. Perhaps this specimen represents a mislabelled specimen from another fauna? Two West African *Pseudagrion* species were described by Pinhey (1973) in the same paper, but neither fits the genus: Relegation was indirectly proposed in the description of *Aciagrion walteri* Carfi & D'Andrea, 1994, an apparent synonym of *Pseudagrion cyathiforme* Pinhey, 1973. Gambles regarded *P. malagasoides* Pinhey, 1973 to represent a species of *Teinobasis* (G.S. Vick pers. comm.). *Teinobasis* is otherwise restricted to the eastern Oriental Region and the Pacific, save a complex of taxa described from Kenya, Madagascar, Malawi and the Seychelles, setting an interesting biogeographic scenario (V. Clausnitzer pers. comm.). What is the relationship of *Mortonagrion stygium* (Fraser, 1954) only African representative of an otherwise purely oriental genus to the varied complex of African *Argiocnemis* species? Finally, the Madagascar endemic *Millotagrion* exhibits similarities to *Aciagrion* not known from that island. The larger coenagrionid genera all require reviews. This is especially required for *Ceriagrion*. Numerous new species of *Pseudagrion*, described since Pinhey (1964a), make a re-evaluation valuable. Smaller taxonomic problems remain in this genus, particularly in the very variable group B (e.g. Dumont 1978). Research has shown that the African *Enallagma* break up into at least four genera, all unrelated to true *Enallagma* (May 1999).

PLATYCNEMIDIDAE

The taxonomic disarray of *Platycnemis* is almost legendary, authors having echoed each other's appeals for revision. The genus has an Equatorial African and a Malagasy radiation, numbering eight and 11 species respectively. The taxonomy of the

Equatorial African group is especially troublesome, and revision shall probably lead to a reduction in the number of recognised species. The entire family would benefit from a phylogenetic study. In the platycnemidines, this would elucidate the relations of the two African radiations with that in the paleartic and with the oriental genus *Copera* Kirby, 1890. In the calicnemiines, the position of *Mesocnemis* and *Metacnemis*, and the origins of the many small, highly localised genera (relicts?) may be revealed. The first two are sometimes likened to the New World coenagrionid genus *Argia* Rambur, 1842 (e.g. Ris 1921).

PROTONEURIDAE

The genus *Elattonneura* is well-represented in the literature (e.g. Kimmins 1938; Legrand 1980, 1985; Lindley 1976), and an overview of it in its entirety would be valuable. *Prodasineura* numbers far less species, but has been treated only fragmentarily. Pinhey (1962b, 1981a) questions the validity of *Prodasineura* as separate from *Elattonneura*, but answering this also requires consideration of the oriental representatives of both. Similarly, *Chlorocnemis* is well-covered (Pinhey 1969a; Schmidt 1951c), but should be reviewed relative to the smaller, poorly known and closely related genus *Isomecognemis*. Cowley (1936) and Schmidt (1951c) regarded *Chlorocnemis* and *Isomecognemis* not as protoneurids, but as platycnemidids. These two genera have much in common with the platycnemidid *Allocnemis*, and the three may form a monophyletic group.

AESHNIDAE

Despite the broad review by Fraser (1962), the necessity of revising African *Gynacantha* is stressed by Pinhey (1974b) and repeated here. This genus is common in collections, which makes the production of good keys, especially to females, urgent. Much scarcer in collections are members of *Heliaeschna*, for which reason their taxonomic status is even more desperate. The African members of *Aeshna* are also awaiting treatment (G. Peters pers. comm.).

GOMPHIDAE

This family is without doubt the most problematic, and all African genera are in need of revision. Exceptions are the monotypic genera, together with *Ceratogomphus*, *Crenigomphus* and *Ictinogomphus*. The relationship of the monotypic *Cinitogomphus* with *Ictinogomphus* and *Gomphidia* deserves attention (Liefstinck 1969; Pinhey 1970d). The most daunting perspective in African odonatology is perhaps the taxonomic state of *Paragomphus*. Numerous species have been described, some only from females, while more stand in collections awaiting treatment. The status of the other genera is similarly bad, but they have fewer species. Gomphids are notoriously difficult to collect, and available material is often in a deplorable condition (e.g. teneral individuals). Although Fraser's (1960b) revision of *Crenigomphus* still appears to suffice, Fraser's (1957) treatment of *Phyllogomphus* is now completely outdated. The genus *Onychogomphus* ranges widely in the Old World and has partly been relegated to other genera. In that respect the remark of Carle (1986) that African representatives "... are very likely *Cornigomphus*" is of importance. For a systematist taking on the problems of gomphid taxonomy, the works of Corbet (1977), Fraser (1949a) and Pinhey (1969c) may offer inspiration (Figure 2 & 3).

CORDULIIDAE

The status of *Phyllomacromia* as an endemic genus distinct from *Macromia* was clarified by May (1997). Recent descriptions of numerous, often quite similar species illustrates the need of revision, despite progress outlined by Gambles (1979). Unravelling the phylogenetic position of the isolated genera *Libellulosoma*, *Nesocordulia*, *Syncordulia*, *Idomacromia* and *Neophya* is of particular biogeographic interest (M. May pers. comm.).

LIBELLULIDAE

This family numbers more species and genera than any other in Africa (Figure 4). The problems in it are similar to those in the second-largest family, Coenagrionidae. Firstly, the true value of many

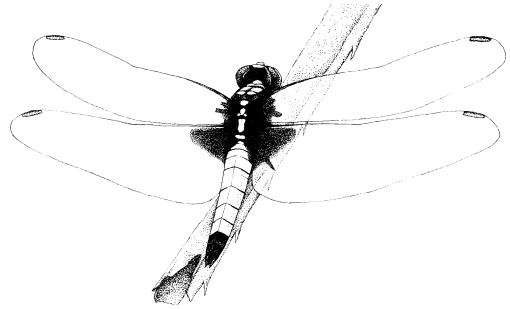


Figure 4. Male of *Cyanothemis simpsoni* Ris. "This is one of the most remarkable Libellulinae seen by me" according to Ris (1915). As monographer of the libellulids, Ris was the best judge. After discussing its unique venation he continues: "The colour-system is, perhaps, still more extraordinary: a very common pattern, sky-blue and black, is obtained, not as in all other known cases by pruinosity, but by pigmentation." The genus is monotypic, endemic to Africa and unmistakable. Unfortunately such cases of taxonomic clarity are rare.

(small) genera must be established. Genera such as *Anectothemis*, *Congothemis*, *Lokia* and *Porpacithemis* have been mentioned as links between other genera and (the weakly defined) subfamilies. The discussion of Pinhey (1966c) on *Aethiothemis*, *Orthetrum* and *Oxythemis* is an example. The lack of clarity has in part been created by an overemphasis of wing venation characters and an underappreciation of their variability by previous authors. The Tetrathemistinae are particularly diverse in Africa, with numerous small genera inhabiting forests. The subfamily is probably an ancient one, and study of the phylogeny appears a promising perspective for biogeography, but also for the clear demarcation of the genera (G.S. Vick pers. comm.). Secondly, many of the larger genera require revisions or reviews.

SUPPORTIVE ACTIVITIES

Besides pure systematic research, the following action is required to support and advocate the research on African Odonata.

Table 1. Regional reviews. Abbreviations: **Sub** = suborders covered (**Z** = Zygoptera; **A** = Anisoptera), **keys** = keys provided (**G** = to genera; **S** = to species).

Reference	Country or region	Sub	Keys
Pinhey 1962a	Africa	ZA	G
Pinhey 1961a	Africa, eastern	ZA	GS
Pinhey 1951	Africa, southern	ZA	GS
Brooks & Jackson 2001	Bioko	ZA	
Pinhey 1976	Botswana	ZA	GS
Vick 2000	Cameroon, southwest	ZA	
Pinhey 1966c	DR Congo, northeast	ZA	GS
Consiglio 1978	Ethiopia	Z	
Pinhey 1982	Ethiopia	A	
Gambles <i>et al.</i> 1998	The Gambia	ZA	
O'Neill & Paulson 2001	Ghana	ZA	
Lempert 1998	Liberia	ZA	
Schmidt 1951a	Madagascar	Z	GS
Fraser 1956	Madagascar	A	GS
Lieftinck 1965	Madagascar	ZA	
Pinhey 1966a	Malawi	ZA	GS
Barlow 1996	Malawi	ZA	
Pinhey 1981b	Mozambique	ZA	
Martens <i>et al.</i> 2002	Namibia	ZA	
D'Andrea & Carfi 1994	Sierra Leone	ZA	
Carfi 1974	Somalia	ZA	
Pinhey 1984b	South Africa	Z	
Pinhey 1985	South Africa	A	
Pinhey 1984a	Zambia	ZA	S
Pinhey 1967b	Zambia, northeast	Z	GS
Lieftinck 1969	Zambia, northeast	A	
Pinhey 1984a	Zimbabwe	ZA	S

REGIONAL REVIEWS & IDENTIFICATION MANUALS

For individuals to research (all aspects of) African Odonata they need means to identify species, as well as knowledge of regional faunas. Table 1 lists such sources, in which the paramount importance of Pinhey's work is again notable. Transferring taxonomic knowledge to a broader public in the form of keys and field guides has a high priority. Such initiatives are underway for the adult Odonata of East Africa (Viola Clausnitzer & Klaas-Douwe Dijkstra), Cameroon (Graham Vick), Namibia

(Andreas Martens) and South Africa (Michael Samways). A key to larvae of all African genera would be another major step forward in African odonatology. Larval keys are in preparation for Cameroon (David Chelmick), Mascarenes (Andreas Martens & Ole Müller) and southern Africa (Michael Samways).

EXPEDITIONS & COLLECTIONS

Study of the taxonomy, identification and biogeography of African Odonata is impossible without good material being available for study. Acquiring

and conserving it is, therefore, as important as systematic research itself. The most important collections of African Odonata are probably in museums in Berlin, Bulawayo, London, Paris and Tervuren. Only the fourth is presently in the hands of a specialised curator. Museums should be aided in the conservation, expansion and research of their collections. It is also necessary to create, expand and conserve collections in Africa itself, so the study of African Odonata can be taken from outside the continent, to within.

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Appendix List of genera of African Odonata. Classification follows Davies & Tobin (1984, 1985), except Gomphidae (Carle 1986). Abbreviations: **n** = number of valid species, in many cases a rough estimate; **e** = genus endemic (or near-endemic if between brackets) to a particular region (- = also found outside Africa; **A** = sub-Saharan Africa; **Ci** = Côte d'Ivoire; **Cm** = Cameroon Highlands; **Cp** = Cape Region; **Ec** = East Coast Forest from Kenya to Mozambique; **Md** = Madagascar and Comoros; **Ml** = Malawi; **Mr** = Mauritius; **Ms** = Mascarenes; **Sc** = Seychelles; **Sl** = Sierra Leone; **Tn** = Tanzania; **Wc** = forests of West and central Africa), **t** = taxonomic status (? = status of endemic genus or placement of species in non-endemic genus requires study; + = review of (parts of) genus required; ++ = revision of genus urgently required); **b** = interesting for study of African biogeography. The number of species discussed in each reference is given between brackets.

(Sub)family	Genus	n	e	t	b	Remark/ reference
Amphipterygidae: Rimanellinae	<i>Pentaplebia</i> Förster, 1909	2	Cm		+	Asahina 1956 (1); Parr 1977 (2)
Calopterygidae: Calopteryginae	<i>Phaon</i> Sélys, 1853 <i>Sapho</i> Sélys, 1853 <i>Umma</i> Kirby, 1890	2 5 11	A Wc (Wc)	? ? ?		Pinhey 1969b (10); Vick 1996 (+1)
Chlorocyphidae	<i>Africocypha</i> Pinhey, 1961 <i>Chlorocypha</i> Fraser, 1928 <i>Platycypha</i> Fraser, 1949	1 31 8	Cm A A	? + ?		Pinhey 1971c Pinhey 1967a (26) Pinhey 1967a (8)
Lestidae	<i>Lestes</i> Leach, 1815	14	-			Pinhey 1980b (14)
Perilestidae	<i>Nubiolestes</i> Fraser, 1945	1	Cm		+	Schmidt 1943
Synlestidae	<i>Chlorolestes</i> Sélys, 1862 <i>Ecchlorolestes</i> Barnard, 1973	7 2	(Cp) Cp			(extends to Ml) Pinhey 1951 (5) Pinhey 1951 (2)
Megapodagrionidae: Argiolestinae	<i>Allolestes</i> Sélys, 1868 <i>Amanipodagrion</i> Pinhey, 1962 <i>Nesolestes</i> Sélys, 1891 <i>Neurolestes</i> Sélys, 1882 <i>Protolestes</i> Förster, 1899	1 1 17 1 8	Sc Tn (Md) (Cm) Md	? + ? +	+	Blackman & Pinhey 1967 Pinhey 1962b (one species in Cm) Fraser 1955a (11) (Cm to Gabon) Fraser 1955b; Gambles 1970 Aguesse 1967 (7)
Megapodagrionidae: Coryphagrioninae	<i>Coryphagrion</i> Morton, 1924	1	Ec		+	Kimmins 1931; Fraser 1955b
Megapodagrionidae: Megapodagrioninae	<i>Tatocnemis</i> Kirby, 1889	10	Md	+	+	Fraser 1960a (7)
Coenagrionidae: Agriocnemidinae	<i>Agriocnemis</i> Sélys, 1869 <i>Argiocnemis</i> Sélys, 1877 <i>Coenagrionemis</i> Fraser, 1949 <i>Mortonagrion</i> Fraser, 1920	16 2 4 1	- - Ms -	? ?		Pinhey 1974a (16) Pinhey 1966b (1); 1970b (1) Pinhey 1974a
Coenagrionidae: Ischnurinae	<i>Aciagrion</i> Sélys, 1891 <i>Enallagma</i> Charpentier, 1840 <i>Ischnura</i> Charpentier, 1840 <i>Millotagrion</i> Fraser, 1953	14 21 5 1	- - - Md	+ + + ?		Pinhey 1972 (10) species to be relegated to endemic genera Fraser 1953b; Liefinck 1965
Coenagrionidae: Pseudagrioninae	<i>Argiagrion</i> Sélys, 1876 <i>Ceriagrion</i> Sélys, 1876 <i>Pseudagrion</i> Sélys, 1876 <i>Teinobasis</i> Kirby, 1890	1 22 96 3	Sl - - -	? + + +		Pinhey 1966b Pinhey 1963 (13) Pinhey 1964a (72) Schmidt 1951a (1); Pinhey 1966a (2)
Platycnemididae: Calicnemidinae	<i>Allocnemis</i> Sélys, 1863 <i>Leptocnemis</i> Sélys, 1886 <i>Mesocnemis</i> Karsch, 1891 <i>Metaenemis</i> Sélys, 1863 <i>Oreocnemis</i> Pinhey, 1971 <i>Paracnemis</i> Martin, 1902 <i>Stenocnemis</i> Sélys, 1886	2 1 4 3 1 1 1	(Cp) Sc A (Cp) Ml Md (Cm)		+	(one species in Katanga) Blackman & Pinhey 1967 Legrand 1982 (3); Lempert 1992 (+1) (one species in Md) Pinhey 1980a Pinhey 1971a Schmidt 1951a Schmidt 1951b

Appendix cont. (*vide* Figure legend for abbreviations)

(Sub)family	Genus	n	e	t	b	Remark/ reference
Platycnemididae: Platycnemidinae	<i>Platycnemis</i> Burmeister, 1839	19	-	++	+	Schmidt 1951a (7)
Protoneuridae	<i>Chlorocnemis</i> Sélys, 1863	12	A		+	Pinhey 1969a (10) Lindley 1976 (11); Legrand 1980 (3), 1985 (6)
	<i>Elaittoneura</i> Cowley, 1935	15	-	+		
	<i>Isomecocnemis</i> Cowley, 1936 <i>Prodasinoura</i> Cowley, 1934	3 6	(Wc) -	++ +		Pinhey 1981a
Aeshnidae: Aeshninae	<i>Aeshna</i> Fabricius, 1775 <i>Anaciaeschna</i> Sélys, 1878 <i>Anax</i> Leach, 1815 <i>Gynacantha</i> Rambur, 1842 <i>Heliaeschna</i> Sélys, 1882	9 1 11 20 9	- - - - -	++ ++ ++		includes <i>Hemianax</i> Fraser 1962 (20) Fraser 1939 (5)
Gomphidae: Austrogomphinae	<i>Lestinogomphus</i> Martin, 1911	5	A	++		Legrand & Lachaise 2002 (2)
Gomphidae: Epigomphinae	<i>Microgomphus</i> Sélys, 1857	7	-	+		includes <i>Africogomphus</i> , Pinhey 1961c
Gomphidae: Gomphinae	<i>Neurogomphus</i> Karsch, 1890	10	A	++		Pinhey 1967c (7)
	<i>Notogomphus</i> Hagen, 1857	19	A	++	+	
Gomphidae: Lindeniinae	<i>Cinitogomphus</i> Pinhey, 1964	1	A	?		Pinhey 1964b, 1970d
	<i>Diatatomma</i> Burmeister, 1839	7	Wc	++		
	<i>Gomphidia</i> Sélys, 1854	7	-	++		Kimmins 1958 (3)
	<i>Itinogomphus</i> Cowley, 1934	3	-			
Gomphidae: Onychogomphinae	<i>Cornigomphus</i> Martin, 1907	1	Wc	?		Fraser 1960b (6) (extends to Ml) Fraser 1952
	<i>Crenigomphus</i> Sélys, 1892	6	A			
	<i>Nepogomphoides</i> Fraser, 1952	1	(Tn)		+	Pinhey 1961b (3)
	<i>Onychogomphus</i> Sélys, 1854	12	-		++	
	<i>Paragomphus</i> Cowley, 1934	31	-	++		
	<i>Tragomphus</i> Sjöstedt, 1899	5	Wc	+		
Gomphidae: Phyllogomphinae	<i>Ceratogomphus</i> Sélys, 1854	2	(Cp)		+	(extends to Katanga) Fraser 1946 Cammaerts 1987 Fraser 1957 (9)
	<i>Isomma</i> Sélys, 1892	1	Md		+	
	<i>Malgassogomphus</i> Cammaerts, 1987	1	Md		+	
	<i>Phyllogomphus</i> Sélys, 1854	20	A	++	+	
Corduliidae: Corduliinae	<i>Libellulosoma</i> Martin, 1907	1	Md	?	+	Fraser 1949b (3)
	<i>Hemicordulia</i> Sélys, 1870	3	-			
Corduliidae: Gomphomacromiinae	<i>Nesocordulia</i> McLachlan, 1882	6	Md		+	Fraser 1956 (5); Legrand 1984b (+1) Barnard 1933 (2); Lieftinck 1961 (1)
	<i>Syncordulia</i> Sélys, 1882	2	Cp		+	
Corduliidae: Idomacromiinae	<i>Idomacromia</i> Karsch, 1896	2	Wc		+	Legrand 1984a (2)
Corduliidae: Macromiinae	<i>Phyllomacromia</i> Sélys, 1878	41	A	++	+	Fraser 1954b (26); Gambles 1979 (12)
Corduliidae: Neophyinae	<i>Neophya</i> Sélys, 1881	1	Wc		+	
Libellulidae: Brachydiplacinae	<i>Anectothemis</i> Fraser, 1954	1	Wc	?		Fraser 1954a
	<i>Chalcostephia</i> Kirby, 1889	1	A			Fraser 1953a
	<i>Congothemis</i> Fraser, 1953	1	Wc	?		
	<i>Eleuthemis</i> Ris, 1910	2	(Wc)	+		Fraser 1958 (2) Pinhey 1966c (4)
	<i>Hemistigma</i> Kirby, 1889	2	A			
	<i>Porpacitbemis</i> Fraser, 1954	3	Wc	+		
	<i>Porpax</i> Karsch, 1896	4	A			
	<i>Thermochoria</i> Kirby, 1889	2	A			

Appendix cont. (*vide* Figure legend for abbreviations)

(Sub)family	Genus	n	e	t	b	Remark/ reference	
Libellulidae: Libellulinae	<i>Aethiothemis</i> Ris, 1908 <i>Hadrothemis</i> Karsch, 1891 <i>Lokia</i> Ris, 1919 <i>Nesciothemis</i> Longfield, 1955 <i>Orbetrum</i> Newman, 1833 <i>Oxythemis</i> Ris, 1909 <i>Thermorthemis</i> Kirby, 1889 <i>Viridithemis</i> Fraser, 1961	9 7 7 5 29 1 2 1	A A A A - (Wc) Md Md	++ + + + - - - ?			Fraser 1953a (5); Liefcinck 1969 (+2) Gambles 1966 (4); Pinhey 1971b (5) Pinhey 1970a (28), 1979 (+1)
Libellulidae: Palpopleurinae	<i>Palpopleura</i> Rambur, 1842	5	-				
Libellulidae: Sympetrinae	<i>Acisoma</i> Rambur, 1842 <i>Brachythemis</i> Brauer, 1868 <i>Bradynopyga</i> Kirby, 1893 <i>Crocothemis</i> Brauer, 1868 <i>Cyanothemis</i> Ris, 1915 <i>Diplacodes</i> Kirby, 1889 <i>Philonomon</i> Förster, 1906 <i>Sympetrum</i> Newman, 1833	2 4 2 6 1 5 1 4	- - - - Wc - A -				Lohmann 1980 (5) Ris 1915 Pinhey 1976 (5)
Libellulidae: Tetrathemistinae	<i>Allorhizucha</i> Karsch, 1890 <i>Archaeopblebia</i> Ris, 1909 <i>Calopblebia</i> Sélyss, 1896 <i>Eothemis</i> Ris, 1909 <i>Malgassopblebia</i> Fraser, 1956 <i>Mesumbethemis</i> Vick, 2000 <i>Micromacromia</i> Karsch, 1890 <i>Monardithemis</i> Longfield, 1947 <i>Neodythemis</i> Karsch, 1889 <i>Notiothemis</i> Ris, 1919 <i>Slenthemis</i> Fraser, 1951 <i>Tetrathemis</i> Brauer, 1868	3 1 2 1 6 1 3 1 8 2 1 10	(Wc) Md Md Wc (Wc) Cm A A A A Wc -	? ? + ? ? ? ? +	+ + + + + + + + + + + +		(two species in Md) Legrand 1986 (3), 2002 (+2) Vick (2000): with key to genera subfamily Longfield 1947 Fraser 1944 (2) Fraser 1951; Aguesse 1968 Fraser 44 (6); Legrand 77 (4)
Libellulidae: Trameinae	<i>Parazyxomma</i> Pinhey, 1961 <i>Pantala</i> Hagen, 1861 <i>Tholymis</i> Hagen, 1867 <i>Tramea</i> Hagen, 1861 <i>Rhyothemis</i> Hagen, 1867 <i>Zyxomma</i> Rambur, 1842	1 1 1 2 6 2	A - - - - -				
Libellulidae: Trithemistinae	<i>Atoconeura</i> Karsch, 1899 <i>Thalassothemis</i> Ris, 1912 <i>Trithemis</i> Brauer, 1868	2 1 37	A Mr -	+ +	+ +		Longfield 1953 (2) Pinhey 1955 Pinhey 1970c (35)
Libellulidae: Urothemistinae	<i>Aethriamanta</i> Kirby, 1889 <i>Macrodiplax</i> Brauer, 1868 <i>Selysiothemis</i> Ris, 1897 <i>Urothemis</i> Brauer, 1868	1 1 1 4	- - - -				
Libellulidae: Zygonychinae	<i>Oligogastra</i> Karsch, 1895 <i>Zygonychidium</i> Lindley, 1970 <i>Zygonyx</i> Hagen, 1867	4 1 17	A Ci -				Lindley 1970 Liefcinck 1963 (4); Pinhey 1964b (11)