ARNOLDIA

ZIMBABWE RHODESIA

SERIES OF MISCELLANEOUS PUBLICATIONS BY

THE NATIONAL MUSEUMS AND MONUMENTS

No. 36 Volume 8 20th November, 1979

THE STATUS OF A FEW WELL-KNOWN AFRICAN ANISOPTEROUS DRAGONFLIES (ODONATA)

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ABSTRACT

It is shown that *mauricianus* should be regarded as the Afrotropical subspecies of *Anax imperator* and *erythraea*, similarly, of *Crocothemis servilia*. Prophalline differences between *C. s. erythraea* and *C. sanguinolenta* are much more reliable than the superficial characters normally used to separate these taxa.

In reconsidering the relationship of *Orthetrum brachiale* to *kalai* it has been shown that these two can be specifically separated but, in considering the insular fauna, it is also found necessary to synonymize *kalai* to the Mauritian-described *stemmale:*

Orthetrum stemmale stemmale (Burmeister)

= *Orthetrum stemmale kalai* Longfield **syn. nov.**

The Seychelles subspecies *O. stemmale wrightii* remains a valid taxon.

INTRODUCTION

The taxa investigated include *Anax imperator* and *Crocothemis erythraea* and their African populations; the *Orthetrum brachiale* group; and a more realistic separation between *Crocothemis erythraea* and *C. sanguinolenta.*

Comparisons are made firstly between European, Egyptian and Afrotropical populations of *Anax imperator* to test the validity of *mauricianus* as a subspecies. Secondly, nearly all the Museum material of the *Orthetrum brachiale — stemmale* complex is re-examined, from continental Africa and insular material. Thirdly, the probability of *Crocothemis erythraea* being a subspecies of the *Oriental servilia* is examined. Further to this, the basis of separation of these from *C. sanguinolenta* is overhauled, with the additional feature of the prophallus as a more reliable means of distinction.

Accepted 18th July, 1979 ISSN 0066-7781
Arnoldia Rhod. **8** (36): 1-7.

1979

Anax imperator Leach

Anax imperator Leach, 1815, Entomology. 1. Neuroptera Linn. *In:* David Brewster's *Edinburgh Encyclopaedia* **9:** 137 (Europe)

Anax mauricianus Rambur, 1842. *In: Histoire Naturelle des Insectes. Névroptères:* 184 (Ile de France)

Rambur's *mauricianus*, described from Ile de France, i.e. Mauritius where it is still quite common (Pinhey, 1976), has frequently been regarded as the Afrotropical subspecies, but in other cases it has been considered the same as *imperator* or, at most a variation of it. Comparisons have recently been made from material in the National Museum, Bulawayo. Prof. D. Allen L. Davies kindly assisted with examples of European *imperator*.

There is, in fact, little difference in *mauricianus* and *imperator* but examination of European, Egyptian and African material from the Afrotropical region, including São Tomé, Madagascar and Mauritius has indicated that the separation of *mauricianus* as a race is nevertheless justified.

Ris (1921: 368) said that *imperator* of Europe differed in being more robust, with thicker abdomen; pterostigmata longer; superior appendage less excised on inner margin before apex.

Examination has shown that the abdomen in both sexes of European specimens is normally thicker, more robust than in those from Mauritius and Afrotropical Africa, but not so in the single ♀ available from Egypt. However, a ♂ from Egypt appears to agree with *imperator*. The pterostigma in forewing is normally longer in European *imperator* but there are exceptions and in some from the Afrotropical region it is just as long; in the ♂ from Egypt it is shorter, like average *mauricianus*. The apex of the ♂ superior appendage may be less incurved before apex or equally incurved in either *imperator* or *mauricianus*. In the Egyptian ♂ it is less incurved. Thus, the character of the superior appendage is not a valid distinction.

The presence or absence of black on the lower portion of the labrum was examined. In males this black could be broad or varying to absence in all the material, European and African. In females a broad black distal portion was present in all the few specimens available from the Palaearctic zone, 3 ♀ from Europe, 1 from Egypt. In all those from the Afrotropical zone the black was very reduced, sometimes absent. One more feature examined was the female cercus. It was found that in the female from Europe and Egypt the cercus was slightly more convex on ventral edge, but generally straighter in Afrotropical material. Insular examples from Madagascar, Mauritius and São Tomé island (Guinea Gulf) agreed in all these particulars with continental African material.

In conclusion, *imperator* tends to have a thicker abdomen in both sexes, but not in the single Egyptian female. The pterostigma, forewing, is usually longer in *imperator*, but with some exceptions (again including Egypt). Labrum of female with thicker, more prominent black band on lower half. Cerci are slightly more convex below.

Although these differences are not very great they are, in my opinion, sufficient to validate *mauricianus* as the **Afrotropical subspecies,** *Anax imperator mauricianus* Rambur.

The single examples of each sex from Egypt are insufficient for consideration as an intermediate status. It would be necessary to study material from many localities in palaearctic North Africa.

Orthetrum brachiale (Beauvois)

Libellula brachialis Beauvois, 1817, *Insectes recueillis en Afrique et en Amérique* (10) 171 (♂ ♀ Oware)

Orthetrum stemmale (Burmeister)

Libellula stemmalis Burmeister, 1839, *Handbuch Ent.* **2:** 857 (Ile de France)

Orthetrum stemmale kalai Longfield, 1936, *Trans. R. ent. Soc. Lond.* **85:** 487, 49 (Kalai island, Zambezi River)

In view of the great variation in the *brachiale* — *stemmale* group Pinhey (1970 288-293) placed the *stemmale* complex in synonymy to *brachialis*, because of th difficulty in separating both males and, particularly, females. Marshall & Gamble (1977: 181, 186) were convinced from examination of West African males tha *brachiale* and *kalai* (ex *stemmale kalai*) were distinct species. In normal *brachiale*, a these authors said, the inner hook is rounded and there is no ridge on the broadly depressed outer hamule. In *kalai* the inner hook is angled and the outer hamule i crossed by a distinct ridge. In some dried specimens shrinkage causes this evidently rather pliable outer hamule to buckle over at the ridge, or where the ridge would be Teneral specimens show the same differences as mature ones.

When my 1970 paper on *Orthetrum* was in preparation I examined a large range o specimens of the entire complex from many parts of continental Africa as well as insular material. It seemed that these differences were submerged in the overall picture However, both sexes of most of this material have now been re-examined, including the island fauna. Typical *brachiale* (fig. 1) has the inner hook not only more rounded but also smaller, less pointed. In the following male *brachiale*-material the ridge on the outer hamule is absent or only partially formed and in the latter instances it may be a question of uneven shrinking, which has slightly crinkled the depressed region.

These *brachiale* were from Natal, Moçambique, Zimbabwe Rhodesia, Botswana, Zambia, north Malawi, south Tanzania, Kenya and Turkana, Sudan, the Nigeria-Cameroun border, southern Ivory Coast and examples from the Guinea Gulf islands of São Tomé and Principe.

The male *kalai* material and variants were then separated and re-examined. Those with large, well-pointed inner hooks (fig. 2), angled on their ventral edge, were from southern and northern Moçambique, Zimbabwe Rhodesia, northern Zambia, Tanzania, Kenya coast, Sudan, north Zaire, Gabon, Republic of Central Africa, Congo Republic (Brazzaville), Cameroun, Nigeria-Cameroun border, northern Nigeria, Ghana and Ivory Coast. Most of them were mature, darkish or dark pruinose males, but with a few tenerals. Paler pruinose males were noted from northern and southern Moçambique, Zimbabwe Rhodesia and Tanzania.

There were exceptions in which the inner hook was fairly large and angular but the ridge on the outer hamule was poorly developed: northern Zambia (Samfya), north Malawi (Nkhata Bay), Congo Republic (Bangui and Kelle Forest) and Ivory Coast (Abidjan); and other exceptions with inner hook more rounded, outer hamule with ridge: Zimbabwe Rhodesia (Chipinga and Que Que), north Malawi (Vizara) and Congo Republic (Bobua de Bokanga). Also, islands in the Indian Ocean, Madagascar and Mauritius, generally showed similar conditions to *kalai* rather than to *brachiale*, in mature or immature males; these representing *stemmale*, mainly with "kalai" form appendages. Seychelles specimens represent the more distinctive subspecies *wrightii*, which are uniformly smaller specimens with distinctive facial markings.

The Mauritian specimens varied in size of specimens, in size and also in form of the hamules, but only to the extent recorded above for exceptions to *kalai*. Since over thirty male *stemmale* from different parts of this topotypical island were examined and none agreed with true *brachiale*, it seems quite possible that only *stemmale* now occurs there. Perhaps true *brachiale* never occurred in Mauritius but the variation seen in the populations may have confused the issue in the past.

These results seem to corroborate the Marshall-Gambles belief in the distinctness of *brachiale* and *kalai*. However, there seems to be no real difference between males of *kalai* and *stemmale stemmale*, across continental Afrotropical Africa, Madagascar and Mauritius. But *wrightii* remains a Seychelles subspecies of *stemmale* as formerly believed.

Confirmation would require differentiation of the females. Examination of these indicated separation of *brachiale* primarily on the terminal segments 7-10 of the abdomen (figs. 3, 4). Only inappreciable differences could be found in the vulvar aperture.

In ♀ *brachiale* (which included specimens taken in copula) these end segments were much paler than in all the *kalai-stemmale* material. Segment 7 in *brachiale* is black with a broad yellow central annulus which is sometimes severed dorsally and laterally by black carinae; segments 8-9 black with sub-lateral yellow streaks; 10 black with distal yellow or green saddle on dorsal surface or mainly yellow. The vulvar aperture has pronounced rounded lateral swellings, which often tend to be rather oblique.

In *kalai* segments 7-9 are all or mainly black at maturity, segment 10 again with distal yellow or green saddle or nearly all yellow. Segment 8 and 9 may sometimes have yellow lateral traces and in teneral *kalai* segment 7 is black with a yellow band at two-thirds, not centrally. Tenerals of Mauritian *stemmale* and Seychellian *wrightii* are almost as black as their mature females. In *kalai* the vulvar aperture has lateral ridges rather than swellings, more parallel to the median line. In *stemmale* from Mauritius the condition of the vulvar lip varies from lateral ridges to the absence of these, with only a thick ridge across the aperture itself. In *wrightii* there are lateral ridges as in *kalai*.

In concluding this assessment of the position it appears, from both sexes, that *brachiale* must be separated from *kalai*. Nevertheless, allowing for the evident variations in continental *kalai* and Mauritian *stemmale*, which have identical hamules, these two represent a single unit, with *kalai* as a synonym of *stemmale* and Seychelles *wrightii*, with distinctive markings, is restored as a race of *stemmale:*

Orthetrum stemmale stemmale (Burmeister)
= *Orthetrum stemmale kalai* Longfield **syn. nov.**
and *Orthetrum stemmale wrightii* Selys

Crocothemis servilia (Drury)

Libellula servilia Drury, 1770, *Illustr. Nat. History* **1:** 111, 113, pl. 47 fig. 6 (♂China)

Crocothemis erythraea (Brullé)

Libellula erythraea Brullé, 1832. *In: Expéd. scient. de Morée* **3**(1) Zool. (2) Anim. Artic.: 102 (♂ Moravia)

Crocothemis servilia, erythraea and sanguinolenta Ris, 1911, *Catalog Coll. Zool. Selys-Longchamps* (5)**13:** 533

Crocothemis servilia erythraea Fraser, 1936. Odonata vol. **3.** *In: Fauna British India:* 347

Fraser (1936) and others have at times believed *erythraea* to be a form or race of the Oriental *servilia* but in general, Fraser included, they have been kept separate, at least for African records. In more recent years the subspecific status has been revived by some authors. It now seems time to examine this status and also to distinguish these taxa from *sanguinolenta*, based on more definite characters than have hitherto been accepted:

Crocothemis sanguinolenta (Burmeister)

Libellula sanguinolenta Burmeister, 1839, *Handbuch Ent.* **2:** 859 (♂, Cape)

The differences between *servilia*, *erythraea* and *sanguinolenta* were outlined by Ris (1911, above). Ris separated *sanguinolenta* by a relatively narrower abdomen, its greatest width 2,5 — 3,0 mm; lateral denticles on abdomen robust, each side of segment 5 having 10-12 denticles; pterostigma up to 2,5 mm long, deep red in mature ♂, between black veins.

For *servilia* and *erythraea* Ris said the abdomen was relatively broader, its greatest width 3,5 — 4,5 mm; lateral denticles smaller, finer, more numerous, 20-22 on segment 5. Pterostigma 3,5 — 4 mm, yellow in mature ♂, between black veins.

These may be acceptable as average characters, but since there is considerable overall size variation the greatest width obviously varies. Usually, *erythraea* is larger, more robust then *sanguinolenta*, but this is frequently not the case. The denticles are normally more robust in *sanguinolenta* and vary in number beyond the 10-12, occasionally up to about 15; and in *servilia erythraea* they may be as few as 14 or 15. Pterostigma also varies in length more than Ris' figures and in *sanguinolenta* it is not always red but sometimes yellow at maturity, perhaps an ecological factor.

Of *servilia servilia* only 1 ♂ (from Shillong, Assam) is available in the National Museum, Bulawayo. Ris separated *erythraea* from this on relatively broader wings, abdomen scarlet, ♂ without dorsal black carinal markings on abdomen, but ♀ with black on segments 7-9. In *servilia*, the wings are narrower; abdomen red, ♂ with black carina at least on 8-9, often on other segments and more strongly in ♀.

In a long series of *erythraea* wings are quite often as narrow as in *servilia*. The "scarlet" or "red" abdomen seems to be of no significance, at least in preserved specimens; and in ♂ *erythraea* there is often a black carina on segments 8-9. Ris adds a ♀ character but without examples of this sex in *servilia* no comment can be made. He says the wing apex in ♀ *servilia* is generally broadly bordered with brown, which is not the case in ♀ *erythraea*.

Although the main taxon in Asia is *servilia*, *erythraea* is considered to occur in western Asia. Fraser (1936) distinguished *erythraea* from *servilia*, by saying the wings in *erythraea* lack the brown marginal suffusion of older males and all females of *servilia*; basal orange more extensive; abdomen without black dorsal carinae; bases of hamules more acute and prolonged and hamular hooks lack a minute subapical tooth. Examination of the long series of African *erythraea* in the National Museum, shows that the wings certainly do not develop the brown marginal suffusion, but both the basal orange on the wings and the presence or absence of black dorsal carinae on the abdomen is most variable. When the Oriental *servilia* ♂ was examined, segments 8-9 were found to have thick black dorsal carinae, but the hamules were in no way different from our *erythraea*.

One feature which appears to have been ignored in this genus is the male prophallus and, in fact, this shows a very clear difference between *erythraea* and *sanguinolenta*. In *erythraea* (fig. 5) the prophallus is short, uniformly thick, and often dark brown or black, with a very short terminal flagellum; in *sanguinolenta* (fig. 6) it is long and slender, rather expanded distally, pale brown, with a rounded terminal vesicle. In the Shillong ♂ *servilia* the prophallus is very similar to *erythraea*, indicating that these two are correctly conspecific.

This prophalline difference is a much more exact method of separating *sanguinolenta*. It appears that *erythraea* should be regarded as a subspecies of *servilia*, and not a synonym, chiefly because the latter develops the dark wing margins and the abdomen is more regularly marked with black on the dorsal carina:

Crocothemis servilia erythraea (Brullé) **stat. conf.**

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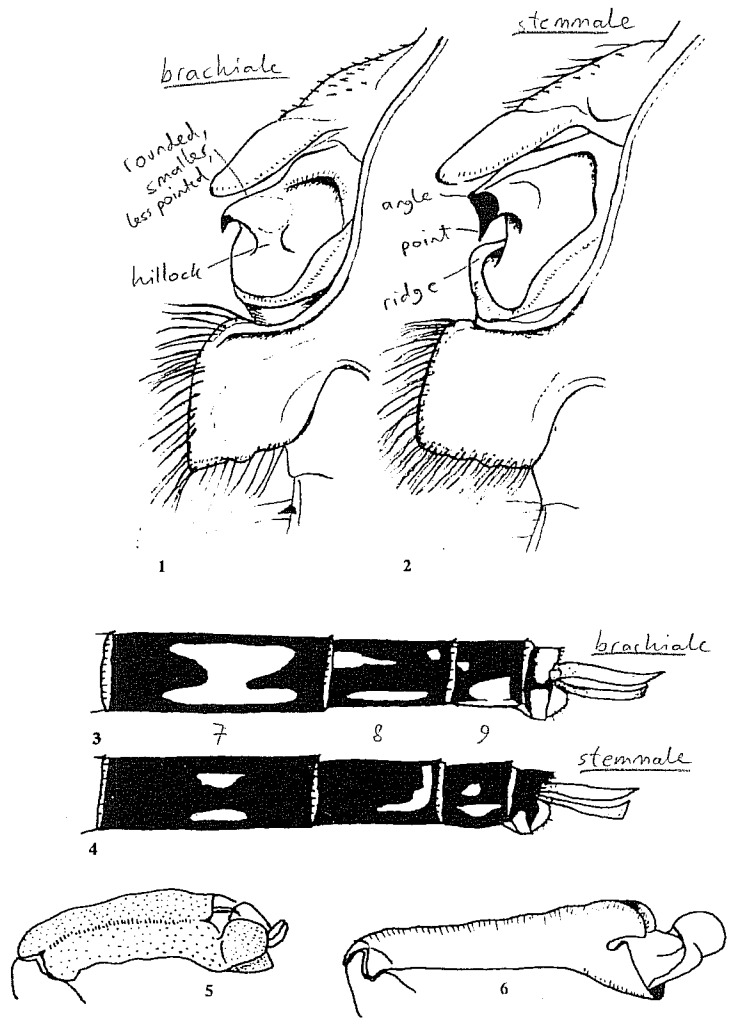

1-4. *Orthetrum*. 1-2 accessory genitalia of ♂ *brachiale* (Uncurri waterfall, Ethiopia), and of ♂ *stemmale* (= *kalai*) (Jimma, Ethiopia); 3-4. abdominal segments 7-10 of juvenile ♂ *brachiale* (Uncurri) and of ♂ *stemmale* (Samfya, Zambia)

5-6. *Crocothemis*, prophallus of ♂ *servilia erythraea* (Jimma) and of ♂ *sanguinolenta* (Matopos, Bulawayo), respectively.