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A NEW APPROACH TO
AFRICAN ORTHETRUM
(ODONATA)

BY

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INTRODUCTION

The genus *Orthetrum* Newman has, in Africa, always proved difficult, despite the important and extensive revision carried out by Longfield (1955). There have been a number of reviews of the species, generally accompanied by keys, particularly those by Ris (1909, 1921), Schmidt (1951), Pinhey (1951, 1961 b, 1962 a, 1966), as well as Longfield's paper. The most notoriously confused section of the genus was the "Stemmale group" which Longfield disentangled into *capense* and *stemmale*. Schmidt erected two new species one of which, *hintzi*, subsequently, together with *abbotti*, became slightly involved with the *Aethiothemis*—*Oxythemis* generic complex. This species and others had become mingled with *guineense*, from which Longfield separated the species *machadoi*. There have been other examples of confused species, with resultant synonymy, but the most important instances were, as stated above, the *falsum* (ex *capense*) and *stemmale* taxa sorted by Longfield.

Yet the position in these last two still remained problematical in the opinion of the present Author. For instance, how can some populations of *julia* Kirby and *falsum* Longfield be distinguished? Longfield suggested that there might be hybridization yet there are many border line cases and this explanation does not appear satisfactory. Then again there are instances where it is not merely difficult but impossible to distinguish *brachiale* (Beauvois) and *stemmale kalai* Longfield. The *stemmale* group has proved an obstacle in sorting Madagascar Odonata and the present Author (1962 b) was puzzled about typical *stemmale stemmale* in Mauritian collections. Other difficulties were found in the long and rather unweildy key devised by Longfield to meet as many eventualities as possible. It was largely reliant on pruinosity, measurements and other variable features. Then the late Dr. Buchholz undertook to revise the genus and there were hopes that these problems would be cleared up. However, it seems that his conclusions were either not finalised or at least they have not been published.

Working recently on a regional Odonata monograph it was found necessary to attempt a clarification before the *Orthetrum* section could be detailed. Knowledge of the habits of most of the species in the field in many parts of Africa, combined with the extensive material in the National Museum have formed a useful working basis. The result of this investigation has at least surmounted the difficulties from the Author's point of view and in submitting the conclusions here it is hoped that some of the problems faced by other workers on the genus may be lessened. The results may seem provocative or even too simplified in the opinion of some specialists but the author considers there is strong evidence for their assumption.

Variation

It has long been recognized that many species of this genus are subject to much variation in size, colour and morphology of body and wing markings. It must now be stressed that the blacker markings have a strong influence in some of them.

Melanism

One of the major features of this genus is the tendency to *melanism*. It does not seem to have been adequately realized in published accounts how strong the melanotic tendency in this genus really is. If this aspect is fully considered it then appears to the Author that some of the difficult problems fall into place. For instance, an Ituri Forest *julia* may seem quite distinct from a *falsum falsum* from, say, Natal or a *falsum capicola* from the South-western Cape Province. Yet in many parts of their ranges there is integration, even with the Cape insect although this is to a much lesser degree. In fact taking all important characters into account there is no way of separating many of the individuals because they are not only one and the same species but they actually form a roughly distributed cline,

from the palest eastern and southern populations to the extremely black equatorial forest dominants (vide *julia*).

The distinctions between *brachiale* and *stemmale kalai* can often be equally definite or indefinite. The hamules and prophallus vary in size, depth of chitination and to some extent in shape. There is a gradation from the palest *brachiale* with white thoracic stripes to the heavily marked *kalai*, even occasionally as completely black as in an extreme melanotic *julia*. The antenodal cross-veins may be plain yellow or black or black surmounted with yellow. In other words the simplest and, it seems, the only solution is that they are conspecific. If this is agreed then *kalai* is only a melanic *brachiale*, not even a race or a cline because of the overlap in the warmer zones, although in the cooler areas only true *brachiale* occurs. This relationship leads to a consideration of the insular members. It means very simply that the darker veined *stemmale* of Mauritius is nothing more than a recessive form of *brachiale* and this is the reason it is neither as common as *brachiale* nor as easily distinguished because of degrees of intermediacy. On Madagascar *brachiale* may be quite normal or sometimes dark, but the investigation has proved that *lemur* Ris (*milloti* Fraser) certainly represents a distinct species. In the Seychelles *wrighti* has developed and diverged in isolation into a more distinctive subspecies, the only true race of *brachiale* other than the nominotypical subspecies.

Thus, all the vicissitudes and confusion that the *stemmale*—*falsum* "complex" passed through could have been lessened if *brachiale* had been brought closer into the picture, since *stemmale*, in the Author's opinion does not specifically exist.

It has been known for a long time that *zernyi* Schmidt is no more than a darker and commoner variety of *hintzi* Schmidt, not a subspecies. Similarly, others have darker or melanic forms. It is shown here that *rhodesiae* Pinhey is no more than a dark palustrine *machadoi* Longfield; *camerunense* Gambles is the darker western race of *caffrum*; and a western subspecies of *chrysostigma* is described in this paper. Occasionally *guineense* Ris produces a dark form. This species is sometimes difficult in the male to distinguish from *julia*.

It is suggested in a survey of distribution after *julia* that the possible cause of blackness may be due to a temperature or a light gradient.

Hamules

A problem which is sometimes harder to surmount is when the hamular hooks or the hamule itself become distorted or the gap is closed. The hamule may be twisted out of its normal plane, particularly on extension of hamule and protrusion of *prophallus* (peneal organ) during coition. As the Author has explained in another paper (in Press) the inner hamule (IH) is hinged (not so obviously in this genus) and this hook can clamp down on the outer hamule (OH). The IH hook (symbols used being those employed by Longfield, 1955) is then frequently more or less hidden behind the OH, particularly in males having large swollen outer hamules. The apparently rare species *saegeeri* Pinhey can be difficult to distinguish

from *julia*, without examination of the distinctive prophallus, when the hamule is clamped down. The IH hook has in fact a pliable soft pad at its base below the OH. When the gap is shut it is often necessary to inspect the IH from two or more angles.

In *Libellulidae* the hamule or hamulus with its inner and outer hooks (the OH sometimes very reduced) is really the posterior hamulus or *hamulus posterior* (IA of Ris). The *hamulus anterior* is obsolescent. The form of IH hook and the development of the OH are vital features in distinguishing the males of this and other genera. In describing the shape of IH it is important to realize, as can be seen in the illustrations, that the arm of the hook has a definite shape and the apical hook itself may be directed backwards in, say, *macrostigma* Longfield, slightly inwards towards the body in *brachiale*, more or less bent outwards or slightly backwards from its stem in *julia*, outwards and downwards in *guineense* or forwards in *caffrum*. The terminal hook may not always follow the main direction of IH, in fact at its apex it is more often slightly bent or twisted. In the case of OH the important consideration is its degree of development and this has helped to formulate the group separation used in this revision. The two extremes are the swollen, prominently bulging OH of *julia* or *saegeri* and the much reduced condition of *caffrum* where it is confined to a basal swelling on the body of the hamule. There are stages in between these to provide the bases for other groups. For instance, *chrysostigma* has only a rather confined OH but at its outer or apical end it forms a ridge or ledge below IH, providing, incidently, a resistance for the clamping mechanism of the IH hook. It is unlikely that the OH is pliable but the bulky outer hamule of *julia* must provide an efficient resistance when IH is closed against it. In another paper (in Press) it is actually suggested that the *purpose* of these hooks is to clamp on to the vulvar aperture during coition. Consequently the more solid the OH the firmer the double vice-like clamp. It must be estimated that the pincer grip is less powerful in *caffrum* with its reduced OH.

Abdominal pattern

A further consideration of importance is the pattern of the distal segments of the abdomen, particularly in the female since it is probably by recognition of the amount of blackness on these segments that the male chiefly selects the correct female. The juvenile male generally reflects the same pattern as the corresponding female but the mature male is often masked on the abdomen, and sometimes on the thorax, by blue pruinosity followed below this exudation by blackening; or the thorax may become blacker with little or no blue exudation. One exception in which female and juvenile male patterns are not similar is *guineense*. On male characters *guineense* is very closely similar to *julia* and suggests common ancestry in its recent antecedents. On the other hand the simpler female abdominal pattern of *guineense* possibly indicates a different origin, since presumably the female pattern is the more selective. If this is so the resemblance of the

male to *julia* may be a case of convergence. Despite this the prophalline similarity is strong.

Vertex

The shape of the vesicle (vertex) is of some value. In *trinacria* it is abnormally high. In a few species the peaks on the apex are very high: *austeni*, *lemur*, *brachiale wrighti*, *saegeri* and moderately high in *brachiale* and *julia*. In others these peaks are very low or almost absent: *angustiventre*, *abbotti*, *hintzi* and *icteromelan*. In the remainder they are lowish to moderate. This is not an employable character since the size of a peak is not easily measured and quite often in dead specimens the vesicles are squashed.

Abdominal denticles

On the ventral surface of the abdomen in both sexes there are denticles along the ventral carina but these show only slight modifications. In at least two species the denticles on segment 3 of the male are abnormally large and numerous: *trinacria* and *icteromelan*, both species with long robust but slender abdomens. In a few others they are numerous but not large: *chrysostigma*, *macrostigma*, *robustum*, *machadoi*. In *angustiventre*, *azureum* and *austeni* they are few in number. In the others they are more uniform.

Anal appendages

The male superior appendage shows some variation in shape and in the ventral denticular armature. In *trinacria* and *africanum*, both with long abdomens, the superior is abnormally long, somewhat slender, the denticles in *trinacria* being particularly numerous, thick, in a long single row. In both *austeni* and *sabina* the denticles are multiple in two rows, unlike all the others examined. The superior of *austeni* is thick and straight; similarly the short thick appendage of *cancellata*; *angustiventre* and *abbotti* (fig. 15 e) have straight superior, not so thick. In *sabina* it is short, slender, rather straight and being yellow the double row of black denticles is very distinct. The other species have more curved appendages (fig. 8 d *caffrum*) and in some the appendage is more slender than in others: *chrysostigma*, *microstigma*, *latihami*, *macrostigma*, *robustum*, *julia*, *icteromelan*, *saegeri*. Then again there is some variation in the length of the denticular row and in the density of denticles. The only features of importance here are whether the superior is straight or curved, how long it is in comparison with segment 10 and whether there is a single or double row of denticles on each appendage.

A less discernible specific distinction is the gap between the apical dorsal teeth on the male inferior appendage. Such variation must influence the position where the inferior teeth can lock on the margins of the occiputal triangle of the female during tandem linkage but it cannot supply any useful guide for separating the species.

Foliations on 8th segment of ♀

These foliations are generally not much assistance except in a few species. In *taeniolatum* they are quite absent, but developed on segment 9. All others examined have foliations on 8 but they are extremely narrow in *trinacria*, moderately narrow and straight edged in *icteromelan*, *africanum*, *sagitta*, *sabina*, *abbotti*; rather narrow but not so straight in many, such as *machadoi*, *chrysostigma* and others. The foliations are broadest in *julia*, *brachiale*, *lemur*, *microstigma*, *azureum*, *macrostigma*, *austeni*, in the last being more rounded. In *macrostigma* their yellow colour is conspicuous.

Diagnostic characters

The specific descriptions will emphasize the more definitive characters of the head, thorax, abdomen, wings and appendages.

Certain morphological aspects are apparently of much lesser importance and some of these will be totally ignored in the descriptive diagnoses of the species. For instance, although black markings on lips and on crest and shield on *front* of the frons are generally characteristic it does not matter if the dorsum of the frons has a narrow or broad black basal band, or no black at all. The occiput is equally unimportant and so are the prothorax and interalary markings. The "thorax" when mentioned will only be the synthorax. The "legs" will refer mainly to the femora and even these may be unreliable guides. The basal three segments of the abdomen are not considered important in markings but their shape is of particular value in the male.

The importance of the hamules has been discussed. The shapes of the body and the alae of the prophallus are important for sections of the genus but closely allied species, like *guineense* and *julia*, have very similar prophalline structure, different from, say, *hintzi*, *machadoi* and *saegeri*. The shape of the anterior lamina, its lip and whether divided at the apex, and the external hairs are characteristic. Less so is the general shape of the posterior lobe which is here called the **genital lobe**. This ventral projection has scattered hairs and often spiny hairs (sometimes more correctly setae). These may have some directive effect during coition. These setal adornments are peripheral in position.

The description of the male inner hamular hook (IH) is important in its orientation, particularly in its normal resting attitude. During stages of coition and prophalline extrusion its position may become more or less altered but this is due to the torsion on the base of IH, the angle of the hook on its stem remaining fairly constant except in variants of the *julia* cline. The hook is therefore directed in some species (e.g. *macrostigma*) distinctly backwards or posteriad; in others, like *hintzi* outwards, i.e. more or less at right angles; forwards in *caffrum* and others; or downwards, i.e. towards the ventral carina of segment 2, in *guineense* or *trinacria*.

Measurements

Before passing on to the Groups and specific diagnoses the question of size must be mentioned. Since there is always some variation in size, sometimes abnormally so, exact limits are not stressed in the descriptions or keys. It is often merely stated whether the insect (or its wing length) is large, moderate or medium, or small. The range in size, abdomen and hindwing, have frequently been given in other papers. Here, unless otherwise stated, in small species the hindwing is less than about 27 or 28 mm long; in medium it is roughly 28 or 29 to 32 mm and in large over 33 mm. If the pterostigma is short it is less than 2.3 mm long, if long it is over 3 mm.

ETHIOPIAN SPECIES***ORTHETRUM* GROUPS AND TAXONOMY**

The Groups employed here are mainly for convenience in splitting up the genus for recognition purposes and keys. They are primarily based on abdominal shape and on the accessory genitalia of the male, the prophallus only partially taken into account because of the difficulty of observing this properly without dissection. Longfield's Groups (1955) were based more on the prophallus. An alternative plan is outlined after this simple grouping.

a. ANGUSTIVENTRE group

Very large, long-winged. Body pale with very sparse black markings and never pruinose. Pterostigma long, radial supplement of 3 rows.

One species, *angustiventre*

By genitalia this belongs to group e.

b. AZUREUM-AUSTENI group

Not homogenous. Shield on crest of frons well marked with black or brown. Abdomen broad, not constricted. Pruinosity develops in mature males. Prior to this the abdomen is orange to reddish brown with black carinae. Anterior lamina bifid at apex.

Species *austeni*, *azureum*, *azureum lugubre*.

By genitalia *austeni* is in group e, *azureum* in g.

c. SABINA group

Frontal shield, at least in male, marked with black or brown. Abdomen constricted on segment 3, then long and slender. Hamule broad, the IH hook turned outwards and with a conspicuous ridge anterior to it.

Species *sabina*, *trinacria*.

d. AFRICANUM group

Labrum all black or mainly yellow, epistome often black. Abdomen strongly swollen on basal segments, then extremely slender, reminiscent of *Olpogastra lugubris* (Karsch).

Species *africanum*, *sagitta*.

By genitalia this group could be included in group g.

e. CAFFRUM group

Lips pale. Thorax normally with one to three clear white or cream stripes on each side. Hamule with prominent IH, since OH is reduced to a basal swelling.

Species *caffrum caffrum*, *caffrum camerunense*, *kollmannspergeri*, *ransonneti*.

The huge species *austeni* and *angustiventre* belong here by accessory genitalia.

f. CHRYSOSTIGMA group

Thorax with or without white lateral stripes. Somewhat like Caffrum group, with prominent IH but the OH continues apically to a ridge or point below IH. Species *chrysostigma chrysostigma*, *chrysostigma toddii*, *microstigma*, *microstigma f. imitans*, *monardi*, *taeniolatum*.

g. MACROSTIGMA group

Not homogeneous. Thorax usually pale at sides. IH very prominent, the hook turned posteriorly and extending beyond OH. OH forms a swelling which curves apically more or less enfolding the soft tissue at the base of IH.

Species *abbotti abbotti*, *abbotti malgassicum* ssp. nov., *kristenseni*, *latihami*, *macrostigma*, *robustum*, *rubens*. (*robustum* is transitional to Brachiale group).

By genitalia *africanum* and *azureum* also belong to this group.

h. BRACHIALE group

An extension of the previous group, with the thorax more heavily marked. IH is turned backwards but it is much less prominent. It does not extend beyond OH, the hamule is broadly depressed and the OH is curved sinuously round the soft tissue below IH. The lip of the anterior lamina is massive. The prophallus here may have either a long body, not deep, the alae having funnels and apical extensions; or the body can be deeper at basal end and the alae are then simple. Species with funnelled alae: *brachiale brachiale*, *brachiale f. kalai*, *brachiale f. stemmale*, *brachiale wrighti*. Species with simple alae *lemur f. lemur*, *lemur f. milloti*.

i. JULIA group

Not homogeneous but usually easy to recognize by the solid OH. Thorax often heavily marked with black or brown. IH not prominent, frequently more or less hidden by the greatly swollen, extended, often massive OH which is the more prominent appendage. The prophallus may have branched or simple alae.

a. Species with branched alae *guineense*, *julia julia*, *julia capicola*, *julia falsum*.

b. Species with simple alae *hintzi*, *icteromelan icteromelan*, *icteromelan cinctifrons*, *machadoi f. machadoi*, *machadoi f. rhodesiae*, *saegeri*.

An alternative group-plan to be more natural must take accessory genitalia and prophalli into account. Only a few species have branched or funnelled alae on the prophallus: *brachiale*, *guineense*, *julia*, *kollmann-*

spergeri, *lemur*, *ransonneti* and *taeniolum*. In all the others the alae vary in shape but they are not bifurcate.

A suggested grouping is on the following lines:

1. **Sabina**:—*sabina*, *trinacria*, a distinctive group.
- 2-3. **Caffrum**:—*caffrum*, *angustiventre*, *austeni*; related to **Ransonneti**:—*ransonneti*, *kollmannspergeri*.
- 4-5. **Chrysostigma**:—*chrysostigma*, *microstigma*, *monardi*; related to the single group-species **taeniolum**.
6. **Abbotti**:—*abbotti*, *africanum*, *azureum*, *latihami*, *macrostigma*, *robustum*, *rubens*. This large group leads on to the next two.
- 7-8. **Brachiale**:—*brachiale*, *lemur*; related to **Julia**:—*julia*, *guineense*.
9. Lastly, **Icteromelan** group:—*icteromelan*, *hintzi*, *machadoi*, *saegeri*.

a. ANGUSTIVENTRE group

Orthetrum angustiventre (Rambur, 1842) Fig. 1.

Synonymy *O. leoninum* Karsch (1891)

O. aequale Karsch (1898)

Diagnostic features

Size large, abdomen over 35 mm, hindwing over 40 mm.

♂, ♀. Both sexes with head, thorax and abdomen yellowish brown, scarcely marked with black. Sparse mesepisternal marking. Legs also yellowish brown. Transverse carinae on abdomen normally black. No pruinosity. Vertex peaks low.

Subcostal cross-veins yellow. Radial supplement of 3 rows. Pterostigma long, about 5 mm, yellow. Membranule white. Superior appendage thickish and straight.

Accessory genitalia. Anterior lamina slightly bifid at apex. Yellow with yellow hair and short spines. Hamule broad, inner hook (IH) very small, turned outwards. OH very like *caffrum*. Genital lobe rounded, yellow. Alae simple. Foliation on 8 of ♀ narrow, yellowish brown. Cerci brownish yellow. Vulvar aperture simple, with thick lips and anterior depressions.

Distribution. Angola, W. Zambia, N. Uganda, S. Sudan, N. Nigeria westwards to Ivory Coast, Guinea, Sierra Leone and Senegal.

Material examined. Zambia, Cameroons, N. Nigeria.

b. AZUREUM—AUSTENI group

Orthetrum azureum (Rambur, 1842).

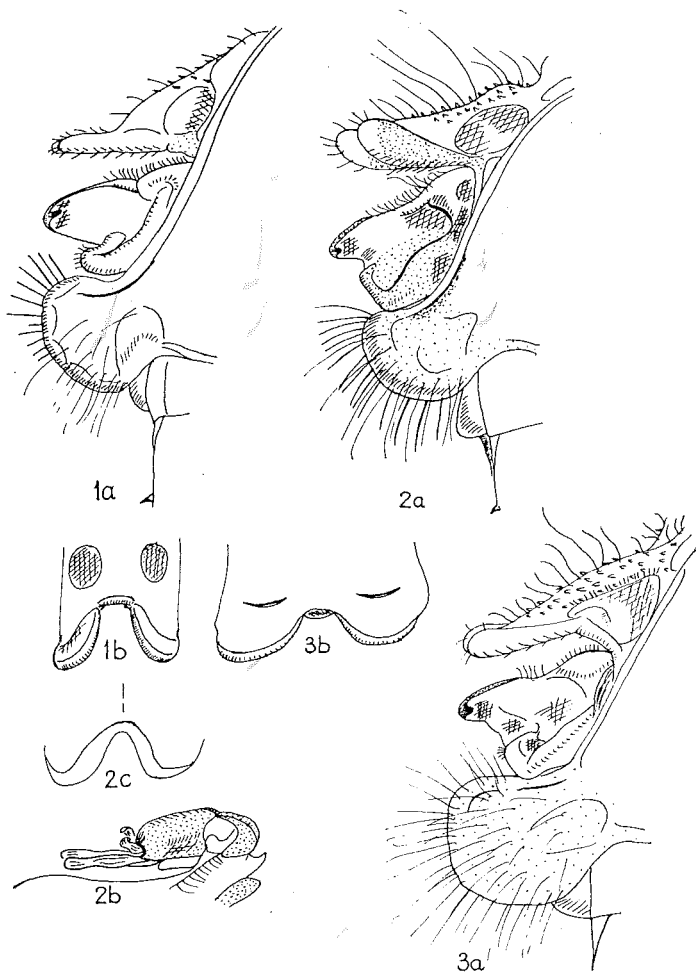
Orthetrum azureum azureum (Rambur) Fig. 2.

Diagnostic features

♂. Lips pale. Frons with black basal band and a black band across crest (even in juveniles). Thorax in immature state pale brown with deeper brown suffusion at humeral suture; older male becomes all deep brown on thorax but not pruinose. Legs mainly black.

Subcostal cross-veins black, radial supplement tending to be 2 rows. All wings with deep amber at base in juvenile and mature state. Pterostigma distinctly yellowish brown between black veins. Membranule grey.

Abdomen broad, not constricted. Segment 5 over 2 mm wide on one side of median dorsal carina. In juveniles the abdomen is pale to reddish brown with thin black carinae; at maturity it is coated dorsally with pale blue pruinosity.



Angustiventre—Azureum groups.

1. *angustiventre* a. ♂ accessory appendages from left (Zambia); b. ♀ vulvar aperture, ventrally (Nigeria).
2. *azureum* a. accessories (S.W. Madagascar); b. prothorax; c. vulvar aperture (Madagascar).
3. *austeni* a. accessories (Zambia); b. vulvar aperture (Congo).

Anterior lamina deeply divided at apex; very thick lips. The lamina projects steeply and is well sloped at closed (anterior) end; coated with longish hair and usually with small spines. Hamule rather like *africanum*, depressed, with small IH; OH forming a slight ridge. Genital lobe rounded with hair and black spinous hair. Alae simple.

♀. Lips pale or with traces of black. Frontal crest with brown smear. Abdominal segments 4-8 or 9 yellow dorsally, broadly black laterally; 8-9 mainly black. Cerci brown. Vulvar aperture with lips thick but simple. Foliations on segment 8 broad, pale brown with broad black border.

Distribution. Madagascar.

Material examined. Madagascar. No appreciable difference between those from Tananarive and those from S.W. Madagascar.

***Orthetrum azureum lugubre* Ris (1915)**

Longfield (1955: 43) considers *lugubre* is probably distinct from *azureum*. No examples have been examined for this revision and it will be left tentatively as a Comoran subspecies of *azureum*.

Notes

The lips are said to be well marked with black, the frontal crest also. The thorax has thick black stripes. Legs mainly black.

Subcostal cross-veins black, radial supplement evidently of 2 rows, pterostigma blackish, long, 3.5 mm. Unlike *azureum* there is no amber at the wing bases. Genitalia said to be similar to *azureum*.

Distribution. Comoro Islands. No material examined.

***Orthetrum austeni* (Kirby, 1900) Fig. 3.**

Synonymy. *Thermothermis monteiroi* Kirby (1900)

Orthetrum afrum (Selys MS) Martin (1908)

Hadrothemis burgeoni Schouteden (1934)

Diagnostic features

The largest *Orthetrum* known, abdomen 37 mm or more, hindwing 45 mm or more. Very robust.

♂. Labium pale. Labrum pale in teneral state to mainly black except lower margin at maturity. The whole face may darken. Frons black at base and on shield, becoming all black on old male. Peaks of vertex high. Thorax in juvenile greenish with thin black antehumeral line; later the sides are chalky blue and in old male the thorax is all blue. Legs reddish brown, with end tarsi black, but at maturity the legs can be all black.

Subcostal cross-veins black, radial supplement of 2 rows, pterostigma 4-5 mm long, yellow between black veins or almost all dark brown in old male.

Abdomen broad and robust, not constricted; each side of segment 4 nearly 3 mm, in juveniles orange brown with black carinae; at maturity coated with pale blue, but segments 9-10 and anal appendages usually remain brown. Superior appendage thick and straight, with a *double* row of ventral denticles.

Anterior lamina pale, the apex bifid; thick orange or brown spines and some hair. Hamule palish and shaped like *caffrum* but IH hook turned outwards. Genital lobe rounded; with brown hair. Alae simple.

♀. Lips and frons pale, not marked with black. Membranule grey. Cerci pale brown. Vulvar aperture with broad lips. Foliations on segment 8 broad and abnormally rounded; pale brown with broad black border.

Distribution. Zambia, Angola, Congo, to Nigeria and westwards to Sierra Leone.

Material examined. Zambia, Katanga, Congo (Kinshasa), Congo (Brazzaville), Cameroons, Gabon, Ivory Coast.

c. SABINA group

Orthetrum sabina (Drury, 1770) Fig. 4.

Synonymy. *Libellula gibba* Fabricius (1798)

Libellula leptura Burmeister (1839)

Libellula ampullacea Schneider (1845)

Lépthemis divisa Selys (1878)

Diagnostic features

♂. Moderate size, slender and pale. Labium usually brown on posterior lobe, labrum pale, frons in front with brown band below crest. Peaks of vertex low. Thorax pale greenish with black antehumeral line and a black-edged yellow stripe on mesepimeron, sometimes also on metepimeron. No pruinosity. Legs yellow with black stripes, but the tibiae may be nearly all black at times.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma pale yellow between thin black veins. Membranule grey.

Abdomen swollen at base, then nearly as slender as *africanum*. Segments 4-10 black, with yellow sub-lateral stripes reaching lateral carinae on segments 4-7; small yellow spots on 8-9 with the lateral carina black. Superior appendage short, slender, straightish and yellow with *double* row of black denticles.

Anterior lamina *without* swollen lips, not bifid at apex, but with characteristic and very long thick orange hair. Hamule with small IH and a ridge above it on anterior margin of hamule. Genital lobe rounded, with hair. Prothallus rather like *trinacria*.

♀. Similar, but the frontal marking is a brown smear on the shield and is very faint in teneralis. Trace of amber on hindwing. Abdomen black with yellow stripes on segments 4-6, segments 7-9 with only traces of yellow, 10 partly yellow. Cerci yellowish. Vulvar aperture with lips widened at sides. Foliations narrow, black, with straight margin.

Distribution. N.E. Africa from Algeria and Egypt to Somalia and Socotra Island; and Asia to Queensland. A desertic species, hence the very pale markings.

Material examined. Egypt, Sudan, Socotra, Arabia, Asia, Australia.

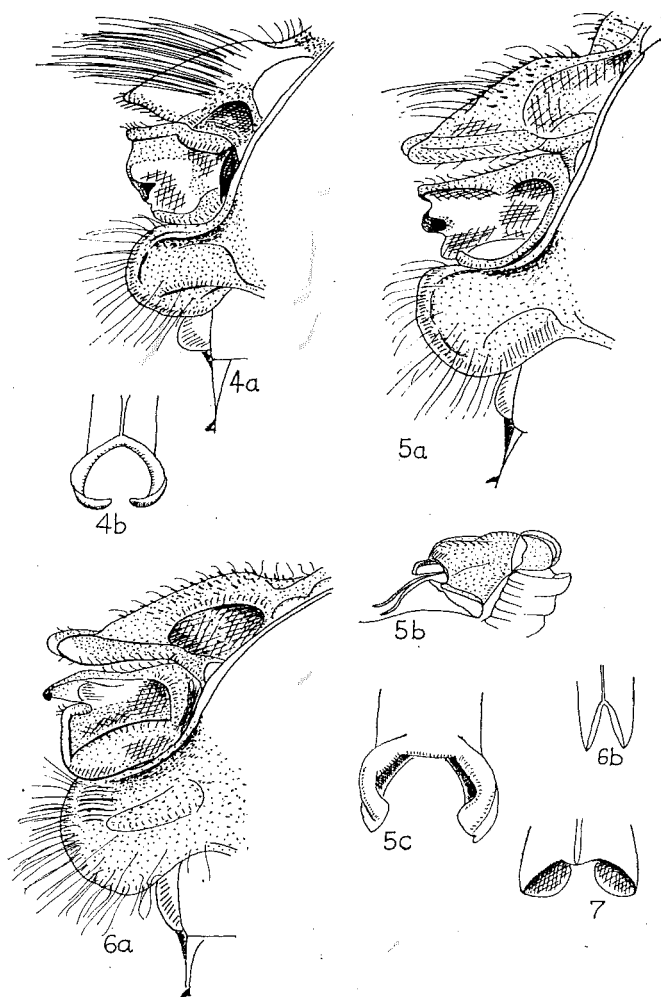
Orthetrum trinacria (Selys, 1841) Fig. 5.

Synonymy. *Libellula clathrata* Rambur (1842)

Libellula breinii Rambur (1842)

Diagnostic features

Large species, with abnormally long abdomen. Abdomen over 35 mm, hindwing over 35 mm, the abdomen the longer.



Sabina—Africanum groups.

4. *sabina* a. accessories (Sudan); b. vulvar aperture (Socotra).
5. *trinacria* a. accessories (Lourenço Marques); b. prophallus; c. vulvar aperture (Malawi).
6. *africanum* a. accessories (Stanleyville); b. vulvar aperture (Congo).
7. *sagitta* vulvar aperture (S. Leone).

♂. Labium all pale or with brown on posterior lobe and sometimes, centrally, on lateral lobes. Labrum pale. Frons with black basal line, a round black macula in groove and a line continuing along groove and down middle of shield. Vertex high but with small peaks. Thorax greenish with thin black antehumeral and sutural lines, but at maturity it is coated with thin darkish blue pruinosity with the lines showing through. Legs black.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma pale yellow between black veins (like *sabina*). No amber patches. Membranule grey.

Abdomen long and slender, pruinose at maturity. Juveniles, abdomen black with yellow bands or spots on segments 4-7 and 10, sometimes also on 9. Anal appendages black, long, straightish with very large number of denticles.

Anterior lamina bifid at apex, the lip moderate; with short exterior spines and white hair. Hamule as in *sabina*, the hook small, with a ridge above it. Genital lobe rounded and having white hair. Prophallus with deep body, short, slender alae which are turned downwards towards the abdominal depression.

♀. Labium all yellow or with black central line on posterior lobe. Frons usually not marked with central line on shield. Legs yellow, with black stripes. No amber on wings. Abdomen marked as in juvenile male. Segment 8 may be all black or with a small yellow dot. Cerci black and exceptionally *long*, more than twice as long as segment 10. Vulvar aperture with lips widened laterally. Foliations extremely narrow, yellowish, straight-edged.

Distribution. Natal to North Africa, mainly in the Eastern half, but with records in the Congo and West Africa. It extends slightly into the palaeartic fringe of Africa.

Material examined. Natal, Botswana, Rhodesia, Moçambique, Zambia, Malawi, Kenya, Kenya-Ethiopia border, N. Angola, N. Uganda, N. Nigeria, Egypt.

d. AFRICANUM group

Orthetrum africanum (Selys, 1887) Fig. 6.

Diagnostic features

Easily recognized among *Orthetrum* by its morphological resemblance to *Olpogastra lugubris* (Karsch), the abdomen being deeply swollen at base, then extremely slender. Moderately large. A smaller form (Nigeria) may require a subspecific name (*infra*).

♂, ♀. Labium broadly black in centre, labrum all black (blackier than other African species), frons pale on shield. Epistome black in mature ♂. Thorax green with thickish black or brown stripes on front and sides (like *julia*).

Subcostal cross-veins black. Radial supplement only 1 row, sometimes partly 2 in ♀. Pterostigma pale brown, between black veins. Wings

without amber patches. Membranule grey.

Abdomen shaped as described above; black, with short yellow lateral streaks on segments 5-6 or 5-7. ♂ anal appendages blackish, long and slender; ♀ cerci greyish brown or partly yellow. Mature ♂ and very old ♀ coated with blue pruinosity on thorax and abdomen.

Anterior lamina shallowly bifid apically, with small spines and short hair. Hamule depressed. IH small, turned outwardly and slightly backward at apex. OH broad. Genital lobe with black spines and some hair. Alae long and simple. Vulvar aperture simple. Foliations narrow, black with straight border.

Distribution. Angola, Congo, to Nigeria and westwards to Guinea including Principe Island. Martin (1915) recorded *africanum* from Tiwi and Shimoni, near Mombasa; from Kijabe (Kenya) and Zanzibar Island. These would seem to be erroneous identifications, possibly *Olpogastra lugubris* (Karsch).

Material examined. Northern Congo (Kinshasa).

Smaller form or subspecies

Examples from Ikoyi Island, S. Nigeria (leg. Gambles) are, as Longfield remarks (1955), nearer *africanum* than to *sagitta*, by virtue of the lengths of the abdominal segments, particularly segment 4, which is longer than in the Sierra Leone species. More especially however, they differ in the labrum. It is almost certain that *sagitta* is a distinct species but the National Museum only has a single female and no male with which to compare the genitalia of *africanum*. The vulvar aperture in the female is distinct. Examples of the small Nigerian taxon were kindly donated by Gambles. These may be either a geographical subspecies or a physiological entity brought about by ecological conditions.

The Southern Nigerian specimens are fully blue pruinose in the males. They resemble the Congo *africanum* in labrum and other respects except in size and in having the anterior lamina more raised or arched at the anterior end. The female from this island has some black on the labium. The labrum, as in the males is totally black. Epistome and front of frons pale. Cerci yellowish.

Distribution. S. Nigeria.

Material examined. S. Nigeria.

***Orthetrum sagitta* Ris (1915) Fig. 7.**

Described from Sierra Leone but there is an example under this name from Forécariah (Guinea) in the Royal Scottish Museum, Edinburgh. Males have not been examined recently by the author but the very small female in the National Museum shows strong evidence of being a distinct species, as Ris considered, not a race of *africanum*.

♀ (Freetown, 4 June, 1963). Face all pale (in Ris type ♂ the labrum has a thin black margin). Vertex, as in *africanum*, with low peaks. Thorax green with well defined brown stripes.

Wing apices more rounded than in *africanum*, somewhat enfumed, the wings rather smoky (probably being adult condition).

Abdomen well swollen at base, then slender. Segments 4-10 black with yellow spots on 4-6. Vulvar aperture broader and thinner-walled than in *africanum*. Foliations narrow, black, straight edged.

Abdomen 27.0 mm, hindwing 27.5 mm. This example differs from *africanum* in its very small size, short abdominal segments, pale labrum, broader wing apices and different genital aperture.

Distribution. Sierra Leone and possibly Guinea.

Material examined. Sierra Leone.

Measurements of size in africanum and sagitta

Segment 4 was measured dorsally to compare with Longfield's measurements. Hindwing lengths are also given.

Length of segment 4.	<i>africanum</i> (Longfield) 7.0-7.5 mm
	<i>africanum</i> ♂ (Stanleyville) 8.5 mm
	<i>africanum</i> ♂ (Ikoyi Isl.) (Longfield) 6.5 mm (National Museum) 7.2, 8.0 mm.
	<i>sagitta</i> ♂ type (Longfield) 5.0 mm
	<i>sagitta</i> ♀ (National Museum) 5.0 mm
Length of hindwing.	<i>africanum</i> (Longfield 33-37 mm including Ikoyi Isl.)
	<i>africanum</i> ♂, ♀ (Congo) 36-37 mm
	<i>africanum</i> (Ikoyi Isl.) 33 mm
	<i>sagitta</i> (Longfield) 30-31 mm
	<i>sagitta</i> ♀ (National Museum) 27.5 mm
	<i>sagitta</i> ♂ (S. Leone—examined 1964 in Paris Museum) 28.5 mm.

It appears that size and length of segments vary considerably in *africanum* and overall size is variable in *sagitta*.

e. CAFFRUM group

Orthetrum caffrum (Burmeister, 1839).

Orthetrum caffrum caffrum (Burmeister) Fig. 8.

Synonymy. *Libellula fasciolata* Rambur (1842)

Libellula subfasciolata Brauer (1865)

Orthetrum truncatum Calvert (1892)

Diagnostic features

Smallish to medium sized *Orthetrum*.

♂, ♀. Lips and front of frons all pale. Peaks of vertex low. Thorax light to dark brown. A white or cream antehumeral stripe and two black-edged white lateral stripes. Legs marked with black in male but more or less pale in ♀. Thorax rather thinly pruinosed in mature male.

Subcostal cross-veins, yellow. Radial supplement of 2 rows. Pterostigma yellow between black veins. Membranule grey.

Abdomen orange, with thin black lateral stripe and black lateral carina; mature ♂ pruinosed blue. No black on dorsal carina. Superior appendages

and cerci black. Anterior lamina slightly bifid at apex; with short spines and few hairs. IH prominent, with hook broad, turned *forwards*. OH confined to basal swelling. Genital lobe more or less rounded, small, with hair but no spinous hair. Prophallus very like *chrysostigma*.

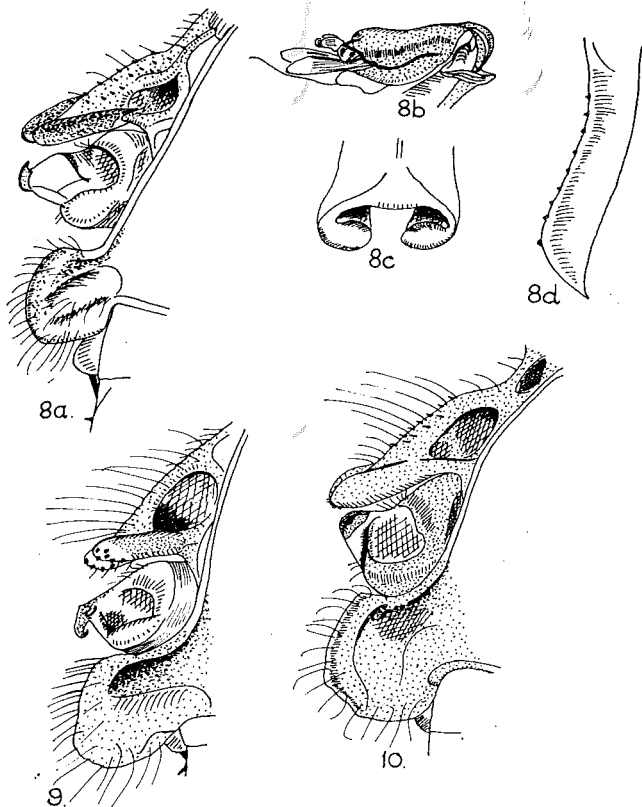
Vulvar aperture with wide lips. Foliations narrow; yellowish edged narrowly with black.

Distribution. Widespread in Africa from the Cape Province to the Sudan and in Madagascar; a West African race (vide infra).

Material examined. Cape Province, Natal and Zululand, Transvaal, Rhodesia, Malawi, South Tanzania, Kilimanjaro (foothills).

***Orthetrum caffrum camerunense* Gambles (1959), comb. nov.**

An example kindly donated by Gambles indicates that apart from only having one white thoracic stripe (on mesepimeron), *camerunense* is almost



Caffrum group.

- 8. *caffrum* a. accessories (Natal); b. prophallus; c. vulvar aperture (Cape Province); d. ♂ left superior appendage.
- 9. *kollmannspergeri*. accessory, ♂ paratype (Adré).
- 10. *ransonneti*. accessory (Egypt).

identical in accessory genitalia with *caffrum*. The specimen lacks the short setae on the anterior lamina and has longer hair on this organ. There is a difference in the shape of the prophalline alae, not enough to consider it specifically distinct. The seemingly larger hamule in Gamble's figure (1959) in comparison with *caffrum* is merely due, of course, to the hamule being more extruded from its socket.

Except for the thoracic stripe and the slight genitalial differences mentioned the male is similar to *caffrum*. The female has not been examined for this revision.

Distribution. E. Nigeria, Central African Republic, Mount Ruwenzori, Cameroons.

Material examined. E. Nigeria, Central African Republic, Mount Ruzenzori.

***Orthetrum kollmannspergeri* Buchholz (1959) Fig. 9.**

Diagnostic features

In its small size and body markings this is very like *taeniolum*. In accessory genitalia it is more like *caffrum*, differing in the hook of IH and in having denticles on the lip of the anterior lamina.

♂. (♀ undescribed, possibly unknown). Lips and front of frons all pale. Peaks of vertex rather low. Thorax with three white stripes each side (as in *caffrum*), the mesepisternal stripe faint at maturity. Legs blackish.

Subcostal cross-veins yellow. Radial supplement of 1-2 rows. Pterostigma very short, only 2 mm, yellowish brown between black veins. Membranule white.

Abdomen with black carinae, but coated with pale blue pruinosity. Superior appendages black.

Anterior lamina shallowly bifid at apex, the lips in apical region with peculiar *denticles*; the outer surface hairy, without spines. IH prominent, with large hook, turned *backwards* and slightly inwards at tip. OH as in *caffrum*. Alae peculiar and distinct from most species, including *caffrum*, in being short and having an inward branch.

Distribution. Central African Republic.

Material examined. Central African Republic.

***Orthetrum ransonneti* (Brauer, 1865) Fig. 10.**

Synonymy. *Libellula gracilis* Selys-Aldarba (1887).

Only included in this section since it has been recorded in Chad.

Diagnostic features

Moderate size, the hindwing 32-34 mm. Pterostigma short. No amber on wing-bases.

♂, ♀. Lips, face, front of frons all pale. Thorax plain yellowish, darkening and with grey-blue pruinosity in mature ♂. Femora brown, blackening at knees.

Subcostal cross-veins blackish. Radial supplement of 1 row. Pterostigma short, 2.0-2.5 mm. No basal amber. Membranule white. Third radial vein unusually flat. Abdomen yellowish with thinly black carinae.

Minute distal dots. Underside of abdomen black. Anterior lamina not bifid apically; with short spines and longish hair. IH prominent with broadish hook turned outwards and resembling *chrysostigma*. OH forms a broad basal swelling. Genital lobe large, squarish, having no spines, only white hair. Alae branched, rather like *guineense* and *taeniolum*. Vulvar aperture swollen at sides. Segment 8 not dilated.

Distribution. Egypt, Sudan, Algeria, Tripolitania, Sahara, Chad, W. Asia.
Material examined. Egypt.

f. CHRYSOSTIGMA group

Orthetrum chrysostigma (Burmeister, 1839)

Orthetrum chrysostigma chrysostigma (Burmeister) Fig. 11.

Synonymy. *Libellula barbara* Selys (1849)

Diagnostic features

♂, ♀. Medium sized. Lips and crest of frons normally without black marking. Thorax and abdomen of ♂ pruinose pale or sometimes darker blue at maturity. Thorax brown in juveniles and in female with white mesepimeral stripe which sometimes still shows in pruinose state but often does not. Legs mainly black.

Subcostal cross-veins yellow. Radial supplement of 1 or frequently 2 rows. Pterostigma yellow-brown between black veins. Membranule grey, or grey outwardly with white inner edge.

Abdominal segments 4-8 in juvenile ♂ orange-brown dorsally with black dorsal carina and black sublateral band touching the lateral carina; segments 9-10 similar but leaving the lateral carina orange. In ♀ the abdomen is orange with black carinae and a black lateral stripe on segments 5-10. Cerci black.

Anterior lamina not bifid at apex but, like several others without divided apices there is a septum separating the lips at the apex; short hairs but no spines on the outer surface. IH prominent, the hook broad, turned outwards. OH forms a *ridge* ending apically in a distinct hirsute ridge below the IH hook. Genital lobe usually squarish, with some bristly hair. Prophalline alae broad but undivided. Vulvar aperture complex, with lip thick in centre, black and angled at sides and with sinuous lateral folds. Foliations narrow, yellowish bordered with black.

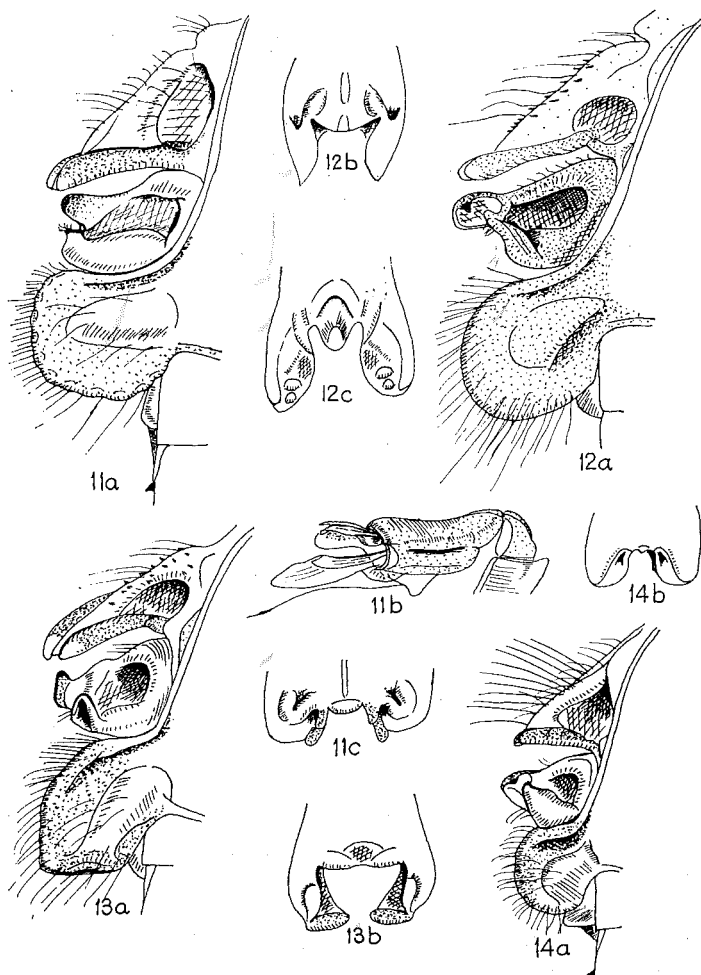
Variation. In a ♂ from Central African Republic the posterior lobe of the labium is black. A dark race is described below from Sierra Leone.

Distribution. Virtually throughout Continental Africa; also some of the fringing islands and palaeartic surrounds.

Material examined. S.W. Cape Prov., N. Cape Prov., Natal, Transvaal, Moçambique, Botswana, Rhodesia, N. Angola, Zambia, Malawi, Tanzania and Lake Rukwa, Katanga, Congo Kinshasa, Central African Republic, Cameroons, N. Nigeria, Ethiopia, Somalia, Sudan, Egypt.

***Orthetrum chrysostigma* subspecies *toddii* nov.**

In its heavier body markings this race is more like *julia falsum* but the accessory genitalia are like *chrysostigma*, even the anterior lamina being just as pale not blackened. The subcostal cross-veins are *black*, not yellow. *Holotype*, mature ♂ (Sierra Leone). Lips and face pale, with a brown smear on centre of lateral lobes of labium. Thorax mainly pale brown laterally

**Chrysostigma group.**

11. *chrysostigma* a. accessories (Marromeu, Moçambique); b. prothallus; c. vulvar aperture (Natal).
12. *microstigma* f. *microstigma* a. accessories (Zambia); b. vulvar aperture (Zambia); c. vulvar aperture (S. Leone).
13. *monardi* a. accessories (Zambia); b. vulvar aperture (Zambia).
14. *taeniolum* a. accessories (Iraq); b. vulvar aperture (N. Nigeria).

but with thick black antehumeral and humeral stripes. No white stripe. Legs mainly black.

Subcostal cross-veins black, with just traces of yellow superimposed on the basal ones. Radial supplement of 1 row. Pterostigma pale brown between thickish black veins.

Abdomen normal, blue pruinose. Transverse carinae black, segments 8-10 totally black. Superior appendage black, inferior mainly yellow. Accessory genitalia as in *chrysostigma*.

Abdomen 27.5 mm, hindwing 29.0 mm.

Distribution

Known only from Sierra Leone. Longfield (1955: 47) says that *chrysostigma* is common in Sierra Leone but does not say whether this is the dark race.

Material examined. Holotype ♂, Kasawe Forest, 16 April, 1965. Named after Alexander Todd, formerly of the Fourah Bay College who collected many interesting Odonata in Sierra Leone.

***Orthetrum microstigma* Ris (1911) Fig. 12.**

forma *microstigma* Ris

Diagnostic features

A dark species, slightly larger than average, with very short pterostigma in the male and the female with unusually broad abdomen for any of the Groups except the azureum-austeni group. Like *julia* the male can be heavily melanotic.

♂. Labium with posterior lobe more or less black. Labrum and crest of frons pale. Peaks of vertex low and very hirsute. Thorax green with thick black dorsal and lateral stripes, but in old ♂ the thorax is all black (like *julia*).

Subcostal cross-veins black. Radial supplement generally 2 rows, less frequently 1 row. Pterostigma not more than 2.2 mm, pale brown between black veins, becoming almost all black. Hindwing with dark amber basal patch (like *julia*). Membranule grey.

Abdomen very black, becoming blue pruinose. Anal appendages black.

Anterior lamina slightly bifid at apex, the lips black, the rest of the hamule normally brown, with few short spines and some long hair. IH prominent, the hook mounted on a flange, directed outwards and slightly backwards. OH with a ridge at apex like *chrysostigma*. Genital lobe large, rounded. Alae broad and simple.

♀. Differs in having the labium all yellowish; thoracic stripes brown, not black; legs brown with black knees. Wings with basal amber which may be very broad on all wings (as in some *julia*). Abdomen abnormally broad, yellowish brown with black dorsal and lateral carinae. Cerci not blackened. Vulvar aperture with folds near margin. Foliations broad, black.

Distribution. Angola, Zambia, northwards to Cameroons and westwards, to Guinea and Sierra Leone; also Uganda and Kenya.

Material examined. Zambia, N. Congo (Kinshasa), Congo (Brazzaville), Uganda, Ruwenzori, Central African Republic, Gabon, Cameroons,

E. Nigeria, Ghana, Sierra Leone.

forma *imitans* Schmidt (1951) **Stat nov.**

Although described as a subspecies this is no more than a less common variety appearing amongst typical *microstigma*. The differences are in the subcostal cross-veins being yellow; the radial supplement more usually 1 row; thorax less heavily marked with black.

Material examined. Zambia, E. and N. Nigeria.

Orthetrum monardi Schmidt (1951) Fig. 13.

Diagnostic features

Smallish. Very like a *microstigma* or like a smallish *chryso stigma* with very short pterostigma and no white thoracic stripes.

♂, ♀. Lips and front of frons pale. Peaks of vertex low. Thorax with thin dark lines, especially in juvenile; no whitish stripes. Legs mainly black in ♂, black at knees in ♀.

Subcostal cross-veins yellow, or black superimposed with yellow. Radial supplement of 1 to 2 rows. Pterostigma only 2 mm, yellowish brown between black veins. Membranule grey.

Abdomen pruinosed; in juveniles and females segments 4-7 orange-brown with black carinae and black lateral spots at both ends of these segments or partial mid-lateral stripe; segment 8 black with orange lateral band, 9-10 mainly black. Cerci of ♀ yellowish.

Anterior lamina very slightly bifid at apex and with septum; some short pale outer spines and sparse hair. IH prominent, with large hook pointing forwards or obliquely outwards (like *caffrum*); OH with apical ridge as in *chryso stigma*. Genital lobe large, with spiny hair. Alae broad, simple rather like *caffrum*. Vulvar aperture with swollen lips. Foliations narrowish, black, rather rounded.

Distribution. Angola, Zambia, Congo, northwards to Kenya, Uganda, N. Nigeria, westwards to Guinea.

Material examined. Zambia, Congo (Kinshasa), W. Kenya, N. Nigeria, Cameroons.

Orthetrum taeniolatum (Schneider, 1845) Fig. 14.

Synonymy. *O. hyalinum* Kirby (1886)

O. brevistylum Kirby (1898)

Diagnostic features

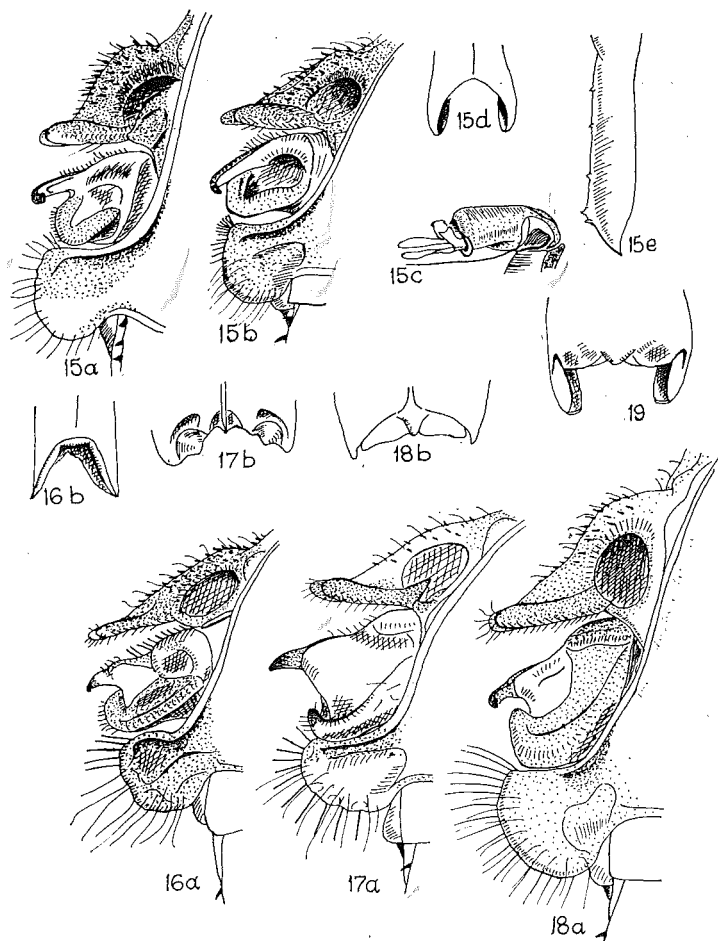
Very small to medium size, the abdomen not distinctly constricted, the thorax with white stripes as a typical *caffrum*. In appearance the smaller examples are like *kollmannspergi*.

♂, ♀. Lips and front of frons pale. Peaks of vertex lowish. At maturity the ♂ thorax and abdomen can be blue pruinose, but the thoracic stripes normally show through. In juvenile ♂ and in ♀ the thorax is brown, pale at sides, with white dorsal stripe and two white lateral stripes as in *caffrum*.

Subcostal cross-veins yellow. Radial supplement of 2 rows, rarely 1. Pterostigma short or shortish, yellow between black veins. Membranule white in ♀, in ♂ grey with white central stripe.

Abdomen rather evenly triquetral; dorsally orange, with black lateral stripe or partial stripe; the lateral carina black on segments 4-8, orange on 9-10. Superior appendage pale. Cerci grey and yellowish.

Anterior lamina *bifid* at apex; the outer surface with thick long hair. IH prominent, the hook slightly back-turned. OH with apical ridge but



Macrostigma group.

15. *abbotti* a. accessories (Rhodesia); b. accessories (Tororo, Uganda); c. prothallus; d. vulvar aperture (Rhodesia); e. left superior appendage.
16. *latihami* a. accessories, holotype (Congo); b. vulvar aperture (Congo).
17. *macrostigma* a. accessories (Zambia); vulvar aperture (Zambia).
18. *robustum* a. accessories, paratype ♂ (Botswana); b. vulvar aperture (Botswana).
19. *rubens* vulvar aperture (S.W. Cape).

more slenderly narrowed than in *chrysostigma*. Genital lobe small, rounded, with hair but no spiny hair. Alae rather like *guineense*. Vulvar aperture with *false* lips. No foliations on 8th segment in ♀, but developed on segment 9. One of these (from Eritrea, vide also *kristenseni*) is peculiar in having very blunt cerci, not acuminate as in normal *Orthetrum*. Other specimens from the same locality are typical *taeniolatum*.

Distribution. N. Nigeria, Somalia, Ethiopia, Sudan, Mediterranean islands, Western Asia.

Material examined. N. Nigeria, Ethiopia, Eritrea, Iraq, India.

g. MACROSTIGMA group

Typified by *O. macrostigma* Longfield.

Orthetrum abbotti Calvert (1892)

Orthetrum abbotti abbotti Calvert Fig. 15.

Synonymy. *O. phillipsi* Kirby (1896)

O. flavidulum Kirby (1898)

O. mundulum Morton (1928)

Oxythemis villiersi Fraser (1949)

The above synonymy may be partly explained because the smaller individuals (as in dwarfs of *Trithemis stictica* (Burmeister)) may have narrowed postdiscal field on forewing with a tendency to 2 rows. *O. mundulum* type is just a small *abbotti*, abdomen 20 mm, hindwing 22 mm. A ♀ *abbotti* seen by the Author (1964) in the Parcs Department collections, Bruxelles Museum, is labelled an *Oxythemis* "type": Lusinga, 1760 m, Upemba, S. Congo.

Diagnostic features

Small to moderate size, most frequently with greenish yellow thorax scarcely marked with black, or the body coated with plain blue pruinosity. ♂. Labium pale or with some black or brown traces; labrum pale. Frons usually with a dark grey smear across the groove and a grey line down centre of shield but less noticeable in teneral. Peaks of vertex extremely low. Thorax pale greenish with very thin dark sutural lines; eventually completely blue at maturity. Legs yellow and dark brown.

Subcostal cross veins yellow. Radial supplement 1 row, occasionally partially 2. Pterostigma longish and broad, yellowish between very *thick* brown veins, as in *hintzi*. Membranule white and grey.

Abdomen pruinosed; in juvenile with segments 4-7 broadly yellow dorsally (the dorsal carina sometimes with fine black traces); black laterally; 8 black with yellow lateral stripe, segment 9 more or less all black. Superior appendage straight. Anterior lamina deeply *bifid* at apex; short spines and few hairs. IH long, the hook small, directed back and then outwards; sometimes obscured by being clamped or closed down against OH. The OH is a V-shaped ridge. Genital lobe rounded, with hairs or, in a Tororo example, with spiny hair. Prophallus with simple alae. Abdomen with black dorsal carina. Segment 4 yellow with narrow black band on lateral carina; 5 to 8 or 9 yellow with black dorso-lateral

band; 9-10 more or less black.

♀. Labium pale; frons without grey marking along groove. Cerci black. Vulvar aperture simple with *false* lip. Foliations narrow, black, straight. *Distribution and variation.* Most of the Ethiopian region of Africa; examples seen from Ivory Coast have stronger thoracic markings and may represent a Western race. Madagascar has a separate race (vide infra). *Material examined.* Natal, Swaziland, Transvaal, Rhodesia, Zambia, Zambia-Katanga border, E. Angola, Kenya, Uganda-Kenya border.

***Orthetrum abbotti* subspecies *malgassicum* nov.**

Diagnostic features

Normally of medium size, as large as the largest individuals from the mainland.

They differ in the frontal shield markings being stronger, in the ♂ often broadly blackish, in the ♀ browner and less extensive. Humeral suture in juvenile ♂ and in ♀ with a broad or broadish brown suffusion.

It appears to be an emergent race, not yet fully distinctive.

Distribution. Madagascar.

Material examined. Madagascar.

***Orthetrum kristenseni* Ris (1911)**

Diagnostic features

Medium size, marked on thorax rather like *caffrum*. Wings frequently marked with golden in costal-nodal area.

♂, ♀. Lips and front of frons pale. Thorax with three black-edged yellow stripes each side, the lateral ones more posterior in position than in *caffrum*. Legs reddish brown marked with black.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma orange, not short. Costal and nodal zones often marked with orange or golden yellow, particularly the female.

Abdomen in juvenile ♂ or in ♀ pale with fine black dorsal carina. Ris (1919) says: Pale reddish brown, finely black on carinae, broader black on the carinae of 8-9.

IH prominent, turned backwards as in *macrostigma*, the OH thicker.

Vulvar aperture described by Longfield (1955) as a "curved cone". By the illustration it seems to resemble the aperture of *hintzi*.

Distribution. Only known from Ethiopia (Abyssinia). No examples available, except a dubious ♀ (Eritrea amongst *taeniolatum*) which is juvenile yet without amber wing markings and has been mentioned under *taeniolatum* for its very blunt cerci. The membranule is greyer than in typical *taeniolatum* and the abdominal markings are slightly different. The vulvar aperture is more like the latter.

***Orthetrum latihami* Pinhey (1966) Fig. 16.**

Diagnostic features

This and *macrostigma* are rather similar to *kristenseni* but both lack the white stripes on the thorax.

♂, ♀. Labium marked with some black or brown, at least the posterior lobe. Labrum and front of frons pale. Peaks of vertex low. Thorax pale brownish laterally, the humeral suture with thick blackish humeral band (like *hintzi*). Legs more or less black. Thorax pruinose in old ♂.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma long, yellowish between black veins. Membranule grey.

Abdomen in mature ♂ grey-blue pruinose. In ♀ segments 4-8 normally yellow dorsally, very broadly black laterally; segments 9-10 mainly black.

Anterior lamina very slightly bifid at apex; the back (anterior end) well sloped, coated with short black spines and some hairs. IH prominent, with long hook directed back (like *macrostigma*). OH broad, curved round apically on to soft base of IH. Genital lobe rounded, with some hairs, but with spinous hair only on anterior margin. Alae simple. Cerci dark brown. Vulvar aperture simple. Foliations narrow and black.

Variation. Sierra Leone examples have the labium all pale and no humeral band, only an antehumeral line. Abdomen also slightly less black. Possibly a western race. Mature ♂ fully pruinose like the normal form.

Distribution. Congo (Kinshasa), Sierra Leone.

Material examined. Congo (Kinshasa), Sierra Leone.

***Orthetrum macrostigma* Longfield (1945) Fig. 17.**

Diagnostic features

Medium size. Similar to *latihami* but generally paler.

♂. Labium all yellow or sometimes with some brown suffusion in centre. Labrum and front of frons pale. Peaks of vertex low. Thorax pale brown at sides, with narrow black dorsal stripes and usually some brownish suffusion near humeral suture (not as strongly as in *hintzi*). Legs partly black.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma long, yellowish between black veins. Membranule grey and white. Abdomen pruinose pale blue at maturity. Juvenile with segments 4-8 orange with black dorsal carina, black lateral band; segment 9 with pale spot, 10 all black.

Anterior lamina deeply *bifid* at apex; the lip black, the rest of the lamina pale, with few short spines. IH prominent the hook very large, directed backwards (not turned). OH narrow, turned forward and inward at apex but not curved round base of IH. Genital lobe rounded, usually dark anteriorly, pale posteriorly with some long hairs and spinous hair; in older ♂ the lobe darkens. Alae simple.

♀ Lips all pale. Thorax yellow with brown antehumeral stripe. All wings deeply amber at base. Cerci black. Vulvar aperture with lateral conical tumours and false lips. Abdomen with black dorsal carina. Segments 4-9 yellow dorsally, broadly black laterally. Segment 8 with broad yellow foliations narrowly edged with black.

Distribution. Angola, Zambia, Tanzania, Katanga.

Material examined. Zambia.

Orthetrum robustum* Balinsky (1965) Fig. 18.Diagnostic features*

Large, the hindwing nearly 35 mm. In appearance rather like *trinacria* but the abdomen not so long.

♂. Labium with posterior lobe black, the black sometimes slightly spreading on to lateral lobes. Labrum and front of frons pale. Peaks of vertex low. Thorax with thin sutural stripes and antehumeral line. A pale ventral spot on mesepisternum. Legs mainly black. Thorax not pruinose. Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma shortish (3 mm), yellowish between black veins. No basal amber. Membrane *white*.

Abdomen blue pruinose at maturity. Juvenile marked as in ♀. Superior appendage black.

Anterior lamina slightly bifid; short sparse hair and short brown bristles. IH rather like *latihami*, prominent, directed back but curved down at tip (rather like *machadoi*). OH like *macrostigma* but broader; but also not curved around base of IH as it is in *latihami*. Genital lobe broad, rounded, with some hair and spinous hair. Alae simple broadened in basal half.

♀. Labium all pale. Legs black at knees. Abdominal segments 4-7 yellowish brown with black carinae and black lateral patch at both or at distal ends; segments 8-9 black, but yellowish at lateral carinae. Cerci black. Vulvar aperture with *false* lips. Foliations narrow, yellowish brown.

Distribution. Botswana, Zambia.

Material examined. Botswana, Zambia.

Orthetrum rubens* Barnard (1937) Fig. 19.Diagnostic features*

Somewhat like a large *caffrum*, with dark red body, no pruinosity and no dorsal cream stripe on thorax. Wings mainly amber in juveniles. S.W. Cape Province.

Paratypes of both sexes in the British Museum (Nat. Hist.) are evidently juveniles (like the series in the South African Museum). The wings are smoky, the costa of the ♀ strongly amber.

♂, ♀. Lips and front of frons unmarked with black. Peaks of vertex low. Thorax reddish brown with brown antehumeral stripe and two brown-edged creamy yellow lateral bands, the brown being thicker on anterior edges. Leg partly black in ♂, black at knees in ♀.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma about 3.5 mm or more, deep yellow between black veins. Bases of all wings usually marked with deep amber; juveniles with strong amber streaks in anterior parts of wings. Abdomen red-brown to orange-red. Segments 4-8 with black dorsal carina, black lateral band and black distal patches or bands; 9-10 black with orange traces.

IH prominent and broad, directed backwards like *macrostigma* and others but the hook minute. OH broad and rather prominent. Alae simple.

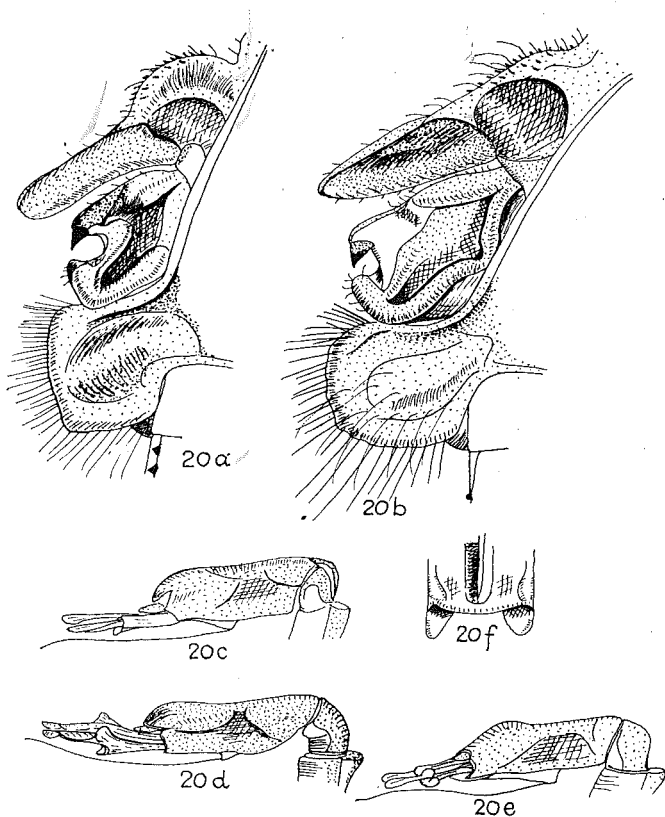
Cerci black. Vulvar aperture with lateral depressions. Foliations narrowish, orange, with broad black border. The pale thoracic stripes become very indistinct in mature females.

Distribution. South western Cape Province.

Material examined. South western Cape. Females only: Blinkwater Stream (Table Mountain, leg. Pinhey), Stellenbosch, Caledon (leg., C. G. C. Dickson). Only the example from Blinkwater stream is morphologically like the type series in having a red body, whitish thoracic stripes, and somewhat amber-fumose wings. It is less mature than the other females.

h. BRACHIALE group

Orthetrum brachiale (Beauvois, 1805) Fig. 20.



Brachiale group.

20. *brachiale brachiale* a. accessories (Vila Luisa, Moçambique); b. accessories, *kalai* (N. Congo); c. prophallus (Moçambique); d. prophallus, *kalai* (N. Congo); e. prophallus, melanic (Forêt d'Isaka, Madagascar); f. vulvar aperture, *kalai* (Cameroons).

New synonymy (see below). *Libellula stemmalis* Burmeister (1839)

Libellula contracta Rambur (1842)

Libellula coarctata Rambur (1842)

Libellula wrighti Selys (1896, Seychelles)

Orthetrum stemmale kalai Longfield (1936)

It has seemed to the present author for some time that *brachiale* and the *stemmale* complex intergrade and must in fact be conspecific: This is due firstly to the difficulty of separating continental *brachiale* from *kalai*. The difference in reality is purely a question of melanic development. As suggested under *julia* the degree of darkening might be due to light or heat. Secondly there is the problem of distinguishing some Madagascar and Mauritius material. The obvious conclusion is that they are all really *brachiale* and its subspecies and forms, except *lemur* which is evidently a distinct species, probably having common ancestry with *brachiale*. Fraser's *milloti* is a race or form of *lemur*. There are only two races of *brachiale*, the nominotypical and *wrighti*. Other taxa are melanic forms, probably recessive instead of being dominant as in *julia*. There is some variation in the prothalli.

The brachiale-stemmale complex

After discussion in correspondence with Gambles the Author considers it necessary to enlarge on the reasons for the synonymy. Gambles believes it possible to separate *kalai* from *brachiale* on the central sculpturing of the hamule. In *brachiale* there is an isolated central tumour, in *kalai* this tumour is replaced by a ridge confluent with the peripheral rim of the OH. In fact, there is no such clear-cut distinction. The IH hook varies considerably and so does this tumour. In older or more heavily chitinised and particularly blacker males, with or without blue pruinosity, there is normally a continuous ridge. In any case sculpturing of the hamule can have little significance in coition. The hooks themselves are of more importance. The true taxon *kalai* is no more than one of several variant melanic forms of *brachiale*. Reasons for this synonymy will be given here, followed by examples chosen from the National Museum collection.

1. In the case of one pair taken in copula at Samfya, Zambia, the male is a very black *kalai*, with black subcostal veins and thorax and the hamular ridge is continuous. The female is a typical *brachiale*, with yellow subcostals and pale thoracic stripes. This was not the first pointer to conspecificity but it is an important fact.

2. The hamule of teneral or juvenile *brachiale* may or may not show a slight central swelling below the base of IH. In later stages the swelling becomes more prominent and elongated, an ellipse or a ridge extended to the peripheral rim of OH.

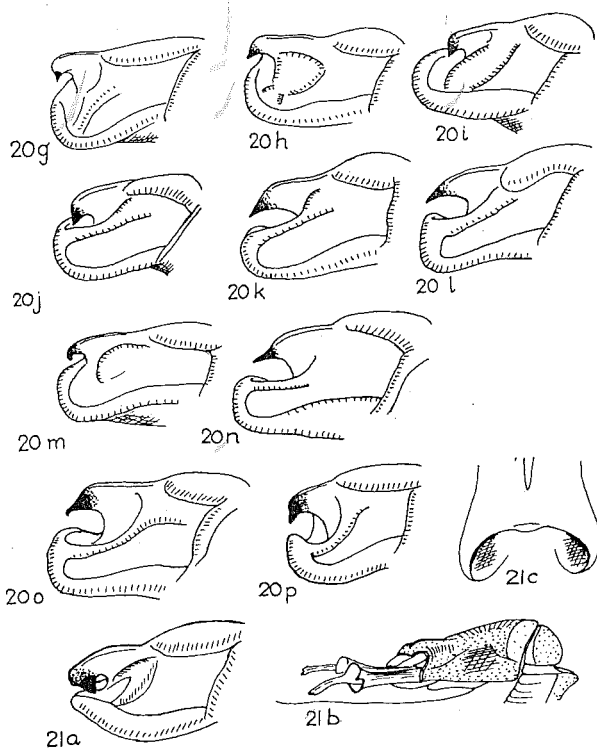
3. Examples with black subcostal cross-veins occasionally show the same range of tumour to ridge development on the hamule. Usually, however, being more sclerotized, the ridge develops at an early stage.

It should be noted that this tumour-ridge developmental phase appears to be confined to continental *brachiale*. In insular tenerals or juveniles from Madagascar, Mauritius and Seychelles, there is a ridge continuous with

the periphery. The ridge is a strengthening feature. Another variable factor is the IH hook, which can vary considerably in size and shape. In true *brachiale* it is often small, sometimes large. In melanics it is normally large, probably influenced by the tendency in hotter, moister areas to greater chitinisation and thickening. If only this hook is taken into consideration it might be thought that several species are involved. When resolved with other factors it is evident that this is not the case but purely a variant appendage of one species.

A selection of male examples can now be considered. The relative positioning of the IH hook is unimportant. It may of course, be wide open, or clamped down against the OH.

Fig. 20 g. Teneral, Bulawayo. Typical *brachiale* with yellow subcostal cross-veins and pale thoracic stripes. IH hook of hamule small the swelling below its base forms a ridge extending to posterior peripheral rim.



Brachiale group.

20. *brachiale* g - p. form of hamule g. teneral, Bulawayo, h. juvenile, Nkata Bay, i. Botswana, j. juvenile, Natal, k. mature, Nkata Bay, l. Nkata Bay, m. mature, Zambia, n. teneral, Madagascar, o. mature *kalai*, Ivory Coast, p. mature subspecies *wrighti*, Seychelles.
21. *lemur* a. hamule (Madagascar); b. prophallus (Anjiro, Madagascar); c. vulvar aperture (Madagascar).

Fig. 20 h. Juvenile, Nkata Bay, Malawi. Typical *brachiale* as before. Hook small, an isolated swelling below it.

Fig. 20 i. Mature, Khwaai River, N. Botswana. A *brachiale* with pruinosed blue thorax. Hook large, a broad central, continuous swelling.

Fig. 20 j. Juvenile, Empangeni, Natal, Typical *brachiale*. Hook large, a ridge below it continuous with the peripheral rim.

Fig. 20 k. Mature, Nkata Bay. Typical *brachiale*. Hook large, the swelling continuous with the periphery.

Fig. 20 l. Fairly mature, Nkata Bay. Intermediate to form *kalai*, the subcostals black and yellow, the thorax sharply contrasting black with pale green stripes. Hook large, the ridge below it continuous with the periphery. A mature blue ♂ from near Lourenço Marques has yellow subcostals as in normal *brachiale*, but the hamule is just like fig. 20 l. A similar example is from Ilonga, Tanzania.

Fig. 20 m. Mature, Gwembe, Zambia. A *brachiale* with yellow subcostals and blue thorax. Hook small, slightly curved at tip. Below it an isolated swelling, ill-defined posteriorly.

Fig. 20 n. Teneral, from Ambatondrazaka, Madagascar. Typical *brachiale* with yellow subcostals and pale thoracic stripes. Hook large, a slight ridge below it continuous with the periphery. Mature and immature examples from Mauritius have similar hamules.

Fig. 20 o. Mature, Tiassale, Ivory Coast. A very blackened *brachiale* form *kalai*. Black subcostals and thorax. Hamule all black, hook large, the ridge continuous.

Fig. 20 p. Mature, from Mahé, Seychelles. A *brachiale wrighti* with black subcostals and blue thorax. Hamule black, hook large, with ridge below it.

Orthetrum brachiale brachiale (Beauvois)

Continental specimens are usually of moderate size, sometimes smallish; so are those from Madagascar. Examples from Mauritius and Seychelles are consistently smaller on average.

Diagnostic features

Thorax with narrowish black dorsal and lateral stripes and generally, when not melanised, with one or two whitish green lateral stripes. Radial supplement always of 2 rows. Subcostal cross-veins yellow, sometimes black overlaid with yellow.

♂, ♀. Labium black centrally, or only black on posterior lobe. Labrum and front of frons pale. Peaks of vertex low. Thorax pale olivaceous or greenish with narrowish black dorsal and lateral stripes, generally showing one or two whitish or whitish green lateral stripes, particularly on the mesepimeron; the mature ♂ grey blue pruinose, obscuring the stripes. Legs mainly black.

Subcostal cross-veins yellow or black superimposed with yellow. Radial supplement distinctly of 2 rows. Amber absent or only a trace, in ♀ more than in ♂. Membranule grey. In Mauritius the amber is absent in ♂, rarely present as a trace in ♀.

Abdomen dark, pruinose pale blue in mature ♂. Juvenile ♂ black, with yellow lateral spots on segments 4-6; female also black, with short yellow lateral bars on 4-6 or 7; 7-9 usually almost all black; 10 black or with traces of yellow. Superior appendage blackish at maturity, but yellow in insular races. Cerci yellow to dark brown.

Lips of anterior lamina massive, not bifid at apex, extending beyond the hamule; with short hair. Hamule broad, very depressed. IH large or smallish, flattish, back-turned, acute at tip; sometimes obscured by clamping on to OH or distortion may show the tip somewhat downturned. OH a sinuous ridge extending well round soft base of IH. Genital lobe massive rounded or square, bristly. Prophallus with long cylindrical body (not deep) and with alae funnelle in basal half.

Vulvar aperture with central crest and *lateral swellings*. Foliations broad, black.

O. brachiale mature males in Mauritius can be fully grey blue pruinose on the thorax, as in continental examples.

Distribution. Throughout Continental Africa, with melanic tendencies towards *kalai* in areas of higher humidity and temperature. Occurs on Madagascar, usually large individuals, occasionally melanotic and then immature ♂ or ♀ are difficult to distinguish from immature *lemur* except by prophallus. Occurs on Mauritius, Rodriguez and Réunion as small individuals.

Material examined. Natal, Moçambique, Rhodesia, Victoria Falls, Botswana, Malawi, Zambia, E. Angola, Katanga, Congo (Kinshasa), Congo (Brazzaville), Tanzania and Lake Rukwa, Kenya, Gabon, Camerons, E. Nigeria, Ivory Coast, Madagascar, Mauritius, Annobon Isl. (Guinea Gulf).

Orthetrum brachiale form *kalai* Longfield **comb. nov.**

Diagnostic features

The main difference from *brachiale* is the darker subcostal row of cross-veins. Medium to largish, darker or much darker than typical *brachiale*. The prophallus varies slightly.

♂, ♀. Labium broadly black; labrum mainly black or lower half black (like typical *julia*). Thorax with thick black stripes, no pale ones; or heavily melanotic. Legs mainly black. Subcostal cross-veins black or black superimposed with traces of yellow. Radial supplement of 2 rows.

Abdomen black with yellow lateral spots on segments 4-6; or pale blue pruinose in mature ♂. Superior appendage yellow in juveniles, then darkening. Prophallus blacker than in normal *brachiale*.

Other features as in typical *brachiale*. A female from Ghana has a black frontal band on the crest, somewhat transitional to *wrighti*.

Variation. Occasional males (Ghana and elsewhere) may be all black on the thorax, like *julia*, and only the hamule will separate them.

Distribution. Recorded amongst *brachiale* in most parts of its range, indicating that it is much more likely a melanotic condition than racial: S.W. Africa to Nigeria and westwards; Rhodesia, Moçambique and north-

wards to Kenya, but mainly scattered individuals.

Material examined. Victoria Falls, Malawi, Zambia, N. Congo (Kinshasa), Kenya coast, Congo (Brazzaville), Central African Republic, Cameroons, Fernando Po, E. Nigeria, Ivory Coast, Ghana.

Orthetrum brachiale wrighti (Selys) **comb. nov.**

This is the only really distinctive subspecies.

Diagnostic features

Smaller than the continental forms of *brachiale* and darker on the face. Occurring solely in the Seychelles it has probably developed its more distinctive features in evolutionary isolation.

♂, ♀. Differ from *brachiale*, chiefly on head markings. Labium and labrum broadly black in adults and teneral; frontal shield broadly black in adult and juveniles. Peaks of vertex very high. Thorax with thick black stripes; mature ♂ blue pruinose but the mesepisternal stripes are still visible. Abdomen black with minute yellow spots on segments 4-6. Superior appendages yellowish in juvenile, dark brown at maturity; inferior yellowish. Cerci yellow.

Otherwise like small *brachiale*. Prothallus similar, with long cylindrical body.

Distribution. Seychelles.

Material examined. Seychelles.

Orthetrum brachiale forma stemmale (Burmeister) **comb. nov.**

A small insect described from Mauritius. The present Author has examined long series of *Orthetrum* from that island (Pinhey, 1962 b) and all have been typical but small *brachiale* except a few males mostly transitional, and one ♀.

In some males the subcostal cross-veins are black superimposed with yellow instead of being plain yellow. In others they are blacker. Otherwise like the series of small *brachiale*. The ♀ is old, with smoky wings. Subcostal veins quite black. Radial supplement of 2 rows but one cell is tripartite on one wing, as though starting a partial third row. Labrum with black lower margin and basal spot. Frons broadly black on shield (as in *wrighti*), on base and on sides; only pale on the crest. In the rest of the series the labrum and front of frons pale as in normal *brachiale*. Genitalia are typical. Cerci yellow.

The obvious inference is that *stemmale* is only a variant of *brachiale*, a melanic recessive, probably Mendelian, which is either being genetically obliterated or is spasmodically developed. Genetical domination by the paler *brachiale* is most likely.

Distribution. Mauritius.

Material examined. Mauritius.

Orthetrum lemur Ris (1909) **stat. nov.** Fig. 21.

Synonymy. *O. milloti* Fraser (1949) **syn. et stat. nov.**

Whether *milloti* is a good subspecies or an ecological form occurring,

perhaps, in drier areas, is not quite clear but here they will be treated as forms. The author is indebted to Prof. R. Paulian for the interesting series. Certainly their areas overlap if not the actual localities.

Forma *lemur* Ris.

Diagnostic features

Largish species, the thorax suffused with smudged black reticulation; the mature ♂ fully pale blue pruinosed, obliterating the black markings. ♂. Labium, labrum and front of frons, broadly black even in teneral. Peaks of vertex very high, as in *brachiale wrighti*. Thoracic black thick and reticulate rather than in stripes; completely pale blue at maturity (in pruinose *brachiale* the black antehumeral stripe still shows through). Legs black.

Subcostal cross-veins black or black superimposed with yellow; radial supplement of 2 rows. Pterostigma dark brown. Basal amber trace on hindwing. Membranule grey.

Abdomen pruinosed. In juvenile black with minute yellow lateral spots on segments 4-6. Superior appendage dark brown. Accessory genitalia very like *brachiale* but the IH hook normally more down-turned. Pro-phallus body shorter than in *brachiale* and not cylindrical but deepened posteriorly.

♀. Labium with less black but labrum and front of frons as black (or deep brown) as in the ♂. Pterostigma lighter brown. Abdominal segments 4-10 black, 4-6 with yellow lateral spots; 7-8 black; segment 9 black dorsally, yellow ventrally; segment 10 mainly yellow. Cerci yellow. Vulvar aperture somewhat like *julia*, having no lateral swellings but without central crest. Foliations broad, black.

Distribution. Madagascar.

Material examined. Madagascar: Tullear region, Anjiro, Ranomafana (Tamatave).

Forma *milloti* Fraser

Diagnostic features

Paler than true *lemur* in facial markings, the blue pruinosity being supposedly deeper. The pruinosity does not separate the two taxa, however, since it varies in both.

♂. Labium and labrum all pale; frons mainly black. Legs with less black. Subcostal cross-veins black superimposed with yellow. Pterostigma paler. Accessory genitalia similar but less blackened. Prophallus similar.

♀. Lips, face, and frons all pale. Otherwise similar. It is more likely that *milloti* is an ecological form not a race. Intermediate stages do occur, for instance, the labrum in *lemur* may be less black.

Distribution. Madagascar.

Material examined. Madagascar: Tullear, Behara, Forêt Befasy (Morondava).

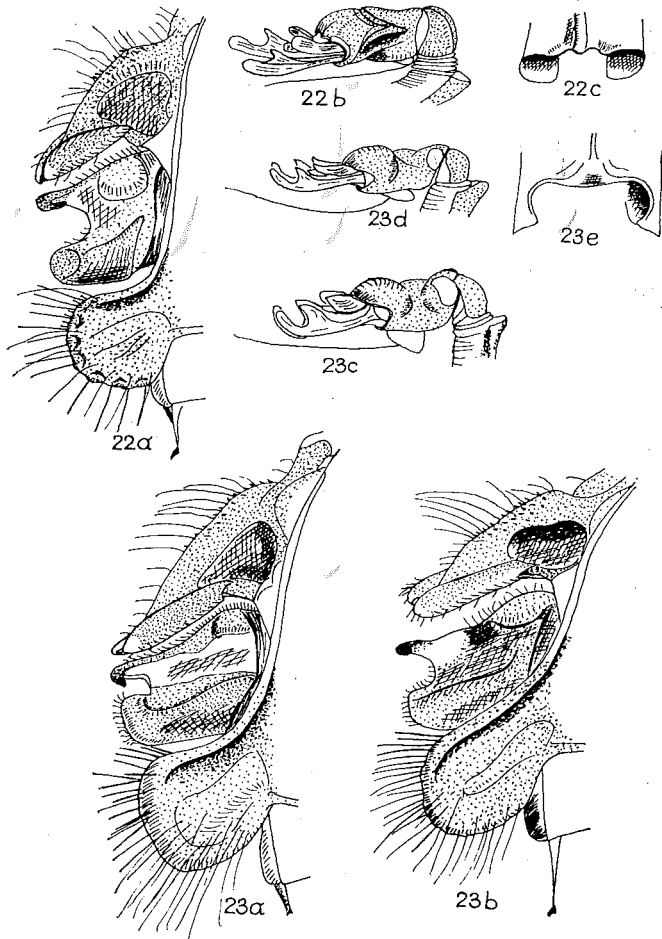
i. JULIA group

Orthetrum guineense Ris (1909) Fig. 22.

Diagnostic features

Medium sized. In genitalia and sometimes in facies, this is very close to *julia falsum*.

♂. Labium black on posterior lobe, with a central band on lateral lobes. Labrum and front of frons pale. Peaks of vertex low. Thorax with black antehumeral stripe and thin sutural lines. All blue pruinose in older ♂, unlike typical *julia*, and with the black antehumeral stripe visible. Legs



Julia group a.

22. *guineense* a. accessories (Zambia); b. prophallus; c. vulvar aperture (Rhodesia).
 23. *julia* a. accessories, *julia* (Ivory Coast); b. accessories, *falsum* (Marromeu); c. prophallus *julia* (Centr. African Republic); d. prophallus, *falsum* (Transvaal); e. vulvar aperture, *julia* (Ivory Coast).

mainly black.

Subcostal cross-veins yellow. Radial supplement of 1 row. Pterostigma shortish, about 2.5 mm, yellow-brown between black veins. Traces of basal amber on hindwing. Membranule grey.

Abdomen blue pruinose. In juvenile black with yellow sublateral spots on 7-9; or yellow with black dorsal carina and broad black lateral band. Superior appendage black.

Anterior lamina with septum at apex, not bifid. Lips broad. Short black spines usually present. Hamule broad. IH *long*, turned outward and slightly downward. OH broad, well swollen, with a shelf along its base. Genital lobe rounded, with long and short spinous hairs and some hair. Prophallus with oblique ridges on body; alae branched, as in *julia*. Very close to *julia*.

♀. Labium pale or with traces of black. Wings occasionally all broadly amber at base. Thorax pale at sides, with narrowish brown antehumeral and humeral stripes. Abdomen quite different to male. Orange-brown with black carinae (like *microstigma*). Cerci dark brown. Vulvar aperture with very widely splayed lips, very like *julia*. Foliations yellow, bordered with black.

Distribution. Natal northwards to Tanzania and Somalia; Angola, Zambia northwards to Nigeria and westwards to Guinea.

Material examined. Rhodesia, Zambia, Zambia-Katanga border, N. Central and East Angola, Katanga, North Tanzania, Kenya, Cameroons, Gabon, Uganda, Togo, Sierra Leone. Particularly common in North and North West Zambia, although in South Katanga it is replaced by the rather similar *machadoi*.

***Orthetrum julia* Kirby (1900) Fig. 23.**

Established synonymy. *O. contractum nigrescens* Foerster (1906)

O. stemmale congoense Fraser (1949)

New synonymy. *O. falsum* Longfield (1955) **syn. nov.**

O. contractum Calvert (1899).

O. stemmale capense Ris (nec. Calvert) (1908).

O. falsum capicola Kimmins (1957) **syn. nov.**

It is quite evident that *julia* and *falsum* are conspecific. Longfield (1955: 26) suggested they hybridized.

In this revision it will be considered that there are three main races, *julia*, *falsum* and *capicola*, although in fact it is much more likely that the relationship is either a cline or due to genetical factors influenced by climatic conditions. The paler forms are to be found mainly in the East and South. The darker or true *julia* is more dependant on higher temperature or humidity. Fraser compared his *congoense* to *stemmale*, showing differences in venation and in dark brown rays on hindwing. In these features, however, it resembles *julia*.

Orthetrum julia julia Kirby

Diagnostic features

Medium to largish, with green thorax thickly striped with black, in the ♂ becoming all black on the thorax, blue pruinose on the abdomen. The labrum is darker than in the other races. Amber on hindwing darker. ♂. Labium broadly black; labrum broadly black at least the lower half. Frons not black on shield. The juvenile has similarly blackened lips. Peaks of vertex rather high. Thorax (as in *microstigma*) green with thick black bands, or all black at maturity, occasionally thinly dusted with blue. Legs black. Intermediates to *falsum* are occasionally pruinose blue on the thorax, with the black antehumeral visible as in *guineense*, at least in N. Zambia. Subcostal cross-veins black. Radial supplement of 1 row. Pterostigma nearly black. Hindwing with dark amber basal patch. Membranule grey.

Abdomen black with yellow lateral spots on segments 4-6 and trace on 7; or pruinosed pale blue. Segments 8-10 almost all black. Superior appendages yellowish, sometimes partially darkening. Anterior lamina not bifid at apex, blackish, with short spines and longish hair. IH with small hook turned obliquely outward and posteriorly; OH massive, swollen. Genital lobe rounded massive, with black spiny hairs. Alae of prophallus divided.

♀. Legs mainly black. Radial supplement of 1 or 2 rows. Abdomen as in juvenile male. Cerci blackish. Vulvar aperture simple, without swellings. In juveniles the wings may be very broadly amber.

Distribution. Angola, Zambia, Congo, to Nigeria and westwards to Sierra Leone.

Material examined. Examples of the westerly *julia* occur as far east as Malawi, amongst *falsum*. N.W. Zambia, Malawi, Congo (Kinshasa), Congo (Brazzaville), Gabon, Uganda, Cameroons, E. Nigeria, Central African Republic, S.W. Sudan, Fernando Po, Ghana, Ivory Coast, Liberia, Sierra Leone.

Orthetrum julia falsum Longfield **stat. nov.**

Diagnostic features

Not so dark as the nominotypical race. More or less medium size.

♂. Labium more or less broadly black. Labrum varying from all pale to having black outer margin and central dot. Frons not black on shield. Thorax green, normally with thick black dorsal and lateral stripes (like juvenile *julia*), scarcely pruinose except in the South. Natal examples, for instance, may have the thorax all grey blue. Legs more or less all black, completely so at maturity.

Subcostal cross-veins black. Radial supplement of 1 row. Pterostigma pale brown, between black veins, often becoming almost all black. Hindwing with amber basal patch. Membranule grey.

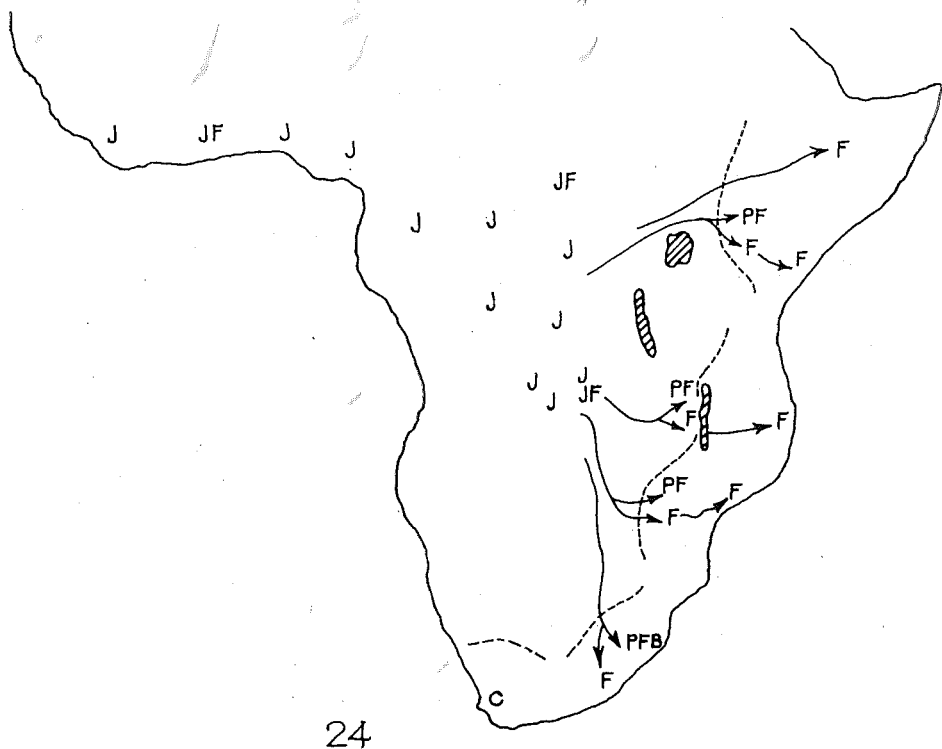
Abdomen pale pruinose blue. Juvenile with segments 4-10 black; yellow lateral spots on segments 4-6. Superior appendage creamy whitish in juveniles becoming black at full maturity.

Anterior lamina not bifid apically, with thick apical septum. Resembles *julia*. IH with small hook turned outwards and sometimes backwards. In

the more southerly examples the hook tends to be twisted outwards at right angles. As in *julia* the genital lobe has numerous black spiny hairs. ♀. Lips usually with less black than in ♂. Legs mainly black. Radial supplement of 1 or partially 2 rows. Segments 4-10 black: 4-6 with broader yellow lateral bars than in ♂. Cerci black. Foliations broad, black. Vulvar aperture simple, wide, thin-walled and exceedingly like *guineense*.

Juvenile ♀ often broadly amber on all wings (*c.f. microstigma*).

Variation. Some examples from Kenya, Malawi and Natal are paler, although the normal form occurs in both territories. The labium is all pale, the black basal band on frons is reduced; thorax pale at sides without the usually thick stripes. Anterior lamina paler, the hamule dark brown instead of black. Otherwise like *falsum*. Intermediate varieties between this and the norm occur sometimes on the Vumba Mountains and at Mount Selinda in Rhodesia. Natal examples range from pale to well striped individuals. Perhaps further investigations may show all these to be



24. Distribution of *julia* cline
 black Sc: J = *julia julia*, F = *julia falsum*, JF = intermediates to falsum, PF =
 pale montane falsum, PFB = blue thorax form. yellow Sc: C = *julia capicola*,
 . . . Tentative boundary between hook of IH twisted and hook straight.

montane ecological variants. On the other hand a similarly pale *falsum* is found at Port St. Johns, Eastern Cape Province, which is at low coastal level. The legs are only black at the knees and the superior appendages are blackish in this specimen. Like all these variants the subcostal cross-veins are black. Southerly examples as mentioned above, may differ in becoming fully pruinosed on the thorax.

Distribution. Eastern Cape Province and Natal northwards to Ethiopia; more westwards, in Zambia, Congo, Uganda, and probably elsewhere, it overlaps with and certainly intergrades with true *julia*.

Material examined. E. Cape, Natal, Transvaal, Moçambique, Rhodesia, Zambia and Barotseland, Malawi, N. Angola, Katanga, Tanzania, Kenya, Ethiopia, Gabon, Congo (Brazzaville), Nigeria.

Orthetrum julia capicola Kimmins **stat. nov.**

Diagnostic features

Paler than typical *julia falsum* and with yellow subcostal veins. Sides of thorax with pale stripes reminiscent of *brachiale*.

♂, ♀. Lips and front of frons all pale. Thorax green with thin black dorsal and lateral stripes (unlike the pale variant of *falsum*) and two paler whitish green lateral stripes. Legs black just at knees in both sexes.

Subcostal cross-veins yellow. Radial supplement tending to be 2 rows. Pterostigma pale brown between black veins.

Segment 4 of abdomen pale with black carinae; 4-7 black with yellowish lateral bands. Superior appendage black. Cerci yellowish. Accessory genitalia not distinctive but paler than in *falsum*. Anterior lamina yellowish brown with black lip; hamule mainly brown; genital lobe pale with black anterior portion.

Distribution. S.W. Cape Province.

Material examined. S.W. Cape Province.

Clines in O. julia. Fig. 24 Selected examples.

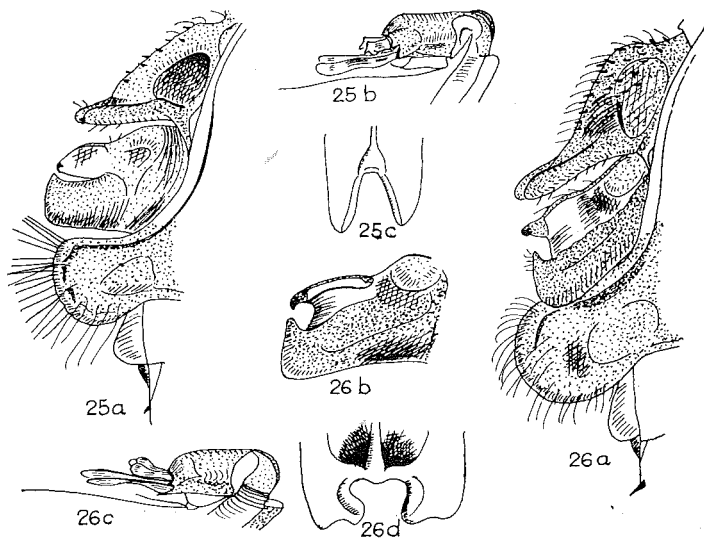
A preliminary overall plan of distribution of the species *julia*, with data from its entire range in the National Museum, is attempted here in the form of a map. It is based purely on male characters since females are less diverse. It seems probable that the primordial centre may have been the West African equatorial forests where *julia* is a dominant member of the *Libellulidae* (together with *Hadrothemis* spp.). In moving East and South East, out of the heavy forest into more isolated patches of forest or bush the species became less densely melanotic. J, the melanic *julia*, shows some tendencies in the equatorial zone here and there to mixed populations (JF).

Nearer the eastern coasts *julia falsum* (F) becomes dominant except in some isolated tropical pockets, particularly Malawi, which has equatorial affinities in other groups as well as here. A side effect of this apparent population movement in the past is the production of a paler form (PF), possibly a more montane bush form. Small areas of PF can be traced from the eastern Cape and Natal northwards at least to Kenya.

In the South East, particularly in Rhodesia and Natal, the mature male may become uniformly pale blue on the thorax. Thoracic blue may be seen elsewhere in the F or even the J range, Malawi for instance, but true *julia* rarely becomes slightly pruinosed on the thorax. The probable reason for this may be surmised. It is the heavy black marking in J and JF populations. Blue exudation on the abdomen or thorax perhaps shields the insects from excessive sun. Black on *julia* J and JF thoraxes absorbs the lesser solar penetration in the equatorial jungles, while blue in more scattered bush country has the opposite effect.

One further complication lies in the aspect of the hook of the inner hamule (IH). In *julia* this hook is normally set obliquely on its stem. When the gap between IH and OH is reduced, as in coition, the angle of twist of this hook may be distorted. At rest, however, in J and JF and some tropical F it is usually turned slightly posteriad. In F nearer the eastern and southern coasts, as well as C, the hook at rest most frequently stands out at right angles to its stem. Here again Malawi shows mixed populations with hook twisted or straight. Some Moçambique forest examples may also have the crooked hook. The very rough division between oblique and right angled hooks is indicated by the dotted line.

It must be emphasized, of course, that these remarks are purely surmise, based as they are on an extensive but single Museum collection. The melanotics, mainly in the equatorial belt, may be blacker through living in heavy forest, with less penetrable light, than in the more open bush country where *falsum* or intermediates are normally dominant. Possibly



Julia group b.

25. *hintzi* f. *zernyi* a. accessories (Malawi); b. prophallus; c. vulvar aperture (Uganda).
 26. *icteromelan cinctifrons* a. accessories (Rhodesia); b. hamule (Zambia); c. prophallus; d. vulvar aperture (Rhodesia).

the temperature gradient might be more influential than the light factor, the darker individuals breeding in warmer conditions. Pockets or tongues of isolated melanics further eastwards, for instance in the general vicinity of *falsum*, may actually live in warmer surroundings. Because of the considerable overlaps *falsum* cannot be regarded as a true subspecies of *julia*. The ideal cline would also show, perhaps, a still more gradual change from *julia* to pale *falsum*, via intermediates, but it is a more elastic term than a subspecies. For convenience in terminology the term subspecies is retained here. Although inexact it does indicate that in the main the paler forms are predominant over a major area, namely the East and South of the Continent.

Orthetrum hintzi Schmidt (1951) Fig. 25.

Synonymy. *O. hintzi zernyi* Schmidt (1951)

Orthetrum vrydaghi Fraser (1954)

Aethiothemis paludinis Fraser (1954)

Oxythemis aequatorialis Fraser (1954)

The synonymised names erected by Fraser probably arose through venational aberration, at least in some degree.

It must be confirmed, as Longfield remarked, that the darker *zernyi* is not a race but a form of *hintzi*. Moreover, it is by far the commoner form. The forms intergrade to some extent.

forma *zernyi* Schmidt

Diagnostic features

Usually small, sometimes medium size. The thorax in juveniles laterally plain yellowish green and, in this form, with thick humeral band.

♂. Labium broadly black (narrower in juvenile); labrum and front of frons pale. Peaks of vertex very low. Thorax in juvenile and teneral yellowish green laterally, with very broad black humeral-antehumeral band. Mature ♂ all black, sometimes thinly pale blue pruinose overlying a melanised thorax. Legs mainly black.

Subcostal cross-veins yellow. Radial supplement of 1 row. Pterostigma long, yellowish between *thick* black veins. Membranule grey.

Abdomen of mature ♂ black with pale blue pruinosity. In juvenile segments 4-9 are yellow dorsally, broadly black laterally. Superior appendage black. Anterior lamina slightly bifid apically and with septum; very sparse, short hair. Hamules massive. IH broad with small hook, turned outward. OH broad, swollen, curved apically towards IH, often obscuring the latter in lateral view. Genital lobe small, rounded, with some bristly hairs. Prophallus with unbranched simple alae as in *caffrum*.

♀. Labium all yellow or just the posterior lobe black. On the abdomen, segments 4-9 are yellow dorsally, black laterally; 10 partly pale dorsally. Cerci black. Vulvar aperture simple. Foliation narrow, black.

Distribution. Natal northwards to Kenya; Angola and Zambia northwards to Nigeria and westwards to Sierra Leone. This form was described from South Tanzania.

Material examined. Natal, Transvaal, Botswana, Rhodesia, Zambia,

Malawi, W. and E. Angola, Katanga, Tanzania, Tanzania coast, Uganda, Cameroons, Ivory Coast.

forma *hintzi* Schmidt

Diagnostic features

Paler than *zernyi* but only differing in minor characters, which may intergrade; and may sometimes prove to be only maturation stages, the younger examples being more like true *hintzi*. The labium in either sex may be all pale or the posterior lobe black. The thoracic humeral band in juveniles is browner and not quite so broad. Otherwise there is scarcely any difference.

Distribution. Described from Portuguese Guinea but individuals may be found in other parts of the geographical range of the species. As explained above it is no more than individual variation, without Mendelian distinction, and in most cases it may prove to be maturational. Few adult pale examples have been examined.

Material examined. Transvaal, Rhodesia, Moçambique, Zambia, Katanga, Tanzania, W. Kenya, Kenya coast, Uganda.

***Orthetrum icteromelan* Ris (1909) Fig. 26.**

Orthetrum icteromelan icteromelan Ris

It has been pointed out to the Author by Mr. Richard Brooke (December 1969) that the specific name here is an adjective so that the familiar name *icteromelas* has to be altered to the neuter *icteromelan*. Described from Madagascar it has been found necessary to separate the continental African example as a distinct subspecies.

Diagnostic features

Medium size, with longish abdomen. Characterised by distinct black marking on frons, but less developed than in the continental subspecies.

♂, ♀. Differ from the new subspecies *cinctifrons* (infra) in the following respects: Frontal double ring mark thick above, normally incomplete below. In juvenile the thoracic stripes are brown not black. All wing bases in ♀ deeply amber, much more so than in *cinctifrons* and still more widely amber in juvenile ♀. Accessory male genitalia paler than in *cinctifrons*. Genital lobe with black spines.

Distribution. Madagascar.

Material examined. Madagascar.

Orthetrum icteromelan subspecies ***cinctifrons* nov.**

Diagnostic features

This continental race differs from the nominotypical race as indicated above. The longish slender abdomen, well swollen at base, is distinctively separated in the juvenile male and the female by the very clear black markings.

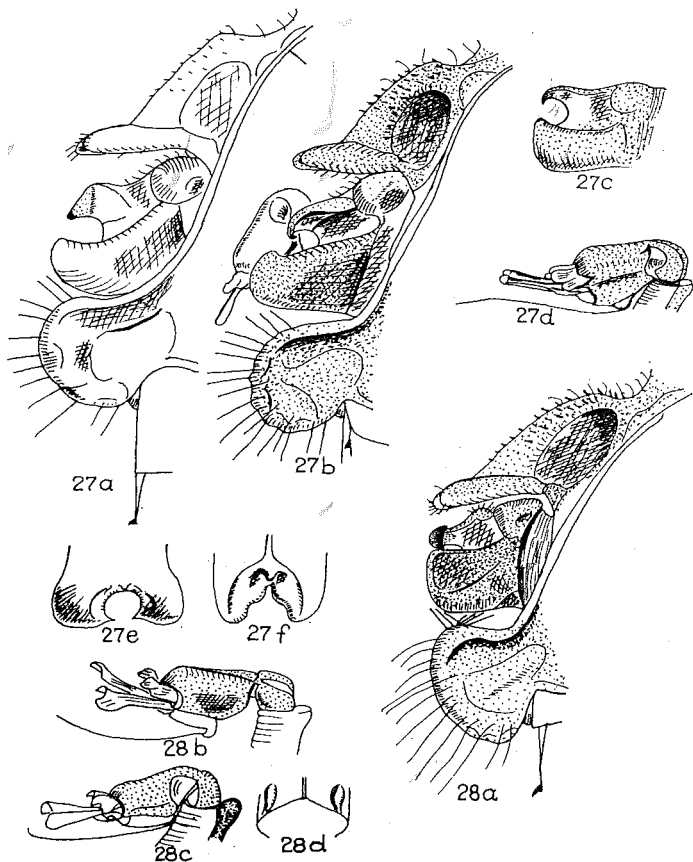
♂. Labium broadly black; labrum pale but usually with a black central dot. Shield of frons sharply edged with a black ring on each half to form a horizontal "8". Peaks of vertex extremely low. Thorax pale pruinose

like the abdomen at full maturity but with the black stripes showing through to some extent. Juvenile and teneral greenish and yellowish with sharp thickish black stripes (not somewhat diffuse as in some other dark species). Legs mainly black.

Subcostal cross-veins yellow. Radial supplement of 1-2 rows. Pterostigma long, yellow, between black veins. No basal amber in ♂, slight trace in ♀. Membranule grey.

Abdomen well swollen at base, then comparatively more slender than others in this group. Segments 4-10 in juvenile black with orange lateral stripes on 4-6. Superior appendage black.

Anterior lamina slightly bifid at apex; long, well arched anteriorly, with short spines. IH small, turned outwards. OH large, swollen, turned



Julia group b.

27. *machadoi* a. accessories, juvenile (Rhodesia); b. accessories, mature (Natal); c. hamule (Botswana); d. prophallus (Natal); e. vulvar aperture (Katanga); f. vulvar aperture (Mombasa).
 28. *saegeri* a. accessories, holotype (Congo); b. prophallus (Carnot); c. prophallus (Mwinilunga); d. vulvar aperture, neallotype (Congo).

in and forwards at apex. Genital lobe large, rounded; with white hair but normally without peripheral spiny hair. Alae not branched.

♀. Labrum pale. Frons with the rings black or brown, faint in teneral. Thoracic stripes black or deepish brown. Legs yellow striped with black. Abdominal segments 4-9 black dorsally, with long yellow sub-lateral stripes; segment 10 yellow dorsally. Cerci black. Vulvar aperture with thick lateral lips and anterior depressions. Foliations narrow with straight edge; yellow with black border.

Distribution. Natal and Moçambique northwards to Tanzania; Angola and Zambia northwards to Cameroons, Sudan and westwards to Sierra Leone.

Material examined. Natal, Moçambique, Transvaal, Botswana, Rhodesia, Zambia, Malawi, Uganda. Types in National Museum.

Orthetrum machadoi Longfield (1945) Fig. 27.

Synonymy. *Orthetrum rhodesiae* Pinhey (1961) **syn. nov.**

It is evident that *rhodesiae* is conspecific with *machadoi* but it is smaller and darker. Since the range of *machadoi* either overlaps with *rhodesiae* or at least encompasses its restricted known distribution it seems safer to consider *rhodesiae* an ecological palustrine form rather than a South Central African subspecies.

forma *machadoi* Longfield

Longfield (1955: 35) says one of the features in which *machadoi* genitalia differ from those of *hintzi* is in the narrow but deep channel between IH and OH. This is not a satisfactory distinction since, of course, the base of IH is always flexible and the gap can easily be altered. The IH often appears digitate, finger-like, in side view.

Diagnostic features

Medium size. Close to *hintzi* but the abdomen is not so black and the thorax has finer lines. The other forma *rhodesiae* is much more like *hintzi* in these respects.

♂, ♀. Lips and front of frons all pale. Thorax with only black sutural lines and brown antehumeral stripe, or with thick thoracic humeral band. Legs mainly pale; all pale in ♀. In old male the thorax is all grey-blue.

Subcostal cross-veins yellow. Radial supplement of 1 row or partly 2 in ♀. Pterostigma long, yellow-brown between black veins. Membranule grey.

Abdomen of ♂ pruinosed at maturity. Juvenile ♂ and the ♀ yellow-brown with black dorsal and lateral carinae or with black sublateral band. Superior appendage blackish. Cerci black. Anterior lamina not bifid at apex; arched at anterior end, with few sparse, short hairs and some setae. IH small, turned back obliquely, the hook bent downwards. OH like *hintzi* but rather larger, thick and prominent, turned anteriorly at apex. Genital lamina rounded, with some spinous hair. Prophalline body short and deeper than in *hintzi* but the alae rather similar. Vulvar aperture with

very thick sinuous false lips. Foliations narrow, black.

Melanic examples occur, referable to the smaller *rhodesiae*.

Distribution. Not very well known due to confusion. Found in most parts of Ethiopian Continental Africa except Cape Province.

Material examined. Natal, Botswana, Rhodesia, Malawi, Zambia, Katanga, N. Congo (Kinshasa), Tanzania coast, Kenya coast, Mount Ruwenzori. Very common in Katanga.

forma *rhodesiae* Pinhey

Diagnostic features

Smaller and darker than *machadoi* and found in swamps instead of flowing water.

♂. Thoracic black humeral band as broad as in *hintzi*; greyish blue pruinose at maturity. Abdomen black with yellow lateral bands.

♀. (ex Zambia collected in copula). Thorax with black antehumeral line instead of a broad humeral band. Legs mainly pale. Hindwing with amber basal patch. Abdomen black dorsally and on lateral carina, with yellowish sub-lateral band. Cerci black. Vulvar lip as in *machadoi*.

Ngamiland (Botswana) ♀ has broad black humeral stripe.

Distribution. Botswana, Zambia, Katanga.

Material examined. Botswana, Zambia, Katanga.

Orthetrum saegeri Pinhey (1966) Fig. 28.

Diagnostic features

Smallish or medium-sized dark species, closely resembling *julia* in appearance but with different IH hook, broader OH and undivided prophalline alae.

♂. Labium broadly black; labrum black with yellow basal band (like *julia*); frons pale on shield, broadly black at base (like *julia*). Peaks of vertex high. Thorax green with thick black stripes more diffuse and linked up than in *julia falsum*. Legs black.

Subcostal cross-veins black. Radial supplement of 1 row. Pterostigma similar, pale brown between black veins. Hindwing with only a trace of pale basal amber. Membranule grey.

Abdomen pale pruinose blue. In juvenile condition black with yellow lateral spots on segments 4-6.

Anterior lamina slightly bifid at apex; with short spines and sparse short hair. Hamule differing from *julia* in having IH ending in a broad out-turned hook (instead of a back-turned pointed hook); OH broader, more massive. Genital lobe rounded, with sparse bristle-hairs and hair. Body of prophallus short, deeper near base than in *julia*; alae not branched.

Metallo type ♀ (Cameroons; in copula). Labium mainly black on posterior lobe but leaving two minute yellow posterior dots; a black inner edge to each lateral lobe. Labrum, frons and vesicle unmarked with black except lateral zones on vesicle. Occipital triangle yellow.

Prothorax yellowish, slightly diffused with brown at sides and with long cream hair fringing the posterior lobe. Synthorax yellowish to green-

ish yellow at sides; faint narrow brown antehumeral and humeral stripes; incomplete stripe on lower part of mesepimeron, some brown suffusion near spiracle; complete stripe on second lateral suture and a faint line on metepimeron. Femora yellowish brown and black; tibiae black with yellow posterior line.

Venation dark brown to black. Subcostal cross-veins black superimposed with yellow. Radial supplement of 2 rows. Pterostigma brownish yellow between black veins. Wings faintly fumose. Traces of pale amber at all wing bases. Membranule grey. Forewings with 12 Ax, 8 Px.

Abdomen brownish yellow; all carinae narrowly black. Segments 4-7 black with short yellowish sublateral bars; 8-9 black with yellow sublateral spots above carina; segment 10 black with yellow posterior-dorsal bar. Cerci black. Vulvar aperture with swollen lateral ridges like *brachiale*. Ova elliptical as usual. Foliations broadish, pale brown with black border.

Abdomen 27 mm, hindwing 31.5 mm, pterostigma 3.3 mm.

Distribution. N. Congo (Kinshasa), Uganda, Cameroons, Republic Central Africa.

Material examined. Holotype ♂ (N. Congo); ♂, ♀ in copula, Carnot, Cameroons, February 1958 (leg. Pinhey), this pair including the metalloth type ♀; ♂, ♀ in copula, Entebbe, Uganda, May 1952 (Pinhey); ♂, Ketta Forest, Ouesso Distr., Republ. Centr. Afr.; ♂, Mwinilunga, Zambia. Metalloth type ♀ in National Museum.

***Orthetrum lorti* Kirby (1896).**

This is recognized as a synonym of *Crocothemis erythraea* (Brullé).

STRUCTURAL KEY TO ETHIOPIAN MALES

1. Radial supplement Rspl distinctly 3 rows. Legs yellowish brown. Very large species with yellowish brown body and long pterostigma *angustiventre*
- Rspl 1-2 rows. Legs marked with black or brown or all dark 2
2. Abdomen broad, not constricted at segment 3, segment 5 over 2 mm wide on each side of dorsal carina 3
- Abdomen constricted at segment 3 (less so in the small *taenio-*
latum) 5
3. Enormous species, hindwing over 43 mm. Frontal shield mainly black. Wings not amber at base *austeni*
- Medium size, hindwing under 33 mm. Frons with black bar on crest 4
4. Lips pale. Thorax pale in immature, diffused with brown in mature ♂. Wings deeply amber at base. Madagascar *azureum*
- Lips marked with black. Thorax with thick black stripes. Wings without basal amber. Comoro Isl. *azureum lugubre*

- 5. Labrum black or (Sierra Leone) yellow. Epistome black. Abdomen much swollen at base, segments 4-10 extremely slender 6
- Labrum not or only partly black. Abdomen not exaggeratedly slender 7
- 6. Larger insects, abdomen over 35 mm. Labrum black *africanum*
- Smaller, the abdomen under 34 mm. Labrum mainly yellow *sagitta*
- 7. Hamule with flange and ridge anterior to IH. Abdomen long and slender 8
- No flange or ridge anterior to IH. Abdomen normally less slender 9
- 8. Abdomen shorter than hindwing. Anterior lamina with long thick orange hair. Thorax not pruinose; with strong black lateral stripes *sabina*
- Abdomen longer than hindwing. Anterior lamina with sparse hair, not orange. Thorax often pruinose but without strong black stripes *trinacria*
- 9. OH broad, swollen and much more prominent than IH. Medium or smallish, often with strong black markings. Rspl usually only 1 row 10
- OH less prominent than IH, sometimes broad but not jutting out 21
- 10. Shield of frons with strong black markings. Abdomen long and slender 11
- Shield of frons not marked with black 12
- 11. Mark on frontal shield a double ring. Thoracic markings black *icteromelan cinctifrons*
- Frontal mark incomplete below. Thoracic markings brown. Madagascar *icteromelan icteromelan*
- 12. Alae of prophallus simple 13
- Alae branched or funnelled, with extension 17
- 13. IH hook broad apically, turned outwards. Labrum black with yellow basal band. Thoracic black lateral markings thick. Peaks of vertex high *saegeri*
- IH hook small, pointed apically. Labrum all or mainly pale. Thoracic black lateral marking sparse 14
- 14. IH hook turned outwards. Peaks of vertex very low 15
- IH hook turned backwards, often appearing rather finger-like. Peaks of vertex moderate 16
- 15. Labium pale or only black on posterior lobe. Thoracic humeral marking moderate *hintzi* f. *hintzi*
- Labium broadly black. Humeral black very broad *hintzi* f. *zernyi*

16. Medium sized insects. Thoracic humeral suture narrowly black *machadoi* f. *machadoi*
 — Small. Humeral suture broadly black *machadoi* f. *rhodesiae*
17. IH hook long, turned out and downwards. OH not markedly prominent. Black thoracic stripes usually thin. Abdomen with yellow lateral spots on segments 7-9. Peaks of vertex low *guineense*
 — IH hook small, tending to be turned more or less backwards. OH prominent. Abdomen with distinct yellow lateral spots on 4-6, 8-9 usually all black or with only traces of yellow. Peaks of vertex high 18
18. Labrum broadly black with yellow basal band. Subcostal cross-veins all black *julia julia*
 — Labrum pale or narrowly black 19
19. Subcostal cross-veins black *julia falsum*
 — Sc yellow 20
20. Thorax with thick black stripes and without pale lateral stripes. Central Africa *guineense*
 — Thorax with thin markings, the sides with whitish green stripes S.W. Cape *julia capicola*
21. OH reduced to a simple basal swelling. Lips always pale. Thorax normally with whitish lateral stripes 22
 — OH prominent, tending to envelop the soft base of IH. Thorax sometimes with whitish stripes 25
22. Membranule white, at least down the middle. Pterostigma very short, under 2.5 mm. IH hook turned more or less backwards 23
 — Membranule grey. Pterostigma not abnormally short. IH hook turned forwards 24
23. Anterior lamina distinctly bifid at apex and with small apical denticles. Hindwing less than 2.8 mm. Thorax with white stripes *kollmanspergeri*
 — Anterior lamina not bifid and without denticles. Hindwing over 31 mm. Thorax without white stripes *ransonneti*
24. Thorax with three white stripes each side. Anterior lamina with short setae and short hair *caffrum caffrum*
 — Only a mesepimeral white stripe plainly visible. Anterior lamina asetose but with longer hair *caffrum camerunense*
25. OH with apical ledge or ridge below IH 26
 — OH without abrupt ledge, merely a fold or swelling to or around base of IH 31
26. Membranule sharply white, at least centrally. Thorax with 3 whitish stripes each side. Small species. N.E. Africa *taeniolatum*
 — Membranule grey or mainly grey, occasionally white on inner edge. At most only one white thoracic stripe 27

27. Labium partly black. Thorax with thick black stripes or all black. IH hook on broad flange, the hook small and turned outwards 28
 — Labium all pale. Thorax usually with thin black lines, and not all black (but may be pruinosed). IH hook not on broad flange 29
28. Subcostal cross-veins Sc black. Rspl usually 2 rows
 *microstigma* f. *microstigma*
 — Sc yellow, Rspl 1 row *microstigma* f. *imitans*
29. IH hook large, directed more or less forwards. No white thoracic stripes. Segments 4-7 of abdomen with black lateral spots at each end *monardi*
 — IH hook small, pointing outwards. Thorax often with white mesepimeral stripe 30
30. Thorax not heavily striped with black but usually with white mesepimeral stripe *chryso stigma* *chryso stigma*
 — Thorax with thick mesepisternal stripes but no white mesepimeral stripe *chryso stigma* *toddii*
31. Anterior lamina with prominent broad lip extending beyond hamules. IH hook flat, sharply pointed, directed more or less backwards (or downwards), not extending beyond the sinuous OH. Genital lobe massive 32
 — Lamina with normal lip, not projecting beyond hamules. IH hook more prominent, extending backwards and well beyond OH. Genital lobe not massive 37
32. Prophalline body not cylindrical. Large Madagascar species. Mature ♂ coated with blue to obscure thoracic markings .. 33
 — Prophalline body long, cylindrical. Variable in size. When thorax is blue the antehumeral stripes are still visible 34
33. Labium and labrum broadly black *lemur* f. *lemur*
 — Lips all pale *lemur* f. *milloti*
34. Frontal shield broadly black. Lips black. Seychelles *brachiale* *wrighti*
 — Frontal shield pale 35
35. Sc yellow. Labrum pale. Thoracic black stripes narrowish and often 1-2 whitish lateral stripes *brachiale* *brachiale*
 — Sc black or black overlaid with yellow. Labrum partly black. Thoracic black stripes thickish but no white stripes 36
36. Small specimens. Mauritius *brachiale* f. *stemmale*
 — Large, dark. Continental *brachiale* f. *kalai*
37. Thorax with whitish lateral stripes 38
 — Thorax without whitish stripes 39
38. Thorax brown with 3 whitish stripes each side. IH hook large, directed backwards. Ethiopia *kristenseni*

- Thorax reddish with only 2 whitish stripes each side. IH hook small, turned up at tips. S.W. Cape *rubens*
39. Frons with grey or black markings on crest and shield. Anterior lamina deeply bifid at apex. Superior appendage straight 40
- Frons without marking on crest and shield. Rspl of 2 rows. Superior appendage curved 41
40. Usually small, the hindwing under 27 mm. Rspl of 1 row. Thorax usually very thinly marked with black *abbotti abbotti*
- Medium size. Rspl 1-2 rows. Humeral suture broadly brown. Madagascar *abbotti malgassicum*
41. Large, the hindwing over 34 mm. IH hook well curved at tip. Pterostigma short *robustum*
- Medium size. IH hook not or scarcely curved at tip. Pterostigma long 42
42. Anterior lamina deeply bifid at apex. Abdomen black dorsally. OH slender *macrostigma*
- Lamina only slightly notched. Abdomen pale dorsally, black laterally. OH thick *latihami*

SIMPLIFIED KEY TO MALES

1. Very large, the hindwing over 40 mm 2
- Moderate to small, the hindwing well under 40 mm 3
2. Abdomen broad, blue pruinose at maturity. Legs reddish brown to black. Rspl of 2 rows *austeni*
- Abdomen slender, never pruinose. Legs yellowish brown. Rspl of 3 rows *angustiventre*
3. Abdomen highly swollen at base then extremely slender 4
- Abdomen not exceptionally swollen at base, nor extremely slender 6
4. Frontal shield with brown band. Anterior lamina thickly coated with bright orange hair. Mainly North Africa *sabina*
- Frontal shield not darkened. Lamina without orange hair. West Equatorial Africa 5
5. Labrum all black *africanum*
- Labrum pale with trace of black *sagitta*
6. Abdomen broad or broadish, not clearly constricted at segment 3 7
- Abdomen constricted at segment 3 8
7. Abdomen broad, segment 5 over 2 mm wide each side of median carina. Thorax not pruinose and without white stripes. Insular species *azureum*

- Abdomen narrower. Thorax either pruinosed or with clear white stripes. Northern parts of Africa *taeniolatum*
- 8. Large species, the abdomen longer than the wings. Frons with black or grey line down shield *trinacria*
- Generally smaller, the abdomen shorter than the wings 9
- 9. Thorax with one or more distinctly white or cream stripes, edged brown or black 10
- Thorax without white or cream stripes 17
- 10. Labium more or less black on posterior lobe. Lip of anterior lamina massive, reaching beyond hamules *brachiale*
- Labium all pale. Lip of lamina not normally extending beyond hamules 11
- 11. Thorax with only a mesepimeral white stripe 12
- Thorax with two or three whitish stripes each side 13
- 12. Radial supplement Rspl of 1 row. Inner hook of hamule directed outwards or backwards *chrysostigma*
- Rspl of 2 rows. Inner hook directed forwards *caffrum camerunense*
- 13. Thorax darkish red, with two white lateral stripes but no dorsal one. S.W. Cape *rubens*
- Thorax pale, with dorsal and two lateral stripes 14
- 14. Pterostigma very short, not more than 2 mm. Membranule mainly white 15
- Pterostigma longer. Membranule grey 16
- 15. IH hook large. Apex of lip of anterior lamina with short denticles *kollmannspergeri*
- Hook small. Lip of lamina narrow, without apical denticles *taeniolatum*
- 16. Wings often bright amber on costa. Hook of IH backturned. Ethiopia *kristenseni*
- Costae not amber. Hook turned forwards *caffrum*
- 17. Pterostigma not more than 2.2 mm long 18
- Pterostigma at least 2.5 mm 20
- 18. Labium partly black. Thoracic stripes thick. Hook of IH points outwards *microstigma*
- Labium all pale. Thoracic stripes thin or absent 19
- 19. With thoracic dorsal stripes. Hook of hamule points forwards. Hindwing under 31 mm *monardi*
- No thoracic stripes. Hook points outwards. Hindwing 32 mm or more *ransonneti*
- 20. IH hook stands out well above hamular base and outer hamule. Sc yellow 21
- IH hook more or less obscured by OH. Sc yellow or black 24

21. Labium all pale. Apex of anterior lamina deeply bifid 22
 — Labium with some black marking. Lamina scarcely bifid at apex 23
22. Rspl of 2 rows. Frontal shield unmarked *macrostigma*
 — Rspl of 1 row. Shield with thin grey or darkish markings or at least a line down centre of shield *abbotti*
23. Medium size, hindwing 30 mm or less. Membranule grey. Humeral black thick *latihami*
 — Large, the hindwing over 34 mm. Membranule white. Thoracic markings linear *robustum*
24. Hamule broadly depressed in middle. OH forming only a sinuous ridge. Anterior lamina extends beyond hamule. Rspl of 2 rows 25
 — Hamule not broadly depressed. OH broad and swollen. Rspl most frequently of 1 row 26
25. Crest of frons not black (except in the Seychelles *brachiale wrighti*). When thorax pruinose the black markings are still visible. The bands in juvenile are not reticulate. *brachiale*
 — Frontal crest black. Pruinosity obscures the black markings. The bands are reticulate. Madagascar *lemur*
26. Frontal crest with strong black marking *icteromelan*
 — Frontal crest without black marking 27
27. IH hook directed back but curved at tip. Lips pale *machadoi*
 — IH hook directed more or less outwards. Labium and often the labrum, marked with black (occasionally pale, as in *julia* from Cape Province) 28
28. Sc black. Peaks of vertex high 29
 — Sc yellow. Peaks of vertex usually low 30
29. Hindwing with distinct but small basal amber. IH hook small and pointed *julia*
 — Hindwing with faint amber trace. Hook broad *saegeri*
30. Thoracic black markings slender. Hook of IH long, down-turned *guineense*
 — Thoracic markings thick, at least at humeral suture. Hook short and small 31
31. Thoracic antehumeral and humeral stripes thick but separate. Sides also striped some *julia*
 — Only a very broad humeral stripe. Sides plain yellowish *hintzi*

KEY TO FEMALES

The female *kollmannspergeri* is not yet known but it is fitted tentatively into this key on the basis of the male characters. A foot-note is appended after this key.

1. Cercus over twice as long as segment 10. Abdomen long and slender, longer than the hindwing. No amber at wing bases *trinacria*
- Cercus not more than about one and a half times as long as segment 10. Abdomen shorter than hindwing 2
2. Abdomen very much swollen at base, then very slender 3
- Not so 5
3. Sc yellow. Labrum mainly pale *sabina*
- Sc black 4
4. Labrum black. Hindwing 33 mm or more *africanum*
- Labrum all yellow. Hindwing 31 mm or less *sagitta*
5. Radial supplement Rspl of 3 rows. Hindwing over 40 mm. Head, body and legs almost entirely yellowish brown. Membranule white *angustiventre*
- Rspl 1-2 rows. Rarely as large (see *austeni*) and not as plain brown 6
6. Enormous species, hindwing 45-50 mm, abdomen 37 mm or more *austeni*
- much smaller, the hindwing not over 35 mm 7
7. Thorax with one or two white or cream lateral stripes 8
- Thorax without white lateral stripes 16
8. Thorax with whitish dorsal stripe on mesepisternum and two lateral white stripes 9
- Without the dorsal stripe 12
9. Membranule all white. Very small species, hindwing less than 25 mm. Foliations on segment 8 absent *taeniolatum*
- Membranule mainly grey. Foliations on segment 8 present 10
10. (very small, the hindwing under 25 mm. Pterostigma only 2 mm *kollmannspergeri*)
- Hindwing normally over 25 mm. Pterostigma longer 11
11. Abdomen broadly black at sides. Thoracic lateral stripes in normal position. Vulvar aperture with very wide lips *caffrum*
- Abdomen not broadly black at sides. Thoracic lateral stripes more posterior. Vulvar scale more like that of *hintzi*. Ethiopia *kristenseni*
12. Segments 7-8 black or black with yellowish lateral spots 13
- Segments 7-8 mainly pale brown or yellowish with some black markings 14
13. Thorax with moderate black lateral stripes. Vulvar aperture with central ridge and lateral swellings *brachiale*
- Thorax without black lateral stripes. Vulvar aperture simple without lateral swellings. S.W. Cape *julia capicola*

14. Thorax reddish with two lateral brown-edged cream stripes.
S.W. Cape *rubens*
- Thorax browner or yellower with only a mesepimeral white stripe 15
15. Segment 5-10 mainly orange dorsally, black laterally. Vulvar aperture with simple lips *caffrum camerunense*
- Segments 5-10 orange with black lateral band across middle of each side. Vulvar aperture complex with uneven lips and folds *chryso stigma*
16. Segments 4-7 yellow, orange or pale brown dorsally, with the dorsal carina pale or black; a lateral black band present or absent 17
- Segments 4-7 broadly black dorsally (not only the carina); laterally also often more or less black 27
17. Dorsal carina of 4-7 not black 18
- Dorsal carina black 21
18. Segment 9 all black 19
- Segment 9 partly yellow 20
19. Femora mainly black. Humeral black usually very broad. Vulvar lips simple *latihami*
- Femora yellowish brown with black stripes. Humeral and ante-humeral stripes usually separate lines. Vulvar aperture with very thick false lips *machadoi*
20. Humeral black very broad. Vulvar lip simple, well arched. Abdomen with black lateral band *hintzi*
- Only narrow dark lines or stripes on thorax. Vulvar aperture with wide, thin lips. Abdomen all yellow with black carinae *guineense*
21. Moderate to large species, hindwing well over 30 mm. Membranule white 22
- Small to medium. Membranule more or less grey 23
22. Thorax pale brown with yellow ventral spot on mesepisternum. Segments 8-9 all black. Pterostigma about 3 mm *robustum*
- Thorax all yellow. All abdominal segments yellow. Pterostigma 2.5 mm or less. Northern arid zones *ransonneti*
23. Segments 4-10 all pale brown with black carinae. Abdomen broad and short *microstigma*
- Segments 4-10 yellow with black carinae. Abdomen not so *guineense*
- Segments 4-10 with broad black markings, especially segments 8-9 24
24. Sc black. Wing bases usually deeply amber. Femora pale brown. Madagascar. Comoro Isl. *azureum*
- Sc yellow 25

25. Pterostigma short, about 2 mm. Femora black at knees. Vulvar aperture with thick false lips *monardi*
 — Pterostigma long. Femora not black especially at knees 26
26. Rspl normally 1 row. Femora marked with black. Vulvar lip simple *abbotti*
 — Rspl 2 rows. Femora all pale. Vulvar aperture complex with false lips *macrostigma*
27. Abdomen long, thick at base, then slender. Legs sharply yellow striped with black. Thorax with sharp black or blackish stripes. Crest of frons usually marked with black *icteromelan*
 — Abdomen not so shaped. Legs more ochreous, brownish or black 28
28. Shield of frons distinctly marked with black. Insular species 29
 — Shield not marked with black 30
29. Thorax with distinct stripes. Segment 9 mainly black. Vulvar aperture with lateral swellings. Seychelles *brachiale wrighti*
 — Thorax with interlacing black bands. Segment 9 black dorsally, yellow ventrally. Vulvar aperture plain, with no lateral swellings. Madagascar *lemur*
30. Antehumeral and humeral stripes brown. Femora black, pale at base. Vulvar lip with lateral ridges. Foliations pale brown with black border *saegeri*
 — Thoracic stripes blacker. Femora all black or the knees black. Foliations black 31
31. Rspl mainly 2 rows. Black on labium confined to posterior lobe. Vulvar aperture with lateral swellings and median crest *brachiale*
 — Rspl more or less 1 row. Labium all pale or, if dark, the black usually spreads on to lateral lobes. Vulvar lip simple, broad, thin, with less of a crest and no lateral swellings *julia*

Some of these females are easy to identify: *angustiventre*; *austeni*; *azureum* (insular); *sabina*; *trinacria*; *sagitta*; *africanum*; *caffrum*; *ransonneti* (Northern Africa); *microstigma*, by its broad pale brown abdomen; *taeniolum*; *abbotti*, unless old or much stained; *macrostigma*; *robustum*; *lemur* (insular); *guineense*, by its very yellow abdomen; and insular *brachiale*.

O. kollmannspergeri is not known in this sex; and the Author has not seen *kristenseni* but its juveniles may be recognizable by the white thoracic stripes, the amber wing-stripes and its known distribution (Ethiopia).

Of the remainder *chryso stigma* is generally discernible by the single white thoracic stripe but sometimes this is obliterated. The yellow Sc, 2 rows Rspl, orange abdomen with black lateral stripe and the vulvar aperture may then be employed. In *monardi* the short pterostigma is the most useful guide, together with the pale abdomen with incomplete black

lateral stripe and the vulvar aperture. In *hintzi* the broad humeral black is an important feature and the single row Rspl distinguishes this from the similarly patterned *latihami*. In both the vulvar aperture is thin and arched. *O. machadoi* usually has more slender thoracic markings, nearer *guineense*, from which it differs in having the black sub-lateral band on the abdomen and the characteristic and often clearly defined vulvar aperture. The dark form *rhodesiae* is patterned more like *hintzi*.

There should be no difficulty with *icteromelan* because of its abdominal shape and vivid striping of abdomen and thorax. The pronounced black shield mark on the frons in the male is less definite, sometimes absent in the female. In juveniles, *rubens* of the S.W. Cape is easy to distinguish by the cream thoracic markings, but these are obliterated, as well as the amber wing-streaks, in the adult. The female can be quite large and may be distinguished by comparison with the very few endemic *Orthetrum* of that area.

This leaves the black-striped species *brachiale*, *julia* and *saegeri* which can only be determined on close and careful inspections of venation and vulvar apertures. The variable *julia* generally has black Sc and a strong tendency to only 1 row Rspl, with 2-3 cells doubled. The other two have a more definite double row Rspl. The labium-labrum markings of all three should be studied. In the paler form of *brachiale* the whitish lateral stripes are usually discernible but in this feature it is not unlike females of *julia capicola* in the S.W. Cape. The vulvar aperture of *brachiale* and *saegeri* have distinct lateral ridges or swellings. These are absent in *julia* and *lemur*.

PALAEARCTIC NORTH AFRICAN SPECIES

In order to complete this review some notes are appended here on species occurring along the North African Mediterranean fringe of this Continent from Morocco to Egypt.

For convenience these can be placed genitally in similar Groups as used for the Ethiopian species on genital grounds although the facies is often very different.

SABINA group

Species *sabina* (Drury), *trinacria* (Selys): vide supra.

CAFFRUM group

Species *ransonneti* (Brauer): vide supra

cancellatum (Linnaeus), *nitidinerve* (Selys)

By abdominal shape *cancellatum* would be in group b.

CHRYSOSTIGMA group

Species *chrysostigma* (Burmeister): vide supra

ramburi (Selys), *coerulescens* (Fabricius),

both of which by abdominal shape are group b.

MACROSTIGMA group

Species *brunneum* (Fonscolombe)

It has the abdominal shape of group b.

Orthetrum cancellatum* (Linnaeus, 1758)Synonymy.* *Libellula frumenti* Müller (1764)*Hydronympha helvetica* Buchecker (1878)*Diagnostic features*

Abdomen short, broader than any of the other African species, each side of segments 4 or 5 about 3 mm wide. Wings large, 35-40 mm. Characteristic anterior lamina.

♂. Face pale. Thorax pale brownish with brown antehumeral stripe, sparse black on sutures.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma short, 2.2-2.8 mm. No basal amber. Membranule grey.

Abdomen pale blue at maturity. Juvenile brownish yellow with black lateral band on segments 4-7 and black carinae; 8-10 mainly black. Superior appendage thick and short. Anterior lamina steep and deeply divided in apical half into two slender arms. Hamule small. IH hook long and acute, turned outwards. OH merely a small basal swelling.

♀. Hindwings slightly tinged with basal amber in median space. Cerci black. Abdominal segments 8-10 yellow dorsally.

Distribution. Morocco, Algeria and Europe.

Material examined. Morocco.

Orthetrum nitidinerve* (Selys, 1841)Synonymy.* *Libellula baetica* Rambur (1842)*Diagnostic features*

Large species, hindwing 35-36 mm. Abdomen triquetral but narrower than others with triangular abdomina.

♂, ♀. Face pale. Thorax brownish yellow with plain whitish lateral stripes. At maturity the ♂ thorax and abdomen are violet blue to blue pruinose. Femora pale brownish.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma long, 3.5-4.5 mm. Radial vein yellow. No basal amber. Membranule white. Abdomen of juvenile ♂ and of ♀ yellowish with thin black carinae. Superior appendage brown and yellow. Cerci yellow.

Anterior lamina very slightly bifid at apex. This and the hamules are very pale. IH small, turned outwards and slightly forwards.

Distribution. Morocco, Algeria, Tripolitania and Mediterranean.

Material examined. Tripolitania.

***Orthetrum ramburi* (Selys, 1848)**

Possibly synonymic of *Libellula anceps* Schneider (1845) but the status of this is uncertain (vide Longfield, 1955: 41).

Diagnostic features

Small or smallish, hindwing 24-29 mm.

♂, ♀. Face all pale. Thorax pale brown with brown antehumeral and sometimes with faint creamy lateral stripes. Mature ♂ pruinosed blue. Femora black at knees.

Subcostal cross-veins cream. Radial supplement of 1 row. Pterostigma small, 2.5-2.8 mm. No basal amber. In juvenile the costal zone is not amber. Membranule white. Abdomen yellowish brown with black carinae; pruinose blue in mature ♂. Anterior lamina steeply raised, with narrow lip, distinctly bifid at apex. IH prominent, broad, back-turned, the hook small and bent outwards. OH curved up to a slight ledge.

Distribution. Morocco to Egypt; S. Europe, W. Asia.

Material examined. Morocco, Algeria, Tripolitania.

Orthetrum coerulescens (Fabricius, 1798)

Synonymy. *Libellula olympia* Fonscolombe (1837)

Probably not found in North Africa. Apparently only dubious female records are known from this Continent. Close to the last species.

Differences from ramburi. Hindwing 28-33 mm. Pterostigma of greater range, 2.2-3 mm. Thorax often with stronger cream lateral stripes. Juveniles with strong amber costal zone on wings. Membranule greyish or whitish. Anterior lamina very steep apically, the lips unusually thick, soft, somewhat bulbous; bifid at apex.

This is the TYPE SPECIES of the genus.

Distribution. Europe. Doubtfully N.W. Africa.

Material examined. Spain, Italy.

Orthetrum brunneum (Fonscolombe, 1837)

Diagnostic features

Moderately large, the hindwing 32-35 mm. Abdomen very broad, triquetral and short.

♂, ♀. Face pale. Thorax pale brown with sparse markings; two yellow lateral stripes. Chalky blue pruinose in mature ♂. Legs mainly black in ♂, pale in ♀.

Subcostal cross-veins yellow. Radial supplement of 2 rows. Pterostigma 2.5-3 mm. No basal amber. Membranule white. Abdomen very broad, pale brown with black carinae; chalky blue in mature ♂. Superior appendage black.

Anterior lamina unusually short, pale, not bifid at apex. IH prominent, the hook turned outwards. OH as in *abbotti*, moderately swollen, the apex down-turned on to the soft base of IH. Alae quite simple.

Distribution. Algeria, Tripolitania, Europe, W. Asia.

Material examined. Spain, S. France, Asiatic Turkey.

KEY TO NORTH AFRICAN SPECIES

- | | |
|---|---------------|
| 1. Abdomen, except basal segments, cylindrical, slender | 2 |
| — Abdomen triquetral, broad | 5 |
| 2. Abdomen very swollen at base, then very slender. Thorax with distinct black lateral stripes. Anterior lamina thickly coated with orange hair | <i>sabina</i> |

- Abdomen not outstandingly swollen, then very slender. Thorax without sharp black stripes. Lamina without orange hair. 3
- 3. Abdomen slightly longer than wings. Frons with black markings on crest and shield. Abdomen black with yellow bands or spots. IH with distinct ridge anterior to hook *trinaeria*
- Abdomen shorter than wings. Frons unmarked in front. Abdomen not mainly black. IH without anterior ridge 4
- 4. Subcostals Sc yellow. Hindwing with trace of basal amber. Abdomen orange-brown with broad black lateral band *chryso stigma*
- Sc blackish. Hindwing without basal amber. Abdomen pale brownish with fine black carinae *ransonneti*
- 5. Radial supplement Rspl of 1 row. Hindwing usually well under 34 mm. Anterior lamina steeply erect. IH prominent, OH curved up to a ledge 6
- Rspl of 2 rows. Larger species. Lamina not steep or if so it is completely bifid in apical half. OH not forming a ledge 7
- 6. Hindwing 28-33 mm. Membranule grey and white. Lamina with very thick bulbous lip. Juvenile amber on costal zones of wings *coerulescens*
- Hindwing 24-29 mm. Membranule white. Lamina with slender lip. Juvenile not amber in costal zones *ramburi*
- 7. Abdomen excessively broad, segments 4-5 about 3 mm wide each side of dorsal carina. Abdomen with black lateral band. Membranule grey. Anterior lamina with apex steep and completely divided into two arms *cancellatum*
- Abdomen broad but not excessively so and without black band. Membranule white. Lamina not steep and scarcely at all bifid 8
- 8. Pterostigma over 3.4 mm. Abdomen only moderately broad. Thorax with white lateral stripes. OH forming only a basal swelling *nitidinerve*
- Pterostigma 2.5-3.0 mm. Abdomen distinctly broad. Thorax with yellow stripes. OH with swelling extending to base of IH *brunneum*

SUMMARY

The African *Orthetrum* have proved a stumbling block for years. Reviews of the species, with keys, were given by Ris, Pinhey, Schmidt and others, but the most important revision of the genus was by Longfield (1955). Buchholz undertook a detailed overhaul but his conclusions have not been made available.

The present Author has found it necessary to re-examine the species to try to find a more satisfactory inter-relationship among some species.

Knowledge of the species in the field, together with the extensive material in the National Museum, has afforded a basis for this revisional work.

It is evident that much of the difficulty hitherto lies in not adequately realizing the strong melanic tendency of some of the *Orthetrum*. Some new synonymy is necessary. For instance, *falsum* and *julia*, *stemmale* and *brachiale* are two examples of conspecificity. Clines or genetic factors are important aspects rather than racial entities in certain species. The possible reason for melanism is discussed. In the Ethiopian region the Author now lists 28 species, but perhaps *lugubre* is also distinct so that the total is 29. A few new infra-specific taxa are described. Keys are included and also a short survey of the palaeartic North African species.

ADDENDUM

Mature ♂ and ♀ *O. kristenseni* Ris sent by A. archer from Goba, Ethiopia. Thorax dark in both sexes, obscuring the white fasciae except a vivid sinuous, mid-lateral cream line.

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