

# The *Odonata* of N. Angola

## Part I

Through the courtesy of Dr. António de Barros Machado, I have been able to study, amongst many other genera belonging to the Dundo Museum, a very large and beautifully preserved series of the genus *Orthetrum* taken in N. Angola in recent years. The results, thanks to the Companhia de Diamantes de Angola, are incorporated below.

In this article the entire African species of *Orthetrum* have been dealt with, as well as those found in Angola. A new genus has been erected to contain two of the species. The rest of the *Odonata*, collected in N. Angola, will follow in Part II.

## A revision of the African species of the genus *Orthetrum*

The African *Orthetrum* have needed revising for a very long time. In spite of Ris' work on them during his magnificent revision of the Libellulinae in the *Cat. Coll. Selys* 1909-1919, both museum taxonomists and field collectors have found great difficulty in naming the species. The genus shows primitive characters, with the last antenodal cross-vein complete and the arculus situated between the 2nd and 3rd antenodal. However, it has dense venation, narrow well-formed triangles in both wings, and a long, complete anal loop in the hindwing. With the primitive venational characters is linked the instability usually to be found, and too much reliance has previously been placed on the venation in determining the species. Out of all the characters previously used, the only one at all helpful is the number of rows of cells in the *Rsp/* loop, which does seem to be fairly constant, at any rate in the males. Most of the other venational characters have been discarded as being hopelessly misleading. More reliance has been placed on general appearance, size, shape and colour pattern. This may seem quite hopeless to those who have tried to differentiate between two or three similar species, and indeed, these subtle distinctions are almost impossible to convey in a Key. For that reason my Key is placed at the end of this revision, as it can only be a 'guide' to determination, a narrowing down of the possible species involved and quite inadequate by itself, to determine any *Orthetrum*. Only a careful inspection under a microscope of the genitalia, together with the perusal of all the characters and comparisons in the text under the species headings, will enable each of them to be correctly named.

By grouping together large series, on the above characters, from all over the African Continent, I found that, in most cases, they did correspond to the different specific characters shown by the genitalia. I have also used the shape of the penis as a group character and am greatly indebted to R. M. Gambles for making the dissections for me, from specimens named by myself. The penis (alae of the glans, and the long central flagellum, which every *Orthetrum* possesses), is very easily damaged or distorted in dried specimens and can be very misleading

as a specific character, but I have found it of great use as a group character. I have not drawn all, as in many groups the shape is so closely alike. All my illustrations, with the exception of *O. coeruleus*, are made from African specimens. In dealing with the colour pattern, I use the terms general, immature, juvenile, subadult. By these I do not mean to imply that the insect is not in its morphologically adult form, but only in stages of colouring leading from general to fully mature.

When dealing with hundreds of specimens, there were always some that would not fit anywhere and these appeared most often in certain geographical regions. Three of these regions are Uganda (where I have done a lot of collecting myself), the borders of the Congo and Northern Rhodesia, and South-West Africa. Are these exceedingly difficult «misfits» hybrids? Dr. Ris thought hybridisation to be very likely and the extreme similarity in many of the genitalia, might make it quite possible. I believe that the Sahara desert in the north, the Kalahari in the south and the forested mountainous «backbone» in between, produced a natural barrier between the *Orthetrum* species, which have only gradually spread round the outer edges of the Continent. Comparatively recently they have been able to get through the much depleted forests in the centre, to meet in such countries as Uganda. Some of the Asiatic and Palaearctic species have not yet penetrated very far. The *Orthetrum* are frequenters of open, or fairly open country. Some are river dwellers and possibly those are the ones that have spread the most rapidly. Swamp, lake and pond dwellers have no doubt tended to remain more stationary. Much more knowledge of the ecological conditions is needed, before the last word can be said on species differentiation in the *Orthetrum*. Many of the present species may eventually be found to be only ecological races, but for the time being, the only hope of distinguishing them was to give them specific rank. I had hoped my studies to have resulted in a drastic reduction of the number of species, but this was not possible. Great confusion has arisen, by formerly including too many differing populations under one name, and the only hope of sorting out the situation was to divide rather than to amalgamate. Over the course of many years I have examined hundreds of specimens, but it was the very large, fresh and beautifully preserved collection from Dundo, N. Angola (where many of the critical species are to be found), which finally decided me to undertake this work. Messrs Elliot Pinhey in Kenya and Robert Gambles in N. Nigeria have also greatly helped with fresh material.

The only sub-species I have kept or named, are those where I have a reasonably good knowledge of their geographical range. I consider that 30 species and a further 6 sub-species, can be differentiated in the Continent of Africa, including the neighbouring Atlantic and Indian Ocean islands.

I have decided to place *O. farinosum* Förster in a new genus, to include also Pinhey's new species *O. fitzgeraldi*. In many ways *farinosum* is close to the genus *Hadrothemis*, where it has been included in the past, and in some ways *fitzgeraldi* is more like an *Oxythemis*. Neither of them fits into *Orthetrum* and both have sufficient characters in common to be included in the same genus.

### The Genus *Orthetrum* Newman, 1833

Found in all the Old World and usually exceedingly abundant in numbers, the genus consists of variably sized dragonflies, but mostly of medium length and rather heavy build. The males, when mature, are often bright pruinose blue. The male abdomen is inflated at the base, sometimes considerably; constricted or not constricted at the third segment; tapering to the 10th segment, or else spindle-shaped (fusiform). The not constricted, tapering abdomen is usually flat below and keeled above, while the spindle-shaped are often distinctly «humped» dorsally on the 2nd segment. The females are mostly much more cylindrical in shape, with the 8th segment foliated, sometimes these tergites forming quite deep «flaps» that often obscure the vulvar scale. The latter is small, with either a thin or an enlarged margin, in many species,

only slightly different. In the greatest number of species, and in both sexes, the abdomen is shorter than the wings, sometimes considerably so.

The head is moderately large, with a sharply defined crest to the frons, forming a shelf and a frontal shield. The prothorax is large, wide, emarginate and fringed with long hairs. The thorax is relatively stout; the legs rather short, very robust and spiny. The wings are long, with numerous antenodal nervures (*An*), the distal one complete in the forewing. The discoidal cell or triangle (*T*) in the forewing, is a narrow triangle with the costal side considerably shorter than the other two, usually crossed by one nervure. The *T* in the hindwing is free. Arculus (*Arc*) between the 2nd and 3rd *An*. *Cu*<sub>2</sub> arising from the posterior angle of the *T*, or else separated from it, a feature not always constant in the same species, or even in the same specimen. *Cu*<sub>2</sub> fairly strongly arched in the forewing. *R*<sub>3</sub> (*M*<sub>2</sub> of Ris) strongly curved. Only one cubital nervure in all wings; no supplementary nervures to the bridge; radial supplement (*Rsp*) well developed; anal loop well developed; pterostigma (*Pt*) variable in size, but usually large; membrane large.

In the following descriptions I have used several characters on the head and thorax to demarcate useful colour patterns, and have figured them in Fig. 1, but the following terms will further explain my meaning. «Basal frons line» is equivalent to Ris' «basisslinie», E. M. Walker's «preocular band» and Asahina's «basifrontal stripe». Frons «shelf» and frons «shield» can be clearly seen in the drawings (Fig. 1). The thoracic stripes in *Orthetrum* often consist of one either side of the dorsal carina (*dc*), where the mesepisterna meet to form the dorsum of the thorax. Two to three stripes are usually grouped on either «shoulder», which is formed by the part of the mesepisternum bordered below by the mesopleural suture, known in Odonata by the more usual term of humeral suture. Laterally there are two sutures known to odonatists as the 1st lateral and 2nd lateral sutures, which correspond to the interpleural and metapleural sutures of the Arthropoda. The 1st lateral suture is only complete in the Agritidae and exceedingly reduced in all Libellulinae, a mere trace being present anteriorly below the metastigma (which is the spiracle situated between the mesopleurum and metapleurum); pigment is often laid down along this area. The 2nd lateral suture, situated posteriorly to the spiracle and complete in all the Odonata, is invariably pigmented. In the *Orthetrum* a prominent carina borders the ventral pleurites of the metepimeron, and is also often strongly pigmented. The abdomen has transverse carinae, often with black pigment diffused onto the cuticle either side, and the lateral carinae (conspicuously «edging» the body when viewed from above) often have a black stripe of varying width which is a good specific character. The ventral longitudinal carinae of the tergites lie completely beneath the abdomen, almost closed over the very reduced sternites and are not of much importance to the colour pattern. The transverse carinae, beneath each segment, usually carry on the pigmentation shown dorsally.

For the wings, I only mention venation in any detail when describing a type of a new species. Otherwise, stress is laid on the colour of the sub-costal cross-veins (*Sc*) proximal to the nodus; on the number of cells between the radial supplement and *IR*<sub>3</sub>, which I call the «*Rsp*/*loop*-cells» and on the colour and size of the pterostigma (*Pt*, length  $\pm$  width, in millimetres). Whether or not there is a yellow (safron or amber-yellow) or a deep amber (golden-brown) fleck at the base of the wings, can be quite important specifically, but it may be sufficiently variable within a species for a minute description by cell-width to be useless. Some populations have more than others, some general specimens more than adults, and many females more than males.

The male genitalia, used in identification, are the accessory or secondary genitalia beneath the 2nd and 3rd segments of the abdomen. The anal appendages are useless for classification in *Orthetrum*. In the secondary genitalia, the shape of the anterior lamina (*AL*) is a useful character, but similar in the species of several groups and the genital lobe is a fairly good group character, but rather similar in all the African *Orthetrum*. The posterior hamules offer the best character, but also are very similar in many species. They are, however, only really variable in the common and, at the same time, widely distributed species. The shape of the inner branch (*IH*) and the shape and position of its end «hook», the size and shape of the outer branch (*OH*)

the Sudan, are the most northerly limits of a further eight species, whilst *kristenseni* is confined to Ethiopia (Abyssinia). South Africa has one species, *rubens*, and one subspecies, *capense capense*, confined to Cape Province and a further ten of the tropical and the Pan-African species. The only species confined to the continental tropical belt are *guineense*, *julia*, *s. kalai*, *angusitventre*, *austeni*, *m. microstigma* and *macrostigma*, with a range from east to west, and the purely western species *m. imitans*, *monardi*, *a. africanum* and *a. sagitta*. Madagascar and the farther Indian Ocean islands have six endemic species and sub-species, and *brachiale*, *icteromelas*, *abbotti* and *caffrum*, all of which range throughout Africa, except the Mediterranean coast.

LIST OF THE AFRICAN SPECIES AND SUB-SPECIES OF ORTHETRUM

- O. brachiale*  
*stemmale stemmale*  
*stemmale kalai*  
*stemmale wrighti*  
*stemmale lemur*  
*niloti*  
*capense capense*  
*capense falsum* sub-sp. n.  
*julia*  
*guineense*  
*caffrum*  
*chryso stigma*  
*monardi*  
*nitidinerve*  
*austeni*  
*microstigma microstigma*  
*microstigma imitans*  
*machadoti* sp. n.
- hintzi*  
*icteromelas*  
*anceps*  
*azureum*  
*lugubre*  
*kristenseni*  
*macrostigma*  
*rubens*  
*angusitventre*  
*africanum africanum*  
*africanum sagitta*  
*abbotti*  
*taeniolatum*  
*ransonneti*  
*brunneum brunneum*  
*sabina*  
*trinacria*  
*cancellatum cancellatum*

AFRICAN SPECIES OF NESCIOTHEMIS LONGFIELD

- N. farinosum* (*Orithetrum farinosum* Förster).  
*N. fitzgeraldi* (Pinhey) = *Orithetrum fitzgeraldi* Pinhey.

1. THE BRACHIALE GROUP

A small group, entirely African or from the Mascarene and Madagascar group of islands. They have almost identically shaped alae on the penis glans and closely similar genitalia.

Shape: — 1-2 abdominal segments quite strongly enlarged dorso-ventrally and very definitely «humped» dorsally. Males very constricted at 3rd segment and enlarging to a spindle-shape (fusiform), the greatest width at 6th seg. 2-2.8 mm. Females moderately stout, but not prominently different in build to the males. All with enlarged tergites laterally on 8th seg., mostly black. The vulvar scale with a thin margin and curved in an elliptic shape.

Genitalia: — Male accessory genitalia large. AL longer than hamule, drooping and heavily thickened at the tip. Lobe large, heart-shaped and hairy. Hamule with /H narrowing to a sharp hook of variable size, sometimes turned completely sideways and outwards, sometimes downwards and outwards. The OH is wider (twice or more) and projects as far, or a little farther, than the inner branch. The alae of the penis glans have the main branch long and straight, and there is a blunt tooth-like lateral projection. The upper processes are reduced to a pair of short, narrow projections.

and the depth and width of the cleft between the branches, are the diagnostic points. A very old male is often difficult to identify, as the hamule tends to shrink, and a specimen with the penis extruded has the shape and position of the *IH* very considerably altered and is then hard to identify. The penis has only been used as a group character in this article; it will help to place the male specimen in the correct group, but too much reliance cannot be placed on the specific differences of such easily distorted, flexible chitinous processes. The outgrowths on the penis glans (the apical part of the 3rd or distal segment of the penis) consist of two terminal alae and a single or paired upper process. These are considerably different in shape in the various groups, but all show a generic resemblance. In all the *Orithetrum* a long up-curved flagellum springs centrally from a chitinised cowl-like projection, but is very easily broken off during dissection. (Note that Barnard (1937) describes the penis upside down).

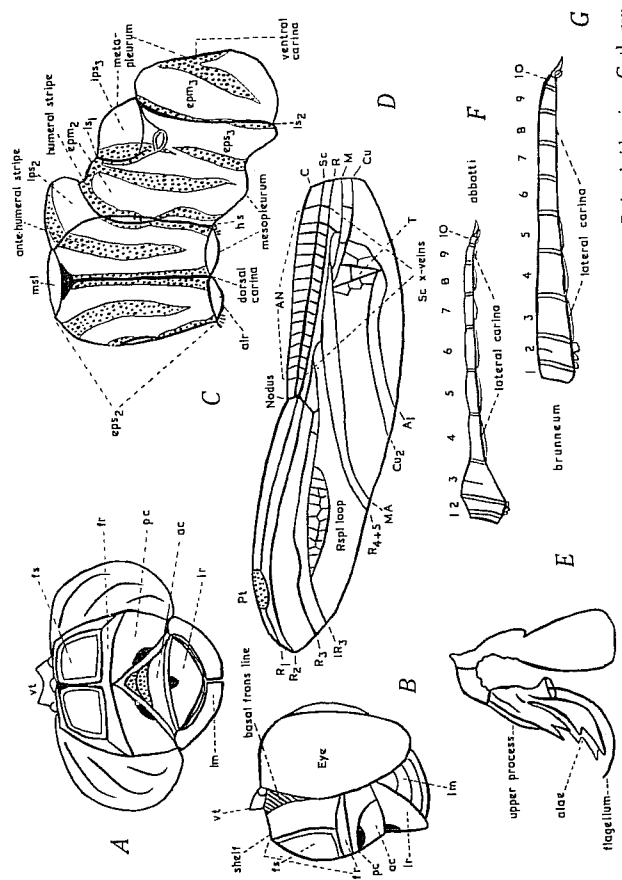


Fig. 1 — Parts of an *Orithetrum* used for identification of species. A: head front view. B: head side view. C: thorax dorsal and right lateral. D: left fore-wing. E: penis. F: antenodal cross-veins. G: abdomen not constricted. ac. anteclypeus. ar. ante-alar ridge. AN. antenodal cross-veins. C. costa. Cu. cubitus. epi<sub>2</sub>, mesepimeron. epi<sub>3</sub>, metepimeron. epi<sub>4</sub>, metepisternum. fr. frons. fs. frons shield. hs. humeral suture. ips. mesinfraepisternum. ip<sub>3</sub>, metinfraepisternum. lm. labium. lr. labrum. ls<sub>1</sub>. 1st lateral suture. ls<sub>2</sub>. 2nd lateral suture. M. medius. msf. mesostigmal lamina. pc. postclypeus. Pl. pterostigma. R. radius. Sc. subcosta. T. triangle. V1. vertex.

Most of the African *Orithetrum* are found south of the Sahara. Mediterranean Africa has four commonly resident species and a further two local species, *anceps* and *nitidinerve*, are only to be found there; *chryso stigma* and *trinacria* are Pan-African species embracing the entire Continent; *brunneum* and *cancellatum* have only been found in Algeria. Egypt adds two more, *ransonneti*, which also reaches across the Sahara to Lake Chad and *sabina*, an Asian-Australasian species, also occurring as far south-east as Ethiopia (Eritrea and Abyssinia). Here also, and in

Pattern:—Greenish-yellow, striped black as follows: with or without a dark centre dorsum; one ante-humeral complete or wedge-shaped; two close together on «shoulder»; 4-5 laterally complete or somewhat obscure. Abdomen with yellow-green pattern centrally in patches extending to lateral carinae, the rest of 4-10 segments, very black. 1-3 segs. with heavy black outlining the yellow-green dorsum of 1-2, and extending laterally along 1-3. All pattern obscured under a light-blue pruinosity in mature males. Females a little yellower and more lightly marked with black, but otherwise closely resembling the males and of very much the same dimensions. They are not so noticeably shorter in the abdomen than in the wings, as in the *capense* group.

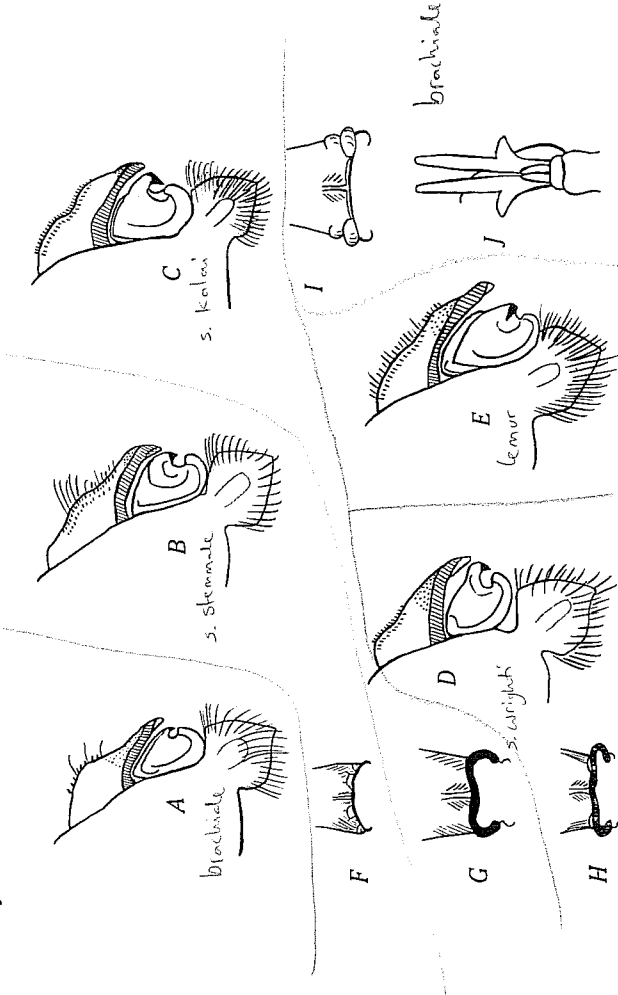


Fig. 2 — *brachiale* Group 1. A to E: male secondary genitalia. F to I: margin of female vulvar scale. J: terminal processes of penis glands. A, I & J: *brachiale*. B & F: *stemmale*. C & G: *s. kalai*. D & H: *s. wrighti*. E: *s. lemur*.

Wings:—Venation all black, or with costa only yellow, or with Sc cross-veins yellow (*brachiale* only). 2 rows of cells in *R<sub>spl</sub>* loop (between *IR<sub>0</sub>* and *R<sub>spl</sub>*) for most of its length. The *stemmale* complex have similar genitalia to *brachiale* and the doubled cells in the *R<sub>spl</sub>* loop. They differ in always having the Sc cross-veins black and in most cases the costa and all the other veins also. The *Pt*, after the first general stage, is always brown to black in colour, and moderately small in size.

*O. brachiale* (P. d. B.)

*Lib. brachialis* Palisot de Beauvois, 1805, *Ins. Afr. Amér.* p. 171.  
This is a moderately large species of wide distribution, but varies in size, pattern and slightly in structure, in the course of its range. It can be distinguished by the double *R<sub>spl</sub>* loop-

cells: the yellow Sc cross-veins (which sometimes suffuse with pruinosity in very mature specimens); the large yellow *Pt* with the thick black costal vein (except in Mauritius specimens, see below); the very green thorax, mostly with reduced brown stripes, giving it a pale appearance (exceptions on the western islands); and, when not obscured by pruinosity, the abdominal pattern. This pattern is shared by the *stemmale* subspecies and the *capense* group, and consists of twin yellow-green patches across the centre of 4-6 segs., extending to the lateral carinae and on to the sternites of the under-surface of the body. In *brachiale*, the yellow-green is usually to be seen underneath on the centre of 7-10 segs. also, and in the younger specimens appears on the upper surface of these segments, in the form of a narrow, elongated patch just above the lateral carinae. Segments 1-3 are largely yellow-green with black transverse carinae and a lateral black stripe. Legs are mostly dark, even when only subadult. In many specimens (more often females), there is an appearance of two pale thoracic bands laterally. These are not similar to the cream stripes of several other species, but are caused by a clear greenish white area between the dark stripes on the mesepimera and metepimera, which darken over with age. Very mature males become completely pruinosely with a light blue colour. Wings have a yellow tinge in old specimens and all have a yellow patch at the base of the hindwings, slightly variable in extent but not usually reaching the 1st antenodal. Membrane a grey-brown with a small white top. Head pale, with a yellow mouth, a small black cone in the labium centre. The frons shield is olive-green or grey-blue. There is a narrow black basal frons-line, quite well defined and extending well down the sides of the shelf. The darkest the frons ever becomes is a greenish grey. The females closely resemble the males in size, build and colour pattern. The abdomen shows more yellow than most males, with heavy black basal patches on 4-7 segs. and most of dorsum of 8-9. 8th has pronounced «flaps» to the tergites, yellow edged black. The cerci vary from yellow to black. The margin of the vulvar scale has a protuberance in the form of a small «hump» at either side, and in very mature specimens, a second, smaller «hump» appears just behind the marginal pair. These «humps» are better defined than the «angled» edges of the *capense* females.

Measurements:—(Mainland), ♂ Abd. 30-33 mm. Hw. 32-35 mm.; ♀ Abd. 29.5-32 mm. Hw. 32-34 mm. *Pt*, both sexes, 3.5-3.8 + 0.8 mm. (length plus width). Abdomen shorter than wings by 1-3 mm. in both sexes.

A very small race is found on Mauritius, closely resembling *stemmale* *stemmale* Burmeister. ♂ Abd. 29-30 mm. Hw. 30-32 mm. *Pt*. 3 + 0.6-0.7 mm. ♀ Abd. 30-32 mm. Hw. 31-33 mm. *Pt*. 3. + 0.6-0.7 mm. Here, the conspicuous difference from the typical race (besides reduced dimensions generally) is the smallness of the *Pt*. and the yellow appendages of the females.

The types (three males and one female), were described by Palisot de Beauvois in 1805 from the Kingdoms of Oware-Benin, in Southern Nigeria. The species may occur on all the Indian Ocean Islands (see *s. stemmale*), and certainly does occur in Mauritius, Rodriguez and Madagascar, and it is common in all east-central Africa. It is found, perhaps not so commonly, in South and S.W. Africa, commonly in all Central and West Africa (including the Guinea Gulf Islands), and as far north as Western Sudan and Somaliland.

*O. stemmale* *stemmale* (Burmeister)

*Lib. stemmalis* Burmeister, 1839, *Hdb. Ent.*, 2: 857.  
*Lib. contracta* Rambur, 1842, *Neur. Inst.*, p. 60.  
*Lib. coarctata* Rambur, 1842, *Neur. Inst.*, p. 61.

*L. stemmalis* was described by Burmeister in 1839 from one male from Mauritius. In 1898 P. P. Calvert examined this specimen, minutely re-described it and illustrated the secondary genitalia by an outline drawing (*Trans. Amer. ent. Soc.*, 25: 84). This places the species without

*s. stemmale*

- Sc. x-veins black.  
 Black or very dark complete surround to centre yellow of frons-shelf.  
 Cleft between branches of male hamule as wide as shallow.  
 Hook of hamule short, pointed and side-turned.
- brachiale*
- Sc. x-veins yellow.  
 No dark surround to frons-shelf.  
 Cleft between branches of hamule narrower than deep.  
 Hook of hamule slender, pointed, down-turned.

The allotype female of *s. stemmale* (Mauritius, 17.4.1954 Brit. Mus. Coll.), is a larger insect than the *brachiale* females I have seen from the island. She is very mature, with the colour pattern largely obliterated by increased melanism and some pruinosity. The wings are worn and entirely suffused with rusty-yellow, the *Pt.* is large and very dark nigger-brown. Head: as in the description by Calvert of type male, except that the frons-shield is all black. Thorax: brownish green, with no central dorsal black stripe and only four clearly marked black stripes, visible from either side. These are, however, mostly quite broad and consist of an ante-humeral, a humeral, a wide one down the mesepimeron anterior to the spiracle, and a narrow stripe the length of the 2nd lateral suture. The ventral carina is black, but the sternum is unmarked. Legs: mostly black, but some dark brown on all the coxae and trochanters, and at the bases of the mid and hind femora, while the fore-femora are mostly brown. Wings: entire venation black. A very small amber-yellow fleck at extreme base of all four wings. Abdomen: very dark brown to black, with light brown bands transversely across 1-3 segs. and yellow patches showing faintly on 4-7 segs., also beneath, 8th seg., as well as enlarged tergites, all black. 9th and anterior half of 10th segs. black. Anal appendages dull ochre-yellow. The margin of the vulvar scale is quite visible and almost flat, with the exception of a slightly raised and angled centre piece, very like that of a female *capense falsum*. Measurements: Abd. 34 mm. Hw. 38 mm. *Pt.* 4 + 0.5-0.6 mm. *Ans* 17|16 10|12 *Pns* 12|12 *Arc.* slightly nearer 3rd *An* than 2nd. *Rsp/* loop-cells doubled for most of the length. *Cu<sub>2</sub>* separated from *T* in hindwing.  
 Abdomen shorter than wings by  $\frac{1}{2}$ -1 mm. in the males and 4 mm. in the female.  
 I agree with Ris' identification of Rambur's type male of *contracta* and type female of *coarctata*, as being both *stemmale stemmale* Burm.

*O. stemmale kalai* Longf.

*O. stemmale kalai* Longfield, 1956, *Trans. R. ent. Soc. Lond.*, 85: 487.  
 Although I captured the type male on an island in the Zambezi River, between Northern and Southern Rhodesia, it would seem that it is more rightfully a western race of *stemmale*. It appears to be fairly common in the Cameroons, where *O. julia* is abundant and the two closely resemble each other. I also know of it from S. Nigeria and the Gold Coast and in all these localities it conforms to type, with heavy black stripes on a dark green thorax and the abdomen becoming a dark pruinose blue in mature males, even sometimes covered with a white pruinosity on a black ground. E. Pinhey has taken *s. kalai* on the Kenya coast and H. Campion figured one specimen from Nyasaland (Ann. Mag. N. Hist., 1921, 8 (9): 240-245), as a form of *brachiale*. In Uganda it is considerably less marked on the thorax and more nearly resembles *brachiale*, which also flies there. In stature, when the two species are compared, *s. kalai* is of slightly heavier build, in size and appearance very like *capense falsum*, but with almost no saffron hindwing bases

any doubt in the *brachiale* group, by the long and prominent *AL* and very large lobe, and also by the two rows of *Rsp/* loop-cells. The costa is yellowish; *Sc* veins blackish (and all others); *Pt.* ochre-yellow and membrane cinereous with a small white base. The head has a black centre to the labrum (middle lobe and medial margins of lateral lobes); a black outer edge to labrum and a black basal centre spot nearly dividing the lip into two yellow spots; a dark olive anteclypeus; a pale olive postclypeus and frons-shield; black along the frons crest, becoming brown at the sides and joining up with the narrow black base-line, to enclose a yellow spot on the top of the frons-shelf. The greenish-luteous thorax is marked with a fairly full complement of brown stripes: 2 antehumeral, one humeral, 2 at the spiracle (ill-defined), 2 at the 2nd lateral suture (one ill-defined) and the latero-ventral metathoracic carina black. There is no central dorsal dark stripe, but 3 mm. of yellow-green between the first of the antehumerals. The wings are hyaline, with the faintest trace of pale yellow at the hindwing base, about one cell wide and the length of the membrane. 15-16 *Ans* forewings; 3 rows post-dorsal cells to level of nodus; *Cu<sub>2</sub>* slightly separated from corner of *T*. The legs have yellow-green on all the femora and tibiae, but otherwise are largely black. The abdomen has a *brachiale*-like pattern. 1-3 segs. predominantly yellow, with 1 and base of 2 black on each side, enclosing an ochreous spot. The dark band extends laterally on 2 and 3 segs. 4-10 predominantly black, 4 with a small ochreous spot each side of base; 4-6 with a median ochreous spot each side of dorsum; 4-9 with a ventral ochreous spot occupying the middle of the segments. Anal appendages luteous. It is a large insect; Abd. 34 mm. Hw. 34.5 mm. *Pt.* 3.6-4 mm.

I have repeated Calvert's description of Burmeister's insect, because it would appear, that after Ris' discussion of it in 1910 (*Cat. Coll. Libell.*, 2: 217), the existence of this species has been doubted and all the Mauritius *Orthetrum* have been named *brachiale* (P. d. B.). Recent captures in the island confirm that *stemmale stemmale* Burmeister is still in existence and can be distinguished (although not easily) from all the others. From *brachiale*, the black *Sc* cross-veins, the black across the frons-shield and the different shape of the hamule will separate, at any rate, the males. From the other *stemmale* sub-species, it is more difficult to distinguish it in *s. kalai* Longf. has no black or blackish surround to a central yellow area on the frons-shelf, and the two branches of the hamule. *s. wrighti* (Selys), from the Seychelles, has the black along the frons upper edge and very similar genitalia, but *s. wrighti* would appear to be a darker green with a blacker pattern, including a black centre dorsal thoracic stripe and it is always several mm. smaller. The hamule hook is slimmer, longer and downturned, whereas in *s. stemmale* it is very pointed, but short, broad and turned sideways. *s. lemur* Ris, of Madagascar, is closer in size, but has not got the black head-markings of the other two island races and the shape of the hamule is considerably different.

Calvert's description of the type, is almost word for word that of a sub-adult specimen captured in Feb. 1954 at 1400 ft. The only differences seem to be: a very narrow black edge to the labrum and the centre spot very small; all the frons-shield black; one broad ante-humeral (the two fused?); no small ochreous spot visible at each side of base 4th seg.; the tarsi almost entirely black; the dimensions smaller. Abd. 32 mm. Hw. 33 mm. *Pt.* 3.8-4 + 0.8-0.9 mm. The species varies a bit in size and also in pattern, according to sex, age and condition. However, the black surround to the central yellow spot on the frons-shelf would seem to appear at quite an early age. It is probable that mature males become entirely pruinose on the abdomen.

As there has been found to be an exceedingly small form of true *brachiale* on Mauritius, compared with the typical mainland specimens, the result is that the sizes of the two species are reversed, especially deceptive being the small size of the *Pt.* in this island *brachiale*. ♂ Abd. 29-30 mm. Hw. 30-32 mm. *Pt.* 3 + 0.6-0.7 mm. ♀ Abd. 30-32 mm. Hw. 31-33 mm. *Pt.* 3 + 0.6-0.7 mm. It is no wonder that the two species have been assumed to be one, as they are exceedingly alike. What factors keep them apart is not known. Perhaps this matter of size is not a constant one and should not be relied on. The distinguishing characters which seem to be good ones, even with quite juvenile specimens, are the following.

## *O. stemmale lemur* Ris

*O. s. lemur* Ris, 1909, *Cat. Coll. Libell.* p. 219.

A large race of *stemmale*, found in Madagascar, where true *brachiale* also occurs. 1-3 abdominal segments are strongly enlarged in depth and prominently «humped» dorsally. The colouring of the head is rather light, with only some small black spots on the labrum, and the labium varying between all yellow to a black centre. *Pt.* is only a light brown and the costal vein is not thickened. Sc cross-veins black, as are all other veins. *Rsp1* loop of double cells. Membrane a dark brown to black and a small but deep amber fleck at base of hindwing. The thorax has heavy black stripes, but the antehumeral is in the form of a broad wedge. The abdomen has the *brachiale* type of pattern, with the black heavy. The abdomen goes entirely pruinose in the mature males. The legs are mostly light in colour. I have not seen a female, but Ris says that she is of much the same build as the male, with yellow cerci. Measurements: ♂ Abd. 32-35 mm. Hw. 35-38 mm. Pt. 3.6-3.8 + 0.8 mm. ♀ Abd. 34-36 mm. Hw. 38-39 mm. Pt. 4 + 0.8 mm. Abdomen shorter than wings in male by 1 mm. and by 3 mm. in females.

## *O. milloti* Fraser

*O. stemmale Milloti* Fraser, 1949, *Mem. Inst. Sci. Madagascar*, 3 : 17.

I have placed Fraser's *milloti*, from Madagascar, in this group, on the strength of the author's statement that the genitalia are «closely similar to *O. s. stemmale*», but the heavy sub-dorsal abdominal stripe is not comparable to the group-pattern. As I have not seen the species, I have no other means of judging. It cannot be *s. lemur*, by its colour pattern, nor presumably a *brachiale*, for the same reason. *Milloti*, therefore, had best receive specific rank, as it is hard to believe that two subspecies of *stemmale* can be found in the same island, large though it is.

## 2. THE CAPENSE GROUP

A small group, entirely African, with closely similar penis glans and genitalia.

Shape:—Very like the *brachiale* group. 1-3 segments quite strongly enlarged dorso-ventrally and very definitely «humped» dorsally. Males constricted at the 3rd abdominal segment, sometimes considerably so. They are moderately or strongly spindle-shaped (fusiform), but are mostly somewhat slimmer in build than the *brachiale* group. With the exception of *capense capense*, where it is of the same length, the abdomen is always a few mm. (2-3) shorter than the hindwings. The females are stout and heavy looking compared with their males. With the exception of *capense capense*, they are mostly very much shorter in the abdomen than the wings (3-6 mm). The tergites of the 8th segment are enlarged; the margin of the vulvar scale is a simple one, as in the *brachiale* group, with a thin edge, either in an elliptic shape or else somewhat squared dorsally by a distinct angle at either corner. The females are difficult to tell apart in this group.

Genitalia:—Male accessory genitalia moderately large, but the hamule more prominent than either the lamina or lobe, with the result that the entire genitalia is less conspicuously heavy looking than in the *brachiale* group. The *AL* is strongly curved (humped) in the centre (viewed in profile) and dips steeply to the tip, which is often, but not in all species, held horizontally. There are always plenty of hairs and often conspicuous spines as well. The *IH* of the hamule is longer than the lamina, narrow and straight, with a decided hook at the tip, either turned sideways and backwards or downwards and outwards. The *OH* is about equal in length to the *IH*, but never longer, and is either rounded or somewhat square. There

and with always some five or more double cells in the *Rsp1* loop. It is, of course, very like *julia*, especially when the latter very occasionally has a few double cells in the *Rsp1* loop, and the *Pt.* is smaller and dark brown. Both species also have identical black on the centre labium and the outer edge of the labrum. The only really distinct difference is the much shorter anterior lamina (*AL*) in the male *julia* and the shorter, stockier appearance of the female of *julia*.

*s. kalai* has a typical *brachiale* pattern on the abdomen, with broad twin yellow patches on the 4-6 segs., reaching the sides and reappearing underneath. A moderately broad black lateral longitudinal stripe extends along the side of the 3rd seg. only. This stripe extends onto the 2nd seg. in *s. stemmale* and onto 1-3 in *s. lemur* and *brachiale*. All this group have a short, but quite conspicuous, yellow-green bar across the 1st and 2nd abdominal segments dorsally and this they share, together with the black lateral longitudinal stripe on the 2nd seg., with *capense capense*, *c. falsum* and *julia*. In all the above species the yellow-green bar on the 2nd seg. is enclosed between two well-defined narrower black crossbars, formed by the transverse carinae plus some extra diffusion either side.

The allotype female (also in Brit. Mus. Coll.) has been selected from a specimen taken at Ahuri, Gold Coast, 1912-1913 (W. H. Patterson). The female of *s. kalai* is larger than the female of *c. falsum* and *julia*, from which species it can also be distinguished by the double row of *Rsp1* loop-cells and the heavier black stripes on the thorax, when mature. It is of heavier build than the female *brachiale*, but when immature and with the *Pt.* still pale in colour and the thoracic stripes not fully formed, it could easily be mistaken for that species. Then the distinction lies in the always black Sc cross-veins of *s. kalai*, the black costa to the *Pt.* not being so thick and conspicuous, and the vulvar scale with a thick margin and no knob-like protuberances as in *brachiale*, nor any «angles» as in the *capense* group. When the female of *s. kalai* is mature and with a full complement of black thoracic stripes and a dark-brown *Pt.*, it is usually easy to tell from *brachiale*, but not in the latter species' far western range, where the pattern is heavier and blacker than is normal. However, the unfailing distinction then is the yellow Sc. cross-veins of *brachiale*. *s. kalai* can also be easily mixed with *microstigma microstigma* and it would be wise to read the description of that species. In dimensions it is similar to the female of *s. stemmale*.

Measurements:—♂ Abd. 29-32 mm. Hw. 31-34 mm. Pt. 3-3.5 + 0.7-0.8 mm. ♀ Abd. 33 mm. Hw. 35 mm. Pt. 3.7-4 + 0.8 mm. Abdomen shorter than the wings by 2 mm. in the males and 2-4 mm. in the females.

## *O. stemmale wrighti* (Selys)

*Lib. Wrighti* Selys, 1869, *Ann. Soc. ent. Belg.*, 12 : 95.

This is a race confined to the Seychelles Islands. It closely resembles *s. stemmale* from Mauritius, and with the exception of the head pattern, *s. kalai* from the mainland. It is a very well defined, uniformly small subspecies, with a bright, yellow «spot» on the frons-shelf, surrounded by a broad black line. A similar frons design is found in *s. stemmale* and *lugubris*. In *icteromelas*, and in some populations of *abbotti*, there is a black horizontal stripe across the frons and a wide black base line, but the sides of the shelf remain yellow and no «spot» is formed dorsally. *s. wrighti* has very black thoracic stripes on a very bright green ground, and there is a black centre dorsal stripe in this sub-species. On a very black abdomen is a *brachiale*-like pattern of yellow-green. Very mature males develop a light blue pruinosity on the abdomen often on the thorax as well. The females are very similar to the males in both size and pattern, but are usually more of an ochre-yellow colour than green. Measurements: ♂ Abd. 26-28 mm. Hw. 27-29 mm. Pt. 2.5-3 + 0.5 mm. ♀ Abd. 26-30 mm. Hw. 28-32 mm. Pt. 3 + 0.5 mm. Abdomen shorter than wings by 1 mm. in the males and 2 mm. in the females.

is a decided, deep and rounded cleft between the two branches of the hamule. The lobe is large, broader than long, with a rounded outline, partially elliptic, and very hairy. The alae of the penis glans are extremely similar in shape in all the species. Claw-like, they only differ in the depth of the notch between the bifid projections. The upper process is large and square.

Pattern:—Very similar to the *brachiale* group, but in mature non-pruinose specimens, the black lateral abdominal stripe tends to become entire. The thorax has a series of up to 8 black stripes on either side of the dorsal carina, as far as the sternum. These stripes vary from light to heavy, the heaviest markings mostly occurring in species from the west of the continent, with *O. guineense* an exception to this rule. *O. capense capense* is the only one in the group with cream thoracic lateral stripes, bordered anteriorly with a black one. The abdomen of all the species

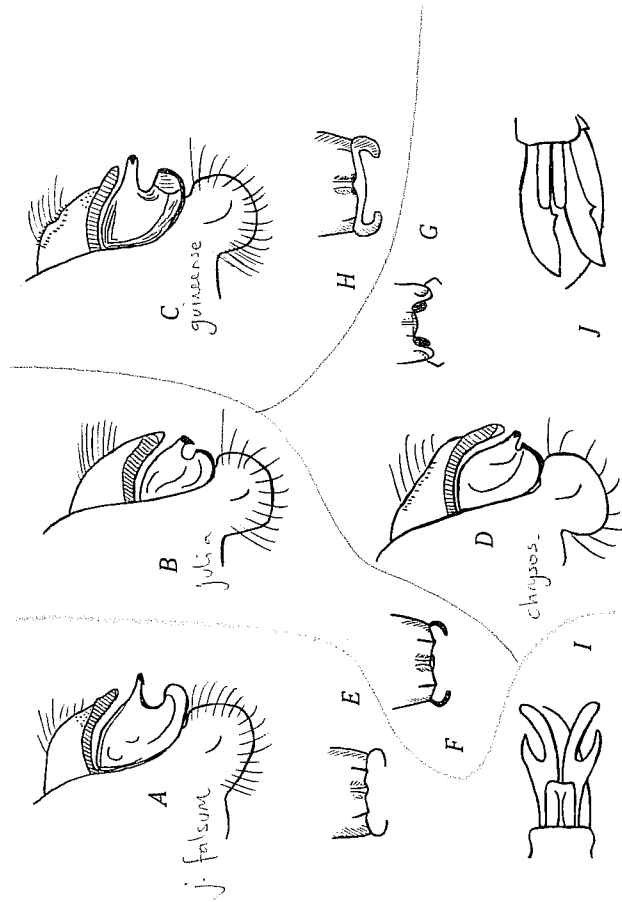


Fig. 3—*capense* Group 2, and *chryso stigma* of Group 3. A to D: male secondary genitalia. E to H: margin of female vulvar scale. I & J: terminal processes of penis glans. A, E & I: *capense falsum*. B & F: *julian*. C & H: *guineense*. D, G & J: *chryso stigma*.

has a black dorsal longitudinal stripe, varying in intensity and often broadening out to entirely cover the last few segments. There is also a black longitudinal lateral stripe and in most species decided stripes of black across the anterior and posterior margins of each segment. These enclose square to oblong yellow patches or spots, which in some, and more especially in females and juveniles, will reach round the segment to the ventral carina, mostly from the 3rd to 6th segs. In adult females, the lateral stripes fuse into one, and sometimes it can be seen as an entire stripe in the males. In most adult males the abdomen is completely pruinose blue, which extends to the thorax and all pattern is lost.

Wings:—All have a small, definite saffron or amber-yellow base to the hindwings and usually a fleck in the forewings. All have only one row of cells between the  $IR_3$  (RS of Ris) and

the  $R_{5+6}$  (exceptionally with a few odd centre cells doubled, more often in females). *O. capense capense* and *guineense* have yellow (or cream) Sc cross-veins and these always remain so, even if lightly obscured by pruinosity. In the other species the Sc cross-veins are always black. The costa is usually yellow for part of its length. The Pt varies as between the species, in *capense falsum* and *julian* it is dark-brown and small, in *capense capense* it is yellow and large, in *guineense* small and light reddish brown.

### *O. capense capense* Calvert

*Lib. (Orithetrum) capensis* Calvert, 1893, *Proc. U. S. Nat. Mus.*, 16: 584.

*O. capense* was described from one male taken in Cape Town and now in the U. S. National Museum. The specimen is in a whole condition, «slight pruinose on the body» and a «weak indication of the cream-colored stripe on the mesepimeron». The sub-costal cross-veins are «brownish», whereas the costal cross-veins are «a shade of black» and «the contrast between the two series is noticeable». The Pt is 3.7 mm. long in all four wings and is a dull orange-yellow with the costal vein black and thickened. These details, kindly supplied to me by Mr. Ashley Gurney from Washington, D. C., supplement Calvert's description, and prove without any doubt that *c. capense* differs from *capense falsum* in the following essential characters: light-colored Sc cross-veins, cream thoracic stripes, large orange-yellow Pt with a thickened black costal vein.

I have examined two dozen specimens from Cape Peninsula and the south-west corner of Cape Colony, and all of them show the cream stripe on the mesepimeron, even in the adult and pruinosed blue males. This cream-colored band is situated between the fine black stripes of the humeral suture and the remnant of the 1st lateral and in some specimens, especially the younger ones, there is often a second cream band, fully or partially complete, posteriorly to the 2nd lateral suture. The entire insect is less marked with black than the tropical sub-species; for instance, there is no black stripe on either side of the dorsal carina, and the ante-humeral is narrow. The yellow face has some slight darkening on the frons and sometimes a very small black centre lobe to the labium. At most, there is a mere trace of saffron on the wing bases, but the Pt is always pale, bright yellow or orange and the costal vein, at this point, is as thick and black as in *brachiale*, in strong contrast to the dark-brown Pt in *c. falsum*, with the thin costa. I cannot, however, find any difference whatever in the shape of the male secondary genitalia, and neither K. H. Barnard, R. M. Gambles nor myself can find any difference in the penis. The margin of the female vulvar scale might just possibly be a little squarer than in the females of *c. falsum*, but the difference is very slight, if it exists at all, the female vulvars are so easily distorted.

Barnard (1937, *Ann. S. Afr. Mus.*, 32 (3): 246) first drew attention to the difference between the Cape form, with constantly pale sub-costal cross-veins and always dark brown to black appendages, and those taken for example in the Transvaal, which were the exact opposite. These two characters seemed to him to be of great importance, but I have found that the colour of the anal appendages varies enormously in *c. falsum* from white (in general specimens) to yellow, brown and lastly black. It would appear to be quite immaterial as to what part of Africa the specimens belong. On the other hand, the black Sc cross-veins are constant in *c. falsum*, also the small brown Pt, and I have never, in all the hundreds I have seen, found one with the cream thoracic stripes that did not come from Cape Colony. The dimensions of *c. capense* would seem to be extremely uniform, and the wings no longer than the abdomen, in either sex. ♂ Abd. 30-32 mm. Hw. 30-32 mm. Pt. 3-3.5 + 0.6 mm. ♀ Abd. 32-33 mm. Hw. 32-33 mm. Pt. 3.5-4 + 0.8 mm.

I have selected as the allotype ♀, a specimen in the British Museum (Natural History) bearing 3 little labels: 1) Cape, Worcester, 1888. (Rev. J. Deacon). 2) 556. 3) 88/83. The collector's name is on the reverse of label no. 1, and the last label refers to the B. M. register.



### *O. capense falsum* ssp. n.

*O. stemmale capense* Ris, 1908, *Jenaische Denkschr.* **13**: 329-330.

Everyone must put it out of mind, that *stemmale capense* Ris 1908 is either a *stemmale* or true *capense*. *L. stemmalis* Burmeister (1839) belongs to the *brachiale* group (see above) and *L. capensis* Calvert (1893) was described from a Cape Town male, that has no relationship with *stemmale*, but is the nominate form (*capense capense*) confined to part of the south-west of Cape Colony, including Cape Peninsula. This subspecies, for so long called *stemmale capense*, I now name *capense falsum*. Its range is possibly of less extent than was at first supposed, because *julia* of Kirby from the west coast and my *stemmale kalai* have very evidently been lumped in with it by most authors. However, I know that it is to be found occasionally in S. W. Africa, South Angola and the central Congo, and quite commonly in Uganda. It is very plentiful in Kenya, Tanganyika, Nyasaland, Portuguese E. Africa, the Rhodesias, Transvaal and Natal. It is also to be found, just as darkly coloured and strongly patterned, in Ethiopia (Eritrea and Abyssinia) and the western Sudan (Darfur).

*O. c. falsum* is somewhat variable in size, colour pattern and amount of saffroning at the base of the wings, the latter more especially in the females. I have not been able to correlate any of these variations with either altitude or habitat preferences. A particularly pale coloured, patternless population occurred on the well forested Mt. Selinda in S. Rhodesia, and exceedingly deeply patterned specimens came from a scrub-covered open river valley near the Uganda-Sudan border, and another from the open Katanga Plateau of the Belgian Congo. Some females with extensively saffroned wings were taken on Mt. Meru, Tanganyika, but equally some very slightly saffroned ones, from exactly the same locality on the same dates. Usually only the tips of the wings are coloured, and the rest remains clear, but very old specimens will develop slight rusty brown over the entire surface. The Sc cross-veins are always black. The dimensions vary indiscriminately in the males: Abd. 30-32, width at 6th seg. 2 mm., Hw. 32-35 mm. Pt. 3-3.5 + 0.6-0.7 mm. ♀ Abd. 29-31 mm. Hw. 32-35 mm. Pt. 3.5 + 0.8 mm. The females are stout and heavy looking compared with the males, and in this species the abdomen is shorter than the wings by 2-3 mm in the males, and 3-4 mm in the females.

As types I have selected, from the collection in the British Museum (Natural History), a ♂ & ♀ from Mt. Kenya, captured by myself. ♂ type, Thoura Forest. (Meru village), 6,000ft., 30.1.1934; ♀ allotype, Thoura Forest. (Meru village), 5,500ft., 1.2.1934.

### *O. julia* Kirby

*O. julia* Kirby, 1900, *Ann. mag. Nat. Hist.* (7) **6**: 75.

This entirely western species is capable of distinction, by the male genitalia, from *c. falsum* and is as worthy of specific rank as any *Oritrithrum*. Also, *c. falsum* is sometimes found in the west and the two species meet, and closely imitate each other in facies, in Uganda. It is a dark green and black, heavily marked insect, becoming pruinose in adults. The labrum, as well as the labium, is largely black. The saffron and amber basal wing patch is fairly extensive and of a deep, intense shade. The Sc cross-veins are always black. The *IH* hamule branch in *julia* is as slender as in *c. falsum*, but the hook at the tip is perceptibly larger and slightly downturned. This causes the hook to partially close the gap between *IH* and *OH*, and therefore the gap is neither so wide nor so shallow as in either subspecies of *capense*. The upper, outer edge of the *OH* ends with a very small knob, not seen in either subspecies of *capense*. It must be admitted that in the Uganda forests, *julia* is exceedingly difficult to distinguish from *c. falsum*, and here is possibly to be found a hybrid population.

### *O. guineense* Ris

*O. chryso stigma guineense* Ris, 1909, *Cat. Coll. Libell.* **10**: 207.

Ris' type male is from Benguela, Angola, and the genitalia of the 2nd abdominal segment are figured on page 208. He describes the male from a Gaboon specimen and the detailed description of the genitalia would seem to place this specimen in my new species *O. machadoi*, which has been seriously mixed with true *guineense*. There is no question as to which species is *guineense*, Ris' drawing of the genitalia on page 208 makes that quite clear, and he fixed this specimen as the type in 1919 (*Cat. Coll. Libell.*, **16**: 1083). The fine series of fresh specimens, of both sexes, from Dundo, leaves no doubt whatever that two species, and possibly even *chryso stigma* at times, have been involved in most of the descriptions. It is *machadoi* that is illustrated on p. 1084 (1919) by Ris, from a male from Cape of Good Hope and it is *machadoi* that is illustrated in 1921 by Ris on p. 398 of 'The Odonata of S. Africa'.

For many years now, I have been more and more of the opinion that Ris had two or more species involved under *guineense*, but we had specimens in the British Museum (Nat. Hist.), now determined by myself as *machadoi*, labelled *guineense* by Ris himself. However, Dr. Ris was himself uneasy about this species and changed his mind two or three times on identifications, always stressing how very variable the species was in appearance and in the shape of the genitalia. If he had only decided to divide the species, it would have been much easier for all taxonomists. I am of the firm opinion, since studying this genus, and several others of as critical a nature, that there is far less variation in structure within a species, than has been supposed. Colour pattern may vary considerably, often enough to constitute a definite race or sub-species, and geographical races may sometimes vary fairly widely in other characters, from the type species.

The specimens from Kenya, that I listed as *guineense* in 1936 in 'Studies of African Odonata' (*Trans. R. ent. Soc. Lond.*, **85**: 493) are all *machadoi* and I have also mis-led Mr. Pinhey into making the same error in his book on 'The Dragonflies of Southern Africa' (1951), the genitalia illustrated on p. 213 fig. 524 are those of *machadoi*. The penis of *guineense* and the genitalia, place it unhesitatingly in the *capense* group. By the penis alone it would be quite impossible to differentiate it. The penis glans is well drawn in Fig. 26d of Barnard's 'Notes on dragonflies of the S. W. Cape, etc.', p. 243 (*Ann. S. Afr. Mus.*, 1937, **32**(3)) which he has erroneously labelled *brachiale*. The difference in the shape of the genitalia between *guineense* and *capense* is only slight, but is quite easy to see in fresh specimens. The «arm» of the *IH*, on which is a small side-turned hook, is wider than in *c. falsum*, where the branch is slightly constricted before the hook. The cleft between *IH* and *OH* is shallower in *guineense*, and the hook gives the appearance of being superimposed laterally on the tip, instead of ending the branch as in *c. falsum*. The *AL* has numerous short spines as well as a few long hairs, that are easily visible in *guineense*, but only lots of fine hairs easily visible in *c. falsum*. *O. guineense* is slim, light in colour and lightly marked in black on the thorax. It is often well marked with black on the labium, but never more than with a black spot on the labrum. The abdomen and the legs are dark, even in young specimens, and pruinose appears early in the males and is of a bright, pale blue shade. The wings always have yellow (or cream) Sc cross-veins and a bright saffron yellow base to the hindwings, often reaching as far as the 1st *An* and down to the posterior border 2-3 cells wide. In many, there is a fleck of saffron in the forewings; the costal vein is yellow, but turns blue-grey with pruinosity. Naturally it resembles *machadoi* extremely closely, and also *chryso stigma*. It is the link between the *capense* and the *machadoi* groups. Measurements: ♂ Abd. 28-31 mm. Hw. 30-33. Pt. 2.7-3.5 + 0.5 mm. ♀ Abd. 29 mm. Hw. 32 mm. Pt. 3.7-4 + 0.7 mm.

The species is mostly a western one, known from all the west African countries, where it is very common, but it has also been taken in Uganda, S. Rhodesia, Tanganyika and Somaliland.



### 3. THE CAFFRUM GROUP

A small, very mixed group, not all confined to Africa, and only held together by their mostly very similar genitalia in the males, and the shape of the alae of the penis glands.

Shape:— In size and shape the species in this group vary from medium to very large, and from being strongly constricted in the abdomen, to no constriction whatever. They are all rather flat below and keeled above.

Genitalia:— The *AL* is rather narrow and mostly flat, and does not project to the end of the hamule; in *nitidinerve* and *austeni* it is very much shorter. In *monardi*, *chryso stigma* and *austeni* it is decidedly curved in the centre. The *IH* of the hamule, in all species, is very prominent and much longer than the *OH*, the latter being short, rounded and inconspicuous, except in *chryso stigma* where it is square, broad and ending with a knob on the upper corner. In *caffrum* and *monardi*, the end hook on the *IH* turns up, as also does this branch of the hamule; in the other species the hook turns sideways. In *nitidinerve* and *micro stigma* the branch of the hamule projects outwards, nearly horizontally, in *chryso stigma* and *austeni* it inclines downwards. All species have a large, broad lobe with an irregularly angular shape, slightly indented on the lower border. The margin of the female vulvar scale is curved and in *chryso stigma* and *austeni* has a narrow margin and two internal 'flaps', while in *caffrum*, *micro stigma* and *nitidinerve* the margin is very swollen and no 'flaps' are to be seen. The vulvar scale of *monardi* is not known. The alae of the penis glands are somewhat sub-lanceolate in shape, with the anal border very slightly angled in *caffrum*, decidedly angled in *monardi* but with the apical border blunter, more triangular in shape in *micro stigma*, and with a definite short ventral tooth in *chryso stigma*, which latter links it to the more deeply notched and bifid *capense* group. In *austeni* the alae are angled at half their length, and narrower at the tips than in *caffrum*, and they are approaching the spatulate form of group 4. The upper process on all these penis glands is lumpy and conspicuous, from one third to half the length of the alae.

Pattern:— The northern *nitidinerve* is very sandy yellow in colour and very lightly marked, the tropical *austeni* is green or yellow-brown and unmarked, the widespread *caffrum* and *chryso stigma* have conspicuous cream thoracic stripes on a reddish yellow or greenish yellow ground, the western *monardi* is like *chryso stigma* without the cream stripes, while the western *micro stigma* is black striped on green, or greenish brown, and closely resembles some of the *capense* group. All of the adult males develop a bright blue pruinoscence on the abdomen and this colour, sooner or later, covers the entire thorax of all except *micro stigma*.

#### *O. caffrum* (Burm.)

*Lib. caffra* Burmeister, 1839, *Hdb. Ent.*, 2 : 856 (No. 52).

The types came from Port Natal and the species is common in all Southern and Eastern Africa and Ethiopia (Abyssinia). It is also found in Madagascar. It has been taken in the Sudan and Uganda, and the extreme eastern highlands of the Congo, also more than once in S. Angola, which latter country it has perhaps reached by way of S. W. Africa. It does not seem, as yet, to have been found in the true West, nor is it in the very extensive Dundo collection from N. Angola. As it is a conspicuous and easily captured species, its absence is significant. In most of its range, the species should be easy to tell in both sexes, because of the conspicuous cream-yellow thoracic stripes, which only begin to be obscured by pruinosity in mature males. The females have a conspicuously orange-coloured radius in the wings, only otherwise found in the Mediterranean *nitidinerve* and the Abyssinian *kristenseni*. Where both are found flying together, the latter can be separated from *caffrum* by the greater extent of golden colour all along the costal border of the wings, and developing into a patch at the nodus. The lateral cream-yellow thoracic stripes are placed more to the posterior in *kristenseni* and the abdomen has no black longitudinal stripe, as in *caffrum*. Adult pruinosed specimens very closely resemble each other and could

only be distinguished by examining the genitalia, but even with a pocket lens it should be easy to see the upturned *IH* of *caffrum* and the downturned one of *kristenseni*. From *nitidinerve*, the immensely large size of the latter, together with the unconstricted abdomen and the huge *Pt.*, should easily separate it.

*O. caffrum* might be confused with *chryso stigma*, when pruinosity obscures all but the cream humeral stripe. They are almost identical in size, shape, colouring and venation, although *caffrum* tends to have more doubled cells in the *Rsp* loop and a lesser number of antenodals. The male and female genitalia, are however, distinctive, as can be seen in the figures, and the radius is always black in the female of *chryso stigma*. Both species, when young, have

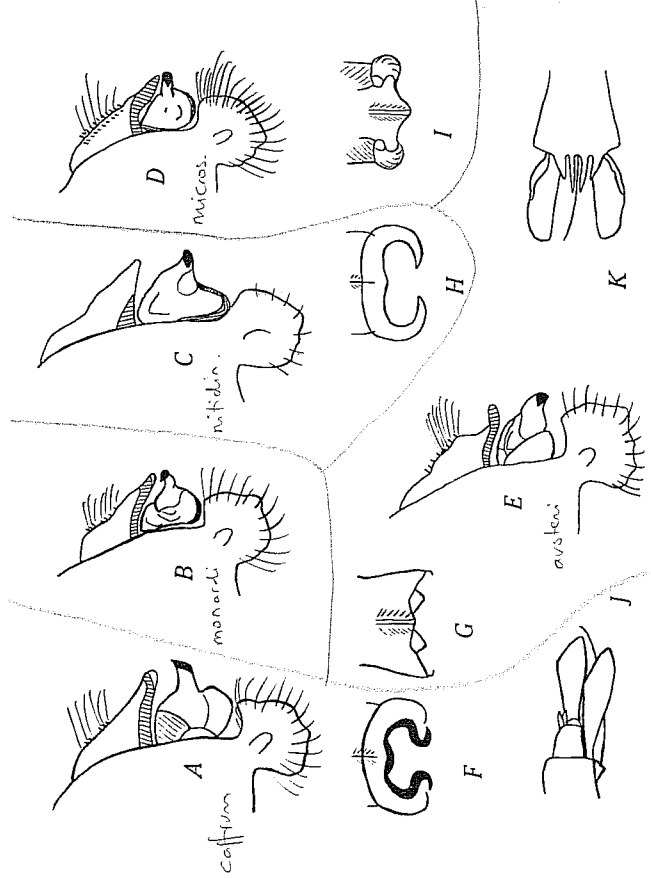


Fig. 4 — *caffrum* Group 3. A to E, male secondary genitalia. F to I, margin of female vulvar scale. J & K, terminal processes of penis glands. A, F & J: *caffrum*. B: *monardi*. C & H: *nitidinerve*. D & I: *micro stigma*. E, C & K: *austeni*.

conspicuously cream-white terga between the wings, and both species have a small, bright yellow *Pt.* between black veins. They both have yellow *Sc* cross-veins and costa (when not pruinosed) and dark grey membranes, also they usually both have small flecks of amber-yellow at the bases of the hindwings, but none in the forewings. I have seen some *caffrum* without any basal colour and, in most cases, it is more evident in *chryso stigma* than in *caffrum*. When the species are non-pruinose on the thorax, then the cream-yellow stripes will easily separate them. In *caffrum* there are three, this number being also found only in *taeniotatum* and *kristenseni*. The first stripe is a very narrow and usually incomplete dorsal ante-humeral, bordered on the outside by a wider, straighter, dark brown to black stripe. The second is broad, curved

posteriorly and reaches from the ventral anterior base of the mesepimeron to the dorsal posterior carina, beneath the forewing. It is bordered either side by a narrow black stripe for the lower half of its length and all these stripes lie just posteriorly to the humeral suture. The third cream stripe is a shorter version of the second, taking exactly the same form and position, posteriorly to the 2nd lateral suture. The rest of the insect is almost unmarked. The yellow head has a well-defined basal frons-line reaching halfway, or a little more, down to the clypeus. The legs are mostly yellow, with the tarsi and part of the tibiae black, as are also the underside of the hind femora in both sub-adult and adult specimens. The abdomen is light yellow-ochre to reddish, with only the lateral carinae finely black and a narrow black lateral stripe sub-dorsally for the entire length, and widening slightly on the 7-10 segments.

In the position of the cream stripes and general colour pattern, *caffrum* is very like *taeniolatum*, but the latter is only a tiny insect in comparison, and absolutely non-constricted in the abdomen. Also, the non-pruinosed males and females of *taeniolatum* have a black central dorsal abdominal stripe, not to be found in *caffrum*. Both sexes have white membranes in *taeniolatum*, which is quite a useful distinction. In the female of *caffrum*, the margin of the vulvar scale is wide and swollen, as it also is in *taeniolatum*, but not in either *kristensenii* or *chryso stigma*. Measurements: — ♂ Abd. 26-30 mm. Hw. 29-32 mm., ♀ Abd. 26-29 mm. Hw. 29-32 mm., Pt. in both sexes, 2.7-3.5 + 0.5-0.7 mm. The abdomen in both sexes, is shorter than the wings by 1-3 mm.

### *O. chryso stigma* (Burm.)

*Lib. chryso stigma* Burmeister, 1839, *Hdb. Ent.*, 2: 857 (No. 58).  
*Lib. barbara* Selys, 1849, *Lucas. Exped. sc. d. l'Algérie*, 3: 117.

The type locality is the Canary Islands, and the secondary male genitalia of the specimens from there do show slight differences from most of the African specimens, but not from all. The Canary Island specimens are all very large, but the colour pattern is absolutely identical, and owing to the impossibility of separating any distinct geographical race from the very extensive collections of this species that I have examined, I am leaving the African specimens as *chryso stigma* (Burm.). However, the individuals seen by me from the Canary Islands, have a wider branch to the *IH* and a less definitely angled upper corner to the *OH*, than in almost all those individuals from south of the Sahara. Ris unhesitatingly placed the Algerian and Moroccan specimens with the typical form, but the three males that I have seen from Algeria, would seem to be closer in form of hamule to those from tropical Africa. On the other hand, I have seen some from Nyasaland that are nearer to the Teneriffe ones, while others are exactly as in Ris' fig. 142 (*Cal. Coll. Libell.*, 1909, 10: 206). I have also seen a few individual males from West African countries, that resemble the typical form. From Arabia I have examined six males, from three different populations, and there the species resembles both forms equally. The few I have seen from Palestine are like the tropical African form. Dr. Ris' Syrian and Sinai specimens were much smaller than the typical form, but half the Arabian specimens I mention above are very large.

*O. chryso stigma* is primarily distinguished from other medium-sized greenish yellow and pruinosed blue, constricted *Orthetrum* by the wide cream-yellow lateral thoracic stripe, just posterior to the humeral suture. It exactly resembles the 2nd stripe in *caffrum*, is also partially bordered in black and is in the same position just below the 'shoulder'. In non-pruinosed specimens, the absence of any other cream stripes differentiates it in both sexes. The black markings are exceedingly restricted on the thorax, the only noticeable ones being two short, narrow ante-humeral streaks. There is a short, faint black streak at the 2nd lateral suture and sometimes one posteriorly on the metepimeron. The abdomen has a narrow lateral black stripe from 1-5 segments, becoming slightly broader on 6-10 segs. in older specimens, but has none

at all in some younger individuals. The upper appendages turn black early in both sexes, and the males become a bright, light pruinose blue early in life. The face is always unmarked, except for a short black basal frons-line, but the frons-shelf and the vertex will become pruinosed in adult males. The legs are mostly yellow or pruinose blue. The wings are hyaline with a small basal amber-yellow fleck in the hindwings, about two cells wide. The membrane is dark grey with a small white anterior edge. The number of the *Rspl* loop-cells is variable, in the largest percentage it is doubled in the centre for from 2-4 cells length, in some it is doubled all the way, and in some it is entirely single. In the majority of cases where it is single, the individuals are small in size, but this is not a constant relationship. Only the genitalia will confidently distinguish adult pruinosed males from equally pruinosed males of *caffrum* and *kristensenii*. To add to the difficulties there is a small race of *chryso stigma*, apparently only to be found in the Gold Coast, in which there is no trace of a cream thoracic stripe, and it therefore exactly resembles *monardi*. However, the genitalia in the males, is unmistakable. I have only seen three individuals taken in very widely separated localities and years apart. I have not yet seen any *monardi* from Portuguese Guinea, the type locality to the north-west, but I have compared these abnormal *chryso stigma* with undoubted *monardi* from the Gold Coast. In Sierra Leone, which lies between the other two countries, *chryso stigma* is abundant, with the normal cream stripe and the tropical African form of genitalia. I cannot name a sub-species on only three specimens, but if a bigger series from the Gold Coast is taken, with the same pattern, then it would be quite possible to do so. Selys' name of *barbara* (1849) is not available for this Gold Coast form, as it was applied to Algerian specimens with normal cream thoracic stripes. This name is available if it is ever decided to divide off a continental African subspecies.

It will be seen that *chryso stigma* is very wide-spread and also variable in some characters. It would appear to be extremely abundant in most localities, certainly in the east and south. Measurements: — ♂ Abd. 26-31, width at 6th seg, 1.7 mm. Hw. 29-33 mm. Pt. 2.6-3 + 0.6 mm. ♀ Abd. 28-30 mm. Hw. 31-32 mm. Pt. 3 + 0.8 mm. Gold Coast form: — Abd. 25 mm. Hw. 27 mm. Pt. 2.9 + 0.6 mm. The abdomen is shorter than the wings by 2-3 mm.

### *O. monardi* Schmidt

*O. monardi* Schmidt, 1951, *Arq. Mus. Bocage* (1949), 20: 174.

This species has only recently been distinguished and described from ten males from Portuguese Guinea. I have also distinguished two in the British Museum (Natural History) from the Gold Coast, named *chryso stigma* (c) and (d) by Ris in 1916 (*Cal. Coll. Libell.*, 1919, 10: 1081). They were collected in Prang, Northern Territory, in 1913, at the same time as two other males and one female. Only one of the latter males is now in existence and it is the *monardi*-like form of *chryso stigma*, discussed under that species above. The female has the last four segments of the abdomen missing. She exactly resembles in every way the two *monardi* males, but as no difference exists between these two and the Gold Coast form of *chryso stigma*, other than in the genitalia, I cannot say to which species she belongs. Schmidt does not compare *monardi* with *chryso stigma*, but with *hintzi*. I would say that there is less danger of mixing it with that species than with *guineense*, because *hintzi* in West Africa is a heavily striped insect, whereas *guineense* has less markings, even in the extreme west of its range. Both species have an entire black lateral abdominal stripe, only one row of *Rspl* loop-cells and a moderately large yellow *Pt*. A percentage of Schmidt's ten *monardi* males had only one row of *Rspl* loop-cells, but just over half the wings in his specimens have the cells doubled from  $\frac{1}{2}$ -2 in the centre of the wings. All four forewings of the two British Museum males have two doubled cells. *O. monardi* has a small yellow *Pt*. These two characters much more closely resemble *chryso stigma* and I have given above my reasons for considering the possibilities of distinguishing this species from *monardi* as the most difficult of all. From normal *chryso stigma*, *monardi* can be told by the

and deep orange-red in the mature insects. The venation is very dense with extra cross-veins in the triangles, but the number of cells in the very long *R<sub>5+6</sub>* loop, remains only doubled. The genitalia in the male is not unlike that of *angustiventris* or of *rassonneti*, and possibly even more like that of *brunneum*, of which species, perhaps, *austeni* is a giant edition. However, the shape of the alae of the penis glans makes it better to place it in the *caffrum* group. In the females of the three species just mentioned above, the margin of the vulvar scale is of a similar plain cleft in shape, whereas the margin in *austeni* is a flattish curve with two dorsal interior flap-like projections, quite unlike any others.

*O. austeni* is found in all West Africa from Sierra Leone to Angola, also in western Uganda and the Congo. It does not seem to be abundant anywhere.

Measurements: — ♂ Abd. 38-40, width 4 mm. Hw. 45-50 mm. Pt. 6 + 1 mm. ♀ Abd. 35-40 mm. Hw. 40-46 mm. Pt. 5.5-6 + 1.2 mm. The abdomen is shorter than the wings by 7-10 mm. in the male and 5-6 mm. in the female.

### *O. microstigma* *microstigma* Ris

*O. microstigma* Ris, 1911, *Rev. Zool. Afr.*, 1: 128.

Dr. Ris' types came from the Cameroons and it would appear to be a very abundant species in that country, and also in other parts of the West. Here it closely resembles both *s. kalai* and *julia* in appearance, but is not quite as dark an insect. It is a medium-sized, spindle-shaped *Orthetrum*, very like those of the *capense* group, but very constricted at the 3rd abdominal segment and noticeably widening more at the 6th seg., which is 2.5-3 mm. (*c. falsum* and *julia* 2 mm.). However, the genitalia are very like *monardi* and not like *chrysostrigma*, and the alae of the penis glans cannot be confidently separated from *monardi* or *caffrum*. From *s. kalai* it is very hard to distinguish, because the latter is as constricted at the 3rd and as wide at the 6th abdominal segments, and in both species the abdomen becomes entirely pruinose in mature males. The difference in size of the *Pt.* is helpful, also the number of cells in the *R<sub>5+6</sub>* loop, these being doubled in *s. kalai* and single in *m. microstigma*. There is a wider, and deeper amber-brown fleck at the bases of the hindwings in *m. microstigma* males, and in the females there is really extensive yellow in all four wings, reaching to the 7. and to the posterior wing-border in the hindwings of some females, but less in others. The venation is all red-brown to black, and the very small *Pt.* is red-brown. The colour of the males varies on the thorax, from quite a light green in the juveniles to almost black in the very mature, and the pattern, when well defined, is of the following black stripes: narrow mid-dorsal, wide ante-humeral and humeral, four diagonal laterals and the outline of the sternum. The abdomen is usually of a yellow-brown to blackish, with the following pattern (if visible): 1-3 segments with only the transverse carinae black dorsally, but a well-defined black stripe laterally on 1-3; 4-10 almost entirely black, with yellow twin patches in the centre of each 4-7 segs., extending down the sides and underneath, a very *brachiale*-like pattern. Anal appendages from light to black in colour, and a good deal of yellow on all the black legs. The head is mostly pale yellow-green, but individual males vary from having an all light labium and labrum, to having a black centre to the labium and a black edge to the labrum. The frons crest turns to a dark grey in old males; there is only a short black basal frons-line. The above description would fit any *s. kalai* male, and several other species as well, and *m. microstigma*, from its pattern, shape and size, belongs to the groups 1 and 2, but is totally unlike in the penis glans and the genitalia.

The females of *m. microstigma*, by their short, stout and stumpy shape, should also belong to group 2. They are usually not much marked with black, being ochre-yellow to greenish brown in colour, the carinae all narrowly black and the thoracic stripes very indefinite. There is no black lateral abdominal stripe, but the black widens into a patch at the sutures on 5-10 segments and there is a broad black dorsal stripe from 7-10 segs. The edges of the foliations on the 8th

smaller size and absence of a cream thoracic stripe. When these two distinctions no longer exist, then the male genitalia alone can determine them. On the whole, *monardi* tends to have less black thoracic markings: there are only very incomplete and indefinite, narrow ante-humeral and humeral, also a trace along the 1st and 2nd lateral sutures. Naturally, this species also closely resembles *machadoi*, and the description of this larger insect should be studied.

Measurements: — ♂ Abd. 24.5-30.5 mm. Hw. 25.3-30.5 mm. Pt. 1.9-2.6 mm. (Schmidt's, Portuguese Guinea), ♂ Abd. 27-28 mm. Hw. 28-30 mm. Pt. 2.25 + 0.5 mm. (Gold Coast). Abdomen either the same length as the wings, or else shorter by 1-2 mm.

### *O. nitidineræ* (Selys)

*Lib. nitidineræ* Selys, 1841, *Rev. Zool.*, p. 243.

This is a Mediterranean species which has never left the coastal countries. It appears to be abundant all over Algeria, and has been taken in Tangiers and Morocco. It is a large, sandy yellow, indefinitely marked species, becoming light pruinose blue all over in the adult males. The wings in both sexes are conspicuous by the golden radius and costa, and the very large golden *Pt.* There are two rows of *R<sub>5+6</sub>* loop-cells. The species resembles a very large *caffrum*, with similar markings, but much less defined. The very short thoracic dorsal markings are not always noticeable, but there are usually two short, broad lateral cream stripes (obscured when mature), just posterior to the 1st and 2nd lateral sutures, the latter finely black in colour. There is no constriction at the 3rd abdominal segment and the long abdomen only tapers very slightly towards the tip. It is rather flat below in the males, cylindrical in the females, and keeled dorsally. This keel is narrowly, but distinctly, black from the 2nd to 9th segments inclusive. The genitalia are most like those of *caffrum* in both sexes, but the drawing will show the difference in the hamule, with the very long, heavy end hook to the *IH*. The margin of the female vulvar scale is less swollen at the sides, than in *caffrum*, curving round to more tapering ends. The female cerci are yellow, and there are no foliations on the 8th tergites. This is unusual in the *Orthetrum*, although they are not conspicuous in *caffrum* female. *O. nitidineræ* is also like a very large *kristenseni*, except that the thoracic stripes of the latter are much more prominent and in a posterior position laterally. The females are even more alike, as both have the black dorsal carina showing up sharply against the yellow back-ground. There can be no comparison between the genitalia of these two species. Measurements: — ♂ Abd. 32-33, greatest width 2.2 mm. Hw. 35-36 mm. Pt. 4.3-4.5 + 0.9-1 mm. ♀ Abd. 29-30 mm. Hw. 34-35 mm. Pt. 4.6-5 + 1 mm. The abdomen is shorter than the wings by 2 mm. in the male and 5 mm. in the female.

### *O. austeni* (Kirby)

*Thermorhethis austeni* Kirby, 1900, *Ann. Mag. Nat. Hist.* (7) 6: 72.

*O. austeni* is the largest *Orthetrum* known, being a broad, flat, keeled, unconstricted species, with immensely long wings. The adult males are tawny yellow or else a pale pruinose blue, and light green in the immature, with very few black markings.

The old females, like the type of *T. montezoi*; Kirby, become a dark brown all over, with smoky coloured tips to the wings. All have reddish legs and dark red to black venation. The head is mostly entirely light green and unmarked, but in some western males, the labrum is black and the frons blackish green. The thorax is usually unmarked laterally, but dorsally there is a narrow, straight black ante-humeral stripe. All carinae are narrowly black, and also the edge of the small foliations on the female 8th tergites. The cerci, in both sexes, become black when mature. There is only a trace of amber-yellow at the bases of the wings, as a rule, but occasionally it extends as far as the first cross-veins in all wings. The huge *Pt.* is bright yellow in the juveniles

tergites are black, and also the tips of the pointed cerci. Very old females become darker and the black increases, but at no time does this species appear to be as heavily marked as in *s. kalai* or *julia*. It is also smaller and less heavily built than *s. kalai*, but not *julia*. The margin of the vulvar scale is very swollen at either side, rising up into two, or more, «humps», and therefore unlike the plain, curved edge of most of the females in groups 1 and 2, or the dorsally placed «humps» of *brachiale* or *capense*.

*O. m. microstigma* is very common in all the West African countries from southern Angola northwards to Sierra Leone. It is known from Uganda and has been taken in Kenya. It seems to be replaced in Portuguese Guinea by a sub-species.

Measurements: — ♂ Abd. 28-32 mm. Hw. 31-35 mm. Pt. 2.2-2.5 + 0.5 mm. ♀ Abd. 25-27 mm. Hw. 30-35 mm. Pt. 2.5 + 0.5 mm. The abdomen is shorter than the wings by 3 mm. in the males and 5-7 mm. in the females.

### *O. microstigma imitans* Schmidt

*O. microstigma imitans* Schmidt, 1951, *Arq. Mus. Bocage*, (1949), 20: 175.

This sub-species, according to Schmidt's description and illustrations on pages 176, 179 and 181-182 of the above publication, exactly resembles the nominate sub-species in genitalia, but is very much less marked with black on the thorax and the abdomen. More important still are the yellow sub-costal cross-veins, reproducing a similar case to *capense* and *capense falsum*. The female is said to be non-constricted at the 3rd segment of the abdomen, with vulvar scale as in *m. microstigma*. The dimensions of this sub-species, based on 42 males and 8 females, overlap the smallest of the nominate form, but are mostly several millimetres smaller, especially in the wings. This sub-species is confined to Portuguese Guinea. Measurements: — ♂ Abd. 26.5-29 mm. Hw. 29-32 mm. Pt. 2.2-2.8 mm. ♀ Abd. 24-26 mm. Hw. 28.5-31 mm. Pt. 2.4-3 mm.

## 4. THE MACHADOI GROUP

This is a big group, linked by the simple, spatulate or flat ribbon-shaped alae of the penis glans, with very short, square, inconspicuous upper processes. The group is sub-divided by the shape of the inner branch (*IH*) of the hamule and the length of the outer branch (*OH*). The group is also completely variable in size, proportionate length of abdomen to wings, shape of abdomen, pattern, colour and whether there are 1 or 2 rows of cells in the *Rsp/* loop. The female vulvar scale varies considerably in the shape of the margin. Indeed, the group is only very lightly knit together, and the penis possibly shows the normal ancestral shape in the *Orthetrum*. There are several species which have an Asian or Palaearctic distribution, and a few mentioned here can, as yet, only be doubtfully called African. The following sub-groups are divided on the shape of the male accessory genitalia, and in A and B, also on the shape of the abdomen.

### A. SUB-GROUP: — ENTIRELY AFRICAN AND WIDESPREAD.

*AL.* short, strongly humped at base, and tip mostly horizontal.

*IH.* short and very wide, small hook at tip.

*OH.* longer than *IH.* prominent.

Lobe. wide, rounded, somewhat sub-orbicular. Shape. small, very slim, constricted at 3rd segment.

*machadoi. hintzi. ictromelas.*

### B. SUB-GROUP: — N. AFRICAN, MADAGASCAR & COMORO ISLANDS, EUROPE AND MIDDLE-EAST.

*AL.* very prominent and very large.

*IH.* very wide and with tiny, acute hook turned sideways and upwards.

*OH.* very wide, same length or shorter than *IH.*

Lobe. as in A. sub-group.

Shape. Flat, almost non-constricted at 3rd segment, tapering.

*anceps. coeruleascens. azureum. lugubre.*

### C. SUB-GROUP: — RESTRICTED DISTRIBUTION IN AFRICA ONLY.

*AL.* very similar to A. sub-group, but a little longer in some species

*IH.* prominent and wide, size of hook variable.

*OH.* shorter than *IH.* square or rounded.

Lobe. as in A. sub-group.

*kristenseni. a. africanum. a. sagitta. angustiventre. macrostigma. rubens.*

### D. SUB-GROUP: — WIDESPREAD, AFRICA ONLY.

*AL.* large, prominently humped near base.

*IH.* long, prominent hook turned backwards and completely downwards.

*OH.* shorter than *IH.*, rather broad.

Lobe. rather short and round.

*abbotti.*

The alae of the penis glans are all very similar. *O. hintzi* has the longest and slimmest, *abbotti* and *angustiventre* have the basal half slightly wider, in *a. africanum* and *a. sagitta* they are slightly «waisted», in *anceps* parallel-sided but somewhat curved. The upper processes are short and very inconspicuous in comparison with those of the *capense* group. The females are very similar in build to their males, in the entire group.

## *O. machadoi* sp. n.

As I have stated under *guineense* Ris, I have based this new species on specimens that have for long been confused under *guineense* Ris. Dr. Ris had the species mixed from the start, and never got them sorted out, and now it is plainly impossible for me to do so geographically. I can but begin all over again and give the distribution as I know it. The species is possibly commoner in East Africa than elsewhere, but it certainly occurs in Natal and S. Rhodesia, and almost certainly in Cape Province, Transvaal and Portuguese East Africa. I have seen specimens from Uganda, N. Angola, Gold Coast and Sierra Leone, and many from Ethiopia (Abyssinia), Kenya and Tanganyika.

The insect is extremely like *guineense*, when adult and pruinoso, and like *hintzi*, at any stage. It only clearly differs in the genitalia: from *guineense* by the *IH* being so broad; and from *hintzi* by the *IH* and *OH* being clearly separated by a narrow, but deep, cleft between them. The *OH* is exceedingly swollen and prominent, much more so than in *guineense* or *hintzi*, and overshadows the rounded lobe. The *AL* is «humped» at the base, like that of *abbotti*, but with shorter spines and no hairs. In the females the margin of the vulvar scale is quite different to that of *hintzi*, being a wide curve with a very swollen edge, increasing with age. This resembles that of female *guineense*, but unlike that species, *machadoi* has inside the opening a pair of inner projections, most conspicuous in general specimens, not black as in *chrysostrigma*, not turned

up on edge, as they are in that species, and they are also thicker and lumpier than those of *chrysosigma*. There are only one row of *Rsp1* loop-cells; the *Cu<sub>2</sub>* is widely separated from the corner of *T*. in the hindwings, as it is in *abbotti* but not in *hintzi*. Both these latter species, that *machadoi* so closely resembles in colour pattern, are very much smaller in dimensions; *machadoi* is of about the same size as *guineense*.

Type ♂, Dundo, Lunda District, N. E. Angola, 13.12.1947. A very mature specimen taken *in cop.* with the allotype female (Types in British Museum). The male is a deep indigo pruinose blue almost all over, and no pattern of any kind to be seen. Abdomen more black than blue posteriorly, with black anal appendages. Legs nearly all black or blue. Labium and labrum entirely yellow-brown, unmarked. Clypeus and genae pale blue-grey; frons-shield dark blue-grey.

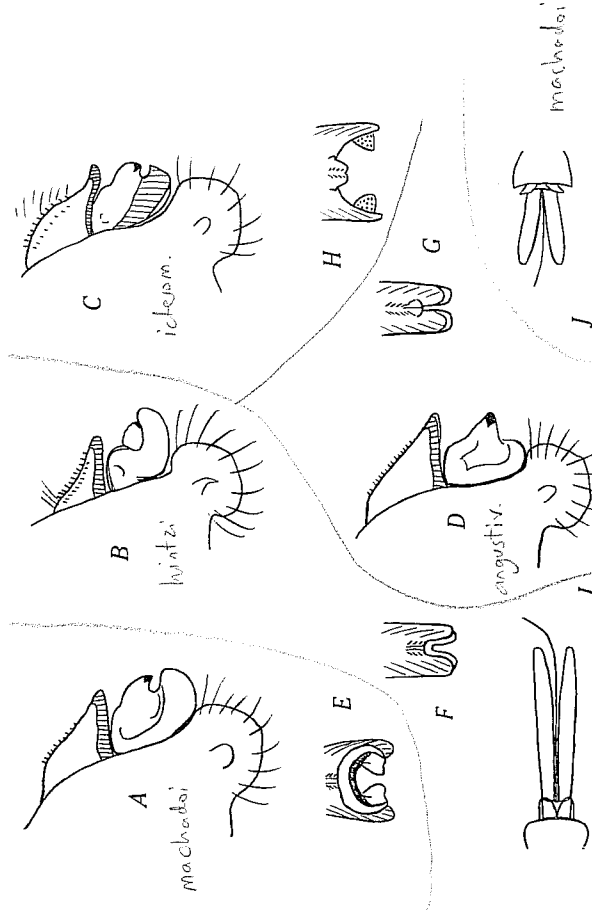


Fig. 5 — *machadoi* Group 4. A to D: male secondary genitalia. E to H: margin of female vulvar scale. I and J: terminal processes of penis glans. A, E & I: *machadoi*; B, F & I: *hintzi*; C & H: *icteromelas*; D & G: *angustiventris*.

Vertex blue-black, and a black basal frons-line, extending partway down the sides to the clypeus, merging into the blue-grey frons. Wings without any trace of saffron at bases, but lightly tinged brown apically from the discoidal cell. *Pt.* yellow, within two thick black veins. Costa cream, and costal and sub-costal cross-veins yellow. Measurements: — Entire length 40 mm. Abd. 27 mm. Hw. 28 mm. Fw. 29 mm. Pt. 3 + 0.7 mm.

Juvenile male paratypes from Dundo (March 1949) and other males from elsewhere. Entirely light yellow-green, marked with black or blackish-brown. No markings on head, except the blackish frons-line, which extends laterally  $\frac{3}{4}$  way to clypeus. On thorax dorsum is a deep brown edging to either side of the dorsal carina, forming a darkened centre, but no definite stripe; also a dark stripe transversely across the anterior border behind the prothorax.

A wedge-shaped ante-humeral and a broad undulating humeral stripe of black-brown are almost fused to form a dark 'shoulder' band. These are followed laterally by two light brown stripes on the mesepimeron and a black lined 2nd lateral suture (the latter sometimes a double stripe). In even more immature specimens, the thorax is unmarked laterally and the 'shoulder' stripes are un-fused. Legs yellow-brown or dark brown. Abdomen with all carinae narrowly black, but only a small patch of black laterally on the 2nd segment. This is a distinction from *abbotti*, which has no black laterally on 1-2 segs., and from *hintzi*, which has some black on 1-3 segs. There is a broad black lateral stripe, along the lateral carina from 4-10 segments and a transverse black band across the sutures of each of these segments, so dividing the yellow-green ground colour, below and above, into rectangular patches of colour. Wings entirely hyaline, or with

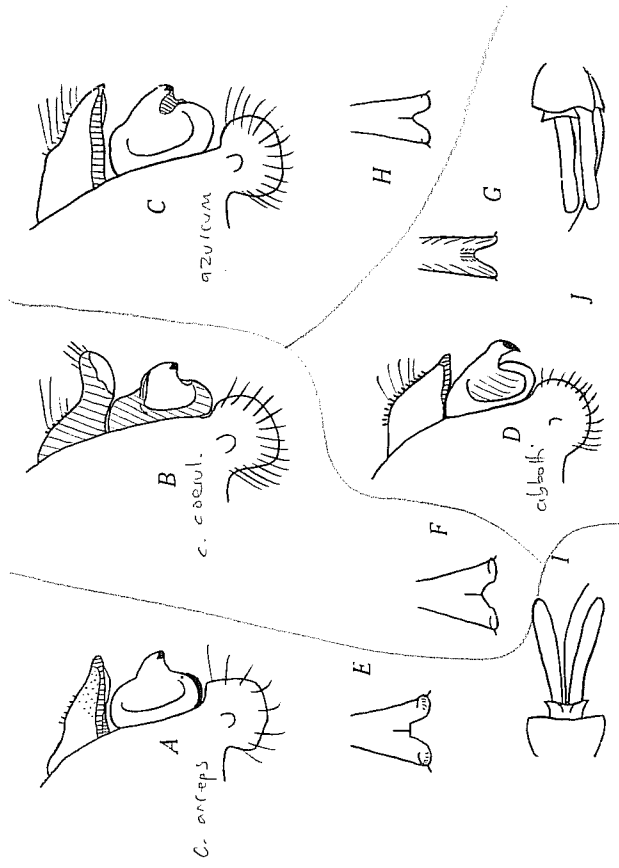


Fig. 6 — *machadoi* Group 4. A to D: male secondary genitalia. E to H: margin of female vulvar scale. I & J: terminal processes of penis glans. A, E & I: *anceps*; B & F: *coeruleascens*; C & H: *azuricum*; D, G & J: *abbotti*.

the tiniest trace of saffron-yellow at the extreme base of the hindwing. *Pt.* pale dull reddish yellow, contrasting with the vivid yellow of *abbotti* and *hintzi*; the two species which most closely resemble *machadoi* when immature. Measurements: — Very uniform. Abd. 28-30 mm. Hw. 28-30 mm. Pt. 3-3.5 + 0.7-0.8 mm. Abdomen the same length as the wings. The largest dimensions are from Ethiopia.

Allotype ♀, taken *in cop.* with type male. A mature specimen of a light yellow-brown to yellow-green colour, heavily marked with black on the abdomen. Head ochre-yellow, yellow-green on clypeus, entirely unmarked, except for a narrow black basal frons-line, extending down the sides partway to the clypeus. Occiput and occipital region bright orange. Prothorax and Thorax yellow-green, quite heavily marked with blackish brown at most sutures. The

thoracic stripes (all irregular or even wedge-shaped) consist of the following: a narrow darkening to the dorsal carina, a wedge-shaped ante-humeral not quite reaching the alar sinus, a broad humeral and short wedge just fused at alar sinus, irregular darkening at centre of mesepimeron and along 1st lateral suture and above stigma on the metepisternum, the entire 2nd lateral suture, a short streak on the metepimeron. (The three «shoulder» stripes are the heaviest and appear first, the lateral markings being absent in less mature females). Between the wings is a wide cream stripe the entire length of these tergites. Legs: all black tarsi; hind tibia black, mid tibia black with fine yellow outer line, fore tibia with yellow outer and black inner halves; femora yellow, hind and mid with a black inner line. All coxae and trochanters yellow. Abdomen: 1-3 segments moderately swollen laterally and dorso-ventrally, and definitely humped dorsally,

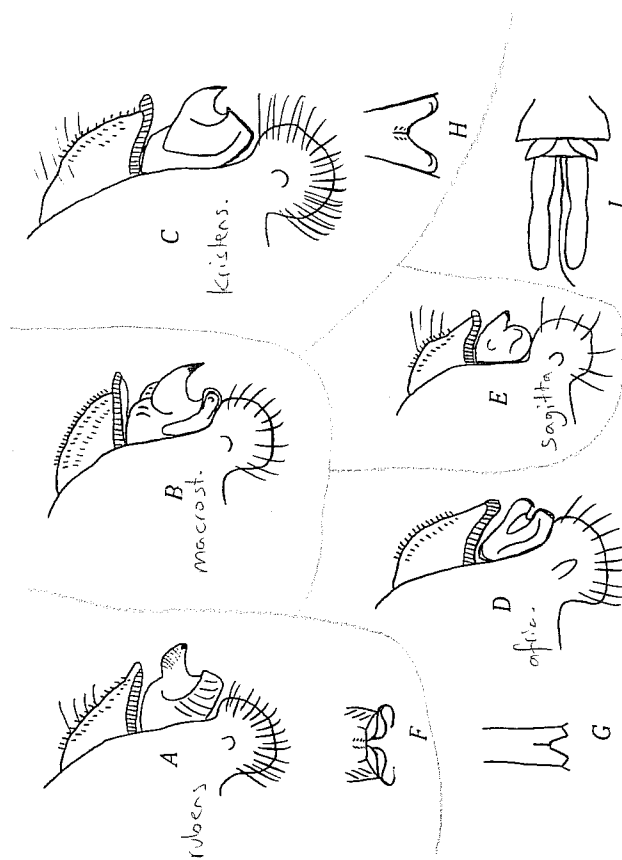


Fig. 7—*machadoid* Group 4. A to E: male secondary genitalia. F to H: margin of female vulvar scale. I: terminal processes of penis flaps. A & F: *rubens*. B: *macrostigma*. C & H: *krisienseni*. D, G & I: *africanum africanum*. E: *a. sagitta*.

ochre-yellow, all carinae narrowly blackish brown and an indication on 2-3 segs. laterally of the black abdominal stripe. 4-7 segments light yellow-brown, with a fine black dorsal carina. A wide, entire black stripe extends above the lateral carina and broadens out at every suture to suffuse the surface dorsally and ventrally. Black almost entirely obscures the 8-10 segs., except for small twin reddish yellow spots anteriorly on 8th and a dorsal patch on 10 th. The 8th seg. has small lateral «flaps», all black. The epiproct and paraprocts are ochre-yellow, but the cerci are missing (they are black, pointed and longer than 10th seg. in the adult paratypes). Wings: hyaline, with orange-yellow bases to all four, extending to the 3rd An. and the discoidal cells. *Pt.* light ochre-yellow, between black veins, the costal one being thickened. Measurements: Abd. (minus cerci) 27 mm. Hw. 28 mm. Pt. 3.5 + 0.7 mm.

The yellow at the wing bases is very variable, being only the merest trace in some of the paratypes, and in others all gradations up to the width on the type female. These distinctions are not confined to separate populations, nor related to any geographical distribution. In this species the abdomen is the same length as the wings, or 1-2 mm. shorter. Measurements: ♀ Abd. 27-29 mm. Hw. 28-29 mm. Pt. 3.5 + 0.7 mm.

### *O. hintzi* Schmidt

*O. hintzi* Schmidt, 1951, *Arq. Mus. Bocage* (1949), 20 : 174.  
*O. hintzi* Zernyi Schmidt, 1951, *Arq. Mus. Bocage* (1949), 20 : 178.

Dr. Schmidt's separation of this species into sub-species on only a considerable darkening of the colouring is not justified when one has a series before one from East, West, South and Central Africa. The types came from Portuguese Guinea and Tanganyika, also I know it from Natal, S. Rhodesia, N. Angola, Nigeria, Gold Coast, Sierra Leone and Uganda. It would seem to be more plentiful in the west than elsewhere. It is the 3rd smallest *Orlithrum* known, and it is hard to distinguish from *abbotti*, or the slightly larger *machadoid*. The mature males become dark pruinose blue when adult and most of the pattern is obscured. Younger males will show the yellow-green thorax striped with black, and still younger males have the abdomen yellow-green with a broad black lateral stripe on the 4-10 segments, and a narrow extension onto 1-3 segs. The black is enlarged at each suture from 3-8 segs. and almost meets dorsally and ventrally to form semi-transverse bands. 9th seg., black and 10th yellow dorsally. The non-pruinosed thorax has a narrow black stripe on the centre dorsum, an ante-humeral and humeral fused into a solid broad band from wing to leg (not quite fused on younger specimens), a double 1st lateral (above and partly below the stigma), the entire 2nd lateral suture and a broad wedge on the metepimeron. In the very young, there are no lateral stripes, but the dorsal ones are acquired early and are more definite and bolder than in *machadoid*, as a rule. The legs are also blacker than *machadoid* at an early age, also the labium has a black centre lobe, becoming all black when mature and the labrum often has a black edge and a black centre spot. The rest of the head is usually light yellow-green, with the clypeus sometimes showing a livid bluish white and the frons-shield darkening to a blue-grey in old males. In this condition they are very like *icteromelas*. The black basal frons-line is well defined and extends laterally halfway to the clypeus. The wings are hyaline, with very small flecks of saffron-yellow at the base of the hind pair only. The *Pt.* is very like that of *abbotti*, large and pale yellow, between thick black veins. The *Cu<sub>2</sub>* is at the corner of the *T.* in the hindwings; there is one row of *Rsp/* loop-cells. Measurements: ♂ Abd. 26-27 mm. Hw. 27-29 mm. Pt. 3.3-6 + 0.6 mm. The abdomen is shorter than the wings by to 3 mm.

Allotype ♀, selected from a N. Angolan specimen, Dundo, March 1949 (in British Museum). A fully mature specimen, yellow-green marked with dark brown or black. Head: without any black, except the basal frons-line. The thorax stripes are very indefinite and more of a brown suffusion along the centre dorsum, than real stripes; the same for the ante-humeral and humeral areas; the 2nd lateral suture and some indistinct streaks between these two. Legs: yellow-green with black tarsi and a fine black inner line on the tibiae. Abdomen: yellow-brown with all carinae black, a wide black lateral stripe from 4-10 segments, a narrow extension on 1-3 segs., all sutures transversely barred with black dorsally and ventrally. 9-10 black with two yellow spots on 9, 8th with enlarged lateral tergites, yellow edged with black. On the dorsum of the 8th seg., there is a reddish yellow wedge-shaped mark, and this would seem to be a distinguishing mark from both *abbotti* and *machadoid*, both with only two dorsal spots, but otherwise extremely similar. Epiproct and paraprocts yellow, cerci black. The large yellow *Pt.* between black veins is only a fraction less wide than that of *abbotti*. The *Cu<sub>2</sub>* is, however, at or very near the corner of the *T.* in the hindwing. The type female is old and her wings are yellow-green all over. There is

only the merest trace of saffron-yellow at the base of both wings, not quite reaching either the 1st *An.* or *Ac.* Measurements: Entire insect 39 mm. Abd. 27 mm. Hw. 29 mm. Pt. 4 + 0.8 mm. The abdomen is shorter than the wings by 2 mm.

In some of the female paratypes, the thorax has no black or brown on the centre dorsum and none below the humeral suture, but in even quite general specimens, the «shoulder» stripes are present, not fused, but the space between of a reddish colour. In all the females the thorax is less marked than in *machadoi*, but is very similar to the female of *abbotti*. If the vulvar scale can be seen, then it can be distinguished from *abbotti*, because it has a doubled edge to the cone-shaped margin, that of *abbotti* being a single thin edge to the margin. Measurements: Abd. 24-27 mm. Hw. 25-28 mm. Pt. 3-3.6 + 0.7 mm. The abdomen is 1-2 mm. shorter than the wings.

### *O. icteromelas* Ris

*O. icteromelas* Ris, 1910, *Cat. Coll. Libell.* 10 : 197.

Ris' type male came from Madagascar, where the species must closely resemble *abbotti* (only larger), because in Madagascar the latter species has adopted the dark grey to black line along the frons crest, so characteristic of *icteromelas*. I have only seen this head-pattern habitually in *abbotti* from Madagascar, and very occasionally in an odd individual from other populations. *O. icteromelas* is, of course much larger than *abbotti* (the 2nd smallest of the African *Oritetrum*) and is about the dimensions of *machadoi*. The abdomen in the males seem to vary between being the same length as the wings in all those I have measured from South and East Africa, and 2-3 mm. longer than the wings in those measured by Dr. E. Schmidt and myself from West Africa. In the females the abdomen is 2-3 mm. longer than the wings, in all localities. The large yellow *Pt.* is very like that of *abbotti*, but slightly narrower in proportion. In *icteromelas* most of the *RspI* loop-cells are doubled, whereas they are single in *abbotti*, *machadoi* and *hintzi*. In mature males the entire abdominal pattern is obscured by a cobalt-blue pruinosity, and this will also extend to the thorax and legs. In non-pruinosed specimens the black pattern is heavy and well defined from an early age. The ground colour is light yellow-green in males and pale yellow-brown in females. The pattern in the latter sex is similar to the males, but narrower and fainter on the thorax, very heavy on the abdomen, and the general appearance is very like the male. The black pattern on the thorax consists of the following: a broad centre dorsum, a broad ante-humeral, a narrower double humeral (1 long, 1 short upper piece) and this humeral joined above the mid coxa to a short broad 1st lateral, another short broad stripe above the stigma, a narrow 2nd lateral. The anterior half of the prothorax is broadly black, the posterior lobe bright yellow-green, with a fringe of yellow hairs. It is this black prothorax and black thoracic centre dorsum, in conjunction with the rest of the well-defined black lateral stripes, that help to differentiate *icteromelas* from *machadoi* and *hintzi*, otherwise, so very similar in appearance. When all the males are pruinosed, the best character is the number of cells in the *RspI* loop and the black on the head. In *icteromelas* the yellow labium has a broad black centre (less in females and young males) and there is a broad black basal frons-line reaching laterally to the clypeus. In addition, most specimens show a black crest to the frons, but not in the young of either sex. This species in West Africa, when very mature, has a very white face, with the black markings well defined. The abdomen has the 1-2 segments fairly deeply widened dorso-ventrally, distinctly humped dorsally and with black transverse carinae. The abdomen is constricted at the 3rd seg. and only widens again slightly, being slim and somewhat cylindrical for the entire length, not wider than 1.3 mm. at the 6th seg. It is in the abdomen, when the markings can be seen, that this species is most unlike any other. Whereas most of the African species have only a narrow black dorsal carina and a broad black stripe low down along the lateral carina, from the 3rd to 10th segments, in *icteromelas* the pattern is reversed, with the lateral carina only black and a broad black centre dorsal stripe from the 3rd to 10th segments. This centre stripe widens at each

segmental suture to embrace the entire segment, and encloses a curved yellow patch laterally on 3-8 segs., 9th is all black and 10th all yellow dorsally. The abdomen beneath is entirely black. For the difference from *macrostigma*, see that species. The genitalia in the male are very similar to those of *africanum*, and the sub-species *a. sagitta*, is very similar in size, but in *africanum*, the abdomen is considerably slimmer in build and the *Pt.* smaller in size. *O. icteromelas* might be confused with *chryso stigma*, because the outer hamule branch (*OH*) has a sharp upper corner, only found otherwise in the Abyssinian *kristsenseni*. However in both these species, the inner branch (*IH*) is longer than the *OH* and narrower than that of *icteromelas*. In the female, the margin of the vulvar scale is also similar to that of *chryso stigma*, owing to the two internal «flaps», but whereas these are yellow in *icteromelas* and lying horizontally, they are black and raised vertically in *chryso stigma*. Unfortunately these vulvars are usually very difficult to see and there is no doubt that the females of these two species can be very similar in appearance. When *chryso stigma* has the typical white shoulder stripes and when the light yellow dorsal pattern is not obscured, then identification is easy enough, but *chryso stigma* sometimes loses all trace of the white stripes and the abdomen may be badly discoloured. The female of *icteromelas* is extremely like the male in shape, size and pattern. She has a more yellow ground colour, and yellow epiproct and paraprocts, with black cerci. She is also very similar to the female of *hintzi*, owing to the dark thoracic stripes and black on the head of that species which, however, is very much smaller. The vulvar scale of *icteromelas*, with its «flaps», is also very similar to that of *machadoi*, but the absence of a wide mid-dorsal stripe on the latter, will help to differentiate the two. Measurements: ♂ Abd. 28-32 mm. Hw. 27-30 mm. Pt. 3.5-4 + 0.8 mm. ♀ Abd. 28-33 mm. Hw. 26-30 mm. Pt. 3.5-4 + 0.8 mm.

### *O. anceps* (Schneider)

*Lib. anceps* Schneider, 1845, *Stell. ent. Ztg.*, Jg. 6 : 111 (Type ♀).

*Lib. ramburii* Selys, 1848, *Rev. Zool.*, p. 16 (allotype ♂).

The species of group 4b seem very closely related to each other, with the exception of *lugubris*. They have only gained a footing in Africa along the north coast and in Madagascar and the Comoro Islands. *O. anceps* is well established in all the North African countries from Morocco to Egypt, but its zoogeographical centre is in the Middle-East. In south-east Europe, I believe that more than one species exists, under what has been known as *anceps* (Schneider). There is certainly *hetena* Buchholz from Greece (*Bonn. zool. Beitr.*, 1954, Sonderbd. Part 1, pp. 66-67), and probably one (or even two) more quite good species from the Balkans. These latter have the *AL* more like *anceps*, but also slightly enlarged at the tip giving a partial resemblance to *coerulescens*, where it is very bulbous. The *Pt*'s are of the large size and elongated shape of that of *coerulescens*. One of the difficulties of determining these new species, is the fact that we do not really know what is *anceps* of Schneider. The species was named from two females, now for ever lost, taken at what is at present known on the maps as Marmaris (or Marmarica), but called by the collector Dr. Loew and the taxonomist Dr. Schneider, «Mermenza». This is on the mainland of Anatolia, almost opposite the island of Rhodes. Unfortunately Dr. E. Schmidt, during his expedition to southern Anatolia in 1952, never captured any specimens of *anceps* (*Ent. Zeit.*, 1954, Jg. 64 : 49-62, 65-72, 74-86, 92-93). However, it would seem to me a fair assumption that the insects taken in Cyprus and Palestine, which I have examined and which I consider to be identical with those from Egypt and further to the west in N. Africa, are true *anceps*, all the more especially because the specimens named *anceps* by Dr. Buchholz, from the Greek islands Naxos and Paros, have been compared with those from Tunisia in Dr. Ris' collection (1954, pp. 65-67). Dr. Bartenel was of the opinion that *coerulescens* was found nowhere out of Europe and that *anceps* is the only one of the two species to be resident in the Middle-East. In the Balkan peninsula, the status of the above two species needed further study (Zool. Anz, 1930, 91 : 67-91). As I have already mentioned, there may quite well be more than one



species in the Balkans. The position further south would appear to be that one species only, *anceps* of Schneider, is not separable even into sub-species, although there is a certain amount of variation in the shape of the *AL*. Individuals in all the populations discussed above vary between looking exactly like the Tangiers specimen in Ris' fig. 135 (Cat. Coll. Libell., 1909, 10 : 186) and that illustrated by Buchholz in fig. 8a (1954, p. 65). I do not, therefore, think it is justified to assume another name for the N. African specimens. *O. ramburii* (Selys) would perhaps be available, because an Algerian male is labelled in de Selys's hand, as the type, in the Brussels collection, although the original description was from Sardinian specimens.

*O. anceps* closely resembles the European *coerulescens*. It is the same size and shape, becomes just as light pruinose blue in the adult male and has the same unmarked yellow-ochre colouring in the immature and in the females. The two well-defined cream thoracic dorsal bands, edged with black, of *coerulescens*, are only very slightly indicated in *anceps*, although the narrow black incomplete humeral stripe is present. In shape *anceps* is only very slightly constricted at the 3rd abdominal segment, is flat beneath and keeled above. It can be confidently told from *coerulescens* in the male, by the smaller and more tapering *AL* (very bulbous in *coerulescens*) and by the very much smaller and more rectangular *Pt.* in both sexes. In none of the females of *anceps* have I seen the strong suffusion of golden yellow along the costal borders, so often met with in *coerulescens*, but in both species the costal and sub-costal veins, also the *Pt.* are a very bright yellow, but there is no colour at the bases of the wings. In both there is only one row of *Rspl* loop-cells, and in both the convex margin of the vulvar scale is very similar.

From *O. b. brunneum*, which has the same colouring, the same shape, and the same-sized *Pt.*, *anceps* can be distinguished by its very small size in comparison, and by the genitalia in both sexes, markedly different in the male, and with a narrower cleft in the centre of the margin of the female vulvar scale in *anceps*.

Measurements: — ♂ Abd. 23-27 mm. Hw. 24-28 mm. ♀ Abd. 23-26 mm. Hw. 24-27 mm. *Pt.* 2.5-2.8 + 0.5 mm. in both sexes. The abdomen is shorter than the wings by 1 mm.

[ *O. coerulescens* (Fabr.) ]

*Lib. coerulescens* Fabricius, 1798, *Suppl. Ent. Syst.*, p. 285.

This European species has twice been reported from N. Africa on females only, Selys recorded a female from Algeria (Lac de Houbeira) in 1871 (*Ann. Soc. ent. Belg.*, 14 : 11), but the specimen is no longer in existence and MacLachlan doubted that *coerulescens* was to be found there (1897, *Ent. Mon. Mag.*, 8 (2) : 152-157). He had, himself, confidently identified another female in a collection from Morocco in 1889 (*Ent. Mon. Mag.*, 25 (1) : 348), which also contained a male *anceps* from the same locality, Esmir. This specimen is also no longer in existence, and I think that both these identifications are doubtful. Neither author, I believe, took into consideration the difference in size of the *Pt.* in these two species, and in other respects the two females are closely similar and cannot be confidently distinguished. The distance between the two Continents would hardly constitute an insuperable barrier; it is more likely that the type of habitat, and perhaps the climate, causes the main separation between the two species. There is far less difference between *coerulescens* and other species from Greece and the Balkans (see *anceps* above). The *AL* in *coerulescens* is always far more enlarged at the tip, but the *Pt.* is much the same in size: 3.5-4 + 0.7-0.8 mm.

*O. azureum* (Ramb.)

*Lib. azurea* Rambur, 1842, *Ins. Névr.*, p. 68.

This is a Madagascar species resembling *anceps* very closely in genitalia and *coerulescens* in pattern. It is a much larger and heavier insect than either and has saffron-yellow patches

at the wing bases, sometimes extending in the hindwings to cover the discoidal cell (*T*) and down to the posterior wing border. It has no more markings on the body than has *anceps*, but the light blue pruinosity only seems to cover the abdomen in mature males. Some adult males show a dark band along the frons crest, and in this they resemble the *stemmale* complex. The costa is a yellow vein, but the *Sc.* veins and the *Pt.* are a very pale reddish brown, and the latter is considerably larger than in *anceps*. The *Rspl* loop-cells are variable in number, some being of 1 row, but more often with 2-5 doubled in the centre, especially in the females. The female vulvar scale has a simple margin, very similar to that of *anceps*. Measurements: — ♂ Abd. 28-29 mm., width 2.5 mm. Hw. 32-33 mm. *Pt.* 3 + 0.8 mm. ♀ Abd. 27-28 mm. Hw. 29-32 mm. *Pt.* 3.5-3.8 + 0.8 mm. Abdomen shorter than wings by 4 mm. in the males, and 2-4 in the females.

*O. lugubre* Ris

*O. azureum lugubre* Ris, 1915, *Ent. Mitteil.*, 4 : 142-143.

Dr. Ris described this species from the Comoro Islands as a subspecies of *azureum* (Ramb.), from 2 males and 1 female. The illustration of the genitalia of the male certainly does closely resemble that of *azureum* and also *anceps*, but it is not identical with either. The rest of the description might quite well be that of a larger-sized *stemmale wrighti* and I felt almost justified in moving it into Group 1. As it is neither *s. wrighti* nor *s. lemur*, and as in the shape and length of the *AL*, it more closely resembles *azureum* (although longer in proportion to the *PH*), perhaps it is better to leave it in Group 4b and give it specific rank.

The head is like that of *s. wrighti*, with a yellow enclosed frontal spot surrounded by a black and dark blue-grey band, which in *lugubre* extends laterally down to the clypeus. The black on the labium and labrum is as extensive as in *s. wrighti*, the black stripes on the thorax are even wider and the abdomen so dark that the pattern could not be seen. The wing venation is entirely black, the *Pt.* black-brown and fairly large, the membrane blackish grey. Presumably there are 2 rows of *Rspl* loop-cells, as Dr. Ris gives that number for *azureum*. There are no saffron basal wing patches. The abdomen is wider at the base than in *azureum*, and narrower and more cylindrical from the end of the 3rd seg. onwards. It must very closely resemble *capense falsum* in appearance, as well as *stemmale*. The legs are very black, with some yellow on the inner side of the femora. Measurements (Ris) : — ♂ Abd. 29 mm. Hw. 33 mm. *Pt.* 3.5 mm. ♀ Abd. 29 mm. Hw. 37 mm. *Pt.* 4 mm.

*O. kristenseni* Ris

*O. kristenseni* Ris, 1911, *Rev. Zool. Afr.*, 1 : 126.

The species is confined to Abyssinia (Ethiopia) and was described from 3 males and 2 females in the Coll. Ris, to which Ris later added 2 females in the British Museum (Nat. Hist.) with broken abdomens. Only one male was in anyway adult and the colouring in the others was a lovely orange-yellow, with exceptionally golden costal and sub-costal veins, enlarging into a golden patch at the nodus and small golden flecks at the bases, also forming quite broad continuous costal bands of gold in the females. The radius is also bright orange. Ris' adult male was somewhat more olive on the head and thorax, and the abdomen thinly pruinose. All had the characteristic 6 cream-coloured thoracic stripes, edged with black posteriorly. These stripes, on either side, consist of an almost entire ante-humeral, a short curved 1st lateral with black over the stigma, and an indefinite broad edge ventrally to the metepimeron. The positions of these stripes, except for the dorsal pair, are much further to the posterior, than in any other cream-striped species of African *Orthetrum*. I was, therefore, scarcely prepared to find the fully mature males (from a small collection recently received), with almost every trace of golden

colour gone from the wings, the minutest trace only left at the nodus and the bases. The head is extremely dark olive-green with blackish frons, only the shelf remaining yellow-green. Thorax dark olive-brown, the dorsal cream and black stripes showing only very faintly, but laterally a narrow white crescent-shaped mark is curved round the stigma. Beneath, is unmarked olive-green. Legs dark red-brown and black. Abdomen pale pruinose blue all over, except 1-2 segs. which are unmarked olive-green. This excessively dark mature male is an extraordinary contrast to the species in a younger stage.

The adult males are very similar to those of *caffrum*, and the way to distinguish them will be found under that species. They are also very like *chryso stigma* and *guineense*, with their moderately swollen and dorsally-humped 1-3 abdominal segments, constricted at 3rd seg. and from there onwards fairly narrow (2 mm. at 6th seg.) and partially cylindrical. The male genitalia are not closely like any other, but nearest to *macro stigma*. The margin of the vulvar scale in the female is a simple curved cone-shape, the 8th segment has small foliations with a narrow black edge, and the dorsal carina is extremely finely black, but there is no lateral stripe. The only black on the head is a narrow basal frons-line. Measurements: — ♂ Abd. 29.32 mm. Hw. 32.3-34 mm. Pt. 2.5-3 + 0.5 mm. ♀ Abd. 28-33 mm. Hw. 31-35 mm. Pt. 2.5-3 + 0.6 mm. The abdomen in both sexes is shorter than the wings by 2-3 mm.

### *O. macrostigma* Longf.

*O. macrostigma* Longfield, 1947, *Afr. Mus. Bocage*, 16: 25-26.

I described this species from six males taken in South Angola in 1932 and 1933 by Dr. Monard, and the only specimen I have since seen is a male in the British Museum (Natural History), from Kambole, Tanganyika, collected in 1895 and with the abdomen missing from the 4th segment. No female is known.

The Angolan specimens are slim and very like *icteromelas* in appearance. The head is entirely pale, except for a short, black basal frons-line. The thoracic stripes are not heavy, but quite well-defined, even in the mature males and are brown to black in colour. There is a stripe either side of the dorsal carina, an ante-humeral and a short humeral, a short one on the 1st lateral suture and a faint one (in the adult Tanganyika male only) on the 2nd lateral suture and up the centre of the metepimeron. In the Angolan juvenile males, the abdomen has a black stripe dorsally and laterally from 3-10 segs., and this also closely resembles *icteromelas*. It differs mostly from the latter species by having less heavy longitudinal and transverse black stripes on the abdomen, and with far less black on the head. It can become entirely pruinose on the thorax, as shown by the type, and on the abdomen, as the Tanganyika specimen indicates. The wings are hyaline with exceedingly minute traces of amber at the bases of both pairs. Costa and Sc. veins are yellow, also the very large Pt. between black veins. The Angolan males all had most of the *Rsp/* loop-cells doubled, but the Tanganyika male has most of them single. The legs are more black than green.

In the male genitalia there is no mistaking *macrostigma*, it is quite unlike any other. The two nearest to it are *icteromelas* and *kristenseni*. Both those species have a broad *OH*. with an angled upper outer corner. The *OH*. in *macrostigma* is narrow, rounded and inconspicuous. Very different is the immense claw-like *IH*. Here, there is no comparison with *icteromelas*, where the *IH*. is broad and ends with a small but definite hook, turned completely sideways and upwards. In *macrostigma* there is no terminal hook, but the entire, narrow, pointed outer edge of the *IH*. is sclerotised into a black shiny claw. Something of the same kind is found in *kristenseni*, but here the *IH*. is considerably shorter and broader. The *AL*. and the lobe are quite inconspicuous compared to the hamule. Measurements: ♂ Abd. 28 mm. Hw. 31 mm. Pt. 4 + 1 mm. Abdomen shorter than wings by 3 mm.

### *O. rubens* Barnard

*O. rubens* Barnard, 1937, *Ann. S. Afr. Mus.*, 32 (3): 246-247.

I prefer to place *rubens* in this group, although the alae of the penis are somewhat broader than in several others in group 4. Barnard compared it to *caffrum* and has drawn the male genitalia at Fig. 26, 1, but mistakenly named it *capense* in the caption. The species, entirely confined to Cape Province, is perhaps most like the Abyssinian *kristenseni*, when both are only sub-adult in colouring, owing to the brilliant golden yellow general effect. As we have seen under *kristenseni*, that species becomes the usual greenish olive and pruinose blue of most fully mature male African *Orthetrum*, whereas *rubens* turns ruby-red on the thorax of the male, with orange head and abdomen. This colouring resembles some of the Oriental species of *Orthetrum* and may indicate an origin from the wide-spread *testaceum* (Burm.) with very similar colouring and genitalia.

In *rubens* the head is all orange-yellow, except the well-defined black basal frons-line. Centre of the prothorax is brown on the anterior parts, orange-yellow on the rest. Thorax orange-yellow in all those I have seen, with the following black: narrow mid carina, narrow ante-humeral, wider humeral and 2nd lateral suture, and both these latter form an anterior border to two cream-white bands. These cream thoracic stripes are in the same positions as those of *caffrum* and *laeniolum*, which helps to differentiate them from *kristenseni*, where the position is further to the posterior. Between the wings, the terga are bright orange-yellow. Abdomen orange-yellow with a heavy black lateral stripe above the carina, a black dorsal carina and a complete broad black transverse band across each segment posteriorly. All 9-10 segments and the anal appendages, black. Beneath blackish brown. The wings are suffused with yellow, especially strongly along the costal region, with the Costa and Sc. veins and Pt. very orange-yellow. The wing-bases are decidedly golden, especially in the females, where the colour sometimes reaches to the arculus, and in *rubens* this golden wing-colour evidently remains in the fully adult. There are more double cells in the *Rsp/* loop, than single ones.

The male genitalia are closer to those of sub-group A, by the very wide *IH*. with a minute hook, but differ in the much shorter *OH*. The latter is rather square and quite wide, and the entire hamule is large and prominent. The *AL*. is very similar to that of *hinzii* and the lobe is also similar. The margin of the female vulvar scale shows two dorsal «flaps», not internal as in *icteromelas* and much more swollen and upturned than the «angled» outline of *capense*. Measurements: ♂ Abd. 28-29 mm. Hw. 29-30 mm. Pt. 3 + 0.6 mm. ♀ Abd. 28-30 mm. Hw. 29-31 mm. Pt. 3.5 + 0.7-0.8 mm. The abdomen is shorter than the wings by 1 mm.

### *O. angustiventris* (Ramb.)

*Lib. angustiventris* Rambur, 1842, *Ins. Névr.*, p. 59.

This is an immensely long, slim and cylindrical species; that could only be confused in flight with *trinacria*, equal in size, shape and pattern. However, the two species are very different in the wing venation. The *Rsp/* loop-cells vary from 3 to 4 rows, the venation is extremely dense, with extra cross-veins in the triangles, and the golden yellow Pt. is 5.5-6 + 1.2 mm. in size. (In *trinacria* the venation is quite open, with not more than a double row of *Rsp/* loop-cells, and the Pt. is only 4.4-5 + 0.8-0.9 mm.). The wings in *angustiventris* are longer than the abdomen in both sexes by 1-2 mm., whereas in *trinacria* the wings are short and the abdomen is longer in the males by 3-5 mm., although of equal length in the females. The genitalia of the two species are very different, as can be seen from the illustrations.

In the immature insects, there are two white dorsal ante-humeral stripes bordered by black, almost at the humeral suture. Laterally, there is always one broad white stripe, partially black-edged, anteriorly on the mesepimeron, and some young specimens show 2 to 3 more

cream-white stripes as far as the sternal border of the metepimeron. All these stripes become completely obscured in adult males as soon as pruinosity begins, which is extensive and dark indigo-blue in this species. The head is entirely pale yellow, only the frons-shield darkening to grey-blue with age. The abdomen is extremely unmarked.

The ground-colour is tawny-yellow and all the carinae are finely black. At the posterior dorsal end of 3-7 segs., there is a small black cross and 8-9 segs. have an elongated black dorsal streak. All appendages are yellow in the immature. The wings are hyaline, with golden costa and Sc. veins, and extensive golden colour all along the costal margin in young males and all females.

The male genitalia is perhaps most like that of *azureum*, with a prominent wedge-shaped *AL*, almost as long as the *IH*, which is very wide, almost horizontal and ends in a sharply pointed, but broad hook, turned completely sideways and backwards. The margin of the female vulvar scale is deeply cleft.

The species is fairly common in the Sudan from the Nile to the Niger, and is also quite abundant in the West African countries that border it: Senegal (the type locality), Gambia, Portuguese Guinea, Sierra Leone, Liberia, Northern Nigeria, and has been taken in Dahomey, Togoland and Northern Uganda.

Measurements: ♂ Abd. 38-40, width 2 mm. Hw. 39.42 mm. Pt. 6 + 1.2 mm. ♀ Abd. 37.40 mm. Hw. 39.41 mm. Pt. 6 + 1.2 mm. (Schmidt makes the measurements smaller: ♂ 33-35, 35-36, 5-5.5; ♀ 34-36, 36-38, 4.7-5.6). The abdomen of both sexes is shorter than the wings by 1-2 mm.

### *O. africanum africanum* (Selys)

*Lepthemis sabina* var. *africana* Selys, 1887. *Ann. Soc. ent. Belg.*, **31** : 21-22.  
*Orthetrum africanum* Ris, 1910. *Cat. Coll. Libell.* **10** : 212.

*O. a. africanum* is also a long, slim insect, extremely black in colour, and the abdomen is longer than the wings in both sexes, by from 2-3 mm. By the shape and dimensions it somewhat resembles *angustiventris*, *trinacria* and *sabina*. It is very distinct from all of them, by the genitalia of the male. *O. angustiventris* can be at once dismissed, by its unique venation, and both this species and *trinacria* have a really much stouter and more cylindrical abdomen, scarcely constricted at the 3rd segment. This cannot be said for *sabina*, and still less for *a. sagitta*, where the shape of the abdomen, closely follows that of *a. africanum*. In all three the 1-3 abdominal segments are excessively compressed into a ball-shape, deeply prolonged ventrally. Then at the third posterior suture, the segment is sharply constricted and not again enlarged to more than 1.5 mm. in width. In *sabina*, the 8-10 segs. of the abdomen are considerably enlarged ventrally, a particularly useful diagnostic character in the females, because in the other species of *Orthetrum* the flap-like extensions are on the 8th tergites only. The males of *sabina* in Africa are easily distinguished by the very distinctive genitalia. The distribution of *sabina* in Africa is as yet entirely north-eastern and that of *a. africanum* entirely western. It is known from the Congo, Portuguese Guinea, Ivory Coast, Togoland, Cameroons and the Guinea Gulf islands.

The distinctions from the Sierra Leone sub-species *a. sagitta*, are very slight. They rest on the length of the male *IH* of the hamule, the length of the 4th abdominal segment, the overall size and less heavy black markings in *a. sagitta*. *O. a. africanum* is yellow to yellow-green in colour, with very heavy black stripes and markings as follows: all centre labium, the labrum, centre post-clypeus, broad basal frons-line (frons front dark grey-blue), centre thoracic dorsal, ante-humeral and humeral joined, two at 1st lateral suture, one at 2nd lateral suture, all posterior half of metepimeron and much black ventrally; all black abdomen

with the following yellow spots, patches or bands: two transverse dorsal bands and two lateral patches on 1-2 segs., one dorsal mark on 3rd seg., 4th seg. only yellow beneath, 5-7 segs. subdorsal patches and beneath, 8-10 segs. and superior appendages all black, inferior appendage yellow. Legs black with yellow trochanters and fore-femora. Between the wings the dorsal terga are conspicuously yellow. Fully adult males are very pruinose all over, and the species, in Principe Island (Guinea Gulf), has smoky tips to the male wings, and these are slightly fuscous all over. On the mainland the wings appear to be quite clear, with only a trace of deep amber colour at the bases. Membrane dark grey to black. All veins black, the *Pt.* red-brown, and only one row of *Rsp/* loop-cells.

The female is extremely like the immature male, with the abdomen scarcely any broader. There is a large black «flap» on the 8th tergite, with a horizontal yellow streak through it, also the posterior half of the 10th seg. and the cerci are yellow. Otherwise the markings are as in the male, with the yellow transverse abdominal bands on 1-3 segs. rather more conspicuous. There is slightly more amber colour at the wing bases. Measurements: ♂ Abd. 35-37, length of 4th seg. 7-7.5 mm. Hw. 33-34 mm. Pt. 3.5 + 0.6-0.7 mm. ♀ Abd. 40, length of 4th seg. 7.8 mm. Hw. 37 mm. Pt. 3.7-3.8 + 0.8 mm. The abdomen is longer than the wings by 2-3 mm.

### *O. africanum sagitta* Ris

*O. sagitta* Ris, 1919. *Cat. Coll. Libell.* **16** : 1086.

Ris' outline drawing of the genitalia of the type male in the British Museum (Natural History), is rather misleading, as he has drawn both the *AL* and the *IH* too long in proportion to the *OH* and the lobe. Neither has he conveyed that the small end hook on the *IH* turns sideways and downwards. The types were a male and female taken in Port Loko, Sierra Leone, 3rd and 2nd of May 1912, by J. J. Simpson. To these Ris has added a female from Lemba in the Congo, which he says himself he had placed «provisionally and undecidedly» with them. I consider that this female is more likely to belong to *a. africanum*, the sub-species which is known from the same locality. No-one had identified *sagitta* again, until R. M. Gambles captured a fully adult male at Lagos, S. Nigeria, with the identically shaped *IH* to the hamule. This insect, taken on 27.3.1952, was pruinose and exactly resembled *a. africanum* in appearance. In March 1954, Gambles again took two males and a female of *africanum* species on the same little island of Ikoyi at Lagos, and the two males are of the same dimensions as the nominate form, which throws grave doubt on the validity of *sagitta*. However, in these males the length of the 4th abdominal segment was 6.5 mm., nearer *a. africanum* by  $1\frac{1}{2}$  mm. Because of the taxonomic differences, slight as they are, and the distance between the known localities, I prefer to keep *sagitta*, at present, as a sub-species of *africanum*, confined to Sierra Leone. If a series from Sierra Leone should show variability in the shape and length of the *IH* of the hamule and the length of the 4th seg. of the abdomen, then *sagitta* cannot even remain as a local sub-species, and must become a synonym of *africanum* (Selys).

The allotype female is the only one definitely known, and she has the following differences from *a. africanum*: very much smaller overall dimensions and the 4th abdominal seg. only 5 mm. long; black cerci and an all black 10th seg.; otherwise she has very much the same yellow & black markings on the head and thorax, and is just as dark on the abdomen above, with yellow spots on 4-6 segs. and mostly all yellow beneath.

When the adults are pruinose, then *a. sagitta* could be mistaken for two other species, common in Sierra Leone, *chryso stigma* and *monardi*, having somewhat similar male genitalia, but *a. sagitta* has a much slimmer build and is longer in the abdomen by 1 mm. than the wings, instead of shorter, as in the other species. Measurements: ♂ & ♀ Abd. 31, length of 4th seg. 5 mm. Hw. 30 mm. Pt. ♂ 3 + 0.6, ♀ 3.5 + 0.8 mm.

## *O. abbotii* Calvert

*O. abbotii* Calvert, 1892, *Trans. Amer. ent. Soc.*, **19** : 162.

*O. Phillipsi* Kirby, 1896, *Proc. Zool. Soc. Lond.*, p. 522.

*O. flavidulum* Kirby, 1898, *Ann. Mag. Nat. Hist.*, **2** (7) : 238.

*O. mundulum* Morton, 1928, *Ent. Mon. Mag.*, **64** (4) : 119-123.

*O. abbotii* is exceedingly common and widespread in Africa, from the Sudan to Cape Province, Abyssinia to Sierra Leone. It is the smallest *Orithestrum* known, with the exception of *taeniolum*. It has a unique form of *IH* to the male hamule, long and drooping, and as long, or longer, than the *OH*. In appearance, *abbotii* closely resembles both *hintzi* and *machadoi*, both when adult pruinosed and when immature. It is then a bright yellow-green little insect, slim and frail looking, with dark-brown to black markings, either increasing with age, or more evident in some populations than in others.

The face is usually all yellow, but there is a brownish centre to the labium in some, and there is always a straight, rather broad, basal frons-line extending laterally more than halfway to the clypeus and ending very squarely. In the Madagascar specimens and in a few from Angola, there is a black edge to the frons-crest, when adult. The type male of *phillipsi*, from British Somaliland, shows a narrow black outline to the frons-shield and some of the South African specimens have the same. The thorax in sub-adult males is very unmarked, having only a slight indication of brown along the dorsal carina and one short brown or black antehumeral stripe. The 1st lateral suture usually shows one dark brown to black stripe (sometimes divided) and there is a short one (sometimes two) on the 2nd lateral suture in most specimens, but no lateral stripes whatever in the juveniles. Pruinosity of a light blue colour begins early and spreads first along the sutures, leaving broad patches and bands of yellow-green between. The insect then blackens beneath the pruinosity (as most other species do) and then becomes completely reversed in pattern, being, when mature, a dark blue black *Orithestrum*, banded with yellow-green. The legs are yellow, with black tarsi, part or all of the tibiae and a streak beneath the femora in adults; this black appears early. The abdomen, when not pruinosed, is broadly striped with black just above the lateral carina, from the constriction at the 3rd posterior segment to the 8th inclusive. All 9-10 black, except beneath. All carinae narrowly black.

The female is yellow to yellow-brown in colour and usually with no trace of dark lateral thoracic stripes. She is very short and stumpy in appearance. The dorsum of the 8th abdominal segment is very black, with only two reddish-yellow patches or spots. In this she resembles larger female of *machadoi*, but the latter has much more black in the pattern, except when general. The male of *hintzi* so closely resembles that of *abbotii* in both size and pattern, that it is indeed hard to find good characters of separation. The *Cu<sub>2</sub>* vein is always widely separated from the lower corner of the discoidal cell (*T*) in *abbotii* (at the corner or only slightly separated in *hintzi*); the margin of the vulvar scale is a thin-edged simple cone in shape in *abbotii* (thicker, giving a double-edged appearance, in *hintzi*); the 8th abdominal segment in *hintzi* has the entire centre dorsum reddish-yellow, whereas in *abbotii* it is distinctly divided into two patches or spots; the basal frons line is broader and ends squarer laterally in *abbotii*, whereas it tapers away in *hintzi*; it is therefore definitely more conspicuous in *abbotii*. I am only too well aware how slight these differences are and how dependent on age and population. I have taken the descriptions from series of both species, and pairs in copulation.

The wings are hyaline, with small traces of amber-yellow in the male hindwings, but rather more in the females and usually a trace in the forewings as well. The costal and sub-costal veins are a very bright golden-yellow and the bright yellow *Pt*. is exceedingly large for the small size of the species, and is enclosed between thick black veins. There is only one row of *R<sub>5+1</sub>* loop-cells.

*O. abbotii* has the typical flat ribbon-shaped alae to the penis glans, as have those of the rest of group 4. In *abbotii* the length of these alae is nearer that of *machadoi* (slightly shorter and

wider), than that of *hintzi* (much longer). *O. abbotii* is placed apart, more than any of the other species in the group, by the shape of the *IH* of the hamule. It is probably, however, the most abundant and widespread of all the species.

Measurements: ♂ Abd. 24-25 mm, Hw. 25-27 mm. ♀ Abd. 22-24 mm. Hw. 25-26 mm. *Pt*. in both sexes 3.5-4 + 1 mm. The abdomen is shorter than the wings by 1-2 mm. in the males and by 2-3 mm. in the females.

## 5. THE TAENIOLATUM GROUP

An Asian group, with only two species to be found in Africa, one very small and one large. They are linked by a somewhat similar shape to the alae of the penis glans.

### *O. taeniolum* (Schneider)

*Lib. taeniolata* Schneider, 1845, *Stett. ent. Ztg.*, **6** : 111.

*Orithestrum brevisitylum* Kirby, 1898, *Proc. Zool. Soc. Lond.*, p. 521.

This is an Asian species, well separated by the shape of the alae of the penis glans, from most other African *Orithestrum*, but nearest to *ransometi* and then to group 3. The alae are almost symmetrically bifid, and with a long and large upper process.

The insect closely resembles a very small *caffrum*, having an almost identical pattern on the thorax of cream-white and black stripes. It is, however, always completely un-constricted at the 3rd segment of the abdomen and exceedingly small in size. The abdomen, when the pattern can be seen, has a black central dorsal stripe, not found in *caffrum* (where the stripe is sub-dorsal). This dorsal stripe is also found, usually quite well-defined, on the females, while there is also a lateral black stripe just above the lateral carina, which may either be only faintly indicated or else quite definite. Except for a narrow black basal frons-line, and some black on tarsi and tibiae, the female is almost entirely a light sandy yellow, and young males are similar.

The male early acquires a bright light blue pruinosity. The genitalia are very like that of *monardi*, but with the inner hamule hook turned upwards as in *monardi*. The very definite dorsal cream stripes should easily distinguish *taeniolum* from even the smallest *chrysostigma*.

*O. taeniolum* is found in the Sudan, Ethiopia (Eritrea) and Somaliland and would seem to be established in these regions, but has not as yet extended its range very far. It is quite common in Asia Minor and Syria and very common in India.

Measurements (African specimens only): ♂ Abd. 22-23 mm. Hw. 24-25 mm. ♀ Abd. 22 mm. Hw. 26 mm. *Pt*. in both sexes 2.25 + 0.5-0.6 mm. The abdomen is shorter than the wings by 2 mm. in the male, and 4 mm. in the female.

### *O. ransometi* (Brauer)

*Lib. ransometi* Brauer, 1865, *Zool. Bot. Wien.*, **15** : 1009.

The type was taken in the Red Sea, and the species seems to be fairly common in Egypt, the oases and mountain regions of the central Sahara, and has been recently taken as far south as the Lake Chad area of French Equatorial Africa. Outside Africa, *ransometi* seems to be mostly found in Persia, Mesopotamia and Arabia.

The entire insect is scarcely marked with any pattern, and in the juveniles the thorax is cream-yellow to a livid colour laterally, somewhat green dorsally, and the abdomen is of a yellow-ochre colour. The females remain so, but the males become completely pruinose very

6. BRUNNEUM GROUP

*O. brunneum brunneum* (Fons.)

*Lib. brunnea* Fonscolombe, 1837, *Ann. Soc. ent. France*, 6: 141.

This is a southern European, Mediterranean and Middle East species, which has been taken several times in Algeria. There it would very closely resemble *Nesiothemis farinosum*, both in size and shape. In the brilliant light blue of the adult males, it would also look like a very large *anceps* or *taeniolatum*, and in many characters both sexes would resemble *ransonneti*; very closely. Indeed, it is useless to describe the colour pattern, as it is only necessary to read that under the latter species, with the sole exception of the underside of the abdomen, which is not entirely black as in *ransonneti*. The shape of the two species is different, *b. brunneum* being flat below and keeled above, also totally non-constricted at the 3rd seg., with the abdomen nearly parallel-sided to the 7th seg. and then tapering off sharply to the tip. I cannot place *b. brunneum* in any group of African *Orithetrum*, it stands quite apart from all, owing to the shape of the alae of the penis glans and the AL. The alae are very small, narrow and pointed, with a solid-looking and square upper process. The AL of the secondary genitalia when viewed dorsally, has a distinct «waist» halfway from tip to base.

The large wings are completely without any trace of colour, the Sc. cross-veins are a whitish cream, the costa varies from yellow-white to pale yellow and the small Pt. follows suit. The membrane is long and pure white. The smallness of the Pt. and the complete absence of colour in the wings, differentiates this species from either *N. farinosum* or the Madagascan *O. azureum*, and the almost complete absence of pattern, distinguishes it from *nitidinerve*, *anceps*, *cancellatum* and other Mediterranean «blue» species. The margin of the female vulvar scale is a simple cone-shape, very like that of *ransonneti*, and indeed, the two species, with similar Pt., clear wings and absence of body-pattern, would be easily confused, especially in the female. The male of *b. brunneum* has a broader, non-constricted abdomen, while *ransonneti* is slightly longer and slimmer, also slightly but clearly constricted. The abdomen in *b. brunneum* is pale beneath, in *ransonneti* all black. Both species are widely separated in the shape of the alae of the penis glans, and the male genitalia are quite distinct. The number of the *R*<sub>3</sub>pt loop-cells is also a good character in both sexes, being single in *ransonneti*, double in *b. brunneum*. There is also the difference in the *R*<sub>1</sub> vein, very flat in *ransonneti* and strongly curved in *b. brunneum*. Measurements (taken from Mediterranean specimens): ♂ & ♀ Abd. 26-28 mm., ♂ width 3 mm. Hw. 30-32 mm. Pt. ♂ 2.5-2.8 + 0.5-0.7 mm. Pt. ♀ 3-3.2 + 0.8 mm. The abdomen is shorter than the wings by 4 mm.

7. CANCELLATUM GROUP

This group of one species recorded for Africa, must remain apart from all others, by the shape of the anterior lamina (AL) of the secondary genitalia, and of the alae of the penis glans.

*O. cancellatum cancellatum* (L.)

*Lib. cancellata* Linné, 1758, *Syst. Nat. ed. x.*, 1: 544, No. 7

This European species has been recorded several times from Morocco and Algeria. It must remain apart from every other group, by the deeply cleft (bifid) AL. I know that it breeds in the Atlas Mountains of Morocco and it is also no doubt a resident in Algeria, although I have only seen mature specimens from there. However, it has been recorded several times and in several localities, once as many as seven were taken together. Although doubt has been thrown on its occurrence in Africa, there is concrete evidence that it is to be found in the North-West.

early, with a bright pale blue pruinosity. The only markings are in black as follows: a well-defined basal from-line extending laterally towards the clypeus, all the carinae finely black, the tibiae and tarsi becoming black very early, minute twin dots dorsally at the posterior end of each of 3-7 segments of the abdomen, the entire undersurface of the abdomen black. This colouring and pattern is exactly repeated in *b. brunneum*, with the sole exception of the black beneath the abdomen. In the male of *ransonneti*, the abdomen is noticeably longer and much slimmer than in *b. brunneum*, but the females are almost identical in length and the slimmness is not so noticeable. *O. ransonneti*, for some reason, has been much more successful in establishing itself in northern Africa, than has *b. brunneum*. There is no possibility of mistaking it for *taeniolatum*, tiny and striped with white, which I place in the same group because of similarity of penis and

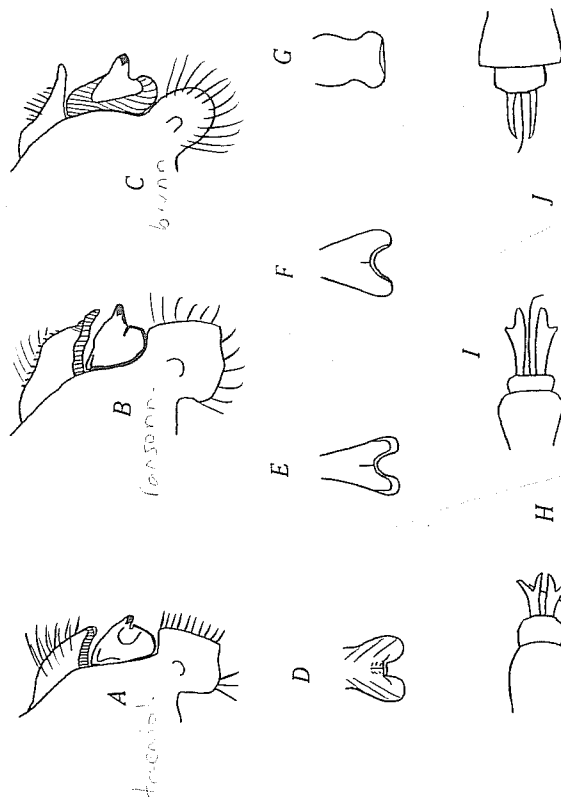


Fig. 8 — *taeniolatum* Group 5 and *brunneum* Group 6. A to C: male secondary genitalia. D to F: margin of female vulvar scale. G: anterior lamina viewed from above. H to J: terminal processes of penis glans. A, D & H: *taeniolatum*. B, E & I: *ransonneti*. C, F, G & J: *brunneum brunneum*.

genitalia. The alae of the penis glans are fairly long and narrow, widening near the tip and with a heel-like projection laterally. They are longer than those of *taeniolatum*, less symmetrically bifid and with a very much shorter upper process. It seems closest to the *caffrum* group.

I think *ransonneti* is unique in the genus *Orithetrum*, in respect to the *R*<sub>3</sub> wing vein (*M*<sub>2</sub> of Ris.) One of the chief characteristics of the venation in the *Orithetrum* is the strongly double-curved *R*<sub>3</sub>, from halfway from the nodus to the wing border. In *ransonneti* there are scarcely any curves whatever and this modification of this important vein should place *ransonneti* as a border-line species.

Measurements (Africa only): ♂ Abd. 30-32, width 2 mm. Hw. 32-34 mm. Pt. 2-2.5 + 0.5-0.6 mm. ♀ Abd. 27-28 mm. Hw. 31-32 mm. Pt. 2.5-3 + 0.6 mm. The abdomen is shorter than the wings by 2 mm. in the male and by 4 mm. in the female.

When the males are adult and pruinose blue, they would resemble those of *b. brunneum*, which is only a little smaller in size and which has the same clear wings with a short squarish *Pt.* The membrane is pure white in *b. brunneum* and grey in *c. cancellatum*. The males of *c. cancellatum* should always appear darker on the thorax, and when the abdominal pattern can be seen, then there is no resemblance, owing to the wide, festooned black sub-dorsal stripes in both sexes of *c. cancellatum*. The species would then much more closely resemble the even smaller and slimmer *Nesiothemis farinosum*, which has an almost identical sub-dorsal stripe, but a straighter one. In *N. farinosum* the *Pt.* is rather long and narrow and the membrane pure white. All three species have double *Rsp1* loop-cells. All fully blue males have the last 4-5 abdominal segments black, and most of the legs black. The head in *c. cancellatum* is never dark, but in very

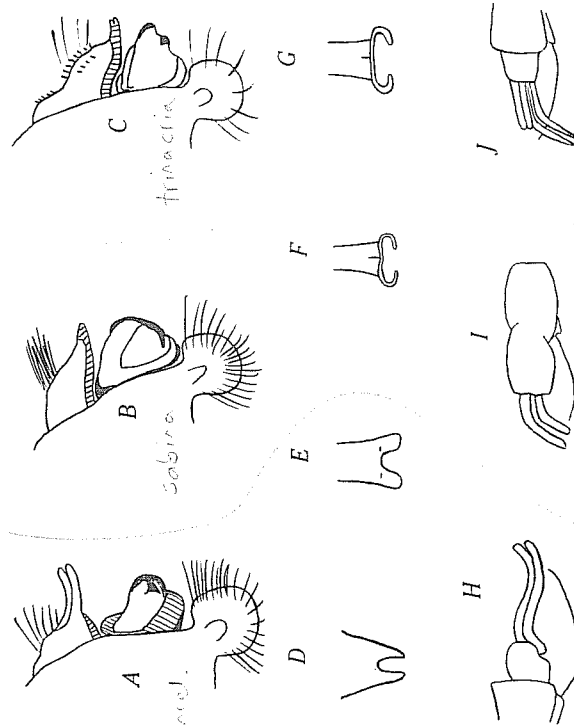


Fig. 9 — *cancellatum* Group. A to C, male secondary genitalia. D, anterior lamina viewed from above. E to G, margin of female vulvar scale. H to J, terminal processes of penis glans. A, D, E & H: *cancellatum cancellatum*. B, F & I: *sabina*. C, G & J: *trinactia*.

old males the top of the frons and the centre labium, become either brownish or leaden coloured. Younger individuals and females have very yellow-ochre faces. The thorax is either yellow-brown or olive-green, with very few black markings, as follows: a short narrow ante-humeral, a wide complete humeral, a narrow complete 2nd lateral suture. The legs are yellow-brown, becoming progressively blacker with age and ending up as very black. The wings are entirely hyaline, no trace of colour at the bases, but in the very mature, the entire wing may look slightly rusty all over. The costal vein stands out as orange-yellow for the entire length, and the *Sc.* cross-veins are pale cream. The short and rather square *Pt.* is dark red-brown to black. The abdomen, when not pruinosed, is a yellow-brown dorsally and chrome-yellow laterally, these areas being separated by a broad black sub-dorsal stripe festooned along the sides from the 2-10 segments, in the females widening on the 8-9 segs. Across the posterior end of each of these

segments, the black is considerably wider than the carinae and the same banding effect is carried round beneath the abdomen. The upper anal appendages are black.

The genitalia of the male resemble those of *sabina* by the «lumpy» shape of the hamule and by the round lobe, but the *AL* is unique with its upturned bifid end. The penis glans is also unlike any other African species and in a place by itself. The alae are long, cylindrical and with a very strong upward curve near their origin and then bent downwards again towards the flagellum. The upper process is extremely solid in appearance. The margin of the female vulvar scale has a deep cleft in the cone-shape, like that of *b. brunneum*, but the abdominal stripes in *c. cancellatum* would distinguish the females at once. Measurements: ♂ Abd. 30-35, width 3.5-4 mm. Hw. 35-40 mm. Pt. 2.6-2.8 + 0.6-0.8 mm. ♀ Abd. 29-32 mm. Hw. 35-40 mm. Pt. 2.8 + 0.8 mm. The abdomen is shorter than the wings by 5 mm. in the males and by 6-8 mm. in the females.

## 8. THE SABINA GROUP

I place in this group two wide-spread species, one with a very restricted distribution, as yet, in Africa, the other almost Pan-African. They are linked by similar genitalia and alae to the penis glans, both of which I consider to be simple and primitive.

### *O. sabina* (Drury)

*Lib. sabina* Drury, 1770, *Ill. Exot. Ins.*, 1: 114-115.

An *Orthetrum* with a very wide Asian and Australasian distribution and a considerable variation in size and colour throughout its range. The primitive type of genitalia and penis, does not however alter, and the males can easily be identified in consequence, except from *trinactia* in the same group. The long shape of the abdomen, longer than the wings, and the extra deep inflation of the 1-3 segments dorsoventrally, is a good distinction from most other *Orthetrum*, while the marked enlargement dorsoventrally of the 6-9 segments, in both sexes, seems unique. The whole of these tergites are enlarged to 2.5 mm. at the widest part and not merely a foliation on the 8th seg. as in most *Orthetrum* females. At first sight *sabina* could be mistaken for a small *trinactia*, but the thorax has an identical pattern of cream-white stripes, edged black, as in *caffrum*. The abdomen has no heavy black stripes, as in *trinactia*, but a similar pattern to *brachiale* of black dividing the yellow into patches. There is a minute fleck of amber-yellow in the hindwings, alongside a narrow black membrane. The anal appendages are conspicuously light yellow and no male ever becomes pruinose, except very occasionally with the thinnest of white powdery dusting. Should the thoracic stripes fail to show up, as they would seem to do on some dried specimens, then the abdominal pattern and its shape should be sufficient to distinguish them.

The genitalia of the male need no explanation, except to stress that the thick tuft of stout hairs on the *AL* is a bright red and unique amongst African *Orthetrum*. The alae on the penis glans are narrow, slightly spatulate and turned sharply downwards towards the upcurved flagellum. There is no upper process and the alae would appear to originate dorsally, which is exactly opposite to those in the other groups. The female has a very simple curved margin to the vulvar scale. A female with missing end to the abdomen and a discoloured thorax, can closely resemble a female *brachiale*, as the wing venation is very similar. However, in *sabina* the vein *Cu<sub>2</sub>* leaves the hindwing triangle definitely wide of the corner, while in *brachiale* it is at the corner. Also *sabina* usually has 1-2 less antenodals in the forewings (though not always). Measurements: (Africa only): ♂ Abd. 30-35 mm. Hw. 28-32 mm. Pt. 3-3.5 + 0.5-0.6 mm. ♀ Abd. 32 mm. Hw. 30 mm. Pt. 3.5 + 0.6 mm. Abdomen longer than the wings by 2-3 mm.

*O. sabina* is established in Egypt, Ethiopia (Eritrea), Somaliland and Sokotra island.

*O. trinacria* (Selys)

*Lib. trinacria* Selys, 1841, *Rev. Zool.*, p. 244.

*O. trinacria* is quite deeply inflated dorso-ventrally on the 1-3 segments, but less abruptly than in *sabina*, being more gradually tapered off beneath the 3rd seg. and from there to the tip, is almost cylindrical in both sexes. It has a thick black dorsal abdominal stripe from the 3rd to the 9th segments, and an interrupted one laterally just above the lateral carina (in old specimens the stripe becomes continuous). The black crosses each segment at the sutures, thus enclosing long twin yellow patches. The 8th seg., is usually entirely black dorsally and the abdomen is black beneath. The head and thorax are very lightly marked. The yellow-green head has only a narrow basal frons line, which extends well down towards the clypeus, and the black thoracic stripes, narrow and often very faint, are as follows: a centre dorsum, ante-humeral, humeral, 1st and 2nd lateral suture. The thorax is greenish yellow to yellow-green, but the entire body becomes a dark pruinose blue in adult males, with some diffuse greyish black on the frons-crest. The wings are quite clear, with no trace of saffron at the bases. Many of the veins, besides the costa and Sc. cross-veins, are yellow, but not conspicuously so, and the long narrow *Pt.* is a very pale cream, and noticeable larger than in *sabina*. This absence of colour on the wings easily distinguishes *trinacria* from *nitidinerve*, where they meet in N. Africa, and from *angustiventre*, when found in the same West African countries. For both these species the pruinose males might be mistaken, but *nitidinerve* has a shorter wider abdomen, and *angustiventre* a much denser venation with 3-4 rows of *RspI* loop-cells (*trinacria* has 2 rows only). Immature males and the females might be mistaken for *sabina* or even *brachiale*, because of the pale thoracic colouring and large cream-coloured *Pt.* The long upper anal appendages become dark in both sexes very early, these appendages being apt to remain conspicuously yellow in the juveniles of both the other two species. The female might be taken for *icteromelas* because of the similar abdominal pattern, but the heavy thoracic striping on the latter and the very small size in comparison, should avoid confusion. The abdomen in the female of *trinacria* is the same length as the long wings.

The male genitalia are closest to those of *sabina*. The *AL* is longer and with a very distinct cleft in the tip, also there is no tuft of red hairs, but some very stout black spines. The hamule is a little less 'slumpy' than in *sabina*, but the rounded lobe 'waisted' at the base, is very similar in both species. The alae of the penis glans are also very similar and would appear to originate from the same dorsal position and curve downwards as in *sabina*. There is however, in *trinacria*, an excessively prominent upper process, so long that it almost forms a 2nd pair of alae, quite half as long as the true pair. The latter are somewhat like those of *b. brunneum*, as they are narrow and tapering and also much longer than the alae in *sabina*. The margin of the vulvar scale in the female, is a wide simple curve.

*O. trinacria* is found in all the northern, eastern and southern countries of Africa, and in most of the western. It has also been taken in the bigger islands off both coasts, and outside Africa is known from Mesopotamia and Sicily (where the types came from). It is quite possibly a migrant, as it has not been taken in Sicily again, and it would seem to vary little in the whole of its range, except a bit in size. Measurements: ♂ Abd. 39-42, width 2 mm. Hw. 34-37 mm. *Pt.* 4.45 + 0.9-1 mm. ♀ Abd. 37-40 mm. Hw. 37-40 mm. *Pt.* 4 + 0.8-0.9 mm. The abdomen is longer than the wings by 3-5 mm. in the males, but of equal size in the females.

KEY TO THE AFRICAN SPECIES OF THE GENUS *ORTHETRUM* NEWMAN

- 1. Cream-white or yellow thoracic stripes . . . . . 2
- No such thoracic stripes . . . . . 13
- 2. 1-2 rows of *RspI* loop-cells . . . . . 3
- 3-4 rows of *RspI* loop-cells, 2 dorsal cream-yellow stripes . . . . . *angustiventre*
- 3. 1 row of *RspI* loop-cells (occasionally a double cell) . . . . . 4
- 2 rows of *RspI* loop-cells (at least in entire centre of loop) . . . . . 7
- 4. Either dorsal or lateral thoracic stripes, but not both . . . . . 5
- 2 dorsal and 2 lateral thoracic stripes; abdomen with central black stripe . . . . . *taeniolatum*
- 5. 2 dorsal thoracic stripes only, no black abdominal stripe . . . . . *coerulescens*
- 1-2 lateral thoracic stripes only . . . . . 6
- 6. *Pt.* 2.6-3 + 0.5-0.6 mm., only 1 lateral thoracic stripe . . . . . *chryso stigma*
- *Pt.* 3.5-4 + 0.7-0.8 mm., sometimes a 2nd lateral stripe posteriorly . . . . . *capense capense*
- 7. Either dorsal or lateral thoracic stripes, but not both . . . . . 8
- 2 dorsal and 2 lateral thoracic stripes; abdomen constricted . . . . . 11
- 8. 2 dorsal thoracic stripes only; abdomen not constricted . . . . . 9
- 2 lateral thoracic stripes only, or dorsal pair merely indicated . . . . . 10
- 9. Abdomen broad, tapering, no black stripes; saffron at wing bases . . . . . *azureum*
- Abdomen long, cylindrical, with heavy black stripes dorsally and laterally; no saffron at wing bases . . . . . *trinacria*
- 10. Abdomen long, narrow, not constricted, no black lateral stripe, *Pt.* very large, 4.3-5 + 0.9-1 mm. . . . . *nitidinerve*
- Abdomen normal, constricted, with heavy black lateral stripes; *Pt.* small, 3-3.5 + 0.6-0.8 mm. . . . . *rubens*
- 11. Abdomen enlarged at posterior end, very constricted at 3; Radius black . . . . . *sabina*
- Abdomen spindle-shaped, moderately constricted at 3; Radius orange . . . . . 12
- 12. Saffron along costal border and a patch at nodus (immature specimens) . . . . . *kristsenseni*
- Not as above . . . . . *caffrum*
- 13. Insects pruinosed either wholly or in part . . . . . 14
- Insects not pruinosed . . . . . 52
- 14. Mature males with dense, light or dark blue pruinescence . . . . . 15
- Only the abdomen pruinose . . . . . 35
- 15. Males densely light cobalt-blue . . . . . 16
- Males entirely dark indigo-blue . . . . . 32
- 16. 2 rows of *RspI* loop-cells; Sc cross-veins dark or yellow . . . . . 17
- 1 row of *RspI* loop-cells; Sc cross-veins yellow . . . . . 23
- 17. Sc cross-veins black or dark; abdomen not constricted . . . . . 18
- Sc cross-veins yellow . . . . . 19
- 18. Very large (abd. 38-40 mm., width 4 mm.); Sc cross-veins dark red to black . . . . . *ausleri*
- Smaller (abd. 26-30 mm., width 2-2.5 mm.); Sc cross-veins reddish brown. . . . . *azureum*
- 19. Abdomen constricted . . . . . 20
- Abdomen not constricted . . . . . 22



- 20. *Pt* 3 mm. or longer, by 0.8 mm. wide . . . . . *brachiale*
- Pt* less than 3 mm. long, by not more than 0.7 mm. wide . . . . . *kristianseni* (1)
- 21. *Pt* 2.5-2.6+0.5 mm. . . . . *caffrum* (1)
- Pt* 2.7-2.8+0.6-0.7 mm. . . . . *Pt* small
- 22. Wings colourless, costa and *Sc* cross-veins white or yellow, radius black *Pt* small *brunneum*
- (2.5-2.8 mm.) . . . . . *Pt* large (4.3-4.5 mm.)
- Wings tinted, costa, *Sc* cross-veins and radius orange, *Pt* large (4.3-4.5 mm.) . . . . . *nitidiverve*
- 23. Abdomen not or only slightly constricted . . . . .
- Abdomen constricted . . . . .
- 24. Abdomen not constricted, very short (22-23 mm.) . . . . . *taeniolatum*
- Abdomen very slightly constricted at seg. 4, longer than above (25-32 mm.) . . . . .
- 25. *R*<sub>1</sub> wing vein very flat . . . . . *ransorneli*
- R*<sub>3</sub> wing vein double-curved as in other *Orithrum* . . . . .
- 26. *Pt* 2.5-2.8+0.5 mm., shape rather square . . . . . *anceps* (2)
- Pt* 3.5-4+0.7-0.8 mm. . . . . *coerulescens* (2)
- 27. Abdomen mostly 24-28 mm. (but also up to 32 mm.); *Pt* yellow, large and wide in proportion to size of insect . . . . .
- Abdomen mostly 29-32 mm. (occasionally less); *Pt* yellow, small and narrow in proportion to size of insect . . . . .
- 28. Abdomen 24-25 mm.; *Pt* 3.5-4+1 mm. . . . . *abbolti*
- Abdomen 26-32 mm.; *Pt* 3-3.8+0.6-0.8 mm. . . . .
- 29. Abdomen 26-27 mm.; *Pt* 3-3.5+0.6 mm. . . . . *hintzi*
- Abdomen 28-32 mm.; *Pt* 3-3.8+0.7-0.8 mm. . . . .
- 30. Abdomen 28-30 mm.; *Pt* 3-3.5+0.7-0.8 mm. . . . . *machadoi*
- Abdomen 30-32 mm.; *Pt* 3.5+0.7 mm. . . . . *capense capense*
- 31. Abdomen from 24.5-30 mm. (mostly 27-28 mm.); *Pt* tiny (1.9-2.6+0.5 mm.) . . . . . *monardi*
- Abdomen from 26-31 mm. (mostly 29-31 mm.); *Pt* 2.7-3+0.5-0.6 mm. . . . . *guineense*
- (*chryso stigma* . . . . .)
- 32. Abdomen long (38-42 mm.), cylindrical, not constricted . . . . .
- Abdomen short (28-30 mm.), constricted, slightly spindle-shaped . . . . .
- 33. 2 rows *Rspl* loop-cells, *Pt* long and narrow . . . . . *trinactia*
- 3-4 rows *Rspl* loop-cells, *Pt* large and broad . . . . . *angustiventre*
- 34. 1 row *Rspl* loop-cells, *Pt* 3-3.5+0.7-0.8 mm. . . . . *machadoi*
- 2 rows *Rspl* loop-cells, *Pt* 4+1 mm. . . . . *macro stigma*
- 35. Abdomen pruinosed cobalt-blue; thorax not pruinosed or only very slightly so . . . . .
- Abdomen pruinosed white (on black ground); thorax dark (black and green) . . . . .
- 36. 1 row of *Rspl* loop-cells; abdomen constricted . . . . .
- 2 rows *Rspl* loop-cells; abdomen constricted or not . . . . .
- 37. *Sc* cross-veins yellow, *Pt* yellow; thorax almost unmarked laterally . . . . .
- Sc* cross-veins black, *Pt* small, dark; thorax heavily striped laterally . . . . .
- 38. Adult thorax very lightly striped dorsally and laterally with dark brown, no wide «shoulder» band; *Pt* small (1.9-2.9+0.5 mm.) . . . . . *monardi*
- Adult thorax not striped laterally, wide «shoulder» band; *Pt* rather large (3-3.5 mm +0.7-0.8 mm.) . . . . . *machadoi*

- 39. The first three abdominal segs. together rather globular, succeeding segs. exceedingly slim, abdomen longer than the wings by 2-3 mm. . . . .
- Abdomen segments 1-3 only moderately enlarged, the succeeding segs. spindle-shaped, shorter than the wings by 2-3 mm. . . . .
- 40. Abdomen 35-37 mm. long, 4th seg. 6.5-7.5 mm. long . . . . . *africanum africanum*
- Abdomen 31 mm. long, 4th seg. 5 mm. long . . . . . *a. sagitta*
- 41. Small light amber fleck at hind-wing base . . . . . *capense falsum*
- Small deep amber fleck at hind-wing base . . . . . *julia*
- 42. Abdomen not constricted; thorax dark greenish brown . . . . .
- Abdomen constricted; thorax green, brown or olivaceous . . . . .
- 43. Abdomen (both sexes) 37-40 mm., *Hw* 45-50 mm., *Pt* 6+1 mm. . . . . *austeni*
- Abdomen (both sexes) 29-35 mm., *Hw* 35-40 mm., *Pt* 2.8+0.7 mm. . . . . *cancellatum*
- 44. *Sc* cross-veins black; thorax brown or olivaceous . . . . .
- Sc* cross-veins yellow; thorax green . . . . .
- 45. Head pale; thorax almost unmarked laterally . . . . . *stemmale lemur*
- (*mitloiti* . . . . .)
- 46. Head marked with black; heavy black stripes on thorax . . . . .
- Black surround to frons-crest; Abd. 26-28 mm.; *Pt* 2.5-3 mm. . . . . *stemmale wrighti* (1)
- No black surround to frons-crest; Abd. 29-33 mm.; *Pt* 3.5-4 mm. . . . .
- 47. Thorax light greenish yellow, stripes narrow, dark brown; frons pale . . . . . *stemmale ketai*
- Thorax bright green, stripes broad, black; frons crest dark . . . . . *icteromelas*
- 48. Abdomen 28 mm., *Hw* 31 mm., *Pt* 4+1 mm, yellow; wing base with small amber fleck . . . . . *macro stigma*
- Abdomen 30-33 mm., *Hw* 32-35 mm., *Pt* 3.5+0.8 mm., yellow; wing base with small yellow fleck . . . . . *brachiale*
- 49. 1 row *Rspl* loop-cells; *Sc* cross-veins yellow or black . . . . . *stemmale ketai*
- 2 rows *Rspl* loop-cells; *Sc* cross-veins black . . . . .
- 50. *Sc* cross-veins black; thorax heavily striped . . . . . *macro stigma imitans*
- Sc* cross-veins yellow; thorax lightly striped . . . . . *m. micro stigma*
- 51. Abdomen at widest part 2.5-3 mm. . . . . *julia*
- Abdomen at widest part 2 mm. . . . .
- 52. All ages without pruinosity; 2 rows *Rspl* loop-cells . . . . .
- Females and immature males without pruinosity; 1-4 rows *Rspl* loop-cells . . . . .
- 53. *Sc* cross-veins yellow; enlarged 6-9 abd. segs. . . . . *sabina*
- Sc* cross-veins black; tapering 6-9 abd. segs. . . . . *tugabre*
- 54. *Sc* cross-veins black; thorax stripes black, variable in width . . . . .
- Sc* cross-veins yellow; thorax striped or unstriped . . . . .
- 55. 1 row *Rspl* loop-cells; abdomen spindle-shaped or very slim . . . . .
- 2 rows *Rspl* loop-cells; abdomen spindle-shaped or not constricted . . . . .
- 56. Abdomen longer than the wings by 1-3 mm., exceedingly slim and cylindrical, both sexes very similar . . . . .
- Abdomen shorter than the wings by 2-6 mm., spindle-shaped, females much shorter and stouter than males . . . . .

(1) Mature males of *s. stemmale* will probably key out here, but with dimensions as for *s. ketai* and from Mauritius only.

(1) The ranges of these two species only overlap in Ethiopia.  
 (2) The ranges of these two species could only overlap on the North African coast.

57. Both sexes large, ♂ abd. 35-37 mm., 4th seg. 6.5-7.5 mm., Hw 33.34 mm., ♀ abd. 40 mm., 4th seg. 7.5-7.8 mm., Hw 37 mm. . . . . *africanum africanum*  
Both sexes smaller, abd. 31 mm., 4th seg. 5 mm., Hw 30 mm. . . . . a. *sagitta*
58. Abdomen at widest 2 mm.; Pt 3-3.5 mm. . . . . (capense falsum) (*julia*)  
Abdomen at widest 2.5-3 mm.; Pt 2.2-2.5 mm. . . . . *microstigma microstigma*  
Black on dorsum of thorax only, no lateral stripes; no black on abdomen, which is wide and not constricted. Immensely large . . . . . *austeni*  
Black on dorsum of thorax, or also laterally; much black on abdomen, which is constricted and spindle-shaped . . . . . *milloti*
59. Dorsal thoracic stripes 2-3; entire black sub-dorsal abdominal stripe . . . . . *milloti*  
Dorsal thoracic stripes 6-8 aside (4 in s. *stemmale* ♀); yellow across centre abd. segs interrupting lateral stripe . . . . . *stemmale stemmale*
60. Black surround to frons shelf . . . . . (Mauritius) *stemmale stemmale*  
No black surround to frons shelf . . . . . (Seychelles) s. *wrighti*  
No black surround to frons shelf . . . . . (Mainland) s. *kalai*  
No black surround to frons shelf . . . . . (Madagascar) s. *lemur*
61. 1 row *Rsp/l* loop-cells (1-2 occasionally doubled) . . . . .  
2 rows *Rsp/l* loop-cells . . . . .
62. Thorax and abdomen with black stripes . . . . . *ransonneti*  
Thorax and abdomen without black stripes . . . . . mostly black dorsally  
Abdomen with heavy black lateral stripe and last segs. mostly black dorsally . . . . .  
Black lateral stripe complete but not wide, less black dorsally on last segs. . . . .  
Heavy black «shoulder» stripes (ante-humeral and humeral), thorax laterally with or without 2 short black stripes . . . . .  
No concentration of black stripes on «shoulder», merely a short ante-humeral; lateral sutures narrowly black, abd. 22-25 mm. . . . . *abbotti*
63. A small reddish yellow wedge-shaped patch dorsally in centre of abd. seg. 8, Abd. 25-27 mm. . . . . *hintzi*  
2 small reddish yellow spots dorsally on abd. seg. 8, Abd. 28-30 mm. . . . . *machadai*
64. Separate ante-humeral and humeral stripes, lateral sutures narrowly black . . . . . *guineense*  
Short ante-humeral stripe, humeral and lateral sutures narrowly black . . . . . (*monardi*)
65. Abdomen not constricted, broad, keeled, 2 black sub-dorsal stripes . . . . . (*microstigma imitans*)  
Abdomen constricted, long or short, somewhat cylindrical, tapering posteriorly . . . . . *cancellatum*
66. Thorax with narrow black stripes, 7-8 aside; oblong yellow on abdomen dividing the black dorsally, laterally and ventrally . . . . . *brachiale*  
Thorax with or without heavy black stripes; an entire abdominal stripe . . . . .  
Thorax with wide stripes, 5-6 aside; abdomen black beneath, with a wide central dorsal stripe . . . . . *icteromelas*  
Thorax with narrow stripes, 4-6 aside; abdomen mostly yellow beneath, with 2 wide lateral stripes aside . . . . . *macrostigma*

## Nesciothemis gen. n.

This genus has been created to take *Orithetrum farinosum* Förster and *Orithetrum fitzgeraldi* Pnhey. Both differ from *Orithetrum* by the shape of the vertex, frons, clypeus, prothorax and claws. They also have no flagellum and no alae on the penis. In the shape of the anterior lamina, hamule and lobe, they somewhat resemble *Hadrothemis* and *Oxythemis*. In venation, *farinosum* cannot be told apart from an *Orithetrum*, having a very well-formed double curve to the  $R_1$ , whereas this latter vein has no double curve in *fitzgeraldi*, and exactly resembles an *Oxythemis* in that respect. However, the rest of the wing venation conforms to that of an *Orithetrum*. In appearance, *farinosum* resembles a light pruinose blue *Orithetrum*, such as *brunneum*, in the adult males, and *cancellatum* in the immature. Females might also be taken for small species of *Hadrothemis*. *N. fitzgeraldi*, on the other hand, is unlike any known *Orithetrum*, by having the last half of the abdomen, in the male, scarlet-red and the first half blue-black, nor is it like *Hadrothemis* in this respect, but it does closely resemble an *Oxythemis*.

Generic characters in distinction to *Orithetrum* :

### Nesciothemis

### Orithetrum

- Vertex rounded. . . . . Vertex knobbed or bifid.  
Frons short in depth of front and with two oval depressions. . . . . Frons deeper and with a doubled triangular shield to the front.  
Clypeus wider than front of frons. . . . . Clypeus narrower than front of frons.  
Posterior lobe of prothorax deeper than wide, or as deep as wide. . . . . Posterior lobe of prothorax considerably wider than deep.  
Teeth of claws small and close to tip. . . . . Teeth of claws large and nearer to centre of claw.  
Anterior lamina low, hood-shaped and short. . . . . Anterior lamina always prominent and never hood-shaped.  
Genital lobe very small and inconspicuous. . . . . Genital lobe always large and conspicuous.  
Penis glans without a flagellum or alae. . . . . Penis glans with a flagellum and alae.

The new name is a pure invention, formed from the «themis» at the end of the names of the nearest generic relations, together with the verb *nescio* — «not to know».

I designate *Orithetrum farinosum* Förster as the type species of the genus.

## Nesciothemis farinosum (Förster)

*Orithetrum farinosum* Förster, 1898, *Ent. Nachr.*, 24 : 169.

*Orithetrum pollinosum* Karsch, 1899, *Ent. Nachr.*, 25 : 372.

*Hadrothemis hyalina* Fraser, 1927 (*nomem nudum*, registered in Brit. Mus. (Nat. Hist.)).

*Nesciothemis farinosum* would be mistaken for an *Orithetrum* wherever it was flying, but on examination would be seen not to conform to the structure of that genus. There are also three visible characters that will help to differentiate *farinosum* from the African species of *Orithetrum*. First, is the shiny blue-black top to the frons and vertex in adult males; second, is

the brown on the tips of the wings in the females and some of the males; third, is the thorax dorsum having one wide centre cream-coloured stripe, reaching from the anterior border of the prothorax to the first segment of the abdomen. The thorax is darkened on either side of this stripe, but is otherwise unmarked. All these three characters can be found in the African genus of *Hadrothemis*, but it does not conform to that genus in other respects. In immature males and in the females, the abdomen is marked as in *O. c. cancellatum*, with broad black longitudinal sub-dorsal stripes, but these are straighter than in *c. cancellatum*, where they are festooned. *N. farinosum* is also considerably smaller and slimmer in build. It is completely without constrictions in the abdomen, tapering very gradually to the 10th segment; it is flat below, keeled above and only very slightly enlarged on the 1-3 segs. The 8th tergites of the female are enlarged into small 'flaps' and the margin of the vulvar scale is a simple oblong opening. The adult males, when pruinose all over, resemble *O. b. brunneum* very closely, except for the longer and narrower *Pt.* in the wings. There is a lot more black on the head of *farinosum* than in either of the two *Orithetrum* species mentioned above, and in any case they could only meet in the extreme north of Africa.



Fig. 10 — *Nesciothemis* genus. A & B: male secondary genitalia. C & D: margin of female vulvar scale. E & F: terminal segment of penis. A, C & E: *farinosum*. B, D & F: *fitzgeraldi*.

The ground-colour of *farinosum* is ochre-yellow, except for the very large labial lobes, which are chrome-yellow, darkening with age up the centre of the closed mouth to black-brown. Clypeus mostly green; frons front mostly marked with dark brown or black; the entire rounded top of frons metallic dark blue in adults. Labrum with the basal half dark brown to black. The thorax becomes progressively darker on the dorsum each side of the centre cream stripe, and the abdomen is largely filled with the wide black sub-dorsals. Pruinosity comes early in the males. The cerci are black from an early stage and very mature males become all black on the last 3-4 abdominal segments. In the legs, all the femora are very yellow above and dark beneath, there is also a yellow line along the tibiae until obscured in mature specimens, but all the legs become very black in pruinose males. The long narrow wings are completely hyaline at the bases; the membrane is very narrow and conspicuously white only at the top. The *R<sub>3+4</sub>* loop-cells are doubled in the centre; the *T* in the hindwing is very occasionally crossed in both sexes.

*N. farinosum* is a very wide-spread species and is found abundantly in every country in Africa south of latitude 20° N. and also occasionally in Egypt. Over its entire range it does not seem to vary, with one unusual exception. This is a distinct form of uniform dwarf size,

which occurs regularly in N. Nigeria and which I have also seen from Sierra Leone. Fraser appears to have seen it from Dahomey (*Bull. Inst. f. Afr. noire*, 1951, 13 (4): 1081). There is no difference whatever in either the genitalia, penis or colouring, and no question of a geographical race arises for those reasons, and also because the normal *farinosum* is found in the same neighbourhood. R. M. Gambles believes there may be a distinct difference in the habitat, which he hopes he may be able to prove. This difference lies in the fact that the typical *farinosum* is only taken by him at ponds and the dwarf *farinosum* at running water. The Dahomey specimens also appear to have been taken at 'rivers'. If this can be proved to be an ecological race, then it might perhaps be named as such, but *pollinosum* Karsch is not available, as that name was given to the large typical form from E. Africa. *H. hyalina* of Fraser, although registered as a type male in the British Museum (Natural History), never had the description published. The name, in any case, is not available, as the specimen is a large typical form from Uganda.

Measurements, lentic form: ♂ Abd. 26-30, width 2-2.2 mm. Hw. 29-33 mm. Pt. 3.5-4.5 + 0.8-0.9 mm. ♀ Abd. 25-28 mm. Hw. 30-34 mm. Pt. 4-4.5 + 0.8-0.9 mm. Lotic form: ♂ Abd. 24 mm. Hw. 27-28 mm. ♀ Abd. 23 mm. Hw. 29 mm.

The abdomen is shorter than the wings by 3-4 mm. in the males and 5-6 mm. in the females.

### *Nesciothemis fitzgeraldi* (Pinhey) (1)

*Orithetrum fitzgeraldi* Pinhey, 1955.

The type male and female in the British Museum (Natural History) were taken at Lake Chila, Abercorn, N. Rhodesia, 31.1.1954 by D. Vesey-Fitzgerald. They are very mature insects and both are largely covered with a thin layer of dark blue pruinose on a black ground. They resemble *Oxythemis* sp. more closely than anything else, with the male's black & red and the female's black & yellow colouring. The venation is partly like an *Orithetrum* and partly like *Oxythemis*, especially in the shape of *R<sub>3</sub>*, which after the proximal 'hump', turns steadily down to the wing border. Both wings are wider than in *Oxythemis* and have a deeper *R<sub>3+4</sub>* loop and deeper discoidal and anal fields: of 3, and then 4 rows to the nodus in the discoidal field of the forewing, and of 3, 4 or even 5 rows in the anal field of the hindwings. The *R<sub>3+4</sub>* loop-cells are doubled in the centre, mostly for 3 cells, occasionally 4 or only 2. Venation mostly black, but the sub-costal and median cross-veins are yellow from base to nodus. Measurements (3 ♂♂ & 1 ♀): Abd. 26-27.5 mm. Hw. 30-31 mm. Pt. 3.8-4.5 + 0.7-1 mm. Abdomen shorter than wings by 3-4.5 mm.

Holotype ♂: Abd. 26 mm. Hw. 30 mm. Pt. 4 + 0.7 mm. It is slim, depressed, keeled and very uniform in width in the abdomen. 1-3 segs. slightly enlarged, 4-6 segs. of equal width (2 mm.), 7-10 segs. tapering away. Head: Frons and vertex blue-black, slightly metallic; small occiput nigger-brown; clypeus olive-green; labrum dark brown; labium all black. Prothorax: blue-black, the deep, rounded, upstanding posterior lobe with long reddish hairs. Thorax: rather short and heavy-looking in proportion, almost entirely blue-black in colour, with a few touches of orange-red near the coxae showing beneath the pruinosity. Legs: long and slender and very heavily armatured, almost entirely blue-black, quite considerably pruinosed, but with a trace of orange-yellow here and there. Tarsi: all black, claws moderately long and stout, with short stout teeth near the tip. Forelegs: tibiae with 7-9 long outer spines, 3 long inner and dense, fine hairs; femora with one long spine and rows of short spines mixed with fine hair. Mid legs: tibiae with 5-6 long inner spines; femora with rows of short spines and much fine hair.

(1) My descriptions of *N. fitzgeraldi* are made quite independently of E. Pinhey's, whose original description I have not seen, but whose MS. went to press at about the same time as mine.

Indigo-blue pruinosity over a yellow ground-colour, with traces to be seen of a wide black lateral stripe, leaving uncovered conspicuous yellow lozenge-shaped patches above the lateral carinae of 4-8 segs. A slight foliation of the 8th tergites. Abdomen beneath mostly yellow, with black down centre of sternites and wide black cross-bands at each suture. The vulvar scale is black, flat, with a simple, slightly curved margin. Epiproct and paraprocts yellow and hairy, the cerci about twice as long, slender, convergent and slightly pointed. Wings: large amber-yellow flecks at bases: forewings to beyond 1st *An* and to the *Arc.*, hindwing to 2nd *An* and to the *Arc.* Membrane dark grey; *Pt* light red-brown with thick black costa. *Arc* well basad to 2nd *An* in all wings.

*Cu*<sub>2</sub> separated from corner of *T*, very widely in hindwings; 4 *Rspl* loop-cells doubled in centre. Nodal index: 8 9 9 8

Hindlegs: tibiae with two rows of 14-15 long spines: femora with rows of short spines (1-2 longer) and no hairs. Abdomen: pruinosed dark indigo-blue on black for 1-5 segs. and anterior third of 6 seg. The rest of 6 seg. and 7-9 segs. scarlet-red. All carinae narrowly black and 2 small black dots postero-dorsally on 6-8 segs. The sides of 9 seg. and all 10 seg. and anal appendages black. Beneath paler: pruinose blue on yellow 1-5 segs., red 6-8 segs., black 9-10 segs. and broadly black across each suture.

Wings: tinged slightly yellow all over and with only a mere trace of amber at the wing bases; membrane dark grey. The large *Pt*. has the lower <sup>2</sup>/<sub>4</sub> light red-brown and the upper <sup>1</sup>/<sub>4</sub> dark brown with a wide black costa. *Cu*<sub>2</sub> is separated from the *T*., widely in the hindwings. *Arc* at the 2nd *An* in left hindwing, but well basad in all the others. The *Rspl* loop is doubled in the centre for 4 3 cells. Nodal index: 8 12 12 <sup>1</sup>/<sub>2</sub> 8

Paratype ♂ in British Museum (Natural History), taken at Lake Chila in April 1954 by E. Pinhey, is as mature as the type and only differs in the following: Abd. 26.5 mm. Hw. 31 mm. *Pt*. 4 + 0.8 mm. *Arc*. at 2nd *An* both hindwings, basad both forewings. Both hindwing *T*'s crossed at extreme apical tip. Nodal index: 8 9 9 9. *Rspl* loop-cells doubled: 3 2.

A paratype ♂, in the Coryndon Museum, Nairobi, and the first taken at Lake Chila by Mr. Vesey-Fitzgerald, 20.3.1951, was examined by myself and was in a less mature stage of colouring. There was still a good deal of greenish-yellow to be seen on all parts. Head: Vertex and top of frons black-brown, slightly blue metallic; lower front to frons, clypeus, genae, and sides of mandibles greenish-yellow; small occiput nigger-brown; labrum and labium suffused with black-brown. Prothorax and Thorax: velvety black, except that the latter has touches of yellow and orange near the coxae and faintly showing on the metepimeron. Legs: mostly black, bases of fore and mid femora and trochanters greenish-orange. Abdomen: first five segments mostly black and last five mostly orange-red. There is a yellow-green horizontal dorsal band across the 1st seg.; dull yellow-green laterally 1-3 segs.; black dorsally 4-5 segs. and anterior third of 6 seg.; a narrow orange-red line longitudinally just above the black lateral carinae on 4-5 segs.; all the rest of 6 seg. and all 7-8 segs. orange-red (except for black transverse carinae); 9 seg. red with lower half of sides black; 10 seg. black with red dorsal spot. Superior anal appendages black, inferior red. Abdomen orange beneath, suffused with black at the posterior end of each segment. Wings: a strong fleck of yellow-amber at all four bases, not quite reaching the first *An*.; membrane light grey with a minute white top. The large *Pt* is between thick black veins, with the lower half ochre-yellow and the upper half nigger-brown. *Arc* at 2nd *An* in all wings; *Cu*<sub>2</sub> separated from *T*, widely in hindwings. *Rspl* loop with the following doubled cells in centre: 4 4 . Nodal index: 8 10 9 8 . Measurements: Abd. 27 mm. Hw. 30 mm. *Pt*. 3.8-4 + 0.8-1 mm.

Allotype ♀: Abd. 27.5 mm. Hw. 31 mm. *Pt*. 4-4.5 + 0.8-0.9 mm. Resembles the male in size and shape and has a lot of dark blue pruinoscence on every black portion of the colouring. However, the ground-colour would seem to be either ochre-yellow or olive-brown. Head: ochre-yellow, with a brownish top to the frons and a dark brown to black basal frons-line extending partway down the sides. Centre of labium black. Prothorax: very long cream-coloured hairs on a dark grey posterior lobe. Thorax: heavily pruinosed indigo-blue over what appears to be olive-brown in colour. Along the entire centre dorsum is a broad ochre-yellow stripe. There are traces of wide black stripes below the pruinoscence, as follows: ? ante-humeral, humeral, 1st and 2nd lateral sutures, mes- and met-epimeron. Legs: half yellow, half black, with black tarsi, and all very pruinosed. Like the male's they are slender and well armatured, closely resembling the holotype in numbers of spines, with the exception of the long spines on the tibiae of the hindlegs, which only number 12 in both rows. Abdomen: depressed, keeled, very slightly enlarged at 2-3 segs., almost uniform width (2.2 mm.) until 8-10 segs., which are narrower.