

Cory (1903) these tubular structures arise developmentally from the dorsal wall of the mesenteron and therefore have been regarded as gastric caecae (Fig. 1, GC).

*Hind gut*: The distal end of the third ventriculus soon after forming short coil leads into the hind gut (Fig. 1, HG). The first part of the hind gut is in the form of a narrow tube which may be termed the intestine (I). The intestine runs backwards to join the second part—the rectum (R) which is much wider and is further distinguished by the presence of longitudinal markings over it. The rectum finally opens dorsally at the posterior end of the abdomen by a vasiform orifice or the anus (A.).

It is interesting to record the presence of a pair of very small thread like structures, the malpighian tubules (MTU), at the junction of mid gut and hind gut. None of the earlier workers on whiteflies has recorded their presence so far. Possibly they escaped notice because of their extremely minute size and small number.

#### Summary

The fore gut of *B. gossypiperda* comprises a pharynx and an oesophagus. A pair of small spherical salivary glands open into the oesophagus by a common salivary duct. The mid gut is differentiated into three ventriculi. There are two well developed gastric caeca originating from the anterior most part of the mid gut. The proximal parts of the first and third ventriculi anastomose to form a filter chamber. The hind gut consists of an intestine and a rectum. A pair of very small thread like malpighian tubules are also present at the junction of the mid gut and hind gut.

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## A NEW SPECIES OF MEGAPODAGRIID DRAGONFLY FROM CONTINENTAL AFRICA

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A new species of *Nesolestes* Selys 1891, a genus previously thought to be confined to Madagascar, is described from Eastern Nigeria. It is compared with the other species, and with the related genus *Neurolestes* Selys 1882 from West Africa.

Hitherto only three species of Megapodagriidae, belonging to three separate genera, *Coryphagrion* Morton 1924, *Amanipodagrion* Pinhey 1962, and *Neurolestes* Selys 1882, have been found on the African Continent, although 22 other species are known to inhabit Madagascar and the surrounding islands. Eleven of these belong to the genus *Nesolestes* Selys 1891, which although itself believed to be purely insular is closely related to the West African *Neurolestes trinervis* Selys 1884. *Neurolestes* differs from all the others in having three ante-nodal cross-veins instead of two, and two to five cubito-anal cross-veins instead of one. Apart from these unusual features, it very closely resembles some of the species of *Nesolestes* both in general appearance and in the structure of the anal appendages.

In December 1961, in the course of a three-day visit to the Obudu Plateau close to the Eastern border of Nigeria, (6° 30' N, 9° 20' E, approximately 5000 ft.), the writer took two males and a female of a *Nesolestes* in a narrow strip of forest flanking a small stream. As was to be expected with its only known congeners confined to Madagascar, this West African species proved to be new. It is described here as *Nesolestes nigeriensis*.

#### *Nesolestes nigeriensis* sp. n.

##### *Male* (holotype)

Head: labium yellowish basally, black apically; face and dorsum of head black with the following markings—a broad bright yellow stripe from eye to eye covering whole anteclypeus and all but apical border of labrum; two small orange spots on otherwise black post-clypeus; wide orange-yellow streaks on either side of vertex, not quite reaching eyes, forming a pale band interrupted by black of vertex; a transverse orange-yellow streak across middle of occiput, with its posterior corners joining two post-ocular spots of same colour; frons with horizontal shelf below vertex, then sharply stepped downwards towards post-clypeus, as in *Ceragrion*; vertex deeply grooved longitudinally between posterior ocelli.

Thorax: Prothorax; anterior lobe collar-like, yellow, separated from middle lobe by a deep groove, which is black; middle lobe yellow dorso-laterally, black in centre with two yellow oval spots; posterior lobe mostly black but yellow at sides.

Pterothorax; a wide black mid-dorsal stripe, crossing basal carina and continuous with black mesoprescutum anteriorly, and posteriorly with hatchet-like lateral expansions extending to meet a narrow pale yellow humeral stripe, and actually crossing humeral suture posteriorly; anterior to these axe-heads, and between the black central and yellow humeral stripes, is a greyish area (looking as if it might be post-mortem discoloration, but it was clearly marked and faintly bluish in the living insect); ante-alar sinuses yellow, margined with black; tergites and wing sclerites marked with yellowish; sides of thorax yellowish with black markings, patterned as shown in Fig. 1a; coxae and trochanters mostly yellow, but black markings on coxae of mid- and hind-legs, and dorsal surface of all trochanters marked narrowly with black; all femora black on extensor surface, flexor surface

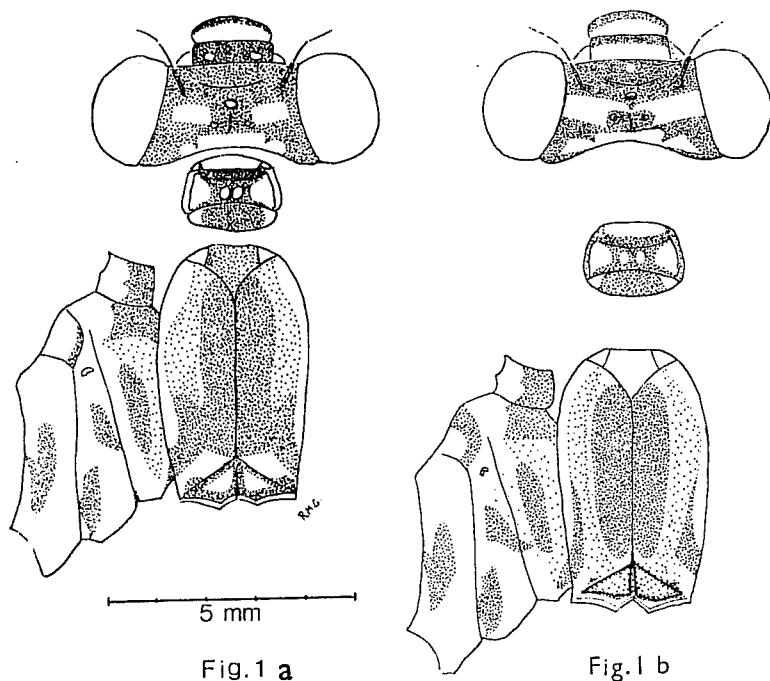


Fig. 1. *Nesolestes nigriensis*. Pattern of head and thorax (diagrammatic).

(a) Male, holotype. (b) Female, allotype.

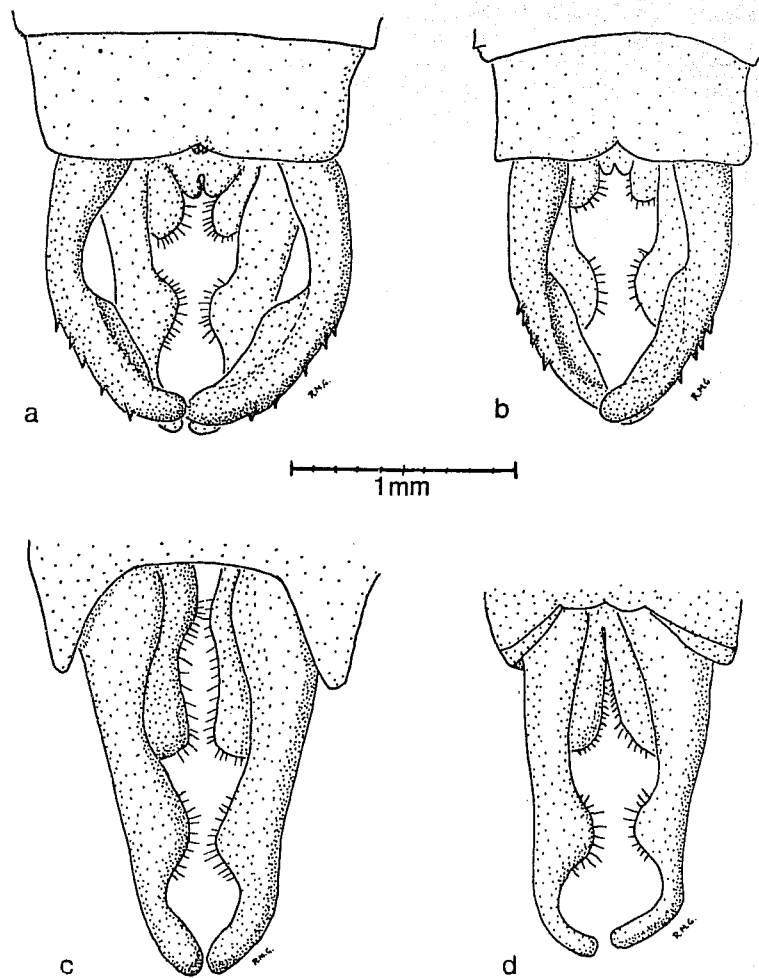


Fig. 2

Fig. 2. Anal appendages, (a) and (b) in dorsal view, (c) and (d) (inferior appendages only) in ventral view.

(a) and (c) *Nesolestes nigriensis* (holotype).

(b) and (d) *Neurolestes trinervis*.

yellow except towards apex; tibiae and tarsi wholly black; tarsal claws with subapical tooth.

Abdomen: dark colour dorsally except for a yellow posterior half to segment 1, a very narrow yellowish longitudinal stripe mid-dorsally on anterior half of segment 2, and very small paler lateral marks just visible at anterior border of segments 3-7; segment 2 is yellow laterally, with a longitudinal dark lateral stripe running the whole length.

Wings hyaline, 2 Ax, arculus at 2nd Ax, Ac at a level midway between 1st and 2nd Ax in forewing, slightly nearer to 2nd Ax in hind; post-nodals 19 in forewings, 18 in hind; origin of  $R_2$  at 6th and 7th Px in left and right forewings respectively, and between 5th and 6th and between 6th and 7th in hind; origin of  $IR_2$  at 10th and between 10th and 11th in fore, at 8th and 9th in hind; origin of  $IR_3$  at subnodus, and of  $R_{4+5}$  proximal to this; origin of 1A considerably distal to Ac and approximately level with middle of quadrilateral; intercalary sectors between main longitudinal veins; quadrilateral long, distal angle not as sharp as in Lestidae and Coenagriidae, its distal border being just over half costal border in forewings, and exactly half in hind; pterostigma brown, and covering two cells of row beneath,  $1.75 \times 0.7$  mm in forewings,  $1.9 \times 0.8$  in hind.

Appendages (Fig. 2, a and c): The anal appendages are very similar to those of *Neurolestes trinervis* (Fig. 2, b and d. See also Fraser 1955a), and resemble these even more closely than they do those of any of the Madagascan *Nesolestes*. (The appendages in this genus are very variable, and in some species the inferiors are greatly reduced or even rudimentary.) The superior appendages are more strongly curved than in *N. trinervis*, and the inferiors—which in the latter species are more or less parallel—are more convergent. Fraser has picturesquely likened the inferior appendages of *Neurolestes* to the feet of a ballerina with the ankle joint fully extended and the toes strongly flexed. This also applies to the present species but the toes are less strongly flexed. The inferior appendages are very slightly longer than the superiors. Superiors with five spines on the lateral margin. (The lateral spines on the superior appendages are variable. The paratype has six on one side and five on the other. A *Neurolestes* received from Pinhey has four on each side, whereas that figured by Fraser has three.)

Accessory genitalia: the penis consists of the usual three divisions (terminology of Fraser 1956), a curved and strongly chitinised stem (less chitinised on its dorsad surface); the corpus, bent almost at right angles to the stem in a dorsad direction, with the angle between the two filled in by a less chitinised and more membranous portion; and the glans, curved round in a circle, the apex dividing into two lateral processes, which in this case overlap the corpus and lie on either side of it. The preputial fold is absent. Where the corpus merges into the glans there is a prominent and well-developed *lamina interna* (terminology of

Schmidt 1915) projecting into the circle formed by the corpus and the glans, in the form of a transverse membranous flap with its apical border widened and so projecting laterally on either side of the glans, and somewhat folded to form a W. The chitinous endoskeleton of the corpus is in the form of a roughly rectangular plate, and the lateral borders of this are continued into the glans as chitinous rami which lead right into the lateral processes. The glans is hollowed out and boat-shaped in both *Nesolestes* and *Neurolestes*. The boat is flat-bottomed, the chitinous rami reinforcing either side of the bottom and converging apically to strengthen the tall prow. The prow is more abruptly narrowed in *Nesolestes nigeriensis* than in *Neurolestes*, and in both it is surmounted by the lateral processes. In *Neurolestes* these processes are slightly larger and start to diverge sooner. In *Nesolestes* the divergence is abrupt and in ventral view the processes appear like a transverse collar. As no figures have been published of the

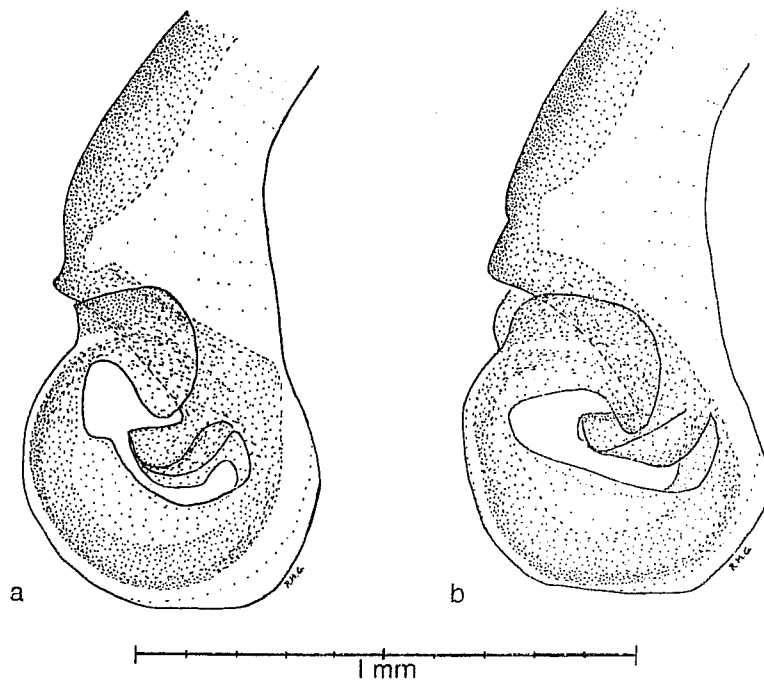


Fig. 3

Fig. 3. Tip of penis, from left,

- (a) *Nesolestes nigeriensis* (paratype).  
 (b) *Neurolestes trinervis*.

penis of *Neurolestes*, both species are figured here (Figs. 3, a and b).

Length of abdomen (without appendages) 38 mm.; hindwing 31.5 mm. Taken on the wing over bushes beside a small stream flanked by a narrow strip of forest, Obudu Plateau, Eastern Nigeria, 21.xii.1961, where it was settling with the wings half-open like a Lestid, and sometimes almost fully open.

*Female* (allotype) (Fig. 1b)

Pattern and colours very similar to those of male, with the following exceptions; post-clypeus with a yellow band instead of two small dots, stretching right across, filling whole of basal half; a single yellowish spot in centre of frons, just anterior to median ocellus; band across vertex extending to eyes, and although partly interrupted by posterior part of vertex, is narrowly continuous between median ocellus and the two lateral ones.

Pterothorax: unlike the male, dorsal black stripe not crossing basal carina, and mesoprescutum wholly yellow; "axe-heads" separated from central stripe instead of joining; greyish "discoloration" as in holotype, but bluer, and a distinctly bluish grey separating black of central stripe from rest of grey; other colours and markings as in holotype.

Abdomen: no central yellow line on segment 2, but basal pale rings on segments 3-8 much more pronounced than in male; dorsum of 9 and 10 blue, 9 with a pair of dark brown dorsolateral marks basally, joined to ventrolateral streaks running the whole length of the segment; appendages black, short, sharp, and conical, 0.6 mm. in length; ovipositor not abnormally long, projecting as far as tip of appendages, unlike some species of the

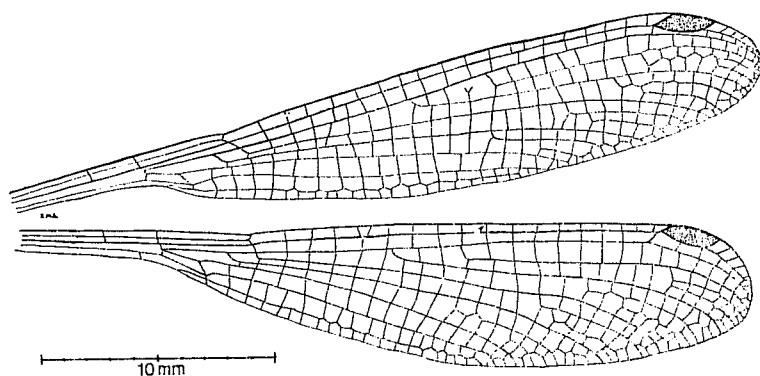


Fig. 4

Fig. 4. *Neurolestes nigeriensis*, venation of right wings (holotype).

genus where it projects by a length equal to that of the last two segments.

Wings: generally similar to those of male, but pterostigma a pale yellowish, framed with dark brown,  $1.6 \times 0.7$  mm. in forewings,  $1.8 \times 0.75$  in hind; arculus at 2nd Ax, Ac at a level nearer to 2nd Ax than to 1st ( $2/3$  the distance between the two): 19 and 17 Px in forewings, 17 and 16 in hind; origin of  $R_3$  at 7th Px in forewings, 6th Px in hind; origin of  $IR_2$  at 10th and 9th in forewings, slightly beyond 8th and slightly beyond 7th in hind; origin of IA nearer commencement of quadrilateral than in male ( $1/4$  way along in all wings except right hind, where it is  $1/3$ ).

Length of abdomen (without appendages) 31 mm.; hindwing 29.5 mm. Taken flying over bushes at the edge of the same strip of forest as the holotype, 20.xii.1961.

The paratype male, taken in the same strip of forest on 20.xii.1961, has abdomen (without appendages) 37 mm., and hindwing 31 mm. Colours and markings exactly similar to holotype except that the orange spots on the post-clypeus are so small and ill-defined as to be scarcely visible, and the transverse occipital stripe does not touch the post-ocular spots; position of Ac, and the origin of IA, resemble those of allotype rather than holotype; 19 and 18 Px in forewings, 18 and 17 in hind.

The new species can be distinguished from all other *Nesolestes* by the anal appendages. The species whose appendages are the most similar, *N. alboterminatus* Selys 1891, can be readily recognised by the milky white opacity at the tip of the wings, as well as having the inferior appendages slightly shorter than the superiors. In *N. angydna* Schmidt 1951, the inferiors are much shorter, and in none of the remaining species do the inferiors in any way resemble the feet of a ballerina as they do in *N. nigeriensis* and *Neurolestes*.

Schmidt (1951), referring to *Nesolestes*, says "The genus stands extraordinarily near *Neurolestes* Selys from the Cameroons, from which it differs by the presence of only 2 antenodals as a rule (3 in *Neurolestes*) and by the lie of the arculus distal to the 2nd antenodal. Even the anal appendages of the  $\delta\delta$  and the penis are similar in the two genera."

Fraser (1955b) unaccountably disagrees with Schmidt, "... Schmidt ... pense que ce genre est extrêmement proche de *Neurolestes* Selys d'Afrique occidentale et affirme que les appendices anaux et les pénis mêmes sont semblables dans les deux genres. Mais les appendices anaux de *Nesolestes* sont très variables et bien que certains d'entre eux soient semblables à ceux de *Neurolestes*, d'autre différent profondément. En ce qui concerne les pénis, je ne vois aucune ressemblance; ceux de *Nesolestes* sont du type banal, tandis que ceux de *Neurolestes* sont très remarquables et tout a fait isolés par leur revêtement de poils raides ou de soies sur les processus latéraux relevés vers le haut; de plus, ces processus sont dirigés vers le bas chez *Nesolestes*."

While it is certainly the case that the anal appendages in *Nesolestes* are very variable, and only in two of the known species, *alboterminatus* and *angydna*, are they closely comparable with those of *Neurolestes* and the new species, neither the present writer nor Pinhey (personal communication) has been able to find these hairs on the lateral processes of the penis, or to confirm that the latter are directed forwards. The specimen of *Neurolestes* on which Fraser (1955a) based the description given in his paper on the Megapodagriidae and Amphipterygidae (from Dehane, Cameroons, collected by Borelly, now in the B.M. Coll., Fraser Bequest) is presumably also his authority for the statements about the uniqueness of the penis in his Madagascar paper (1955b). This specimen has the penis partly pulled out, but not entirely freed from the anterior flap of the vesicle ("Samenkapsel" of Schmidt 1915, which covers the tip of this organ when *in situ*). In most of the Zygoptera the end of this flap is more strongly chitinised at the sides, and membranous between: and this is especially obvious in *Neurolestes* and *Nesolestes*, where the end of the flap is strongly and darkly chitinised to form two arms, the space between which is filled in with a thin, flexible, and pale-coloured membrane. The lateral processes of the penis-tip have been caught up in this membrane, and the curved boat-shaped part has partly uncurled. The two arms, which are fringed with hairs, and of course point forwards, now lie closely beside the concealed lateral processes and it is probable that these arms have been mistaken by Fraser for the processes themselves, which would account for the unique features with which he credits them.

The distal position of the arculus referred to by Schmidt is too inconstant to be regarded as a generic character. Six species in the B.M. have the arculus varying from opposite the 2nd Ax to slightly distal to it. Those with the arculus opposite include two males and one female of *alboterminatus*, two male paratypes of *albicolor* Fraser 1955, one male paratype of *forficuloides* Fraser 1955, and the forewings of a male *martini* Schmidt 1951 (the hindwings of this specimen and all wings in a female having it distal). In three male *drocera* Fraser 1951 the position ranges from very slightly to appreciably distal, the greatest distance being by about half the length of the lower portion of the Ax. A male paratype of *albicauda* Fraser 1952 also has the arculus slightly distal.

Thus the differences between the two genera are reduced to the unusual venational characters of *Neurolestes* (the additional Ax and the extra Cuqs), and in general appearance and other detailed characters the new species further bridges the gap. Fraser (1955a) points out that the venational anomalies of *Neurolestes* are not primitive but must represent some specialised adaptation, and the finding in West Africa of a *Nesolestes* so similar to *Neurolestes trinervis* suggests that the former genus may be similar to some once widespread ancestral form, from

which *Neurolestes* has diverged by developing the extra cross-veins, and which when isolated in the Madagascan region has undergone rapid speciation into a number of different forms. The elongated ovipositor seen in all the Madagascan species whose females have so far been figured (a number are still unknown) may represent an adaptation to local conditions which has not developed in the West African species and its offshoot *Neurolestes*.

The holotype and allotype are in the writer's collection, and will ultimately be bequeathed to the British Museum (Natural History), London.

#### Acknowledgements

The writer wishes to thank Dr. E. C. G. Pinhey for a specimen of *Neurolestes* from the Cameroons; Mr. D. E. Kimmins for facilities for examining specimens in the British Museum Collection; and Miss Cynthia Longfield for calling his attention to Schmidt's 1915 paper, which made description of the genitalia much easier.

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## DRAGONFLIES IN NORTH WALES

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Some notes on dragonflies seen in Anglesey in the summer of 1969 appeared in a recent issue of the *Entomologist* (Mathews, 1969, 102, 193). Unfortunately local records had not been consulted, and in fact the occurrence of *Brachytron pratense* Müll. in this same locality was recorded by T. A. Davies on 20.vi.64. (*Nature in Wales* 1964, 9 (2), 51).

Up to date dragonfly records for the whole of Wales are published regularly in *Nature in Wales* by Bryan Sage. In this Department we keep a card index of all published (and many unpublished) records of insects from North Wales which students are at liberty to consult. We always welcome additions to our local lists from any visiting entomologists, as many insect groups have not been extensively collected in North Wales.