

**LARVAE OF THE GENUS *AESHNA* FABRICIUS
IN AFRICA SOUTH OF THE SAHARA
(ANISOPTERA: AESHNIDAE)**

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9 spp. have been recorded from sub-Saharan Africa, of which only 5 spp. have been described as larvae. A more complete larval description of *A. scotias* Pinhey from Cameroon and a review of the current level of information on the larvae of the genus in the region, are provided here, and the known larvae are keyed.

INTRODUCTION

The fieldwork providing the data for this paper took place in the South West Province of Cameroon in West Africa on four separate study visits; March 1995, July 1996, March / April 1997 and finally November 1998. A total of eight weeks has been spent in the country by members of the Cameroon Dragonfly Project (CDP) concentrating upon the montane rainforests around Mount Kupe. VICK (1999) provides a comprehensive description of the topography and climate of the area and a checklist of the odonate fauna. In addition to the intensive fieldwork carried out during these periods, Otto Mesumbe, a resident of Nyasoso on the foothills of Mount Kupe has been carrying out fieldwork on a regular basis as part of the CDP.

A number of species of *Aeshna* occur outside the study area and in order to provide comparative data I have examined material in the collections of the Natural History Museum (BMNH) in London.

METHODS AND MEASUREMENTS

Collecting techniques used in the field involved sifting aquatic vegetation, debris, leaf litter and mud using sieves of approximately 1 mm mesh. All specimens encountered were then collected and either reared to adult or preserved in 75% ethyl alcohol.

Wherever possible measurements are of final instar exuviae. Ratios stated apply to earlier instars. Measurements have been made using a graticule eyepiece within a binocular eyepiece at $\times 10$ magnification. The illustrations for this paper have been reproduced from photographs taken at between 10 and 40 times magnification. The photographs have been scanned and digitally enhanced using a vector-based software drawing package.

STATUS AND DISTRIBUTION

The genus *Aeshna* is poorly represented in Africa, with only nine species found in the sub-saharan area of the continent. The most widespread species is *A. rileyi* (Calvert) which PINHEY (1961) describes as occurring in "most of Ethiopian Africa". It has never been recorded from Cameroon. *A. ellioti* Kirby is widespread but appears to be concentrated in the central and eastern areas. This species is rare in South Africa (M. Samways, pers. comm.). *A. scotias* Pinhey has been recorded from Uganda, Robert Gambles (G.S. Vick, pers. comm.) collected an exuvia which he suspected to be of this species from Nigeria. I have examined the Gambles material now contained in BMNH, but have been unable to locate the specimen. *A. scotias* was discovered in Cameroon by Mary Vick, who collected two females from Mount Kupe in 1995 (VICK, 1999). The CDP expeditions of 1996, 1997 and 1998 recorded this species, mainly as larvae, from a number of localities. The remaining species all have restricted distributions. *A. minuscula* McLachlan and *A. subpupillata* McLachlan are endemic to South Africa (SAMWAYS et al., 1993) although *A. subpupillata* has recently been recorded from Zimbabwe and Mozambique (M. Samways, pers. comm.). *A. meruensis* Sjöstedt occurs in Tanzania. *A. yemenensis* Waterston is endemic to the mountains of southwestern part of the Arabian peninsula (WATERSTON, 1984). The remaining two species, *A. moori* Pinhey and *A. wittei* Fraser are both described from the Congo and further research is needed to establish their distribution.

All species appear to require similar forested habitats (both still and flowing waters) and are hardly known from altitudes lower than 600 m.

LARVAL DESCRIPTIONS OF THE GENUS *AESHNA* IN AFRICA

SAMWAYS et al. (1993) deal comprehensively with the South African endemic species *A. minuscula* and *A. subpupillata*, comparing the latter with its close relative *A. rileyi*. The larvae of *A. moori*, *A. meruensis*, *A. wittei* and *A. yemenensis* are unknown. This paper deals with the three remaining species *A. scotias*, *A. ellioti*, and *A. rileyi*. In the interests of brevity I have not attempted to describe all features but to highlight the distinctive characteristics for the purposes of identification.

The adult hindwing lengths of the three species dealt with here are (in mm; δ/δ): *A. scotias* 54/54; – *A. rileyi* 48/48; – *A. ellioti* 40/38. It is clear from an examination of the adult insects that *A. scotias* is the largest of the three – a fact which is reflected in the larval material.

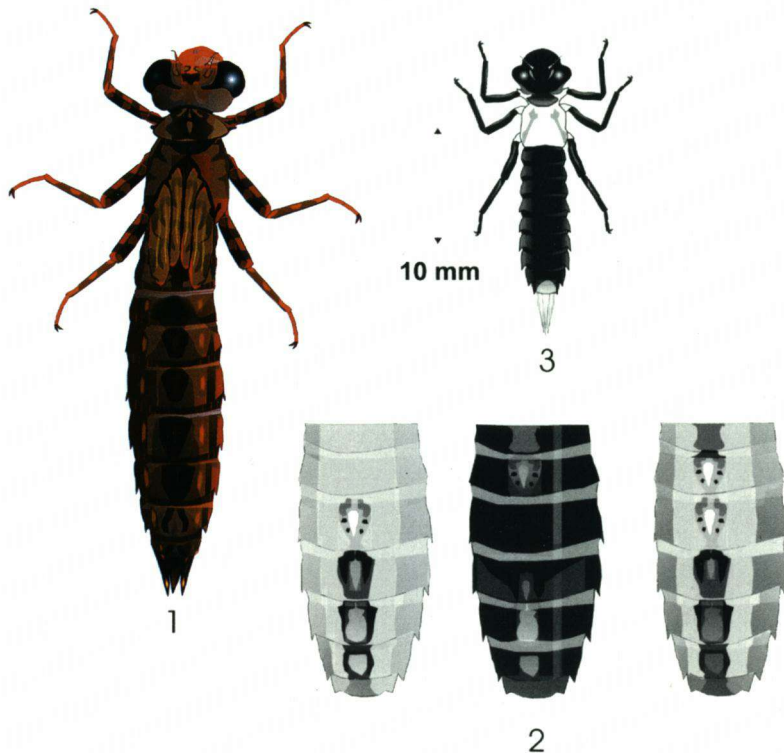
AESHNA SCOTIAS PINHEY, 1952

Figures 1-3, 5-8, 12

Material (5 adult ♀, 28 larvae). – [The month of collection is indicated in roman numerals]. – CAMEROON: Mt Nlonako, alt. 985 m, 1 ♀, XII; – Ngomin (Ehine stream), alt. 1120 m, 1 ♀, X; 7 larvae, X/XI; – Kodmin (Ndine stream), alt. 900 m, 1 ♀, VI; 15 larvae, VI, XI; – Mt Kupe, Nyasoso, alt. 920 m, 2 ♀, III; 1 larva, X; – Muandon Crater lake, alt. 1000 m, 5 larvae, IX, XI.

Although all attempts at breeding late instar larvae have failed, I have no doubt in associating the larvae discovered with the adult specimens for the following reasons: (1) The larvae are clearly not of any other genus within the Aeshnidae. *Anax* is eliminated by head shape and abdominal spines. *Gynacantha* and *Heliaeschna* are eliminated by size and lack of palpal setae; – (2) The only species of the genus *Aeshna* we have encountered in Cameroon is *A. scotias*; – (3) The spiniform epiproct of *A. scotias* was described by PINHEY (1959) and is probably unique amongst aeshnid larvae in Africa. It is present in our specimens.

MORPHOLOGICAL FEATURES. – The most striking feature of the larvae of *A. scotias* is its wide range of colouring. Figure 1 shows the final instar female. Some



Figs 1-3. *Aeshna scotias*: (1) final instar, ♀; – (2) range of abdominal patterns; – (3) black and white patterning of early instar larvae.

insects (having recently passed through an ecdysis) are completely white whilst others are black. In one case the larvae had a white thorax and anal appendages and in all other respects was completely black (Fig. 3). This type of colouring can be found in other Aeshnidae. WILSON (1995) shows an early instar larvae of *Anax immaculifrons* with a black and white banded pattern. The majority of specimens are tawny brown with distinctive dark patterns on the dorsal surface of the thorax. Extreme examples of abdominal patterning are shown in Figure 2.

The other distinctive features of *A. scotias* are its labium and anal appendages. In both cases these differ from all other known *Aeshna* species in Africa.

The key features of the labium (Figs 4 & 5) are: labial palpi with distinct curved end hook (other African species have a square palpus with a barely detectable end hook); strong median lobes to the prementum each crowned with a distinctive black tubercle. No tubercle present in other species.

The anal appendages are also unusual in that the epiproct, cerci and paraprocts are all strongly pointed (Figs 6 & 7). In all other species of *Aeshna* in Africa the epiproct has a cleft (Fig. 8). In late instar insects the gonapophyses of the females extend beyond the margin of the ninth abdominal segment.

The body is glabrous with some granulation. It is conspicuously less granular than *A. rileyi*.

M e a s u r e m e n t s (in mm). – Unfortunately we do not have any final instar exuviae from which to give final measurements of the larvae. The most important measurements of the largest specimens that we have collected of the two sexes are (♂/♀): overall length 36.1/52.6, head width 6.4/9.5, metafemur length 4.5/6.7, abd. length 23.9/36.0, abd. width 6.1/9.2, labium: prementum overall length 7.8/11.0, width 3.5/5.2, extension (both sexes) 2nd coxa rear, wing case extension over abd. segm. 0.5/3.0, abd. dorsal spines (both sexes) 0.0, abd. lateral spines (both sexes) 6-9 (5 minute), lower app. (paraprocts) 3.2/4.8, upper app. (cerci) 1.0/1.8, ratio upper:lower spp. 0.3/0.4, epiproct 3.2/4.4, gonapophyses (ratio of seg. 9) ♀ 1.25.

The range of sizes of the larval material collected is considerable and shows no obvious seasonal size variation. All the habitats in which *A. scotias* was found are permanent and do not appear to suffer substantial seasonal fluctuation.

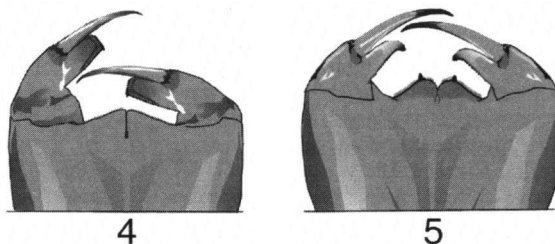
HABITAT. – Locations at Mt Nionake, Ngomin, Kodmin and Mt Kupe are all forested streams from 1.5 to 5 m. wide. The Muandon Crater lake was the only still water habitat although most larvae here were collected at the entrance of the feeder stream into the lake. In all cases with the exception of location 5, the forest canopy provided almost total cover.

AESHNA RILEYI (CALVERT, 1892)

Figures 4, 11

M a t e r i a l (5 final instar exuviae, held in BMNH, London, bequested by F.C. Fraser). – BELGIAN CONGO: no precise locality, 1 ♂ (length 37.5 mm), no date; – Elisabethville, 2 ♂ (length 38.0 mm), 1 ♀ (length 40.0 mm), X-1935; – KENYA: Sagana River, 1 ♂, bred (length 35.1 mm), 30-1-1952.

MORPHOLOGICAL FEATURES. – The fact that the material analysed was all final instar exuviae means that abdominal markings will be less obvious. However there are some dark markings on the dorsal surface of the thorax but not as distinct as those on *A. scotias*.



Figs 4-5. Labia details (dorsal view, top portion): (4) *Aeshna rileyi*; – (5) *A. scotias*.

Bearing in mind that none of the *A. scotias* material is final instar, it is clear that *A. rileyi* is a smaller insect and its abdomen and thoracic areas around the coxae and femorae are strongly granulate.

The labium follows a much more conventional *Aeshna* appearance (Figs 4 & 5): labial palpus with weak point at end; median lobes not separated and without tubercles.

In both *A. scotias* and *A. rileyi* there is a dense line of thin short setae along the distal margin of the prementum.

One feature of *A. rileyi* that has always been considered diagnostic is the supracoxal process which in most *Aeshna* spp. is bifid. BARNARD (1937) illustrates the head and prothorax of *A. rileyi* and shows the single projection (Fig. 10). PINHEY (1959) describes the supracoxal process as “simple”. However, his illustration shows a split bifid process which is present in all the specimens that I have examined. Certainly the rear projection is larger and is clearly divided from the front portion (Fig. 11). The process is, however, unquestionably bifid. For comparison the supracoxal process of *A. scotias* is also illustrated (Fig. 12).

AESHNA ELLIOTI KIRBY, 1896

BMNH (London) has a fine collection of adult *A. ellioti* and its subspecies *A. e. usambarica*. Two bred specimens of final instar exuviae are labelled as *A. ellioti*. Having examined both of these specimens I can state unequivocally that these specimens are not *A. ellioti*. In my opinion these exuviae are of the genus *Anax* and therefore wrongly labelled. As I have no access to any other specimens of *A. ellioti*, I rely upon historical data for the purposes of this paper. PINHEY (1959) illustrates the abdomens (segments 7 to 10 and appendages) of both *A. ellioti* and *A. e. usambarica*. The only difference between the nominate race and the subspecies relate to the relative lengths of the upper appendages (cerci) compared to the lower appendages (paraprocts). The ratio is as follows:

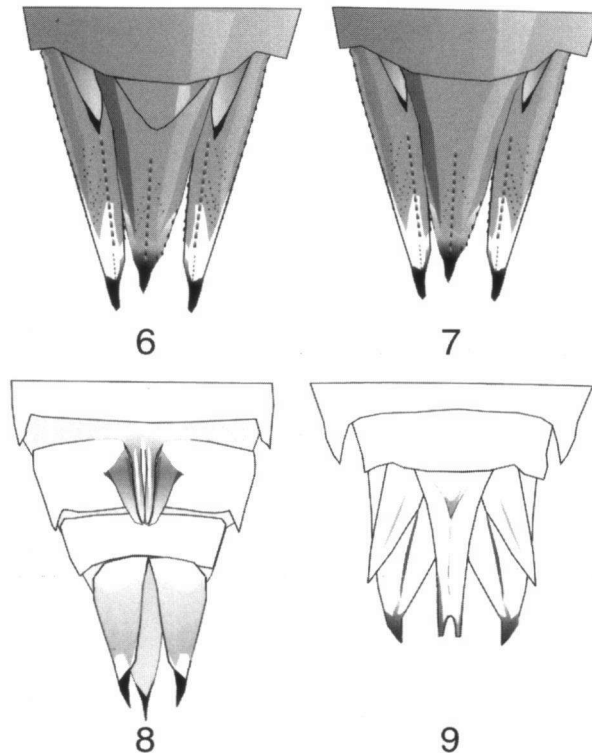
- *A. e. ellioti*: 0.67, ♀
- *A. e. usambarica*: 0.75, ♂

The problem with this separation is that the sexes cannot be compared. As the male cerci are often longer than those in the female, the feature cannot be considered as diagnostic until more material is available.

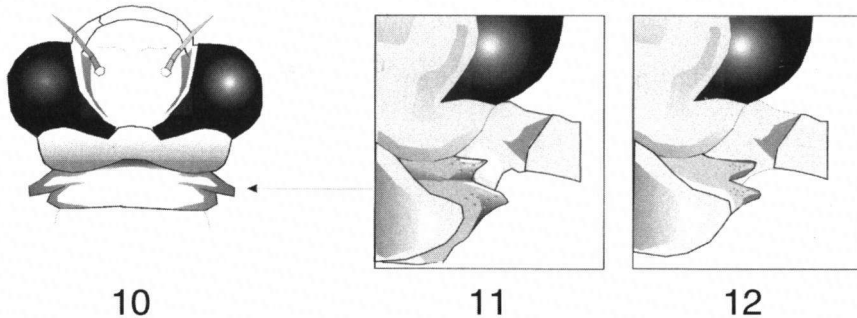
Pinhey's description of *A. e. ellioti* is based upon the "... shuck of a female nymph bred by Dr V. van Someren at Sagana River, Mount Kenya" (PINHEY, 1959). Unfortunately there is no date quoted, but this information coincides with the locality given for the final specimen listed above as being *A. rileyi*. The specimen label reads as follows: "*Aesh. rileyi* bred Sagana R. 30-1-52 V.v.S.". The specimen in the Museum is a male. Is this coincidence or could the specimen be labelled wrongly and, in reality, be an example – the only known example – of *A. ellioti*.

Certainly the specimen is slightly smaller than the other examples. PINHEY (1959) states that *A. ellioti* is 34-35 mm long. This specimen is 35.1 mm long. Having examined all the specimens there do appear to be some slight differences:

- The anal triangle of *A. ellioti* (suspected) is more compressed and shorter. This may of course be simply a distortion resulting from emergence of the adult insect.



Figs 6-9. Anal appendages: (6) *Aeshna scotias*, ♂, dorsal view; – (7) *A. scotias*, ♀, dorsal view; – (8) *A. scotias*, ♀, gonapophyses, ventral view; – (9) *A. rileyi*, ♂ (after BARNARD, 1937).



Figs 10-12. Supra-coxal processes: (10) *Aeshna rileyi*, original illustration, after BARNARD, 1937. – (11) actual detail of *A. rileyi*, drawn from specimen in BMNH; – (12) *A. scotias*.

– The end of the abdomen and anal triangle are much more prominently granular with courser granules than on the other specimens.

Interesting though this information is, it remains speculation until more information or larval material is available for examination.

PINHEY (1959) describes the supra-coxal process as simple. I can find no appreciable difference between this and any of the specimens of *A. rileyi*.

Table I
Measurements of *Aeshna rileyi* and *A. ellioti* (supposed) males

Dimensions	<i>rileyi</i>	<i>elliotti</i> (supposed)
Overall length	37.5	35.1
Greatest width of head	7.7	7.6
Length of metafemur	5.8	5.5
Length of abdomen	25.0	22.6
Width of abdomen	7.4	7.7
L a b i u m		
Prementum, overall length	7.4	
Prementum, overall width	4.0	
Extension	rear 1st coxa	
T h o r a x		
Wing case extension (over abdominal segment)	3.2	3.7
A b d o m e n		
Dorsal spines	6-9 (5 vs)	6-9 (5 vs)
Lateral spines		
Lower appendages	2.9	2.6
Upper appendages	2.1	2.4
Ratio upper/lower appendages	0.7	0.9
Epiproct		2.5

The relative size information relating to *A. rileyi* and *A. ellioti* (supposed) is given in Table I.

A. scotias has 7 antennal segments of which the third is the longest. *A. rileyi* has a long final segment of the antennae with an indistinct break. Ignoring this, *A. rileyi* has 6 segments which is confirmed by implication by SAMWAYS et al. (1993). The specimen of *A. ellioti* (supposed) has, unquestionably, 7 segments.

DISCUSSION

WATSON (1992) carried out a review of relationships of adults of the genus *Aeshna*. Unfortunately, *A. scotias* material was not available and hence was not discussed. In comparison with the European and nearctic species. The larvae have unique characteristics which are summarised below with a list of those species (albeit not exhaustive) found to have similarities:

Character	Similar species
– pointed epiproct	– <i>A. draco</i> from Venezuela
– labial palpi with distinct curved end hook	– <i>A. constricta</i> , <i>A. canadensis</i> , <i>A. clepsydra</i> (all North American)
– strong median lobes to the prementum each crowned with a distinctive black tubercle	– <i>A. clepsydra</i> from North America has strong median lobes but there are no species which possess the strong black tubercles

The larvae of *Racenaeschna angustistrigis* Calvert and *Allopetalia pustulosa* Selys both of which are known from Venezuela (DE MARMELS, 1990, 2000), also possess a spiniform epiproct and have distinctive tubercles on the margin of the prementum.

A KEY TO THE LARVAE OF THE KNOWN AFRICAN SPECIES OF THE GENUS *AESHNA* SOUTH OF THE SAHARA

The aim of this key is to assist in identification of larvae in the field. The state of our knowledge of the genus *Aeshna* in Africa is that only tentative suggestions can be put forward for determination. This key should be used only for final instar larvae and exuviae.

- 1 Epiproct pointed. Labial palpus with distinct curved hook. Large species in excess of 45 mm long. Central and west Africa *scotias* Pinhey
- Epiproct with deep cleft 2
- 2 Lateral spines on segments 7-9 of abdomen. Labial palpus with distinct setae on palpus and on movable hook. South African endemic *minuscula* McLachlan
- Lateral spines on (at least) segments 6-9 of abdomen 3
- 3 Large species 45 mm long. Lateral spines on segments 5-9 of abdomen. Labial palpus without trace of point. South African endemic *subpupillata* McLachlan

- Smaller species less than 40 mm long. Lateral spines on segments 6-9 (minute spine on segment 5) 4
- 4 Species 37-40 mm long. Widespread African species *rileyi* (Calvert)
- Small species no more than 36 mm long. Very strongly granular at end of abdomen and on anal triangle *elliotti* Kirby (suggested)

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REFERENCES

- BARNARD, K.H., 1937. Notes on dragon-flies (Odonata) of the S.W.Cape with descriptions of the nymphs, and of new species. *Ann. sth Afr. Mus.* 32: 169-260.
- BRIDGES, C.A., 1994. *Catalogue of the family-group, genus-group and species-group names of the Odonata of the world* (3rd edn). Bridges, Urbana, IL.
- CORBET, P.S., 1953. A terminology of the labium of larval Odonata. *Entomologist* 86: 191-196.
- DE MARMELS, J., 1990. Nine new Anisoptera larvae from Venezuela (Gomphidae, Aeshnidae, Corduliidae, Libellulidae). *Odonatologica* 19(1): 1-15.
- DE MARMELS, J., 2000. The larva of *Allopetalia pustulosa* Selys, 1873 (Anisoptera: Aeshnidae), with notes on aeshnoid evolution and biogeography. *Odonatologica* 29(2): 113-128.
- PINHEY, E.C.G., 1951. The dragonflies of southern Africa. *Transv. Mus. Mem.* 5: 1-335.
- PINHEY, E.C.G., 1952. Three new species of Odonata from eastern Africa. *Occ. Pap. Coryndon meml Mus.* 3: 13-16.
- PINHEY, E.C.G., 1959. Notes on African Odonata nymphs. *J. ent. Soc. sth Afr.* 22: 469-488.
- PINHEY, E.C.G., 1961. *A survey of the dragonflies (order Odonata) of eastern Africa*. Brit. Mus., London.
- PINHEY, E.C.G., 1962. A descriptive catalogue of the Odonata of the African Continent, pts 1, 2. *Publicoões cult Cp. Diam. Angola* 59: 1-162, 165-322.
- SAMWAYS, M.J., G. CARÇINI & M. DI DOMENICO, 1993. The last instar larvae of the south African endemics *Aeshna minuscula* and *Aeshna subpupillata* (Anisoptera: Aeshnidae). *Odonatologica* 22(1): 83-88.
- VICK, G.S., 1999. A checklist of the Odonata of the South-West Province of Cameroon, with a description of *Phyllogomphus corbetiae* spec. nov. *Odonatologica* 28(3): 219-256.
- WATERSTON, A.R., 1984. Odonata from the Yemens and Saudi Arabia. *Fauna Saudi Arabia* 6: 461.
- WATSON, J.A.L., 1992. The affinities of *Aeshna brevistyla* (Rambur) (Anisoptera: Aeshnidae). *Odonatologica* 21(4): 453-471.
- WILSON, K.D.P., 1995. *Hong Kong dragonflies*. Urban Council, Hong Kong.