WEST AFRICAN TRIAENODES MCLACHLAN (TRICHOPTERA: LEPTOCERIDAE).

1. INTRODUCTION AND SUBGENUS TRIAENODELLA MOSELY

The long-horned caddisfly genus Triaenodes McLachlan is cosmopolitan although the distribution in the Neotropical biogeographical region appears to be restricted to Central America and the northern part of the South American continent. In total, about 175 species have been described, of which 38 are known from the Afrotropical biogeographical region (Morse 1999). A key to the African Triaenodes species was given by Kimmins (1962). Until now, ten species had been described or recorded from West Africa. In a preliminary check-list of the caddisflies of Ghana, Kjærandsen & Andersen (1997) listed 17 species of Triaenodes from the country, of which nine were assumed to be undescribed. Later an additional new species, T. kwadwo sp. n., from Ghana is described and figured; this species does not readily fit into any subgenus. A key to the subgenera of West African Triaenodes males and a key to the males of subgenus Triaenodella are provided.

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Key-words. – Trichoptera, Leptoceridae, Triaenodini, Triaenodes, new species, Ghana, West Africa

When erecting the genus Triaenodella Mosely for two East African species, T. cheliferus and T. clavatus, Mosely (1932a) stated that the genus was separated from Triaenodes mainly by the scent-organ apparatus in the male situated in the scape of each antenna. The scent organ takes the form of a tuft of specialized scent-hairs arising at the extreme base of the scape and is covered by a hinged flap. Triaenodella was subsequently treated as a subgenus of Triaenodes by Ross (1944), based on the presence, in Triaenodella, or absence, in Triaenodes sensu stricto, of a male antennal scape scent organ.

The tribe Triaenodini was erected by Morse (1981) for the genera Adicella McLachlan, Allosetodes Banks, Erotesis McLachlan, Triaenodes McLachlan, and Ylodes Milne, based on two synapomorphies: mesopleural katepisternum constricted dorsally and male tenth tergites fused dorsally. Recently, Andersen & Holzenthal (1999) placed Allosetodes as a synonym of Triaenodes. According to Morse (1981), the genera assigned to Triaenodini arose from an ancestor in which the cubital vein in the hind wing lost its apical fork.

Yang & Morse (1993) outlined the phylogeny of
the Triaenodini and divided *Triaenodes* into three subgenera, including their newly erected subgenus *Austrotriaena* for eight species occurring in the Oriental and Australian biogeographical regions. However, the placement of the Australian species was questioned by Neboiss & Wells (1997). When describing 44 new Australian species Neboiss & Wells (1998) discussed the characters used to delimit the subgenera, or, according to them, the ‘true nature’ of the structures associated with the inferior appendage. Instead of assigning their new species to subgenus, they placed the Australian species in two species groups and split the largest group into several species ‘complexes’.

Two of the subgenera, *Triaenodes* sensu stricto and *Triaenodella*, occur in the Afrotropical biogeographical region. Yang & Morse (1993) redefined *Triaenodella*, stating that most *Triaenodes* species do have a male antennal scape scent organ. Subgenus *Triaenodella* Mosely sensu Yang & Morse is characterized in the males by the basal plate process of the inferior appendage secondarily absent and the mesal basodorsal process of the inferior appendage curved caudad and ventrad, with an enlarged apex which is either clavate, broadly truncate or subdivided into two processes. Subgenus *Triaenodes* sensu stricto is characterized in the males by an abbreviated basal plate of the inferior appendage with a long, slender, recurved process, and the phallus with distinctive lateral ridges for resting or guiding the slender process of the basal plate (Yang & Morse 1993).

Most West African species readily fit the subgeneric characteristics given by Yang & Morse (1993), but some of the species from West Africa belonging to subgenus *Triaenodes* sensu stricto have a rather short and stout or even clubshaped curved process originating from the abbreviated basal plate rather than a long, slender, recurved process. One of the newly described species, *T. kwadwo* sp. n., does not fit readily into any subgenus as the recurved process of the inferior appendage is lacking and the mesal basodorsal process of the inferior appendage is reduced. At present, we prefer not to assign this species to subgenus awaiting further studies on the phylogeny of the genus, thus leaving it unplaced to subgenus.

The present paper forms part of the scientific results of a joint project on freshwater entomology in Ghana established in 1991 between the Institute of Aquatic
Biology, C.S.I.R., Ghana; the Department of Zoology, University of Ghana; and the Museum of Zoology, University of Bergen, Norway. The new species of *Triarenodes* described in this paper are based on material collected in Ghana (see Kjærandsen & Andersen 1997). Further, all species belonging to subgenus *Triarenodella* previously described or recorded from the West African countries of Benin, Burkina (Upper Volta), Cameroon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo (fig. 1) are redescribed.

**MATERIAL AND METHODS**

Methods used in preparing, examining, and illustrating genitalia are those that are commonly used in the study of Trichoptera (see Blahnik 1998). The terminology is adopted from Morse (1975), Schmid (1980, 1994), and Yang & Morse (1993). The measurements, in millimeters, are given as the range followed by the mean when more than three specimens are measured.

The description of the three new species as well as most of the redescriptions are based on Ghanaian material. However, one of the described species, *T. palpalis* Banks, was not taken in Ghana during the project and the redescription is based on the holotype housed in the Museum of Comparative Zoology, Harvard University, Cambridge.

Holotypes and paratypes of the species described below, as well as material of most of the species redescribed are deposited in the University of Minnesota Insect Collection, St. Paul, Minnesota, U.S.A.; paratypes and material of species redescribed are also deposited in the Museum of Zoology, University of Bergen, Norway and the National Museum of Natural History, Washington, D.C., U.S.A. If not otherwise stated, the specimens are preserved in alcohol.

The following codes are used to indicate the collections in which specimens are deposited:

- ISNB Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium.
- MCZ Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A.
- UMSP University of Minnesota Insect Collection, St. Paul, Minnesota, U.S.A.
- ZFMK Zoologische Forschungsinstitut und Museum ‘Alexander Koenig,’ Bonn, Germany.
- ZMUB Zoological Museum, University of Bergen, Bergen, Norway.

**SYSTEMATIC PART**

*Triarenodes* McLachlan

*Triarenodes* McLachlan, 1865a: 110 [Type species *Leptocerus bicolor* Curtis, 1834, subsequent selection of Ross 1944].

*Triena* McLachlan, 1865b: 34 [preoccupied] [Type species *Curtis, 1834, subsequent selection of* Ross 1944].

*Allosetodes* Banks, 1931: 421 [Type species *Allosetodes platynotis* Banks, 1931, monobasic]. – Andersen & Holzenthal 1999; 10 [as synonym].

*Allosetodes* Mosely, 1932a: 308 [Type species *Triarenodella chelifera* Mosely, 1932a, original designation]. – Ross 1944: 244 [as subgenus]. – Yang & Morse 1993: 162 [redefined as a valid subgenus].

*Allostriaena* Yang & Morse, 1993: 164 [Type species *Triarenodes trifidus* Kimmins, 1957a, original designation, as a subgenus].

**Diagnostic characters (adults)**

Male scape with setose scent organ, covered with long flap (fig. 2). Forewing stem of M lacking or weak, fork II subtriangular (fig. 3); hind wing with forks I and II present (fig. 4). In males, basal plate of inferior appendage with long, slender, recurved process, with at most only few subapical setae (fig. 7); process can be secondarily reduced (figs. 5, 6).

The West African *Triarenodes* species are medium sized, with forewing lengths between 5.1 to 11.5 mm. Forewing colour varies from light yellowish-brown to dark brown, usually unicolourous, but some species appear to have distinct patterns. The antennae are more than three times the length of the forewing, and both males and females have a long antennal scape; the male scape has a setose scent organ, covered with a long flap. The maxillary palp is slightly shorter or about half the length of the forewing, segment IV is the shortest, segment V the longest, segments I, II, and III of approximately the same length or segment I somewhat shorter than segment II or III; in most species with inconspicuous setae, but in *T. proszynskii* (Marlier & Botosaneanu) and *T. palpalis* Banks with strong, marginal seta. Tibial spur formula is 1,2,2. In the forewing forks I, II, and V are present, fork II is basally subtriangular; discal cell is long, and broad apically; stem of M is lacking or incomplete (i.e., the thyridal cell is absent). In the hind wing forks I and II are present; stem of M is present or incomplete, and Cu is unbranched (i.e. fork V is absent).

In the male genitalia the abdominal segment IX is narrow to comparatively broad, tegumen and pleura are well sclerotized to semimembranous, sternum is extended posteriad, with or without V-shaped ventrolateral excision. Preanal appendages are short to long, rounded, triangular or digitate, and setose. Upper part of tergum X is reduced or prominent, single or lobed, with or without setae or spine-like setae. Lower part of
Fig. 2. *Triaenodes proszynskii* (Marlier & Botosaneanu), scape, pedicel and 1st flagellar segment. – Figs. 3, 4. *Triaenodes kwadwo* sp. n., wings. – 3, Forewing; 4, hindwing. – Figs. 5-7. Inferior appendages. – 5, *Triaenodes kwadwo* sp. n.; 6, *Triaenodes ghana* Kimmins; 7, *Triaenodes darfuricus* Mosely. – Abbreviations: A = anal vein; Cu = cubitus; dc = discoidal cell; E = emarginal vein; M = media; MA = anterior media; MP = posterior media; P = plical vein; R = radius; S = sector; s = sectorial crossvein; SC = subcosta; I, II, V = primary apical cells, or ‘forks’, I, II, and V.
tergum X is reduced or prominent, single, lobed or cleft. Inferior appendages are uni-articulated and complex, with or without short spine-like setae, with or without seta-bearing papillae, with or without setose or papillose apicominal lobe, with or without setose lateral basodorsal process, with or without setose mesal basodorsal process, and with an abbreviated basal plate not articulating with phallobase, with or without process extended caudad. Phallus is with or without lateral flanges, with or without paramere spines, and is lacking distinct phalicata.

Key to the subgenera of West African Triaenodes McLachlan males

1. Basal plate of inferior appendage with recurved process, (fig. 7) subgenus Triaenodes sensu stricto  
   – Basal plate lacking recurved process ..................2
2. Mesal basodorsal process of inferior appendage present, (fig. 6) subgenus Triaenodella Mosely  
   – Mesal basodorsal process of inferior appendage absent, (fig. 5) incertae sedis (T. kwadwo sp. n.)

Subgenus Triaenodella Mosely

As defined by Yang & Morse (1993) the subgenus is characterized in the males by the lack of a basal plate with recurved process and by having the mesal basodorsal process of the inferior appendage curved caudad and ventral, with an enlarged apex which is either clavate, broadly truncate, or subdivided into two processes.

Of the West Africa species, five previously described species apparently belong in this subgenus, Table 1. The male of T. palpalis Banks is not known. However, based on the female, the species appears to be closely related to T. proszynskii (Marlier & Botosaneanu), and the species should thus belong in subgenus Triaenodella. In addition two newly described species are assigned to this subgenus.

Key to the males of West African Triaenodes McLachlan, subgenus Triaenodella Mosely

The male of T. palpalis Banks is not known, but it will probably key to T. proszynskii (Marlier & Botosaneanu).

1. Large, brown species, wing length > 10 mm........  
   – Smaller, yellowish- or reddish-brown species, wing length < 8 mm.................................2
2. Mesal basodorsal process of inferior appendage deeply forked or distinctly bilobed.................3  
   – Mesal basodorsal process of inferior appendage digitate, slightly expanded subapically (fig. 8) ....

Table 1. Check-list of West African Triaenodes McLachlan species. Subgenus Triaenodella Mosely, and unplaced species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Distribution</th>
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<tbody>
<tr>
<td>Subgenus Triaenodella</td>
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<tr>
<td>T. akosua sp. n.</td>
<td>Ghana, Ivory Coast</td>
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<tr>
<td>T. amma sp. n.</td>
<td>Ghana</td>
</tr>
<tr>
<td>T. dolobratus Gibbs, 1973</td>
<td>Ghana</td>
</tr>
<tr>
<td>T. ghana Kimmins, 1957</td>
<td>Ghana, Cameroon, Democratic Republic of the Congo, Ivory Coast</td>
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</tbody>
</table>

| T. palpalis Banks, 1920 | Ivory Coast, Ghana, Sierra        |
| T. proszynskii (Marlier & Botosaneanu, 1968) | Leone |
| T. serratus Ulmer, 1912 | Sudan, Democratic Republic of the Congo, Ghana, Ivory Coast, Nigeria, Tanzania, Uganda, Zimbabwe |

| Incertae sedis          |                                   |
| T. kwadwo sp. n.        | Ghana                             |

3. Upper part of tergum X short, bilobed ........4  
   – Upper part of tergum X with long, median process; distal one half subtriangular with strong, spine-like setae ventrally (figs. 16, 17).............  
   – T. dolobratus Gibbs

4. Inferior appendage with lateral basodorsal process (fig. 12)  
   – Inferior appendage lacking lateral basodorsal process ..................................................5

5. Lower part of tergum X slightly curved ventral; phallus with asymmetrical dorsolateral flanges and brush of strong spines medially and apically (figs. 22, 25)  
   – Lower part of tergum X with distal three quarter strongly curved, spiny; phallus without brush of strong spines (figs. 42, 43, 45, 46)  
   – T. serratus Ulmer

Triaenodes akosua sp. n.  
   (figs. 8-11)


Etymology. – Twi, akosua, meaning a female born on Sunday; named in the Ashanti tradition of naming children after the day they are born, signifying that the species description was written on a Sunday; the name is a noun in apposition.
Figs. 8-11. *Triaenodes akosua* sp. n., ♂ genitalia. – 8, Lateral; 9, dorsal; 10, ventral; 11, phallus, lateral.
Figs. 12-15. *Triaenodes amma* sp. n., ♂ genitalia. – 12, Lateral; 13, dorsal; 14, ventral; 15, phallus, lateral.
Figs. 16-21. *Triaenodes dolobratus* Gibbs, ♂ genitalia. – 16, Lateral; 17, dorsal; 18, ventral; 19, lower part of tergum X, dorsal; 20, apex of lower part of tergum X, ventral; 21, phallus, lateral.
Diagnosis
The species shows similarities to *T. legonus* Mosely described from Kenya (Mosely 1939a) in the shape of the preanal appendages and the lower part of tergum X. However, the two species can easily be separated on the shape of the inferior appendages, which have a projecting, pointing apex in *T. akosua*, while the apex in *T. legonus* is broadly rounded.

Description
Male (n=10). – Forewing length 6.2-7.2, 6.8 mm; hind wing length 4.8-5.5, 5.1 mm. Eye 0.37-0.40, 0.38 mm wide. Antenna at least 15.9 mm long, including 0.49-0.58, 0.54 mm long scape; scape with well developed scent organ and brush of light reddish-brown seta. Maxillary palp segment lengths (in mm): 0.43-0.48, 0.46; 0.52-0.61, 0.56; 0.55-0.63, 0.59; 0.35-0.40, 0.38; 0.61-0.76, 0.71. Colour in alcohol overall light reddish-brown.

Male genitalia (figs. 8-11). Abdominal segment IX with rounded anterior margin; tergum narrow; pleural region broadly rounded, posterior margin setose; sternum triangular, produced posteriad. Preanal appendage long, narrow, setose. Upper part of tergum X apparently absent. Lower part of tergum X strongly sclerotized spine, slightly curved ventrad; in dorsal view divided almost to base. Inferior appendage sub-triangular, with apex pointing, projecting dorsomedial, setose; apicomosomal lobe triangular, dorsal margin scalloped, with strong spine-like setae mesally; lateral basodorsal process short, triangular, with long seta apically; mesal basodorsal process projecting posterodorsad, slightly sinuous, weakly enlarged subapically, with few strong seta along posterior margin and apically. Phallus curved, with large, symmetrical, membranous flange medially; phalotremae sclerite uniserial; apex membranous, truncate.

Distribution and habitat
The species is known from the Brong Ahafo Region in Ghana and from Ivory Coast. The single male from Ghana was taken in a light trap at a large rather slow flowing river in the central part of the country.

*Trienodes amma* sp. n.
(figs. 12-15)

Type material. – Holotype ♀: GHANA: Western Region: Ankasa Game Production Reserve, 16.xi.1995, at light, NU FU-project (UMSP).

Etymology. – Twi, *amma*, meaning a female born on Saturday; named in the Ashanti tradition of naming children after the day they are born, signifying that the species description was written on a Saturday; the name is a noun in apposition.

Diagnosis
The species shows similarities to *T. ghana* and to *T. kimilus* Mosely described from the Democratic Republic of the Congo (Mosely 1939b), in having long, narrow preanal appendages, and lower part of tergum X as a strong, narrow spine. However, in *T. amma* the lower part of tergum X is much longer and more strongly curved than in the two other species. It further differs from *T. kimilus* in having a mesal basodorsal lobe of inferior appendage, which is forked medially. From *T. ghana* it can also be separated by having a more complex inferior appendage with a clavate apicomosomal lobe.

Description
Male (n=1). – Forewing length 5.1 mm, hind wing length 4.1 mm. Eye 0.31 mm wide. Antenna at least 16.4 mm long, including 0.33 mm long scape; scape with well developed scent organ and brush of dark-brown seta. Maxillary palp segment lengths (in mm): 0.37, 0.55, 0.57, 0.31, 0.70. Colour in alcohol overall dark, reddish-brown.

Male genitalia (figs. 12-15). Abdominal segment IX with anterior margin broadly rounded; tergum narrow; pleura with posterior margin rounded, membranous, with few seta; sternum subtriangular, strongly produced posteriorly; in ventral view with posterior margin truncate, shallowly notched medially. Preanal appendage long, narrow, setose. Upper part of tergum X paired, very small, triangular lobes. Lower part of tergum X long, strongly sclerotized, curved spine, pointing anteroventrad; in dorsal view slightly asymmetrical with apex pointing to the right. Inferior appendage complex; apicomosomal lobe clavate with triangular, setose ventral process and digitate dorsal process with strong spine-like seta mesally; basodorsal process short, digitate, with few seta apically; mesal basodorsal process curved caudad, forked medially, dorsal process with triangular, setose apex, ventral process with enlarged apex, with few, curved setae posteroventrally. Phallus tubular, slightly curved, symmetrical, with long, rounded flange in basal two third, and membranous apex.

Distribution and habitat
The single specimen was taken at light at a small, moderately fast flowing river in the humid, coastal forests in southwest Ghana.

*Trienodes dolobratus* Gibbs
(figs. 16-21)


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Figs. 22-25. *Triaenodes ghana* Kimmins, ♂ genitalia. – 22, Lateral; 23, dorsal; 24, ventral; 25, phallus, lateral.
Diagnosis
The species can easily be separated from other Afrotropical *Triaenodes* species on the distinct shape of the upper part of tergum X which in its distal half is triangular with strong, spine-like setae ventrally.

Redescription
Male (n=1). Forewing length 7.0 mm, hind wing length 5.5 mm. Eye 0.43 mm wide. Antenna at least 21.8 mm long, including 0.83 mm long scape; scape with well developed scent organ and brush of reddish-brown setae. Maxillary palp segment lengths (in mm): 0.60, 0.67, 0.83, 0.37, 0.89. Colour in alcohol overall reddish-brown.

Male genitalia (figs. 16-21). Abdominal segment IX triangular with broadly rounded anteroventral corner; tergum very narrow; pleural region slightly rounded, posterior margin setose; sternum quadrate, produced posteriad; in ventral view with posterior margin excised, and pronounced subquadragular, lateral corners. Preanal appendage long, narrow, setose. Upper part of tergum X with long, median projection; basal half tubular, medially with paired, short, rounded, lateral lobe; distal half triangular, pointed apically, with strong, spine-like setae ventrally. Lower part of tergum X narrowly triangular mesally, distal half slender, curved slightly ventrad; in dorsal view triangular basally, distal half slightly sinuous, apex bilobed, asymmetrical, with pebbly surface. Inferior appendage subrectangular, apicomalesomal, with strong, spine-like setae; lateral basodorsal process small, setose; mesal basodorsal process prominent, deeply forked, left and right sides asymmetrical, left side with ventral process narrow, sinuous, with pointed apex projecting dorsad, with one strong setae subapically; in ventral view apex recurved mesad; right side in ventral view with ventral process subapically turned laterad, with pointing, slightly sinuous apex; dorsal process wider, curved, pointing caudad, setose subapically; right side with dorsal process slightly longer than left process. Phallus curved with asymmetrical, dorsomedial, membranous flange; left flange small, rounded; right flange longer, posteriorly triangular; with small, indistinct phallotremal sclerite.

Distribution and habitat
Gibbs (1973) recorded the species from the type locality in the Eastern Region in Ghana only. The present paper adds a record from the Volta Region, where a single specimen was taken in a light trap close to a small, moderately fast flowing stream.

Material examined. – GHANA: Volta Region: River Uwue south of Lipke Mate, 1♂, 6.xi.1995, at light, NUFU-project.

*Triaenodes ghana* Kimmins (figs. 22-25)


Diagnosis
The species shows similarities to *T. amma* n. sp. and *T. kimilus* Mosely from the Democratic Republic of the Congo, in having long, narrow preanal appendages, and lower part of tergum X as a strong, narrow, spine. However, *T. ghana* can easily be separated from the two by the groups of spine-like setae on the phallus. It further differs from *T. kimilus* in having a mesal basodorsal lobe of inferior appendage, which is forked medially. From *T. amma* it can also be separated by the lower part of tergum X being shorter and less curved, and by having a stout subquadragular inferior appendage with a triangular apicomalesomal lobe.

Redescription
Male (n=10). Forewing length 7.0-7.8, 7.4 mm; hind wing length 5.3-6.0, 5.5 mm. Eye 0.40-0.48, 0.43 mm wide. Antenna at least 22.9 mm long including 0.70-0.80, 0.75 mm long scape; scape with well developed scent organ and brush of yellowish-brown setae. Maxillary palp segment lengths (in mm): 0.55-0.63, 0.58; 0.55-0.63, 0.58; 0.63-0.73, 0.67; 0.31-0.37, 0.34; 0.73-0.88, 0.81. Colour in alcohol overall yellowish-brown.

Male genitalia (figs. 22-25). Abdominal segment IX with anterior margin rounded; tergum narrow; pleural region rounded, membranous, posterior margin with few seta; sternum triangular, strongly produced posteriorly, in ventral view with concave apical margin. Preanal appendage long, narrow, setose. Upper part of tergum X short, bilobed. Lower part of tergum X a strong, narrow, spine, curved ventrad; in dorsal view slightly sinuous, with tapering apex curved to the left. Inferior appendage stout, subquadragular, mesally excavated, with posterior triangular lobe curved mesad; apicomalesomal lobe triangular, apex rounded, with strong, spine-like setae mesally; mesal basodorsal process forked medially, ventral fork strongly curved ventrad, tapering, with two seta apically; dorsal fork narrowly ovate, with few, strong, curved seta, projecting caudad. Phallus curved, asymmetrical; with well developed dorsolateral flanges, flanges medially with group of strong, spine-like seta pointing caudad; subapically row of few strong, spine-like seta, apically with group of strong, spine-like seta pointing anteriad; phallotremal sclerite distinct.
Figs. 26-30. *Triaenodes palpalis* Banks, ♂ genitalia of holotype. – 26, Lateral; 27, dorsal; 28, ventral; 29, spermathecal sclerite, lateral; 30, spermathecal sclerite, ventral.
Distribution and habitat

The species was described from the Volta Region in Ghana by Kimmins (1957b), and was included in the check-lists from Ghana (Gibbs 1973, Kjærandsen & Andersen 1997). Jacqueumont (1961) recorded the species from Upemba National Park in the Democratic Republic of the Congo. The present paper adds records from Ivory Coast and Cameroon. In Ghana the species has been taken in the Western, Greater Accra, Volta, and Eastern Regions where it was encountered frequently both at rather fast flowing streams and at larger, more slowly flowing rivers.


_Triaenodes palpalis_ Banks (figs. 26-30)

_Triaenodes palpalis_ Banks 1920: 352. Type locality: CAMEROON: Ja River, Bitze; MCZ, sex not stated.


Diagnosis

The male is not known. However, character states of the female show that it is undoubtedly closely related to _T. proszynskii_, and should thus be placed in the subgenus _Triaenodella_. See _T. proszynskii_ for diagnosis.

Redescription

Female (n=1). – Forewing length 12.9 mm; hind wing length 11.2 mm. Eye 0.83 mm wide. Antenna broken, scape 0.97 mm. Maxillary palp segment I-IV lengths (in mm), segment V missing: 1.27, 1.38, 1.51, 0.79. Colour uniformly light yellowish-brown in pinned specimen.

Female genitalia (figs. 26-30). Abdominal segment VIII with sternum densely setose posteriorly; in ventral view with posterior corners rounded, medially broadly concave. Segment IX with tergum broad, with two pairs of papillose lobes, anterior pair small, triangular; posterior pair digitate, extending caudal beyond tip of tergum X; pleuron rounded, setose. Tergum X setose, with right angled dorsal corner and straight posterior margin; in ventral view with lower margin of anal opening with rounded, median projection, not visible in dorsal view. Lamellae setose, subrectangular with rounded posteroventral corners. Spermathecal sclerite in ventral view with posterior two third circular, with posteriorlateral, subtriangular projections and strongly sclerotized median structure, with two rounded lobes projecting anterad and triangular, pointed projections pointing dorsolateral; anterior one third narrowing, with weakly bilobed apex; in lateral view with dorsal part approximately one half of the length of ventral part.

Distribution

The species was described from Cameroon by Banks (1920). Gibbs (1973) recorded _T. palpalis_ from the Eastern Region in Ghana and mentioned that there are four females of the species from Njala in Sierra Leone in the collection at BMNH. We have examined one of these females from Ghana and two of the females from Sierra Leone and found that they all belong to _T. proszynskii_. We thus conclude that there are no reliable records of _T. palpalis_ except for the type material.

Material examined. – Holotype ♂, ‘Bitze, Ga River, Cameroons Oct Nov. [handwritten on white unbordered label]; Triaenodes palpalis Bks type [handwritten on pink, double-red-bordered label]; Type 10825 [printed / handwritten on dark red, unbordered label]; N. Banks. [printed on white, unbordered label].

_Triaenodes proszynskii_ (Marlier & Botosaneanu) (figs. 2, 31-41)

_Triaenodella proszynskii_ Marlier & Botosaneanu 1968: 13, figs. 8-9. Type locality: IVORY COAST (COTE D’IVOIRE): provenance d’Abidjan; INSMR; ♂


Diagnosis

_Triaenodes proszynskii_ and the female of _T. palpalis_ can be easily recognized among the Afrotropical _Triaenodes_ on their large size and the long maxillary palpi with dense, dark brown setae along dorsal and ventral margins. The male of _T. palpalis_ is not known, but based on features in the female it could be rather similar to the male of _T. proszynskii_. The females of the two species can be separated on the shape of the lamellae which are subovate with slightly concave ventral margins in _T. proszynskii_, while subrectangular with rounded posteroventral corners in _T. palpalis_, and of the spermathecal sclerite which in ventral view is hexagonal, with curved anterolateral lobes and rounded anterior apex in _T. proszynskii_, while in _T.
Figs. 31-36. *Triaenodes proszynskii* (Marlier & Botosaneanu). ♂ genitalia. – 31, Lateral; 32, dorsal; 33, ventral; 34, lower part of tergum X, dorsal; 35, left inferior appendage, caudal; 36, phallus, lateral.
Fig. 37-41. *Triaenodes proszynskii* (Marlier & Botosaneanu), ♀ genitalia. – 37, Lateral; 38, dorsal; 39, ventral; 40, spermathecal sclerite, lateral; 41, spermathecal sclerite, ventral.
Figs. 42-46. *Triaenodes serratus* Ulmer, ♂ genitalia. – 42, Lateral; 43, dorsal; 44, ventral; 45, phallus, left side lateral; 46, phallus, right side lateral.
palpalis the posterior two thirds is subcircular, with posterolateral, subtriangular projections and strongly sclerotized median structure, and with anterior one third narrowing, with weakly bilobed apex.

Redescription

Adults (male, female: n=10). – Forewing length 10.5-11.5, 10.9 mm (♀); hind wing length 8.5-9.6, 9.0 mm (♀); 8.3-9.8, 8.8 mm (♂). Eye 0.57-0.64, 0.61 mm wide (♀), 0.59-0.73, 0.65 mm wide (♂). Antenna at least 37 mm including scape 0.86-0.98, 0.93 mm long (♀); 35 mm including scape 0.76-0.94, 0.84 mm long (♂); male scapus with distinct scent organ and dense dark-brown brush (fig. 2). Maxillary palp segment lengths (in mm): 1.03-1.18, 1.11; 1.06-1.27, 1.14; 1.24-1.36, 1.30; 0.55-0.70; 0.66; 1.70-1.80, 1.73 (♀); 0.98-1.22, 1.08; 1.04-1.30, 1.21; 1.31-1.50, 1.39; 0.67-0.75, 0.71; 1.64-1.82, 1.69 (♂); both sexes with dense dark-brown setae along dorsal and ventral margins. Colour in alcohol overall dark greyish-brown.

Male genitalia (figs. 31-36). Abdominal segment IX with anterior margin slightly rounded; tergum narrow; pleural region bluntly triangular, setose; sternum triangular, strongly produced posteriorly, in ventral view with shallow v-shaped excision apically. Preanal appendage long, narrow, setose. Upper part of tergum X long, slender, pointed apically with short setae in apical one third; with pair of short, blunt, lateral projections at basal one quarter. Lower part of tergum X heavily sclerotized, slightly sinuous, split into two asymmetrical, spine-like processes two thirds from base; right process gradually tapering, curved slightly lateroventrad; left process bent ventrad subapically, with tapering apex projecting ventrolaterad. Inferior appendage stout, subtriangular, with short, spine-like setae apicomesally; mesal basodorsal process projecting posteroventrad; base prominent, forming heavily sclerotized bridge between left and right appendages; apically broadly triangular, slightly concave, with pair of tooth-like projections anteroventrally. Phallus slender, cylindrical, curved; with strong, tapering paramere ventrally; phallobasal sclerite u-shaped.

Female genitalia (figs. 37-41). Abdominal segment VIII with sternum setose posteriorly; in ventral view with posterior corners rounded, medially broadly concave. Segment IX with tergum broad, dorsally with short, rounded, median projection; with one pair of short, papillose lobes, not reaching tip of tergum X; pleuron broadly rounded, setose. Tergum X setose, with rounded dorsal corner; in ventral view with lower margin of anal opening broad, with rounded, lateral corners, weakly concave medially, clearly visible in dorsal view. Lamellae setose, subovate, with slightly concave ventral margin. Spermathecal sclerite in ventral view hexagonal, with curved anterolateral lobes and rounded anterior apex; in lateral view with dorsal part of approximately same length as ventral part.

Distribution and habitat

The type material includes one male from the Abidjan Region in the Ivory Coast and one male from Damongo Daboya in northern Ghana (Marlier & Botosaneanu 1968). Gibbs (1973) included the species in his check-list of Ghanaian Trichoptera based on the record given by Marlier & Botosaneanu (1968). Kjærandsen & Andersen (1997) gave a new regional record from Volta Region. The present paper adds records from the Eastern and Western Regions in Ghana.

Gibbs (1973) recorded two females of T. palpalis from Ghana. We have examined one of these females housed in BMNH and found that it belongs to T. prosynkii. Further Gibbs (1973) mentioned four females of T. palpalis from Njala in Sierra Leone. We have examined two of these females and found that they also belong to T. prosynkii.

Triaenodes prosynkii is thus taken in Ghana, Ivory Coast and Sierra Leone. In Ghana the species appears to be distributed mostly in the southern forested parts of the country where it has been trapped close to streams and moderately to fast flowing small rivers.


Triaenodes serratus Ulmer (figs. 42-50)

Triaenodes serratus Ulmer 1912: 110-111, fig. 38. Type locality: SUDAN: Schilluk-Issel, ZFMK, 8°.


Diagnosis

The species shows similarities to T. bifidus Jacquecart described from the Democratic Republic of the
Congo (Jacquemart 1966b), *T. falcatus* Kimmins from South Africa (Kimmins 1956), and *T. siculus* (Barnard) described from Namibia (Barnard 1934) in the shape of the lower part of tergum X, which is strongly sclerotized, with base projecting caudad and with strong, recurved spine-like process. But only in *T. siculus* does this process bear spines distally similar to those in *T. serratus*. However, the two species can apparently be separated on the length of the preanal appendages, which in *T. serratus* reaches well beyond the base of the lower part of tergum X, while in *T. siculus* it is shorter than the base of tergum X.

**Redescription**

Male (n=7-8). – Forewing length 7.0-7.3, 7.2 mm; hind wing length 5.2-5.6, 5.4 mm. Eye 0.39-0.47, 0.42 mm wide. Antenna at least 21.6 mm long, including 0.61-0.72, 0.69 mm long scape; scape with well developed scent organ and brush of yellowish-brown seta. Maxillary palp segment lengths (in mm): 0.47-0.58, 0.54; 0.50-0.61, 0.57; 0.60-0.66, 0.64; 0.35-0.39, 0.36; 0.68-0.84, 0.77. Colour in alcohol overall yellowish-brown.

Male genitalia (figs. 42-46). Abdominal segment IX with anterior margin broadly rounded; with tergum narrow, pleural region with posterior margin rounded, with small triangular projection medially bearing long setae; sternum subtriangular, produced posteriorly; in ventral view with rounded posterior corners and weakly convex posterior margin. Preanal appendage long, narrow, setose. Upper part of tergum X paired, very small, rounded lobes. Lower part of tergum X long, strongly sclerotized, base projecting caudad with strong, recurved spine-like process, projecting ventrad, with fine seta medially, spiny in distal one fourth, the number and shape of spines variable; in dorsal view with base narrowly triangular, with recurved spine-like projection often asymmetrically curved to the left. Inferior appendage with basal one half subquadriangular, posterodorsally with triangular, pointing projection, posterodorsal corner with short, thick spine-like seta mesally; mesal basodorsal process curved caudad, clavate, with ventral process narrowly triangular, slightly curved, pointing ventrad, with dorsal process rounded, projecting caudad, setose apically. Phallus large, curved, asymmetrical; with strong spine subbasally on right side; with large, rounded flange medially on left side; apex broad, trough-like with apical membranes and fine setae; phallotremal sclerite small.

**Remarks**

There is some variation in the number and size of the spines on the curved process of the lower part of tergum X (figs. 47-50). Some of the specimens from Ivory Coast have comparatively small and numerous spines, while the specimens from Zimbabwe had the inferior appendage more similar to that drawn by Kimmins (1957b: fig. 12A).

**Distribution and habitat**

The species was described from the Schilluk-Insel in Sudan by Ulmer (1912). The species was later recorded from Jinja in Uganda (Kimmins 1957b), and from...
Garamba National Park in the Democratic Republic of the Congo (Jacquemart 1966a). The present paper adds records from Ivory Coast, Ghana, Nigeria, Tanzania and Zimbabwe. In Ghana the species was taken at light close to medium sized to large moderately fast flowing rivers in the northern parts of the country.


Incertae sedis

The wing venation (figs. 3, 4) and scape with distinct scent organ and brush of seta (fig. 51), places the following species, *T. kwadwo* sp. n., in *Triaenodes*, but the species does not fit in any of the subgenera as defined by Yang & Morse (1993). The lack of an abbreviated basal plate and curved process of the inferior appendage should place the species in subgenus *breviata* with long, paired spines, but these species all have a phallic basal plate and curved process, and abbreviated basal plate with curved spine, and the phallus with two pairs of strong spines, renders the species distinct.

Diagnosis

The very simple male genitalia, lacking apicolobal lobe, lateral basodorsal process, mesal basodorsal process, and abbreviated basal plate with curved spine, and the phallus with two pairs of strong spines, renders the species distinct.

Description

Male. (n=8-9). – Forewing (fig. 3) length 5.4-6.1, 5.7 mm; hind wing (fig. 4) length 4.2-4.5, 4.3 mm. Eye 0.34-0.39, 0.36 mm wide. Antenna at least 17.5 mm long, including 0.68-0.77, 0.71 mm long scape; scape with well developed scent organ and brush of yellowish seta (fig. 51). Maxillary palp segment lengths (in mm): 0.43-0.45, 0.45; 0.48-0.56, 0.52; 0.47-0.56, 0.50; 0.29-0.34, 0.32; 0.53-0.60, 0.57. Colour in alcohol overall yellowish-brown.

Male genitalia (figs. 52-55). Abdominal segment IX with anterior margin straight; tergum narrow; pleural region rounded, setose; sternum broadly triangular, in ventral view posterior margin with rounded corners, shallowly v-shaped excavation mesally. Preanal appendage short, rounded, setose. Upper part of tergum X short, broad, setose, with small, rounded lobes basolaterally. Lower part of tergum X triangular in lateral view, with ventral margin concave; in dorsal view split to base, projections curved laterad apically. Inferior appendage long, narrow, tapering, apex pointed, weakly curved mesad; with low dorsomedian crest; with broad, triangular basal projection, bearing strong, spine-like setae. Phallos broad in basal two thirds; with sclerotized phallothelial sclerite dorsolaterally; with two pairs of tapering spines medially, dorsolateral pair curved, with apex pointing ventromesad; dorsomesal pair straight, pointing caudad; distal part weakly curved, through-shaped, with broadly rounded apex.

Distribution and habitat

The species is known from the Western, Eastern and Volta Regions in Ghana, where it has been taken in light traps close to streams and small rather fast flowing rivers.
Figs. 52-55. *Triaenodes kwadvoe* sp. n., ♂ genitalia. – 52, Lateral; 53, dorsal; 54, ventral; 55, phallus, lateral.
ACKNOWLEDGMENTS

We are indebted to Dr. P. Perkins, Museum of Comparative Zoology, Harvard University, Cambridge, for the loan of type material of *Triaenodes palpalis*, to Dr. P. Barnard, The Natural History Museum, London, for the loan of material of *T. prosonkii* from Ghana and Sierra Leone, and to Dr. O. S. Flint Jr., National Museum of Natural History, Washington, for loan of West African *Triaenodes* material.

The project in Ghana was funded by The Norwegian Universities’ Committee for Development Research and Education (NUFU). Thanks are due to the Ghana Wildlife Department for permission to collect in the Ankasa Game Production Reserve and Kakum Forest Reserve, and to J. S. Amakye and the staff at the Institute of Aquatic Biology, CSIR, Achimota, Ghana, for field assistance. We also want to thank J. Kjærandsen, University of Bergen, Norway, who participated during most of the field work and who sorted out and identified parts of the material. The article was written while the senior author was on sabbatical at the Department of Entomology, University of Minnesota.

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Received: 15 May 2001
Accepted: 5 June 2001