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# Water mites from West Africa (Acari: Hydrachnidia)

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## Original research

### ABSTRACT

Abstract. Ten new species of water mites are described from Ghana, i.e. *Limnesia* (*Limnesia*) *stagnalis* n. sp. (Limnesiidae), *Hygrobatopsis* (?) *convexipalpis* n. sp., *Hygrobatopsis* (*Hygrobatopsis*) *pauciglandulosa* n. sp., *Hygrobatopsis* (*Hygrobatopsis*) *dentipalpis* n. sp., *Hygrobatopsis* (*Hygrobatopsis*) *pseudoniloticus* n. sp. (Hygrobatidae), *Neumania* (*Soarella*) *fusiformis* n. sp., *Neumania* (*Soarella*) *ghanaensis* n. sp., *Unionicola* *heversi* n. sp. (Unionicolidae), *Arrenurus* (*Megaluracarus*) *chutteri ankasa* n. sp. and *Arrenurus* (*Micruracarus*) *circulodorsalis* n. sp. (Arrenuridae). Three subspecies are raised to full species, i.e. *Mamersa expansa* Cook, 1979 nov. stat. (Hydryphantidae), *H. coriaceus* (Lundblad, 1952) nov. stat. (Hygrobatidae) and *Nyangalla* (*Ecpolopella*) *acuticaudata* K. Viets, 1916 nov. stat. (Unionicolidae). *Ecpolus dorsofenestratus* Lundblad, 1949 is synonymized with *Neumania* (*Alloneumania*) *marginata* (K. Viets, 1916). The adults of *Hygrobatopsis* (*Hygrobatopsella*) *inflatus* (K. Viets, 1925), a species known thus far as deutonymph only, the females of *Tubophora limnesioides* Walter, 1935, *Hygrobatopsis niloticus* Walter, 1922, *Arrenurus* (*Megaluracarus*) *geniculatus* Koenike 1898 and *Momonides ghanaensis* Smit, 2012, and the male of *Piona damasiella* Cook, 1966 are described for the first time. Many new records are presented for Ghana and the Gambia.

**Keywords** Ghana; the Gambia; systematics; new species; new records

**Zoobank** <http://zoobank.org/96CFD924-75DE-4BCE-81B7-E5D35AAD1920>

## Introduction

Research on water mites from Western Africa started at the beginning of the 20th century with a series of publications of Karl Viets (1911, 1912, 1913/1914, 1916, 1925). All the papers of Viets were dealing with water mites from Cameroon. Cook (1966) published one of the most comprehensive studies with the water mites from Liberia. A review on all African papers on water was given by K. Viets (1953) and K.O. Viets (1970). Since then, relative few papers have been published on the water mites from West Africa (see Table 1). A number of publications are dealing with a wider range in Africa but include material from West Africa (Table 2).

This paper deals with water mites from Ghana and the Gambia not treated in any of the papers from Table 1 or 2. Not included are most specimens of the genera *Eylais* Latreille (current state of knowledge of the genus insufficient) and *Hydrodroma*, *Atractides* and *Torrenticolidae* (these will be published in separate papers). Despite a long history in the study of water mites from West Africa, our knowledge is still poor. The aim of this study is, therefore, to increase the knowledge of water mites from West Africa.

## Material and methods

The material described in this paper has been collected in 1998 (the Gambia), 2011 and 2013 (Ghana). All material from this study is collected by the author, unless stated otherwise.

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Holotypes, paratypes and all non-type material will be lodged in Naturalis Biodiversity Center, Leiden (RMNH). The following abbreviations are used: a.s.l. – altitude above sea level; Cx-I–IV – first to fourth coxae; Cxgl-1-42 – coxoglandularia 1–4; Dgl-1–4 – dorsoglandularia 1–4; IV-leg-6 – sixth segment of fourth leg; L – length; NHRS – Swedish Museum of Natural History, Stockholm; NP – National Park; suture line Cx-III/IV – suture line between third and fourth coxae; P1–5 – palp segments 1–5; SMF – Senckenberg Museum, Frankfurt a. Main; Vgl-1-3 – ventroglandularia 1-3. All measurements are in  $\mu\text{m}$ , measurements of palp and leg segments are of the dorsal margins, measurements of paratypes are given in parentheses. Ventral length is measured from the tip of Cx-I till posterior idiosoma margin. Numbers are given as male/female/deutonymph or adult/deutonymph. All coordinates are taken with a GPS. Coordinates given as degrees, minutes and seconds are taken from Google Earth and are by approximation. Data on the world distribution are taken from Smit (2020).

**Table 1** References after 1986 dealing with West African water mites.

Reference	Country(ies) in W Africa	Taxa
Green et al (1974)	Cameroon	<i>Arrenurus</i> Dugès, 1834
Cook (1979)	Ghana, Nigeria, Uganda	all
Smit (1994)	Cameroon, the Gambia	all
Gledhill (2003)	Nigeria	<i>Dockovdia</i> Gledhill, 2003
Gledhill & Vidrine (2002)	Nigeria	<i>Unionicola</i> Haldeman, 1842
Gledhill & Agbolade (2006)	Nigeria	<i>Dockovdia</i> Gledhill, 2003
Hevers (2010)	Ivory Coast	<i>Unionicola</i> Haldeman, 1842
Smit (2012a,b)	Ghana	<i>Momonides</i> Lundblad, 1941, Arrenuridae Thor
Pešić & Smit (2014)	Ghana	Torrenticolidae Piersig
Pešić & Smit (2015)	Ghana	<i>Atractides</i> Koch, 1837
Smit (2014)	Ghana	<i>Kawamuracarus</i> Uchida, 1937; <i>Bharatohydracarus</i> Cook, 1967
Smit (2016)	Ghana	Aturidae Thor

**Table 2** References dealing with a wide area in Africa which include material from West Africa.

Reference	Country(ies) in W Africa	Taxa
Gerecke (2004)	Cameroon	<i>Diplodontus</i> Dugès, 1834
Gerecke (2006)	Cameroon	Harpagopalpidae K. Viets
Gerecke (2009)	Cameroon, Liberia	<i>Thoracophoracarus</i> K. Viets, 1914
Gerecke (2017)	Cameroon, Liberia	<i>Hydrodroma</i> Koch, 1837
Pešić et al. (2013)	Cameroon, Ghana	Mideopsidae Koenike
Smit (2012b)	Ghana	Arrenuridae Thor

## Taxonomy

### Family Eylaidae Leach

#### Genus *Eylais* Latreille, 1796

##### *Eylais degenerata* Koenike, 1897

New record. **The Gambia**. 0/0/1, pond ± 5 km W of Basse, along road Basse-Bansang, Upper River Division, 12 Feb. 1998.

Distribution. A widespread species, known from Europe, Asia and Africa.

### Family Limnocharidae Grube

#### Subfamily Limnocharinae Grube

#### Genus *Limnochares* Latreille, 1796

##### *Limnochares (Limnochares) expansipalpis* Cook, 1966

New record. **Ghana**. 1/0/0, Apkonu stream, downstream of falls, Logba Tota, 6°53.054' N 0°28.024' E, 362 m a.s.l., 21 Feb. 2013.

Distribution. Liberia (Cook 1966), Ghana (this study).

### Family Hydrachnidae Leach

#### Genus *Hydrachna* Müller, 1776

##### *Hydrachna mirifica* (Koenike, 1893)

New records. **Ghana**. 1/0/0, lake near Mankessim, 5°16'3.93" N 1°0'11.74" W, 3 Jan. 2010, leg. P. Wondergem; 1/0/2, Lake Kokrobite, Weija, 5°33'7.90" N 0°22'34.69" W, 7 Jan. 2010, leg. P. Wondergem; 2/1/2, drinking water reservoir, W of Accra, 5°33.133' N 0°22.147' W, 14 m a.s.l., 21 Feb. 2011; 2/1/1, Inlet Volta River at Kpong, 6°09.183' N 0° 03.709' E, 25 m a.s.l., 10 Mar. 2011; 1/5/5, Fist pond, Ankasa NP, 5°17.415' N 2°38.384' W, 89 m a.s.l., 14 Feb. 2013; 2/1/2, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara.

##### *Hydrachna spinosa* Koenike, 1893

New records. **Ghana**. 1/1/0, Fish pond along road Elubo-Axim, E of entrance Ankasa NP, 5°09.637' N 2°38.682' W, 36 m a.s.l., 27 Feb. 2011.

Remarks. From Niger *H. spinosa subtilis* Walter, 1931 has been reported (Walter 1935). I follow Lundblad (1969), who synonymized this subspecies with the nominate taxon.

Distribution. Widespread in Africa south of the Sahara.

##### *Hydrachna tchadensis* Smit, 1994

New records. **The Gambia**. 1/0/0, pond ± 5 km W of Basse, along road Basse-Bansang, Upper River Division, 12 Feb. 1998.

Distribution. Cameroon (Smit 1994), the Gambia (this study).

### Family Hydryphantidae Piersig

#### Subfamily Diplodontinae K. Viets

#### Genus *Diplodontus* Dugès, 1834

A widespread genus, with several species known from Europe, Asia, Africa and Australia.

**Diplodontus schaubi (Koenike, 1893)**

New records. **Ghana.** 0/2/2/, pool Damango, 9°03.983' N 1°48.419' W, 185 m a.s.l., 4 Mar. 2011; 1/0/0, pool Nsu Appiah, near Kakum NP, 5°22.895' N 1°25.012' W, 159 m a.s.l., 12 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara.

**Subfamily Hydryphantinae Piersig**

**Hydryphantes (Polyhydryphantes) incertus Koenike, 1893**

New records. **Ghana.** 1/0/1, pool 1 Ankasa NP, 5°17.407' N 2°38.378' W, 59 m a.s.l., 26 Feb. 2011; 0/1/0, Amansuri Wetland, 5°00.398' N 2°35.162' W, 12 m a.s.l., 26 Feb. 2011; 1/0/0, Fish pond along road Elubo-Axim, E of entrance Ankasa NP, 5°09.637' N 2°38.682' W, 36 m a.s.l., 27 Feb. 2011; 0/1/1, pool Damango, 9°03.983' N 1°48.419' W, 185 m a.s.l., 4 Mar. 2011; 1/0/0, Lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013; 3/11/2, pool Nsu Appiah, near Kakum NP, 5°22.895' N 1°25.012' W, 159 m a.s.l., 12 Feb. 2013; 0/1/1, First pond Ankasa NP, 5°17.415' N 2°38.384' W, 89 m a.s.l., 14 Feb. 2013; 0/1/0, Second pond Ankasa NP, 5°17.424' N 2°38.286' W, 58 m a.s.l., 14 Feb. 2013; 1/0/0, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013; 1/2/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara.

**Subfamily Mamersinae K. Viets**

**Genus Mamersa Koenike, 1898**

A genus with several species known from the Afrotropical, Oriental and Australasian regions.

**Mamersa expansa Cook, 1979 – nov. stat.**

New records. **Ghana.** 1/1/0, lake near Mankessim, 5°16'3.93" N 1°0'11.74" W, 3 Jan. 2010, leg. P. Wondergem; 3/1/2, roadside pool along road Axim-Elubo, 4°58.162' N 2°24.815' W, 9 m a.s.l., 25 Feb. 2011; 3/1/0, Amansuri Wetland, 5°00.398' N 2°35.162' W, 12 m a.s.l., 26 Feb. 2011; 4/2/0, shallow part Amansuri Wetland, 4°59.635' N 2°35.417' W, 26 Feb. 2011; 1/0/0, First pond, Ankasa NP, 5°17.415' N 2°38.384' W, 89 m a.s.l., 14 Feb. 2013; 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Remarks. Cook (1979) described this taxon as a subspecies of *M. testudinata* Koenike, 1898. Now the nominate taxon and its subspecies have been found on the same locality, they cannot belong to the same species. Moreover, the differences between the two taxa are quite large. Cook (1979) mentioned already the separation of Cxgl-1 and -2 by the genital plates. *Mamersa expansa* is much longer than *M. testudinata* and the genital plates are much longer (see Table 1). Consequently, the number of acetabula is much larger in *M. expansa*.

For differences between males and females see under *M. testudinata*.

Distribution. Uganda (Cook 1979), Ghana (this study).

**Table 3** Measurements of the dorsal shield and genital plate of *Mamersa expansa* and *M. testudinata*.

Species	Sex	Length of dorsal shield	Length of genital plate	Reference
<i>Mamersa expansa</i>	Males	1064-1200	334-395	Cook 1979
	Females	1261-1337	380-410	
<i>Mamersa testudinata</i>	Males	608-713	160-192	This study
	Females	680-859	211-227	

## ***Mamersa testudinata* Koenike, 1898**

New records. **Ghana.** 1/0/0, lake near Mankessim, 5°16'3.93" N 1°0'11.74" W, 3 Jan. 2010, leg. P. Wondergem; 3/1/0, pool 2 Ankasa NP, 5°17.250' N 2°38.092' W, 66 m a.s.l., 27 Feb. 2011; 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 10 Mar. 2011; 1/0/0, Second pond, Ankasa NP, 5°17.424' N 2°38.286' W, 58 m a.s.l., 14 Feb. 2013; 0/0/1, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013; 2/6/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Remarks. Females have a wider pre-genital sclerite than males, in the latter the pre-genital sclerite is more triangular. Moreover, the genital plates have a short anteromedial extension in the females, which is absent in the males.

Distribution. Widespread in Africa south of the Sahara.

## **Family Lebertiidae Thor**

### **Genus *Lebertia* Neuman, 1880**

A genus with numerous species known, but from the Afrotropical region only two species have been described, one from South Africa and one from Liberia (Cook 1966).

### ***Lebertia (Lebertia) liberiensis* Cook, 1966**

(Figure 1)

New record. **Ghana.** 4/2/3, Supon stream near Asiakwa, Atewa Hills, 6°15.530' N 0°30.642' W, 250 m a.s.l., 7 Mar. 2011.

Remarks. Cook (1966) illustrated the female only, but the male is more characteristic with the long setae on the posterior part of the genital flaps (Figure 1). This species has many swimming setae, also on II-leg-5 (one). III-leg-5 has up to seven swimming setae. The integument is lineated.

Distribution. Liberia (Cook 1966), Ghana (this study).

## **Family Oxidae K. Viets**

### **Genus *Africoxus* Cook, 1966**

#### ***Africoxus (Africoxus) curvisetus* (K. Viets, 1916)**

New record. **The Gambia.** 1/0, small pond Kampanti, Western Division, 7 Feb. 1998.

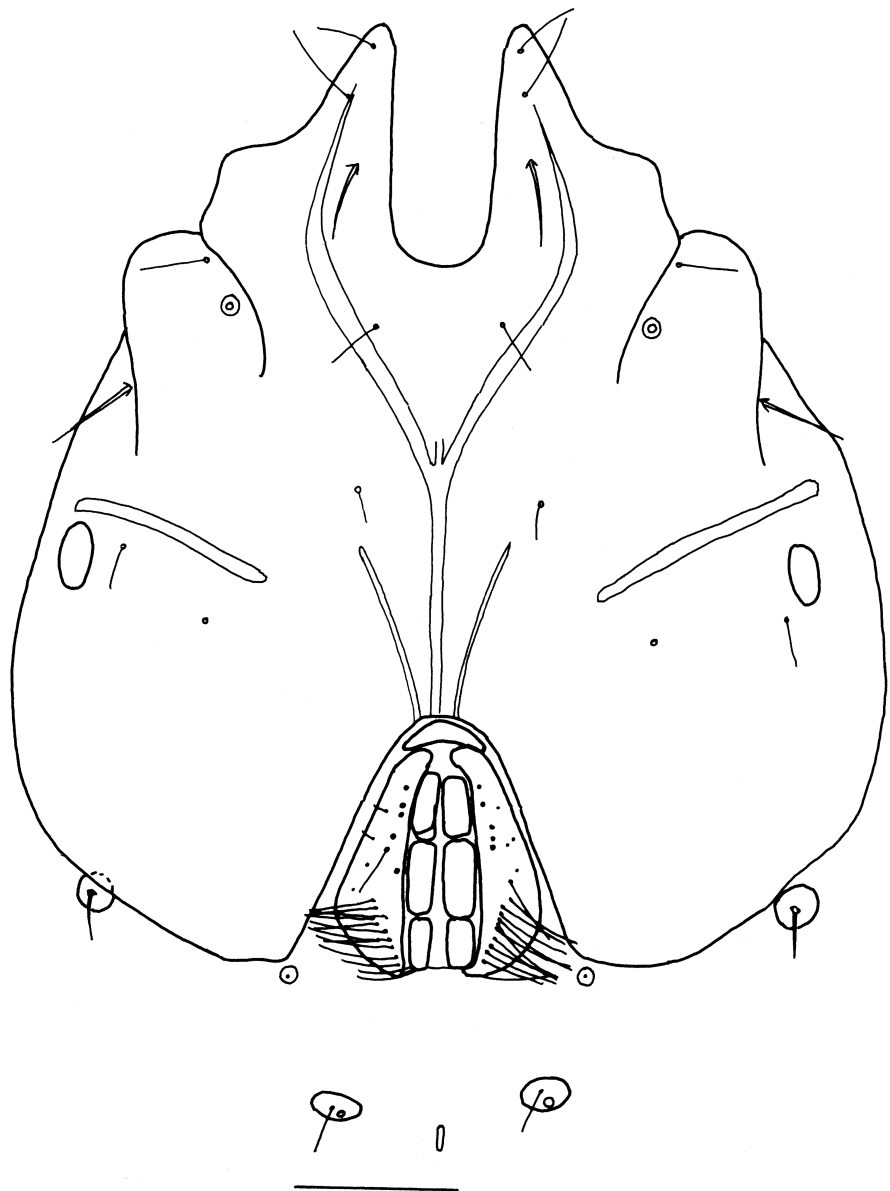
Distribution. Cameroon (K. Viets 1916), Liberia (Cook 1966), Ethiopia (Lundblad 1942), Congo (Lundblad 1949), Kenya (Lundblad 1952), the Gambia (this study).

### **Genus *Oxus* Kramer, 1877**

#### ***Oxus (Oxus) stuhlmanni* (Koenike, 1895)**

New record. **Ghana.** 1/0, pool Axim Beach Hotel, Axim, 4°51.405' N 2°14.103' W, 25 Feb. 2011; 2/0, roadside pool along road Axim-Elubo, 4°58.162' N 2°24.815' W, 9 m a.s.l., 25 Feb. 2011; 1/0, shallow roadside pond along road Axim-Elubo, 5°09.080' N 2°37.354' W, 46 m a.s.l., 27 Feb. 2011; 1/0, roadside pond W of entrance to Ankasa NP, 5°10.277' N 2°39.357' W, 37 m a.s.l., 14 Feb. 2013; 1/0, Second pond, Ankasa NP, 5°17.424' N 2°38.286' W, 58 m a.s.l., 14 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara.



**Figure 1** *Lebertia (Lebertia) liberiensis* Cook, venter male. Scale bar: 100  $\mu$ m.

**Family Limnesiidae Thor**

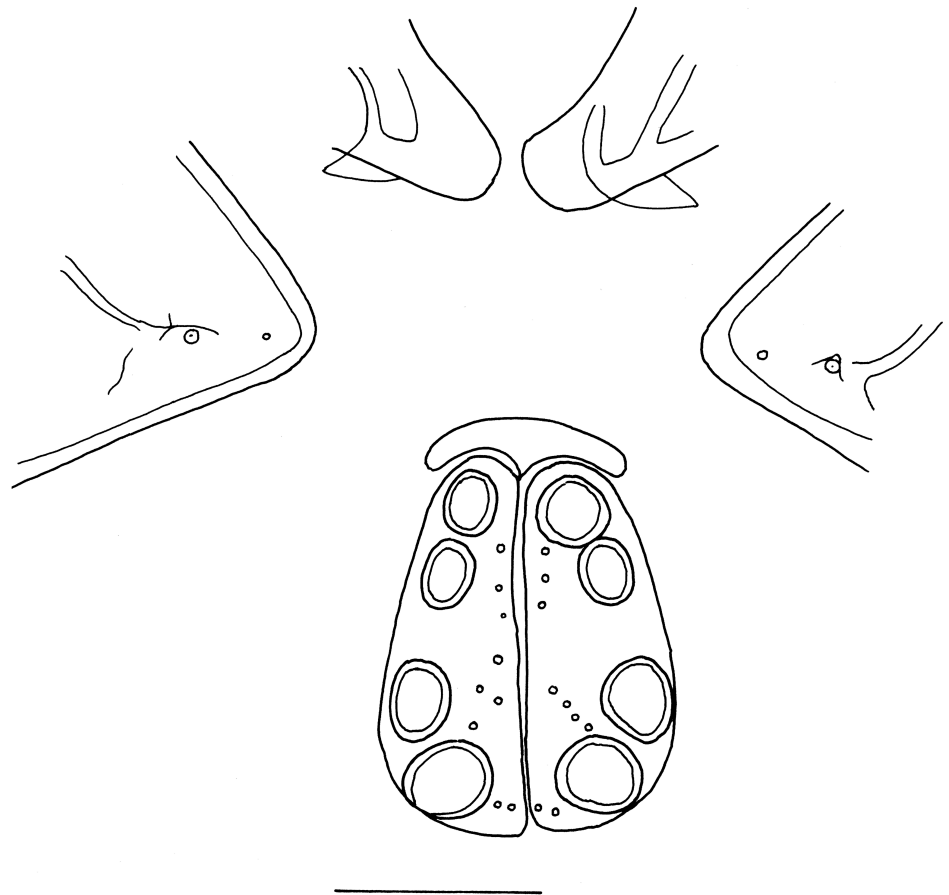
**Subfamily Limnesiinae Thor**

**Genus *Limnesia* Koch, 1836**

***Limnesia (Limnesia) longidens magnipora* Cook, 1966**

New records. **Ghana.** 2/3/2, Pool 1 Ankasa NP, 5°17.407' N 2°38.378' W, 59 m a.s.l., 26 Feb. 2011; 1/2/2, First pond, Ankasa NP, 5°17.415' N 2°38.384' W, 89 m a.s.l., 14 Feb. 2013.

Remarks. In all but one aspects similar to the description given by Cook (1966). The posterodorsal platelet of the males of this study has a straight anterior margin instead of a



**Figure 2** *Limnesia (Limnesia) monodi* Walter, genital field region female, Avu lagoon. Scale bar: 100  $\mu$ m.

rounded anterior margin.

Distribution. Liberia (Cook 1966), Congo (K.O. Viets 1973), Ghana (this study).

***Limnesia (Limnesia) maglioi* Cook, 1966**

New records. **Ghana.** 1/1/0, roadside pool along road Axim-Elubo, 4°58.162' N 2°24.815' W, 9 m a.s.l., 25 Feb. 2011.

Remarks. See under *L. monodi*.

Distribution. Liberia (Cook 1966), Ghana (Cook 1979, this study).

***Limnesia (Limnesia) monodi* Walter, 1946**

(Figure 2)

New records. **The Gambia.** 1/1/1, pond Chamois Bridge, Basse, Upper River Division, 11 Feb. 1998; 8/2/1, pool along Prufu Bolon stream, Basse, Upper River Division, 12 Feb. 1998. **Ghana.** 0/1/0, Lake Agbo near Dahwenya, 5°46'44.80" N 0°3'4.36" E, 27 Dec. 2009, leg. P. Wondergem; 2/15/2, Black Volta River at Buipe, 8°45.674' N 1°27.320' W, 76 m a.s.l., 6 Mar. 2011; 0/5/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 10 Mar. 2011; 0/8/0, Lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013; 13/19/0, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013; 0/3/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.



Remarks. The male matches the description of Walter (1946) and Lundblad (1949), but almost all female specimens have the Cx-I separated (Figure 2), unlike the descriptions of the latter authors. In a few females of this study Cx-I are near-fused. Lundblad (1949) described the subspecies *L. monodi processifera* with Cx-I separated, but this subspecies has smaller acetabula. Other subspecies have Cx-I fused, or the female is unknown. For the time being I assigned the specimens from this study to the nominate taxon.

Males of *L. maglioi* and *L. monodi* are easy to separate in the large (*monodi*) or small (*maglioi*) ventral extension of P4, but females of *L. monodi* with Cx-I separated are very similar to *L. maglioi*. The only differences are the more slender palp of *maglioi*, and possibly Cxgl-4 are closer to the associated seta in *maglioi*.

Distribution. Widespread in Africa south of the Sahara.

### ***Limnesia (Limnesia) paracampanulata* Cook, 1966**

New records. **Ghana.** 4/0/0, Ankasa River, Ankasa NP, 5°13.011' N 2°39.126' W, 60 m a.s.l., 13 Feb. 2013; 16/5/0, Ankasa Exploration Base trail stream, Ankasa NP, 5°16.415' N 2°38.751' W, 80 m a.s.l., 14 Feb. 2013; 2/2/0, Ankasa Exploration Base trail stream, upstream, Ankasa NP, 5°16.376' N 2°38.655' W, 94 m a.s.l., 14 Feb. 2013; 3/0/0, Amedzofe Falls, 6°50.656' N 0°26.868' E, 599 m a.s.l., 20 Feb. 2013.

Distribution. Liberia (Cook 1966), the Gambia (Smit 1994), Ghana (this study).

### ***Limnesia (Limnesia) stagnalis* n. sp.**

Zoobank: [F7999793-634A-42EF-B557-906500A8FF83](https://doi.org/10.24349/5d6U-DX5N)

(Figure 3A-D)

**Material examined.** Holotype male, shallow part Amansuri wetland, Ghana, 4°59.635' N 2°35.417' W, 26 Feb. 2011 (RMNH). Paratypes: one male, one female [young], Amansuri wetland, Ghana, 5°00.398' N 2°35.162' W, 12 m a.s.l., 26 Feb. 2011 (RMNH).

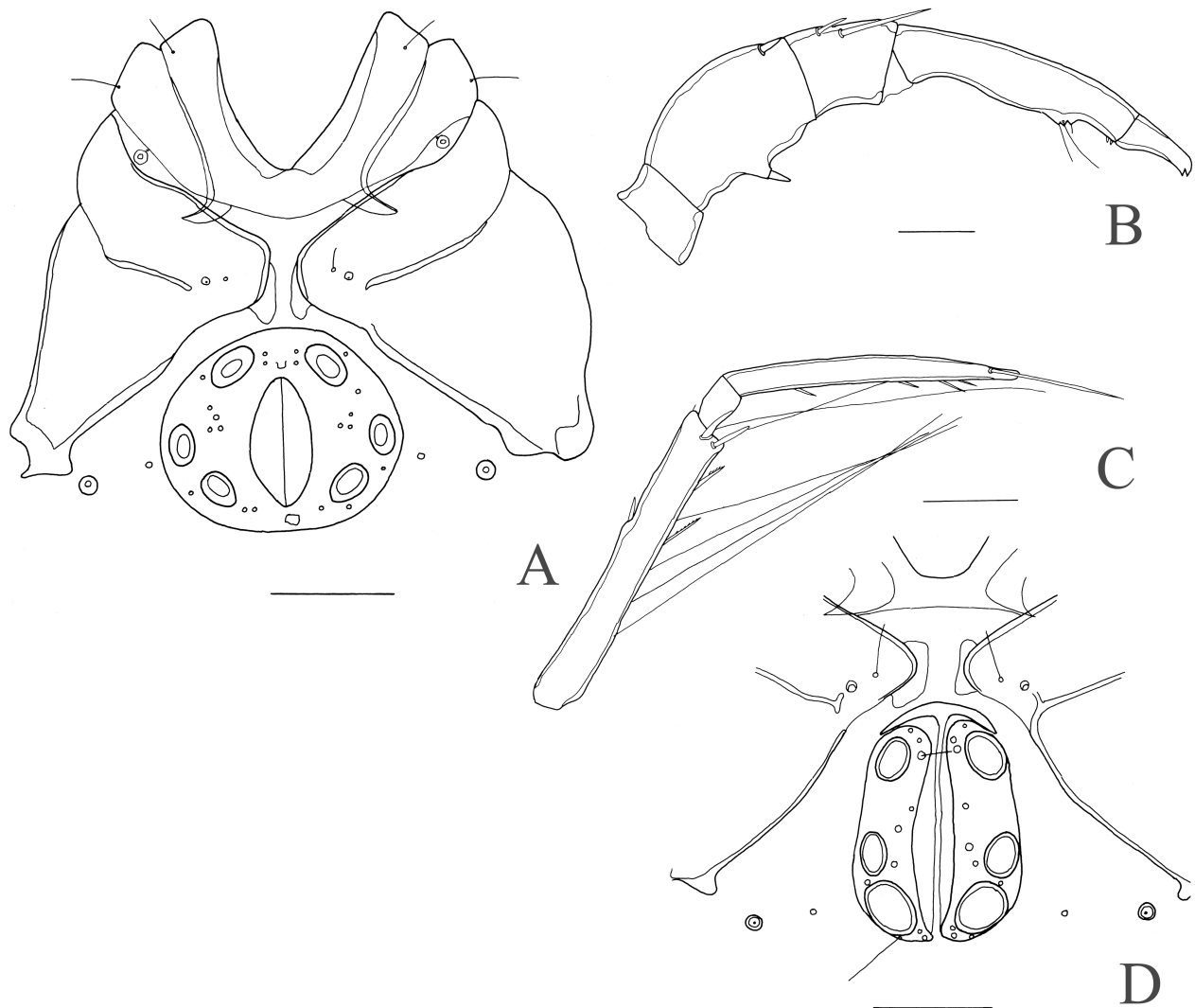
**Diagnosis.** P2 ventrally with a setal tubercle, seta longer than tubercle; Cx-I fused medially, Cxgl-4 close to accompanying seta.

**Description.** Male: Integument smooth. Idiosoma dorsally 583 (632) long and 510 (575) wide, ventrally 616 (656) long. Dorsum posteriorly with a pair of small platelets, 30 and 36 long, respectively. Cx-I fused medially, apodemes of anterior coxae short. Cx-III + IV medially with a short secondary sclerotization. Cxgl-4 located close to accompanying seta (Figure 3A). Genital field with three pairs of acetabula, 160 long and 186 wide; gonopore 106 long. Second and third pair of acetabula closer to each other than to first pair. Length of P1–5: 26, 105, 72, 160, 44. P2 ventrally with a setal tubercle, and a seta directed anteriorly, this seta longer than the setal tubercle. P4 ventral margin undulating, with 2+1 setal tubercles (Figure 3B). Length of I-leg-4–6: 104, 122, 118. Length of IV-leg-4–6: 172, 176, 172; length of terminal seta 73; IV-leg-6 geniculated (Figure 4C), but not in the paratype. Swimming setae: III-leg-5 five, IV-leg-4 four or five, IV-leg-5 six. Excretory pore not sclerotized.

Female: Idiosoma dorsally 583 long and 130 wide, ventrally 624 long. Coxae as in male. Genital field 200 long, pregenital sclerite 102 wide. Genital field with three pairs of acetabula, second and third pair closer to each other than to first pair (Figure 3D). Length of P1-5: 28, 122, 96, 208, 55. Palp as in male. Length of I-leg-4-6: 114, 134, 112. Length of IV-leg-4-6: 211, 227, 219; terminal seta of IV-leg-6 78 long. Swimming setae: III-leg-6 six, IV-leg-4 five, IV-leg-5 seven. Excretory pore not sclerotized.

**Etymology.** Named for its occurrence in a wetland.

**Remarks.** The new species is close to *L. lacustris* K.O. Viets, 1973 from Kivu Lake, Congo. It differs in the following characters (in parentheses *L. lacustris*): Cxgl-4 close to accompanying seta (widely separated), genital field of male rounded (with an indistinct to distinct posterior extension), seta of P2 longer than setal tubercle (about as long as setal tubercle). Moreover, the palp of the new species is much longer, e.g., P4 of the male measures 160 in the new species



**Figure 3** *Limnesia (Limnesia) stagnalis* n. sp., A-C holotype male, D paratype female. A – venter; B – palp; C – IV-leg-5-6; D – genital field region. Scale bars: A, D 100 =  $\mu\text{m}$ , B-C = 50  $\mu\text{m}$ .

and 100-110 in *lacustris* (K.O. Viets 1973). The new species has the fourth leg with more swimming setae than in *lacustris*.

***Limnesia (Limnesia) walteri* Migot, 1926**

New records. **Ghana.** 1/0/0, Kue River, Kyabobo NP, 8°31.087' N 0°36.049' E, 208 m a.s.l., 25 Feb. 2013.

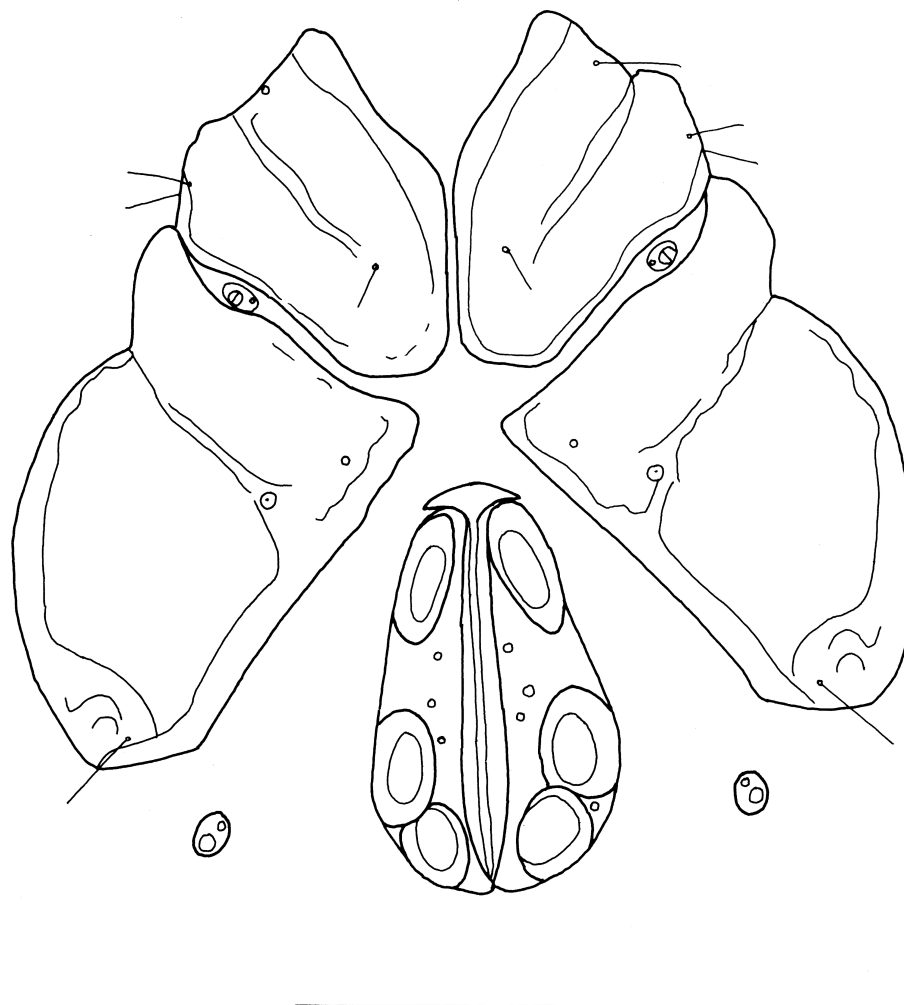
Distribution. Mediterranean countries, Mauretania (Walter 1946), Kenya (Lundblad 1942), South Africa (K.O. Viets 1964), Togo (Bader 1981), Ghana (this study).

**Genus *Tubophora* Walter, 1935**

A genus with two species known from the Afrotropical region.

***Tubophora limnesioides* Walter, 1935**

(Figure 4)



**Figure 4** *Tubophora limnesioides* Walter, venter female. Scale bar: 100  $\mu$ m.

New records. **Ghana.** 1/0/0, small rainforest stream upstream Sagyimase, Atewa Hills, 6°13.964' N 0°33.116' W, 654 m a.s.l., 8 Mar. 2011; 2/3/0, Apkonu stream, downstream of falls, at Logba Tota, 6°53.054' N 0°28.024' E, 362 m a.s.l., 21 Feb. 2013.

Description. Female: Idiosoma dorsally 616 long and 478 wide, ventrally 632 long. Gnathosoma attached to a protrusable tube. Cx-I+II medially separated. Cx-III medially bluntly pointed, Cxgl-4 well separated from associated seta (Figure 4). Genital field 158 long, with three pairs of acetabula, second and third pair closer to each other than to first pair. Length of P1–5: 24, 52, 48, 72, 38. Length of I-leg-4–6: 96, 96, 80. Length of IV-leg-4–6: -, 116, 136; terminal seta of IV-leg-6 66 long. Legs without swimming setae.

Remarks. Thus far, known only from the male holotype, and the female is described here for the first time.

Distribution. Ivory Coast (Walter 1935), Ghana (this study).

**Family Sperchontidae Thor****Genus *Sperchon* Kramer, 1877*****Sperchon (Hispidosperchon) biscutatus* Lundblad, 1941**

New records. **Ghana.** 1/0/1, Tagbo River downstream of falls, 7°00.708' N 0°34.326' E, 394 m a.s.l., 23 Feb. 2013; 0/1/0, Kue River, Kyabobo NP, 8°31.087' N 0°36.049' E, 208 m a.s.l., 25 Feb. 2013.

Distribution. Kenya (Lundblad 1952), South Africa (K.O. Viets 1964), Congo (K.O. Viets & Böttger (1974), Ghana (this study).

***Sperchon (Hispidosperchon) mutatus* K.O. Viets, 1981**

New records. **Ghana.** 9/12/2, Apkonu stream, downstream of falls, at Logba Tota, 6°53.054' N 0°28.024' E, 362 m a.s.l., 21 Feb. 2013; 0/1/0, Agumatsa River at first bridge, Agumatsa Wildlife Sanctuary, 7°06.830' N 0°35.760' E, 253 m a.s.l., 22 Feb. 2013; 1/0/0, Tagbo River, downstream, 7°00.974' N 0°33.471' E, 255 m a.s.l., 23 Feb. 2013; 0/1/0, Laboun River downstream of falls, Kyabobo NP, 8°19.836' N 0°35.487' E, 342 m a.s.l., 24 Feb. 2013.

Remarks. The male from Tagbo River, downstream is intermediate between the two species. Palp and venter are as described for *S. mutatus*. The dorsum, however, lacks the ornamentation of *mutatus* and is similar to *biscutatus*. A hybrid form?

Distribution. South Afrika (K.O. Viets 1981), Ghana (this study).

**Family Hygrobatidae Koch****Genus *Atractides* Koch, 1837*****Atractides (Atractides) vietsi* (Cook, 1966)**

(Figure 5A-E)

New record. **Ghana.** 0/1 [palp + I-leg-5–6 mounted]/0, small rainforest stream upstream Sagyimase, Atewa Hills, 6°13.964' N 0°33.116' W, 654 m a.s.l., 8 Mar. 2011.

Material for comparison. *Atractides rectipes* (K. Viets, 1924), holotype male, Müke-Fluß, Kamerun, 15 Jan. 1916 (slide 45938, SMF). *Atractides vietsi* (Cook, 1966), paratype male, stream at Bridge No 19 on Bomi Hills Road, Liberia, 23 Jan. 1957 (sign. 36, leg. Cook) (slide 53005, SMF; paratype female, stream at Bridge No 19 on Bomi Hills Road, Liberia, 23 Jan. 1957 (sign. 36, leg. Cook) (slide 53006, SMF).

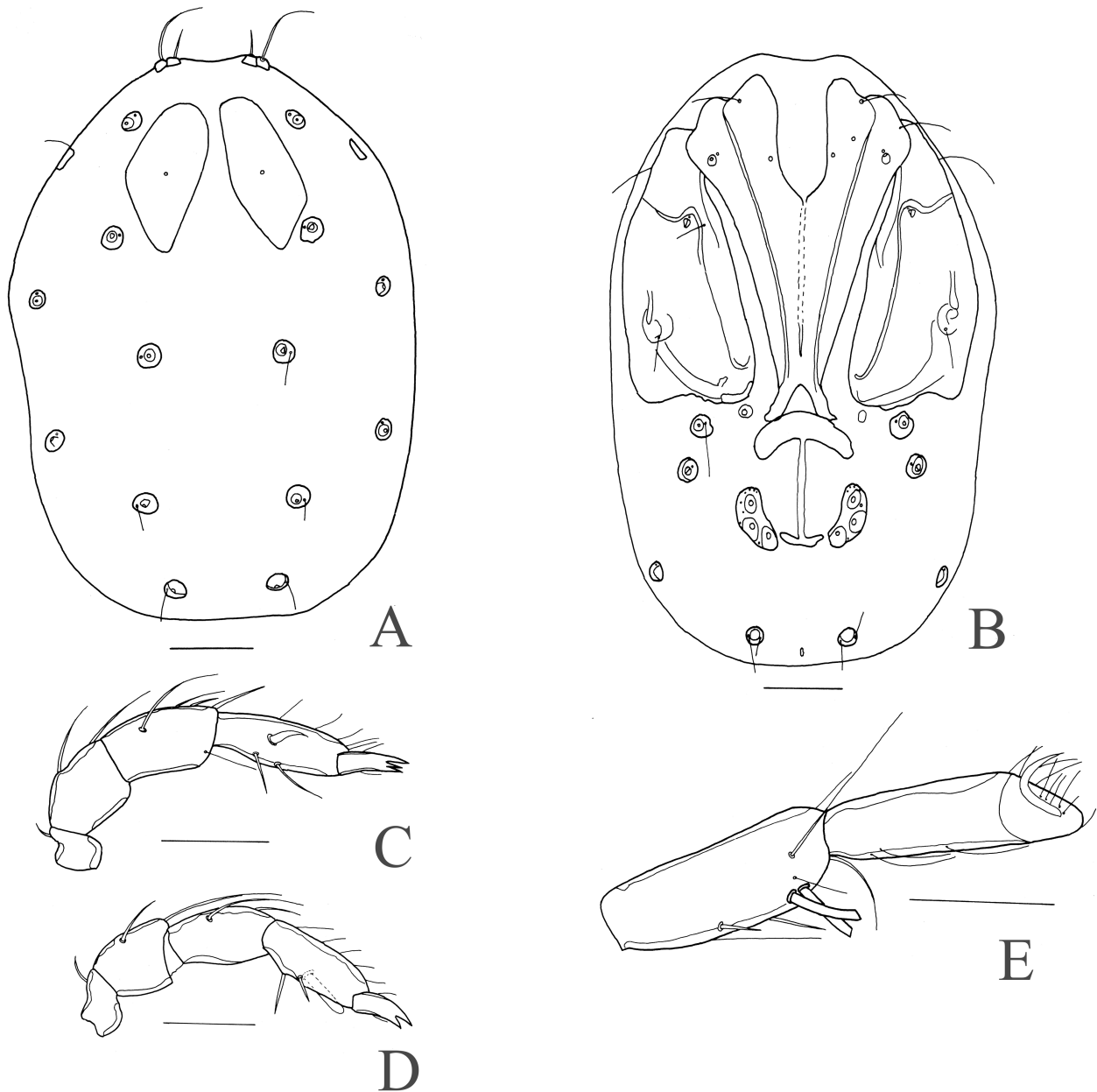
Remarks. According to Cook (1966), the differences between males of *A. rectipes* and *A. vietsi* are the single dorsal platelet in the former and the paired dorsal platelets in the latter. Unfortunately, the female of *A. rectipes* is unknown. The female of *vietsi* has a pair of dorsal platelets, as in the male (Figure 5A). A character not discussed by Cook (1966), is the shape of the two distal setae of I-leg-5. These are slightly curved in both species, but rounded at its tip in *rectipes*, and truncated in *vietsi* (and not pointed as illustrated by Cook 1966) (Figure 5E). Given these differences, the female of this study must be assigned to *A. vietsi*.

Distribution. Liberia (Cook 1966).

**Genus *Hygrobates* Koch, 1837*****Hygrobates (Hygrobatomegapus) coriaceus* (Lundblad, 1952) – nov. stat.**

New records. **Ghana.** 1/0/0, Ankasa River, Ankasa NP, 5°13.011' N 2°39.126' W, 60 m a.s.l., 13 Feb. 2013; 0/1/0, Tagbo River, downstream, 7°00.974' N 0°33.471' E, 255 m a.s.l., 23 Feb. 2013.

Remarks. Initially, this taxon was described as a subspecies of *H. spathuliferus* (Lundblad, 1927). However, Lundblad (1952) reported *H. coriaceus* from the same locality as the nominate taxon, and therefore, they cannot belong to the same species. Also, in the Supon



**Figure 5** *Atractides (Atractides) vietsi* Cook, female. A – dorsum; B – venter; C – left palp; D – right palp; E – I-leg-5–6. Scale bars: A-B = 100  $\mu$ m, C-E = 50  $\mu$ m.

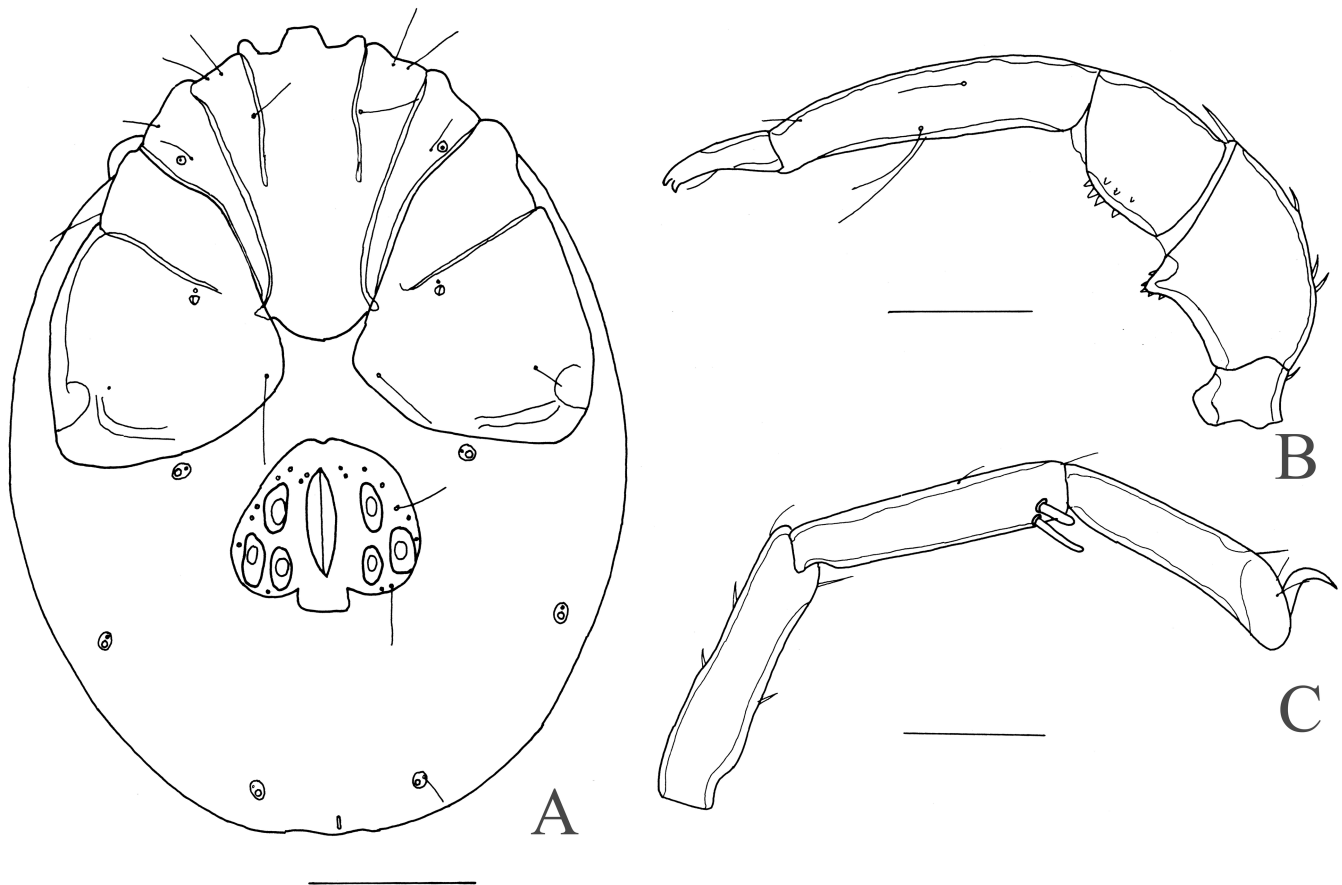
stream I collected both taxa. They are easily separated by the shape of the projection of P2: relatively short in *coriaceus*, and long in *spathuliferus*. Males of *coriaceus* have a ventral shield, but this can be absent in young specimens. More characters to separate the two species can be found in K.O. Viets (1963).

Distribution. Uganda (Lundblad 1952), South Africa (K.O. Viets 1963), Ghana (this study).

***Hygrobates (Hygrobates) dentipalpis* n. sp.**

Zoobank: [6229E1E4-B4C7-4E31-B803-60971D506602](https://doi.org/10.24349/5d6U-DX5N)

(Figure 6A–C)



**Figure 6** *Hygrobat (Hygrobat) dentipalpis* n. sp., holotype male. A – venter; B – palp; C – I-leg-4-6. Scale bars: A = 100  $\mu$ m, B-C = 50  $\mu$ m.

**Material examined.** Holotype male, stream Asukuma, Kakum National Park, Ghana, 5°26.995' N 1°25.071' W, 131 m a.s.l., 12 Feb. 2013 (RMNH). Paratypes: One male, same data as holotype (RMNH); 1/0/0, Supon stream near Asiakwa, Atewa Hills, Ghana, 6°15.530' N 0°30.642' W, 250 m a.s.l., 7 Mar. 2011 (RMNH); 1/0/0, River Tordzi, 6°32.819' N 0°41.445' E, 79 m a.s.l., 19 Feb. 2013; 1/0/0, Kue River, Kyabobo NP, Ghana, 8°31.087' N 0°36.049' E, 208 m a.s.l., 25 Feb. 2013 (RMNH).

**Material for comparison.** *Hygrobat sudafricanus* K.O. Viets, 1963: male, Klein Vaal River near source, Südafrika, Val. 857, Chütter leg., 11 Nov. 1959 (slide 51656, SMF); female, Klein Vaal River near source, Südafrika, Val. 857, Chütter leg., 11 Nov. 1959 (slide 51657, SMF); male, Klein Vaal River near source, Südafrika, Val. 857, Chütter leg., 11 Nov. 1959 (slide 51658, SMF); female, Klein Vaal River near source, Südafrika, Val. 857, Chütter leg., 11 Nov. 1959 (slide 51660, SMF).

**Diagnosis.** Anterior coxae only slightly tapering posteriorly; genital field with three pairs of acetabula; P2 with an anteroventral extension with several denticles, P3 with several relatively large denticles.

**Description.** Male. Integument finely lineated, only visible at higher magnification. Idiosoma dorsally 446 (360-413) long and 369 (300-356) wide, ventrally 486 (405-454) long. Dorsum without platelets. Anterior coxae only slightly tapering posteriorly. Cx-I fused medially. Suture line Cx-III/IV incomplete, Cxgl-4 located near this suture line, Cx-IV rounded medially (Figure 6A). Genital field 102 long and 112 wide, with three pairs of acetabula in a triangle; gonopore 64 long. Length of P1-5: 20, 78, 50, 116, 41. P2 with an anteroventral

extension with several small denticles, a few denticles present posterior to this extension, but these only visible in ventral view. P3 ventrally with four relatively large denticles, medially with a few more denticles. P4 slender (Figure 6B). Length of I-leg-4–6: 103, 104, 72. I-leg-5 distally with two setae, one of these slightly bowed (Figure 6C). Length of IV-leg-4–6: 136, 154, 124. Legs without swimming setae.

Female: Unknown.

**Etymology.** Named for the presence of relatively large denticles on P3.

**Remarks.** The new species is similar to *H. niloticus* Walter, 1922 in the presence of an anteroventral extension of P2, with several denticles on this extension. However, *H. niloticus* has strongly tapering anterior coxae. Males of *Hygrobates sudafricanus* K.O. Viets, 1963 from South Africa, have P3 with 5–6 smaller denticles, P2 has a less extending anteroventral extension with larger and fewer denticles (about 2–3), in the new species there are about 6–7 small denticles on the anteroventral extension. Females of *H. sudafricanus* have P2 with a larger anteroventral extension and P3 with larger denticles, but the female of the new species is unknown.

### ***Hygrobates (Hygrobates) laceratus* Lundblad, 1927**

New records. **Ghana.** 2/1/0, Kintampo Falls, 8°05.413' N 1°41.881' W, 235 m a.s.l., 3 Mar. 2011; 3/4/0, Fuller Falls, 8°04.975' N 1°47.842' W, 189 m a.s.l., 6 Mar. 2011; 6/10/0, small rainforest stream upstream Sagyimase, Atewa Hills, 6°13.964' N 0°33.116' W, 654 m a.s.l., 8 Mar. 2011; 13/16/0, Akaa Falls, 6°10.516' N 0°11.723' W, 180 m a.s.l., 9 Mar. 2011; 0/4/0, Namini stream, Kakum National Park, 5°23.396' N 1°23.294' W, 185 m a.s.l., 12 Feb. 2013; 1/0/0, Ankasa Exploration Base stream, Ankasa NP, 5°16.413' N 2°38.810' W, 81 m a.s.l., 14 Feb. 2013; 13/10/0, plunge pool Kulugu River, 6°51.365' N 0°25.101' E, 388 m a.s.l., 19 Feb. 2013; 2/5/0, Kulugu River, 6°51.365' N 0°25.101' E, 388 m a.s.l., 19 Feb. 2013; 0/1/0, Kulugu River, upstream, hyporheic, N of Biakpa, 6°51.223' N 0°25.141' E, 410 m a.s.l., 20 Feb. 2013; 5/5/0, Amedzofe Falls, 6°50.656' N 0°26.868' E, 599 m a.s.l., 20 Feb. 2013; 8/14/0, Kulugu River, upstream, N of Biakpa, 6°51.223' N 0°25.141' E, 410 m a.s.l., 20 Feb. 2013; 1/0/0, Apkonu stream, downstream of falls, at Logba Tota, 6°53.054' N 0°28.024' E, 362 m a.s.l., 21 Feb. 2013; 5/2/0, plunge pool Tsatsudo Falls, 7°07.390' N 0°23.365' E, 179 m a.s.l., 22 Feb. 2013; 6/1/2, Tagbo River downstream of falls, 7°00.708' N 0°34.326' E, 394 m a.s.l., 23 Feb. 2013; 11/4/1, Laboun River downstream of falls, Kyabobo NP, 8°19.836' N 0°35.487' E, 342 m a.s.l., 24 Feb. 2013; 3/4/0, Kue River, Kyabobo NP, 8°31.087' N 0°36.049' E, 208 m a.s.l., 25 Feb. 2013; 41/27/0, unnamed stream between Apepem and Koju Amu, Atewa Hills, 6°10.252' N 0°36.520' W, 424 m a.s.l., 27 Feb. 2013; 7/2/0, unnamed stream upstream Sagyimase, Atewa Hills, 6°13.966' N 0°33.114' W, 671 m a.s.l., 28 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara.

### ***Hygrobates (Hygrobates) liberiensis* Cook, 1966**

New records. **Ghana.** 0/1/0, Ankasa Exploration Base trail stream, upstream, Ankasa NP, 5°16.376' N 2°38.655' W, 94 m a.s.l., 14 Feb. 2013.

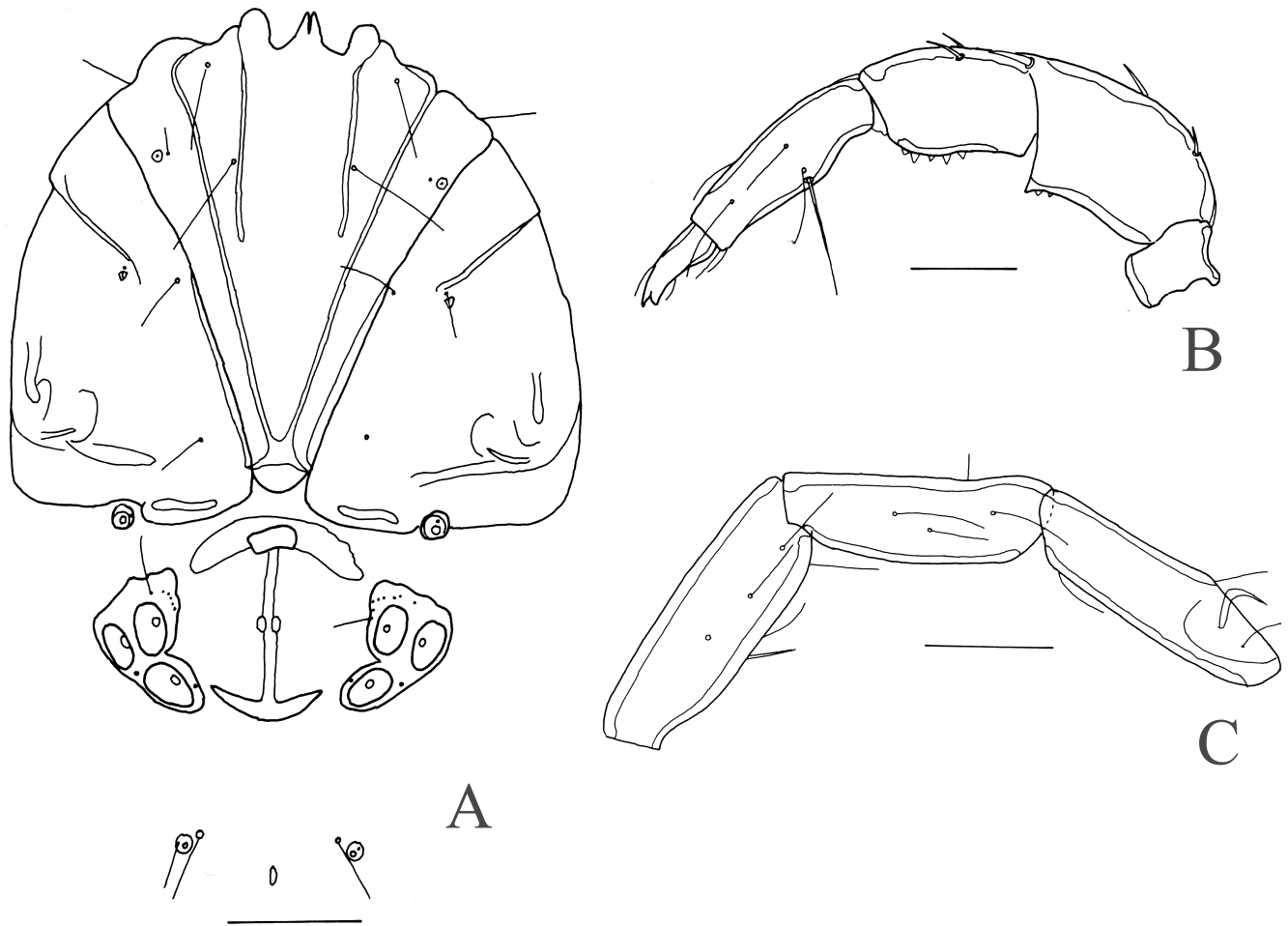
Distribution. Liberia (Cook 1966), Ghana (this study).

### ***Hygrobates (Hygrobates) niloticus* Walter, 1922**

(Figure 7A–C)

New record. **Ghana.** 0/1/0, unnamed stream crossing road to Ankasa NP, 5°11.435' N 2°39.429' W, 20 m a.s.l., 27 Feb. 2011.

Description. Female. Integument finely lined, only visible at higher magnification. Idiosoma dorsally 591 long and 462 wide, ventrally 640 long. Cx-I fused medially. Anterior coxae tapering and extending far posteriorly, reaching almost posterior margin of Cx-IV. Posterior to anterior coxae a small area of secondary sclerotization. Suture line Cx-III/IV incomplete, Cxgl-4 located near this suture line. Posterior to Cx-IV an area of secondary



**Figure 7** *Hygrobat (Hygrobat) niloticus* Walter, female. A - venter; B – palp; C – I-leg-4–6. Scale bars: A = 100  $\mu$ m, B-C = 50  $\mu$ m.

sclerotization, not incorporating Vgl-1. Genital field 144 long and 259 wide, with three pairs of acetabula. Pregenital sclerite small, surrounded by a large area of secondary sclerotization. Length of P1–5: 28, 118, 76, 104, 40. P2 anteroventrally with several denticles, ventral margin of P3 with about five relatively large denticles. Length of I-leg-4–6: 118, 104, 74. First leg segments rather stocky, I-leg-5 anteriorly without stout setae.

Distribution. Sudan (Walter 1922), Ghana (this study).

***Hygrobat (Hygrobat) pseudoniloticus* n. sp.**

Zoobank: [OF6BBBE8-EF76-4B8C-88C6-17D4A7EE3754](https://doi.org/10.24349/5d6U-DX5N)

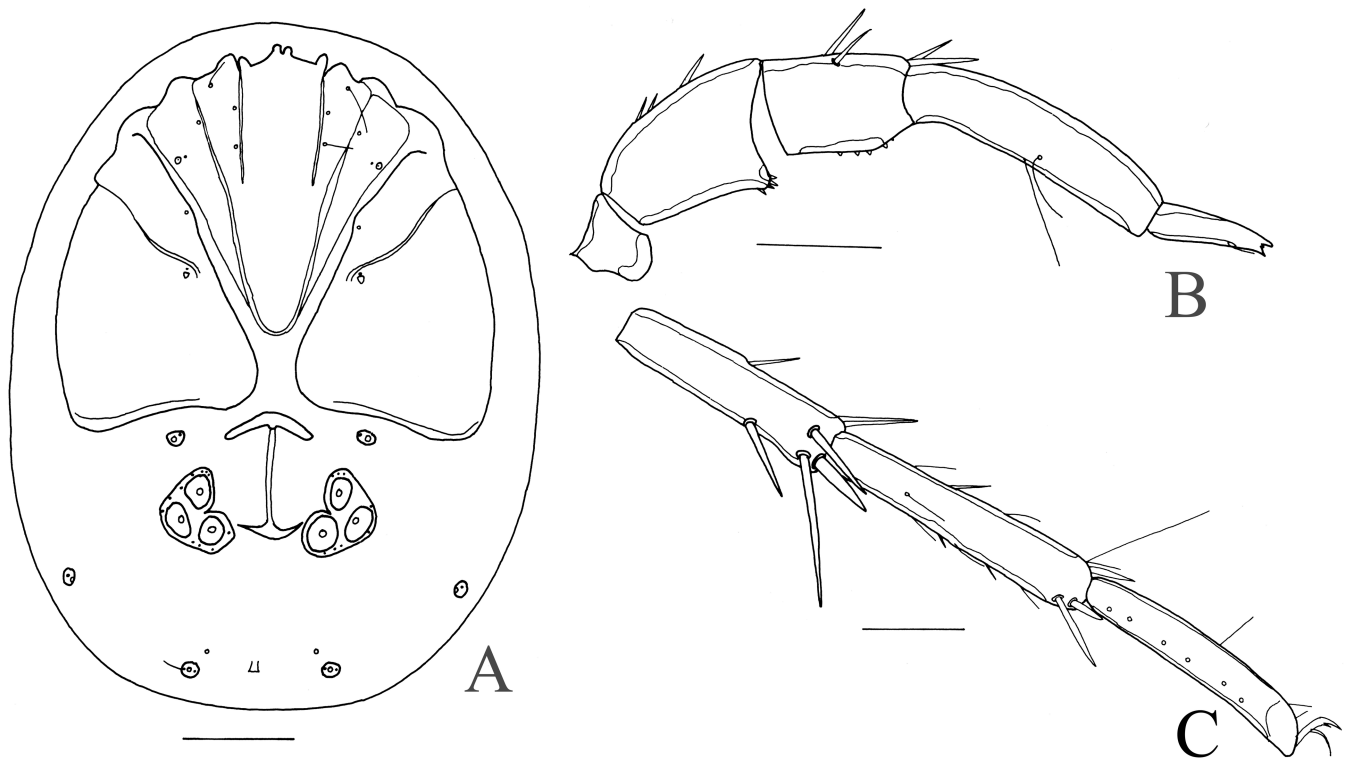
(Figure 8A-C)

**Material examined.** Holotype female, Ankasa Exploration Base stream, Ankasa NP, Ghana, 5°16.413' N 2°38.810' W, 81 m a.s.l., 14 Feb. 2013 (RMNH). Paratype: One female, same data as holotype (RMNH).

**Diagnosis.** Female: Anterior coxae tapering, extending far posteriorly; P2 with an anteroventral extension, with several denticles, P2 with a few, relatively large denticles; first leg segments slender.

**Description.** Female: Integument finely lineated, only visible at higher magnification. Idiosoma dorsally 612 long and 462 wide, ventrally 608 long. Dorsum without platelets.





**Figure 8** *Hygrobates (Hygrobates) pseudoniloticus* n. sp., holotype female. A - venter; B - palp; C - I-leg-4-6. Scale bars: A = 100  $\mu$ m, B-C = 50  $\mu$ m.

Gnathosoma fused with Cx-I. Cx-I fused medially, extending far posteriorly, reaching middle of Cx-IV. Suture line of Cx-III/IV incomplete; Cxgl-4 located near suture line Cx-III/IV. Genital field 114 long and 196 wide, with three pairs of acetabula in a triangle. Pre-genital sclerite 82 wide. Length of P1-5: 28, 82, 62, 116, 48. P2 with a short anteroventral extension, covered with a few denticles. Ventral margin of P3 with about five denticles. P4 slender, near ventral margin two fine setae. Length of I-leg-4-6: 118, 140, 136 (till tip of segments). First leg segments slender. Length of IV-leg-4-6: 168, 190, 172 (till tip of segment). Legs without swimming setae.

Male: Unknown.

**Etymology.** Named for its similarity with *H. niloticus*.

**Remarks.** *Hygrobates pseudoniloticus* n. sp. is similar to *H. niloticus* in long and tapering anterior coxae. Unfortunately, *H. niloticus* is insufficiently described. The figures provided by Walter (1922) are sketchy and lack details, and only one male was known to Walter. The holotype is apparently lost. It is, therefore, difficult to decide which of the two species with long and tapering anterior coxae of this study belongs to *H. niloticus*. The latter species is quite large (the male is 700 long), and the anterior coxae are extremely tapering. Therefore, I assigned the largest of the two species, with the longest and most tapering anterior coxae to *H. niloticus*.

### ***Hygrobates (Hygrobates) soari* K. Viets, 1911**

New records. **Ghana.** 4/0/2, unnamed stream crossing road to Ankasa NP, 5°11.435'N 2°39.429' W, 20 m a.s.l., 27 Feb. 2011; 0/1/0, Black Volta River at Buipe, 8°45.674' N

1°27.320' W, 76 m a.s.l., 6 Mar. 2011; 1/0/0, small rainforest stream upstream Sagyimase, Atewa Hills, 6°13.964' N 0°33.116' W, 654 m a.s.l., 8 Mar. 2011; 0/7/0, Lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013; 1/1/1, stream at Boti Falls, 6°11.508' N 0°13.010' W, 273 m a.s.l., 9 Mar. 2011; 13/4/0, Afiaso stream, Kakum NP, 5°30.087' N 1°26.373' W, 114 m a.s.l., 12 Feb. 2013; 3/2/0, stream Asukuma, Kakum NP, 5°26.995' N 1°25.071' W, 131 m a.s.l., 12 Feb. 2013; 5/4/0, Ankasa River, Ankasa NP, 5°13.011' N 2°39.126' W, 60 m a.s.l., 13 Feb. 2013; 2/0/0, Ankasa Exploration Base trail stream, upstream, Ankasa NP, 5°16.376' N 2°38.655' W, 94 m a.s.l., 14 Feb. 2013; 3/5/0, tributary of Oguntwe, Ankasa NP, 5°16.563' N 2°38.733' W, 78 m a.s.l., 14 Feb. 2013; 0/1/2, Nubui River, Agumatsa Wildlife Sanctuary, 7°06.986' N 0°35.548' E, 254 m a.s.l., 22 Feb. 2013; 1/0/0, plunge pool Tsatsudo Falls, 7°07.390' N 0°23.365' E, 179 m a.s.l., 22 Feb. 2013; 1/3/0, unnamed stream upstream Sagyimase, Atewa Hills, 6°13.966' N 0°33.114' W, 671 m a.s.l., 28 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara.

### ***Hygrobat* (*Hygrobatomegaps*) *spathuliferus* (Lundblad, 1927)**

New records. **Ghana.** 0/1/0, Kintampo Falls, 8°05.413' N 1°41.881' W, 235 m a.s.l., 3 Mar. 2011; 16/8/2, Kulugu River, 6°51.365' N 0°25.101' E, 388 m a.s.l., 19 Feb. 2013; 26/26/13, Kulugu River, upstream, N of Biakpa, 6°51.223' N 0°25.141' E, 410 m a.s.l., 20 Feb. 2013; 6/5/3, Apkonu stream, downstream of falls, at Logba Tota, 6°53.054' N 0°28.024' E, 362 m a.s.l., 21 Feb. 2013; 2/0/0, Tagbo River, downstream of falls, Ghana, 7°00.708' N 0°34.326' E, 394 m a.s.l., 23 Feb. 2013; 2/0/0, Laboun River downstream of falls, Kyabobo NP, 8°19.836' N 0°35.487' E, 342 m a.s.l., 24 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara.

### **Genus *Hygrobatopsis* K. Viets, 1924**

A genus with three species known thus far, one from Cameroon (K. Viets 1925) and two from South Africa (Cook 2005).

### ***Hygrobatopsis* (?) *convexipalpis* n. sp.**

Zoobank: [A728411D-45EA-479D-A935-EC4DB3846D2A](https://zoobank.org/A728411D-45EA-479D-A935-EC4DB3846D2A)

(Figure 9A-D)

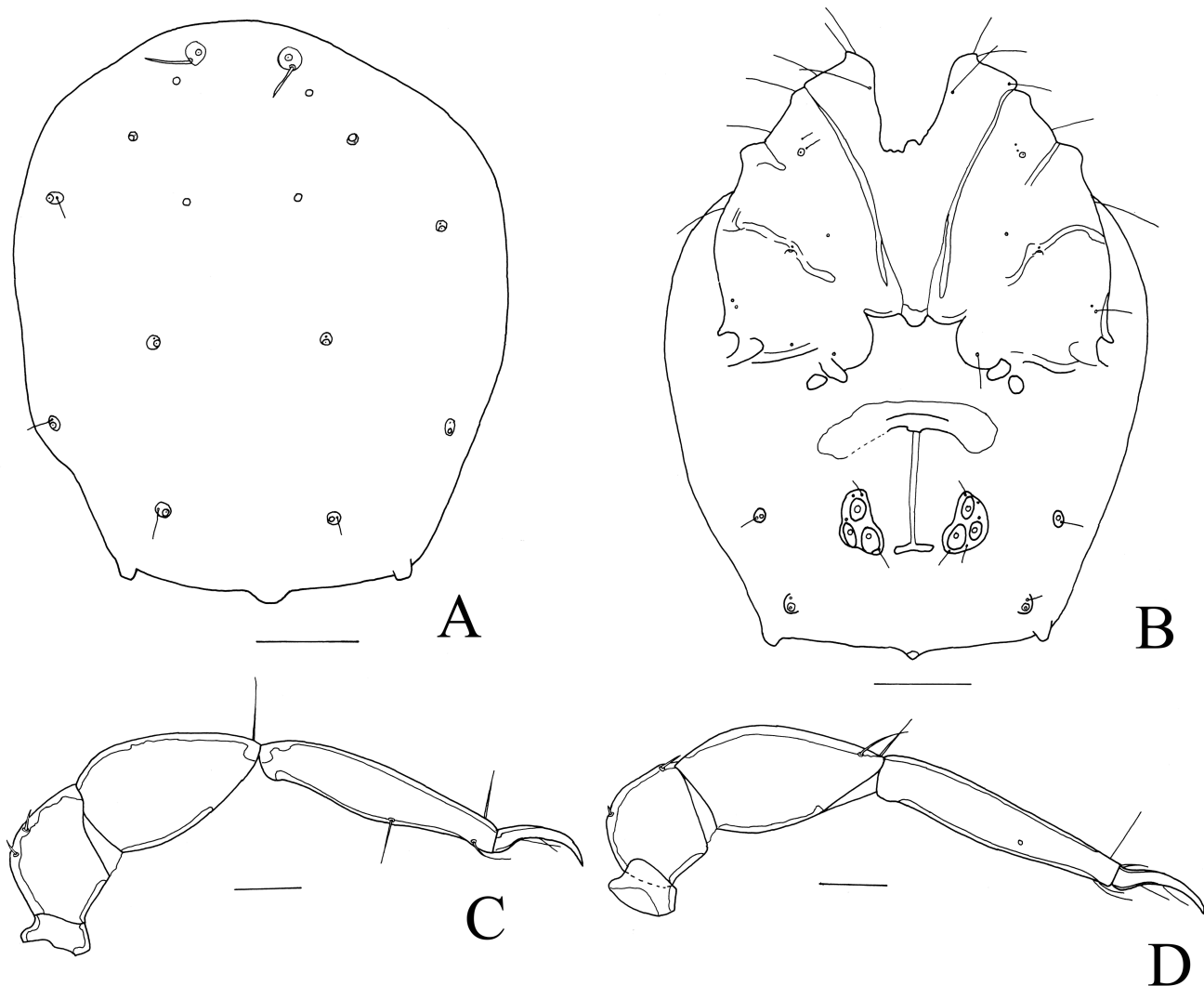
**Material examined.** Holotype female, stream Asukuma, Kakum NP, Ghana, 5°26.995' N 1°25.071' W, 131 m a.s.l., 12 Feb. 2013 (RMNH). Paratype: one female, same data as holotype (RMNH).

**Material for comparison.** *Hygrobatopsis levipalpis* (K. Viets, 1924). One female (photograph), stream Koptawelil, Kenya, Feb. 1925, leg. F. Bryk (NHRS-GULI000073414); one female (photograph), stream Koptawelil, Kenya, 29 Jun. 1925, leg. F. Bryk (NHRS-GULI000073415).

**Diagnosis.** Dgl-1 not on sclerites, gonopore relatively short, P3 with a convex ventral margin.

**Description.** Female: Idiosoma dorsally 543 (583) long and 478 (486) wide, ventrally 599 (624) long. Dgl-1 not on sclerites (Figure 9A). Gnathosoma lightly fused with Cx-I. Suture lines of Cx-III/IV incomplete, Cxgl-4 near the latter suture line. Cx-IV posteromedially with a short projection (Figure 9B). Genital field 144 long and 148 wide, with three pairs of acetabula. Pregenital sclerite appearing large due secondary sclerotization lateral and anterior to the pregenital sclerite, but this sclerite itself small. Excretory pore near posterior idiosoma margin. Idiosoma posterolaterally with a pair of large glandularia tubercles. Length of P1–5: 23, 99, 146, 186, 68. P3 with a convex ventral margin (Figure 9C-D). Length of I-leg-4–6: 134, 155, 108. I-leg-5 without downturned seta. Length of IV-leg-4–6: 180, 210, 124. Legs without swimming setae.

Male: Unknown.



**Figure 9** *Hygrobatopsis* (?) *convexipalpis* n.sp., holotype female. A – dorsum; B – venter; C – palp; D – palp. Scale bars: A-B = 100  $\mu$ m, C-D = 50  $\mu$ m.

**Etymology.** Named for the convex P3.

**Remarks.** The new species is close to *Hygrobatopsis levipalpis*. The female of this species is not well-described. In the original description (K. Viets 1924), only the male has been described. Lundblad (1927) reported the female of this species, but in his material no males were present. I examined his specimens with the help of some photographs. P3 of Lundblad's specimens have a more or less straight ventral margin (like the male), P4 has a more distinct ventral bulge (Figure 10A-B), Dgl-1 are on small sclerites and the gonopore is relatively longer. Moreover, P3 and P4 of Lundblad's specimens measure 93 and 129, respectively, much shorter than the specimens from this study.

***Hygrobatopsis* (*Hygrobatopsella*) *inflata* (K. Viets, 1925)**

(Figures 11A-E, 12A-D)

New records. **Ghana.** 0/1/0, unnamed stream crossing road to Ankasa NP, 5°11.435' N 2°39.429' W, 20 m a.s.l., 27 Feb. 2011; 0/1/1, stream Asukuma, Kakum NP, 5°26.995' N 1°25.071' W, 131 m a.s.l., 12 Feb. 2013; 1/2/0, Kulugu River, upstream, N of Biakpa, 6°51.223'



**Figure 10** *Hygrobatopsis (Hygrobatopsis) levipalpis* (K. Viets), female. A = palps of slide NHRS-GULI000073415; B = palp of slide NHRS-GULI000073414. Photographed by Gunvi Lindberg (© 2021 Naturhistoriska riksmuseet). Original photo cropped, light levels and contrast adjusted. Made available by the Swedish Museum of Natural History under Creative Commons Attribution 4.0 International Public License, CC-BY 4.0 [<https://creativecommons.org/licenses/by/4.0/legalcode>].

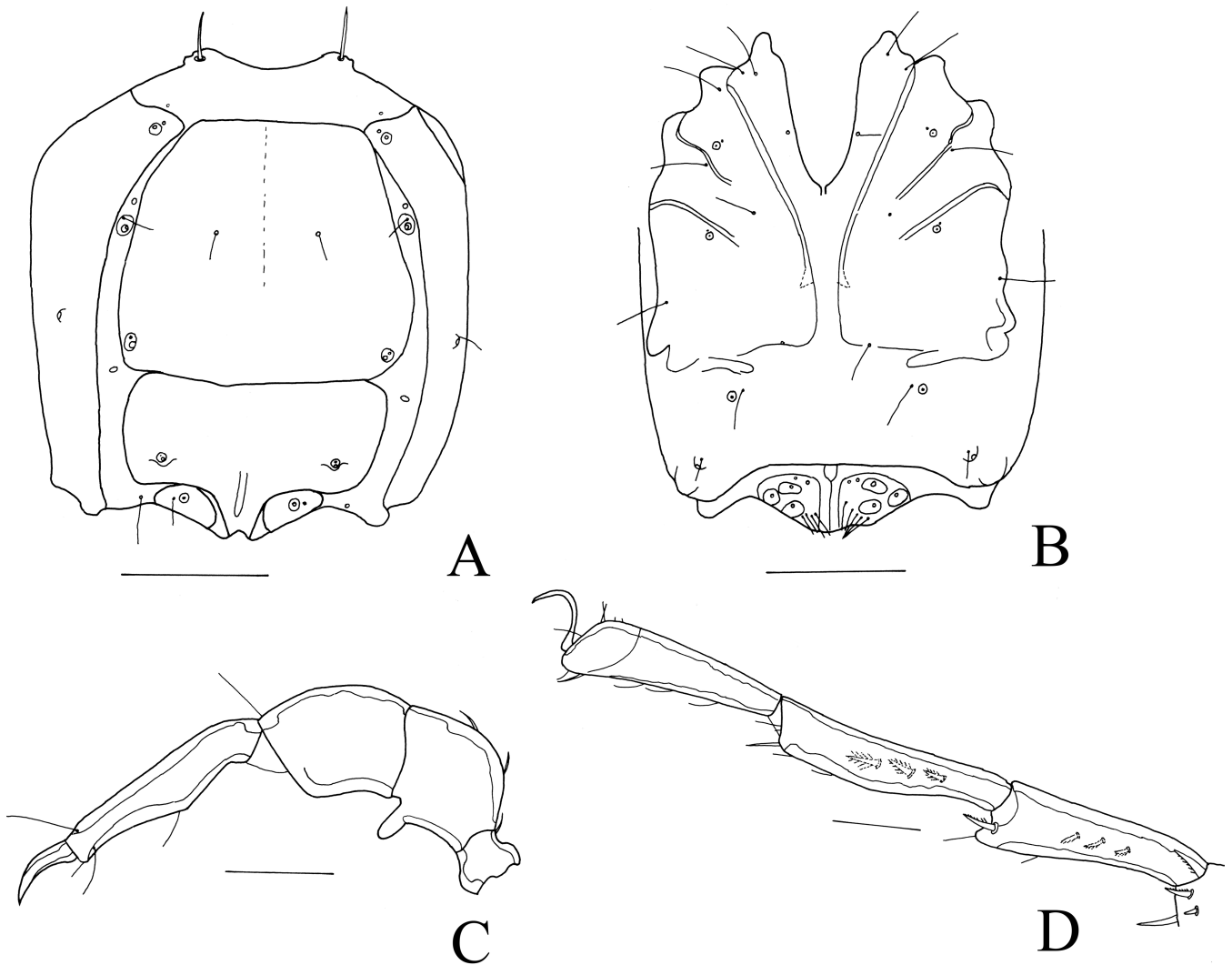
N 0°25.141' E, 410 m a.s.l., 20 Feb. 2013.

**Description.** Male: Idiosoma dorsally 332 long and 200 wide, ventrally 348 long. Dorsum with a 4-part dorsal shield, consisting of a large anterior plate, 180 long and 194 wide, with the postocularia and one pair of glandularia, a smaller posterior plate with one pair of glandularia and two small platelets flanking the posteromedial projection, each with a glandularium (Figure 11A). Gnathosoma narrowly fused with Cx-I. Coxae incorporated in a ventral shield, not including the genital field. All suture lines of coxae incomplete. Cxgl-4 located near suture line Cx-III/IV (Figure 11B). Genital field terminal, 100 wide, with three pairs of acetabula on a pair of separate genital plates; medial and posterior margin with a row of setae (Figure 11C). Length of P1–5: 18, 70, 72, 100, 36. P2 anteroventrally with a large projection, P4 ventrally bulging, P5 slender (Figure 11D). Length of I-leg-4–6: 92, 102, 74. I-leg-5 anteriorly with a few fine setae. Length of IV-leg-4–6: 120, 132, 102. Fourth leg much heavier than first three legs, claw relatively large. IV-leg-5 and IV-leg-4 medially with three pectinate setae, IV-leg-4 anteromedially with one pectinate seta (Figure 11E). Swimming setae absent.

Female: Idiosoma dorsally 567–583 long and 470–518 wide, ventrally 575–616 long. Dgl-1 on a large sclerite (Figure 12A). A small area of integument posterior to the preocularia sclerite reticulated, but this reticulation absent in the rest of the integument. Posterior dorsal and ventral glandularia on large tubercles. Gnathosoma narrowly fused with Cx-I. Cxgl-4 near suture line Cx-III/IV. Posterior to Cx-IV a large area of secondary sclerotization. Also anterior to genital field a broad sickle-shaped area of secondary sclerotization (Figure 12B). Genital field 160 long, genital plates compact, 74 long, with three pairs of acetabula. Excretory pore on a large terminal tubercle. Length of P1–5: 30, 104, 118, 158, 56. Anteroventral projection of P2 more slender than in male, tip with a few minute denticles. Ventral margin of P4 less bulging than in male (Figure 12C). Length of I-leg-4–6: 130, 142, 103. I-leg-4 anteroventrally with two blunt stout setae, I-leg-5 without downturned seta (Figure 12D). Length of IV-leg-4–6: 176, 191, 132. Swimming setae absent.

**Remarks.** K. Viets (1925) described *H. inflata* based on the deutonymph only. Thus far, the adults of this species were unknown. The palp of the deutonymph of *H. inflata* as described by Viets agrees well with the palp of the adults and deutonymph collected in Ghana, especially the bulging ventral margin of P4 in combination with P2 with a ventral projection is characteristic.

The male of the new species is remarkably similar to the South African *H. bella* Cook, 2005, given the distance between the two countries. The anterior dorsal plate of *H. bella* is narrower and more elongated, and the posterior dorsal plate of *bella* is more or less as long as



**Figure 11** *Hygrobatopsis (Hygrobatopsella) inflata* (K. Viets), male. A – dorsum; B – venter; C – genital field; D – palp; E – IV-leg-4–6. Scale bars: A–B = 100  $\mu$ m; C–E = 50  $\mu$ m.

wide (wider than long in *inflata*). The anteroventral projection of P2 is less slender compared to *bella*. The female is well-characterized by its large glandularia tubercles and the large sclerite with Dgl-1.

Distribution. Cameroon (K. Viets 1925), Ghana (this study).

***Hygrobatopsis (Hygrobatopsis) pauciglandulosa* n. sp.**

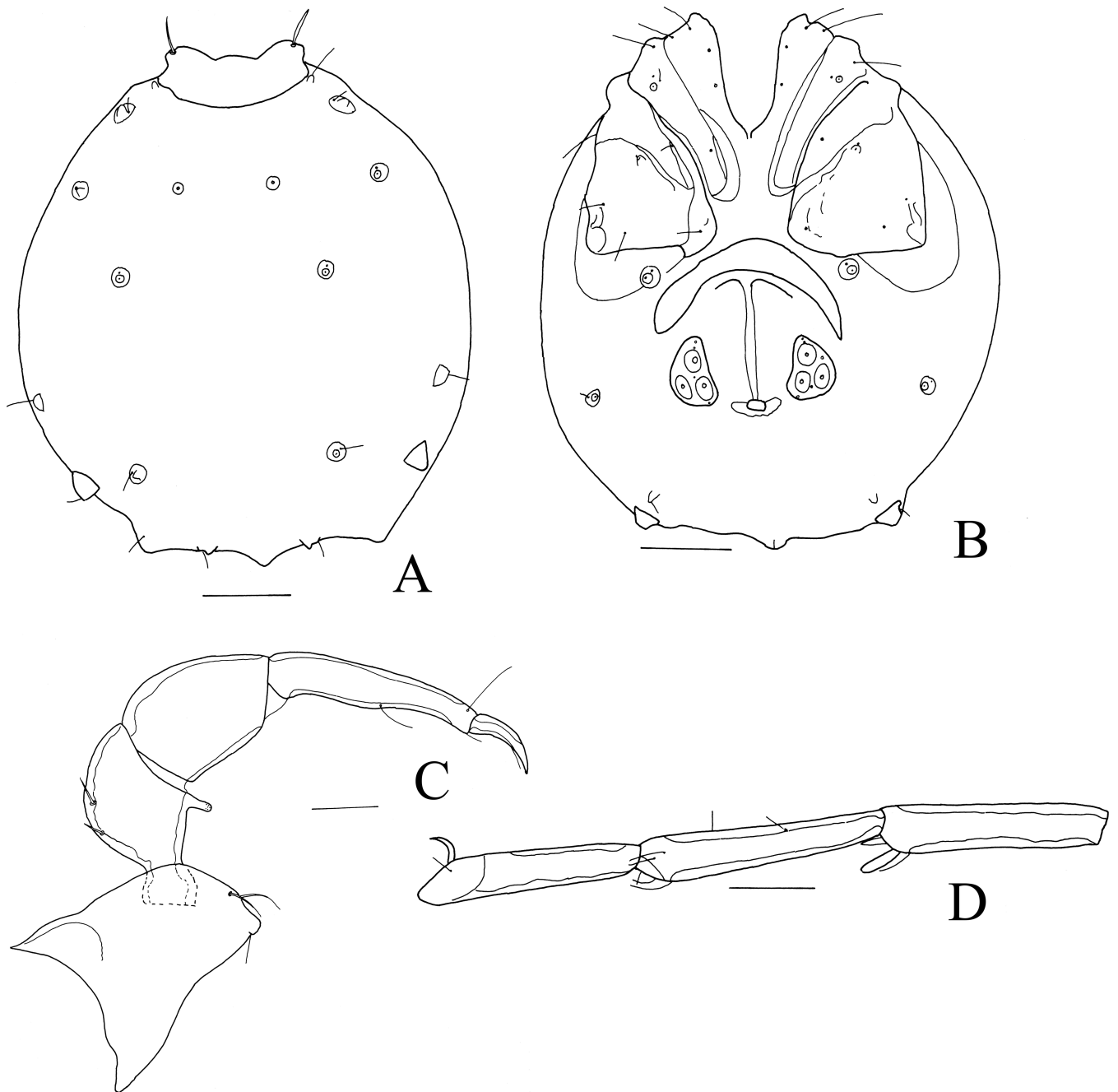
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(Figures 13A–E, 14A–B)

**Material examined.** Holotype male, Ankasa Exploration Base stream, Ankasa NP Ghana, 5°16.413' N 2°38.810' W, 81 m a.s.l., 14 Feb. 2013 (RMNH). Paratype: one female, Ankasa River, Ankasa NP, Ghana, 5°13.011' N 2°39.126' W, 60 m a.s.l., 13 Feb. 2013 (RMNH).

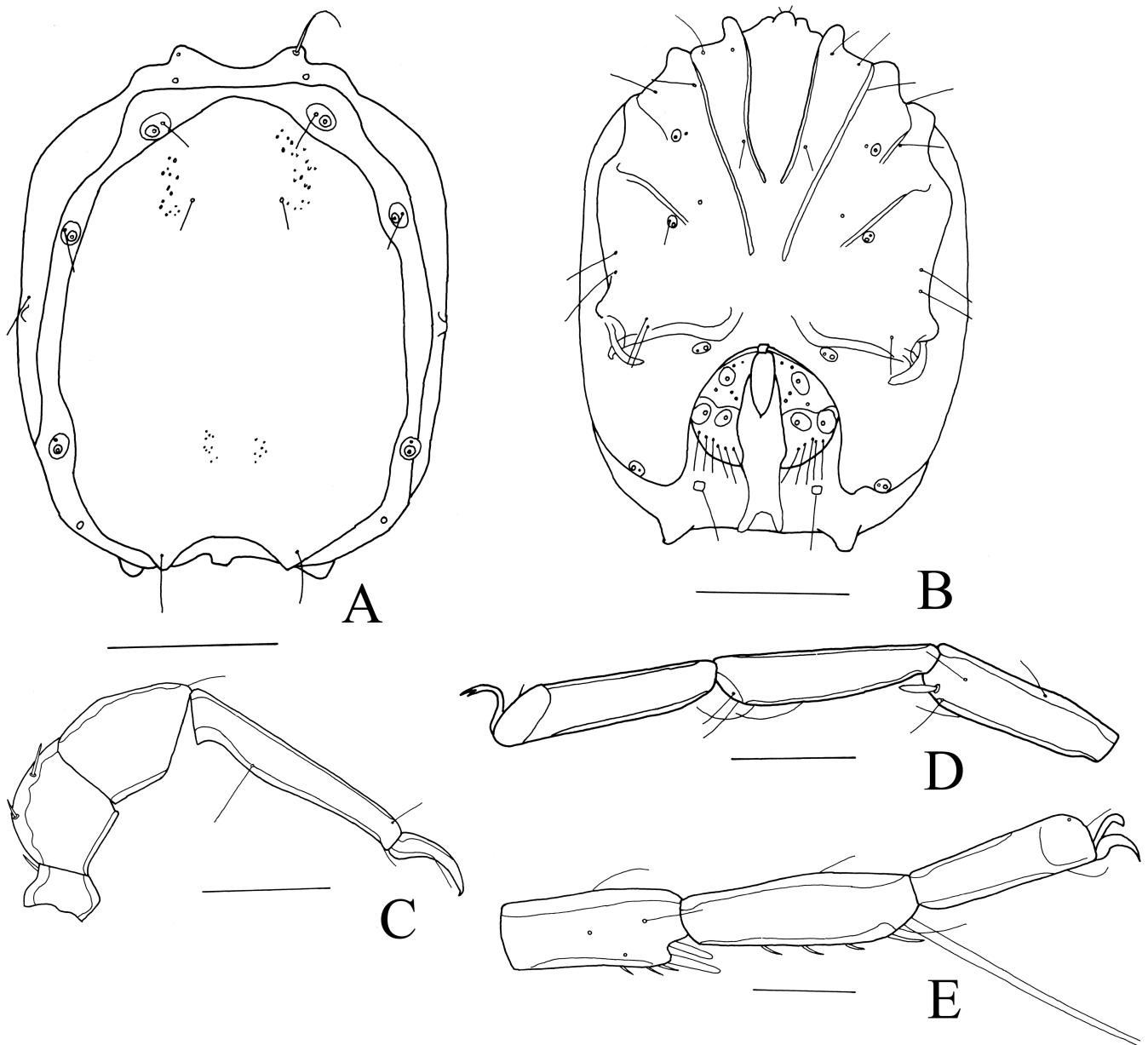
**Diagnosis.** Both sexes: legs with swimming setae. Male: Dorsum with a dorsal shield, with the postocularia and one pair of glandularia; Vgl-3 fused with ventral shield.

**Description.** Male: Idiosoma dorsally 296 long and 251 wide, ventrally 340 long. Dorsum with a large dorsal shield, 259 long and 206 wide, with the postocularia and posteriorly with one



**Figure 12** *Hygrobatopsis (Hygrobatopsella) inflata* (K. Viets), female. A – dorsum; B – venter; C – palp + gnathosoma; D – I-leg-4-6. Scale bars: A-B = 100  $\mu$ m; C-D = 50  $\mu$ m.

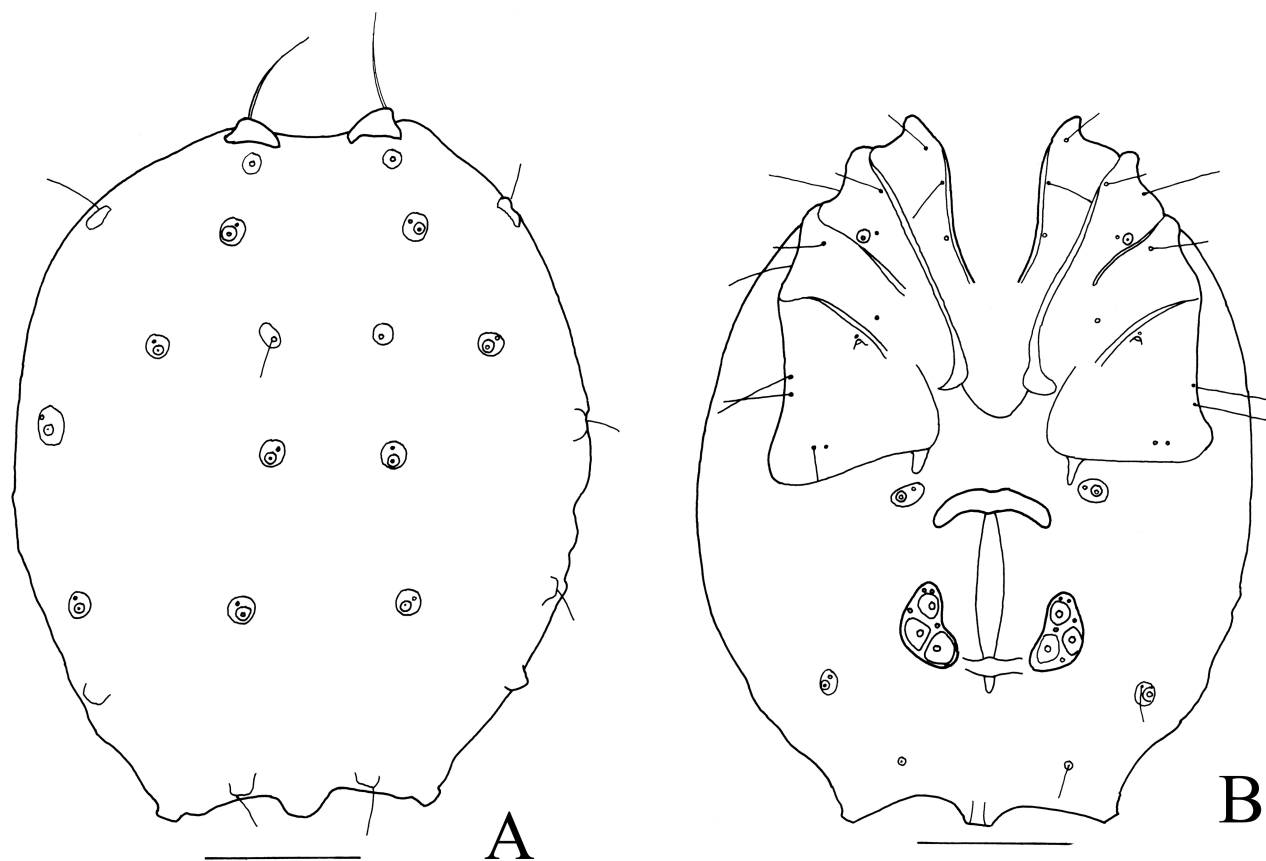
pair of glandularia. Dorsal furrow with three pairs of glandularia (Figure 13A). Gnathosoma lightly fused with Cx-I. Venter with a ventral shield incorporating the coxae and Vgl-3. Genital field 92 wide, lying in a deep genital bay (Figure 13B); gonopore 38 long. Genital field with three pairs of acetabula, posterior to the acetabula numerous setae. From the gonopore extends a hyaline, open tube-like structure. Near posterior idiosoma margin a pair of large tubercles. Excretory pore fused with dorsal shield. Length of P1-5: 17, 50, 56, 96, 32. P2 without a ventral projection, P4 slender, ventrally slightly bulging, P5 slender (Figure 13C). Length of



**Figure 13** *Hygrobatopsis (Hygrobatopsis) pauciglandulosa* n. sp., holotype male. A – dorsum; B – venter; C – palp; D – I-leg-4-6; E – IV-leg-4-6. A-B = 100  $\mu$ m, C-E = 50  $\mu$ m.

I-leg-4-6: 79, 90, 68. I-leg-5 anteriorly with a few fine setae, one of these elongated (but lost due to mounting), no downturned seta present (Figure 13D). Length of IV-leg-4-6: 88, 112, 88. Fourth legs much heavier than other three legs (Figure 13E). Swimming setae: III-leg-5 and IV-leg-5 with two swimming setae, II-leg-5 with a short swimming seta.

Female: Idiosoma dorsally 441 long and 365 wide, ventrally 470 long. Integument finely lined. Dgl-1 each on a small sclerite (Figure 14A). Gnathosoma lightly fused with Cx-I, but fusion more extensive than in male. Posterior margin of Cx-IV with short projections. Genital field 122 long, with three pairs of acetabula in a somewhat triangular configuration (Figure 14B). Genital plates 57 long, pregenital sclerite 82 wide. Excretory pore on a tubercle near posterior idiosoma margin. Idiosoma posterolaterally with a pair of large glandularia tubercles.



**Figure 14** *Hygrobatopsis (Hygrobatopsis) pauciglandulosa* n. sp., paratype female. A – dorsum; B – venter. Scale bars: A-B = 100  $\mu$ m.

Length of P1–5: 22, 80, 86. 152, 48. Palp as in male. Length of I-leg-4–6: 92, 93, 70. I-leg-5 anteriorly with a few fine setae, one of these elongated. Length of IV-leg-4–6: 120, 148, 110. Swimming setae: II-leg-5, III-leg-5 and IV-leg-5 with two swimming setae.

**Etymology.** Named for the presence of few glandularia on the dorsal shield of the male.

**Remarks.** Thus far, two species were known of the nominate subgenus. The male of *Hygrobatopsis levipalpis* K. Viets, 1925 (Cameroon) has a more shallow genital bay, Vgl-3 is not fused with the ventral shield and P4 is more bulging ventrally. The male of *Hygrobatopsis sudafricana* Cook, 2005 (South Africa) has the dorsal shield with three pairs of glandularia and the genital bay is shallow too. Both these species lack swimming setae. The presence of swimming setae will separate the female from other species of the genus.

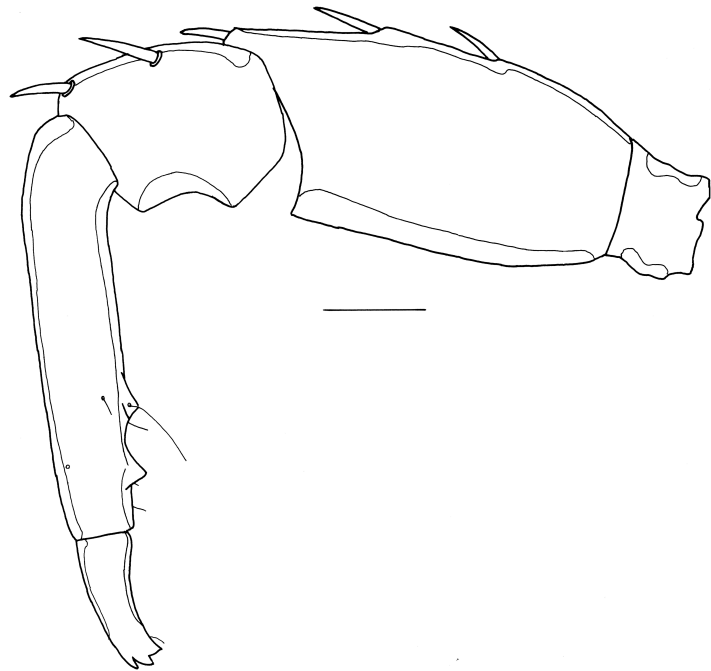
### **Genus *Tetrabates* Thor, 1922**

A genus with three or four species known from the Afrotropical region.

#### ***Tetrabates (Liberiobates) bomiensis* (Cook, 1966)**

New records. **Ghana.** 0/1/0, Kintampo Falls, 8°05.413' N 1°41.881' W, 235 m a.s.l., 3 Mar. 2011; 0/1/3, Supon stream near Asiakwa, Atewa Hills, 6°15.530' N 0°30.642' W, 250 m a.s.l., 7 Mar. 2011; 0/1/0, Ankasa Exploration Base stream, Ankasa NP, 5°16.413' N 2°38.810' W, 81 m a.s.l., 14 Feb. 2103; 1/0/0, Ankasa Exploration Base trail stream, upstream, Ankasa NP,





**Figure 15** *Piona angulata* Viets, palp male. Scale bar = 50  $\mu$ m.

5°16.376' N 2°38.655' W, 94 m a.s.l., 14 Feb. 2013.

Distribution. Liberia (Cook 1966), Ghana (this study).

***Tetrabates (Tetrabates) szalayi* (Lundblad, 1949)**

New records. **Ghana.** 0/2/0, Ankasa Exploration Base stream, Ankasa NP, 5°16.413' N 2°38.810' W, 81 m a.s.l., 14 Feb. 2103.

Distribution. Congo (Lundblad 1949), Liberia (Cook 1966), Ghana (this study).

**Family Pionidae Thor**

**Subfamily Pioninae Thor**

**Genus *Piona* Koch, 1842**

***Piona africana* K. Viets, 1940**

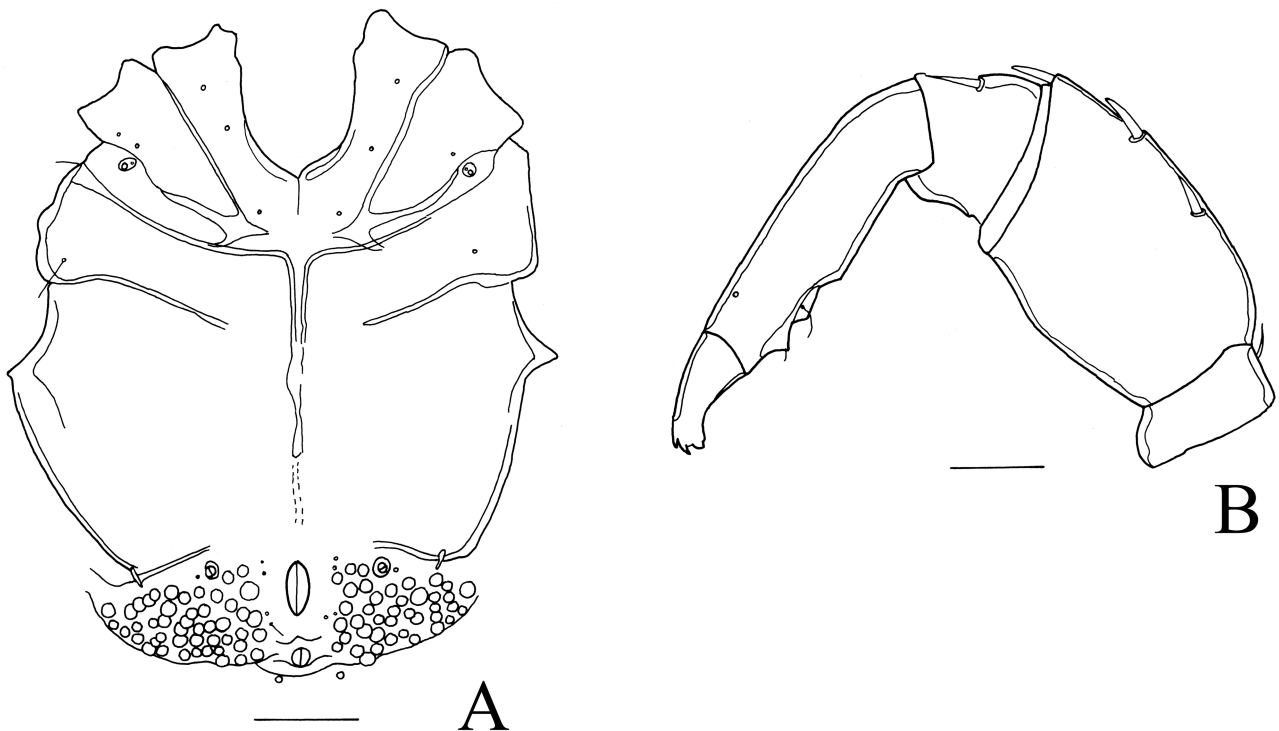
New record. **Ghana.** 9/4/3, Amansuri Wetland, 5°00.398' N 2°35.162' W, 12 m a.s.l., 26 Feb. 2011; 3/0/0, shallow part Amansuri Wetland, 4°59.635' N 2°35.417' W, 26 Feb. 2011.

Distribution. Cameroon, Tanzania (Koenike 1895), Liberia (Cook 1966), Uganda (Cook 1979), Ghana (this study).

***Piona angulata* K. Viets, 1921**

(Figure 15)

New records. **The Gambia.** 1[mounted]/0/0, pond Chamois Bridge, Basse, Upper River Division, 11 Feb. 1998. **Ghana.** 1/1/0, pool 2 Ankasa NP, 5°17.250' N 2°38.092' W, 66 m a.s.l., 26 Feb. 2011; 0/1/1, Second pond, Ankasa NP, Ghana, 5°17.424' N 2°38.286' W, 58 m a.s.l., 14 Feb. 2013.



**Figure 16** *Piona damasiella* Cook, male. A – venter; B – palp. Scale bars: A = 100  $\mu$ m, B = 50  $\mu$ m.

Distribution. Widespread in Africa south of the Sahara.

***Piona angulata multiacetabulata* Cook, 1966**

New records. **Ghana.** 5/3/3, pool 1 Ankasa NP, 5°17.407' N 2°38.378' W, 59 m a.s.l., 26 Feb. 2011; 4/4/2, fish pond along road Elubo-Axim, E of entrance Ankasa NP, 5°09.637' N 2°38.682' W, 36 m a.s.l., 27 Feb. 2011; 4/2/0, pool Damango, 9°03.983' N 1°48.419' W, 185 m a.s.l., 4 Mar. 2011; 5/1/2, First pond, Ankasa NP, 5°17.415' N 2°38.384' W, 89 m a.s.l., 14 Feb. 2013.

Distribution. Liberia (Cook 1966), Ghana (this study).

***Piona damasiella* Cook, 1966**

(Figure 16A-B)

New record. **Ghana.** 0/1/0, lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013; 1/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Description. Male: Idiosoma of the male of this study not fully sclerotized, dorsally 680 long and 547 wide, ventrally 688 long. Apodemes of anterior coxae short. Cx-III+IV fused with genital field. Genital field with numerous acetabula, extending laterally beyond posterolateral corner of Cx-IV (Figure 16A). Excretory pore probably fused with genital field. Length of P1–5: 30, 176, 64, 179, 64. P2 with a slightly convex ventral margin, P4 ventrally with three small setal tubercles (Figure 16B). Length of I-leg-4–6: 192, 215, 178. Length of IV-leg-4–6: 219, 235, 162. III-leg-6 with one of the claws elongated. Swimming setae: II-leg-5 one, III-leg-4 four, III-leg-5 two, IV-leg-4 three, IV-leg-5 five.

Remarks. The male of this species has not been described previously. Compared to *P. damasi* Lundblad, 1949, the genital plates are longer and extend more laterally. As in the female, the ventral margin of P2 is slightly convex, but straight in *P. damasi*.

Distribution. Liberia (Cook 1966), Nigeria (Cook 1979), Ghana (this study).

### ***Piona seyrigi continentalis* Lundblad, 1952**

New records. **Ghana.** 5/0/1, fish pond along road Elubo-Axim, E of entrance Ankasa NP, 5°09.637' N 2°38.682' W, 36 m a.s.l., 27 Feb. 2011; 1/3/1, shallow roadside pond along road Axim-Elubo, 5°09.080' N 2°37.354' W, 46 m a.s.l., 27 Feb. 2011; 1/0/0, pool Damango, 9°03.983' N 1°48.419' W, 185 m a.s.l., 4 Mar. 2011; 2/2/1, Second pond, Ankasa NP, Ghana, 5°17.424' N 2°38.286' W, 58 m a.s.l., 14 Feb. 2013.

Remarks. One of the males from the fish pond along road Elubo-Axim has around 35 pairs of acetabula, all other males have less than 30 pairs of acetabula. According to Cook (1966) the only reliable character to separate the nominate form and *continentalis* is the number of acetabula, 30-38 in the *seyrigi seyrigi* and 16-26 in *seyrigi continentalis*. This study shows there can be an overlap in the number of acetabula, and that this character is not always reliable.

Distribution. Uganda (Lundblad 1952), Liberia (Cook 1966), Ghana (this study).

## **Family Unionicolidae Oudemans**

### **Subfamily Encentridophorinae K. Viets**

#### **Genus *Encentridophorus* Piersig, 1897**

##### ***Encentridophorus (Encentridophorus) tumidus* Walter, 1937**

New records. **Ghana.** 2/14/0, Amansuri Wetland, 5°00.398' N 2°35.162' W, 12 m a.s.l., 26 Feb. 2013; 0/6/0, shallow part Amansuri Wetland, 4°59.635' N 2°35.417' W, 26 Feb. 2011; 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Remarks. The assignment of this species is uncertain. Cook (1966) tentatively assigned specimens from Liberia to this species, which was described by Walter (1937) based on the female only. The specimens from Ghana match the description of Cook (1966) well.

Distribution. Angola (Walter 1937), Liberia (Cook 1966), Ghana (this study).

##### ***Encentridophorus (Encentridophorus) vietsi* Bader, 1981**

New records. **The Gambia.** 0/3/0, small pond Kampanti, Western Division, 7 Feb. 1998; 0/8/0, pool Prufu Swamp, Basse, Upper River Division, 10 Feb. 1998; 1/0/0, pool along Prufu Bolon stream, Basse, Upper River Division, 12 Feb. 1998. **Ghana.** 3/4/2, pool Damango, 9°03.983' N 1°48.419' W, 185 m a.s.l., 4 Mar. 2011; 1/13/0, Black Volta River at Buipe, 8°45.674' N 1°27.320' W, 76 m a.s.l., 6 Mar. 2011; 0/8/0, rock pools upstream Fuller Falls, 8°04.958' N 1°47.749' W, 188 m a.s.l., 6 Mar. 2011; 0/2/0, lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013; 1/10/0, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013.

Remarks. Viets (1916) assigned specimens from Cameroon to *E. spinifer* (Koenike, 1893), a species described initially based on the female sex only. However, *Encentridophorus* females show few species-specific characters, and therefore I agree with Bader (1981) that the assignment of Viets (1916) is questionable. Bader (1981) described his specimens from Cameroon as *E. vietsi* Bader, 1981, and postulated that the specimens of Viets might belong to this species. My male from the Gambia has the posterior idiosoma margin with 4+1 (in the holotype 5+1) pairs of stout setae, but is otherwise similar to *E. vietsi*. In my opinion the male from the Gambia and the specimens from Viets (1916) belong all to *E. vietsi*. The number of stout setae at the posterior idiosoma margin is, therefore, 4–6 pairs of setae + a separated seta on each side. Bader (1981) was the opinion that the specimens reported by Walter (1939) from Chad do not belong to *E. vietsi*, but belong possibly to a new species. Bader based this opinion

on the measurements of leg segments and the number of swimming setae. I disagree with Bader, and I don't see any marked differences between the specimens from Chad and Cameroon.

Distribution. West Africa, previously reported from Cameroon (Viets 1916; Bader 1981), Chad (Walter 1939), the Gambia, Ghana (this study).

### Subfamily Pionatacinae K. Viets

#### Genus *Neumania* Lebert, 1879

#### *Neumania* (*Alloneumania*) *marginata* (K. Viets, 1916) – nov. comb.

*Ecpolus dorsofenestratus* Lundblad, 1949 – new syn.

New records. **The Gambia.** 0/5/0, pool Prufu Swamp, Basse, Upper River Division, 10 Feb. 1998; 0/1/0, pond ± 5 km W of Basse, along road Basse-Bansang, Upper River Division, 12 Feb. 1998. **Ghana.** 1/1/0, pool 2 Ankasa NP, 5°17.250' N 2°38.092' W, 66 m a.s.l., 26 Feb. 2011; 0/1[young]/0, shallow roadside pond, along road Axim-Elubo, 5°09.080' N 2°37.354' W, 46 m a.s.l., 27 Feb. 2011; 0/7/2, First pond, Ankasa NP, 5°17.415' N 2°38.384' W, 89 m a.s.l., 14 Feb. 2013; 0/3/0, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013; 0/2/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Remarks. Cook (1966) suggested that *Neumania marginata* K. Viets, 1916 might belong to the subgenus *Alloneumania*. Males of *Neumania dorsofenestrata* (Lundblad) and females of *N. marginata* have been collected together in this study, and I consider them belonging to the same species (both with hook-like lateral extensions of coxae and extensive secondary sclerotization). Therefore, the suggestion of Cook (1966) was correct. I do not see any differences between the males from Ghana and Congo, and therefore I propose to synonymize *N. dorsofenestrata* with *N. marginata*. Young males do not have a dorsal shield.

Walter (1935) reported this species from Niger and Burkina Faso. His illustration of the female shows a narrow strip of secondary sclerotization along Cx-IV. However, *N. marginata* has very broad and distinct secondary sclerotization along Cx-IV, almost completely filling the medial space between Cx-IV. In my opinion the specimens of Walter (1935) must be assigned to *N. separata* Cook, 1966. The female of this species has a genital field which is very similar to that of *N. marginata*, but lacks the broad secondary sclerotization. Walter & Bader (1952) reported *N. marginata* from Kenya, but they illustrated the deutonymph only. Therefore, it is not clear to which species their material belongs.

Distribution. Cameroon (Viets 1916), the Gambia, Ghana (this study).

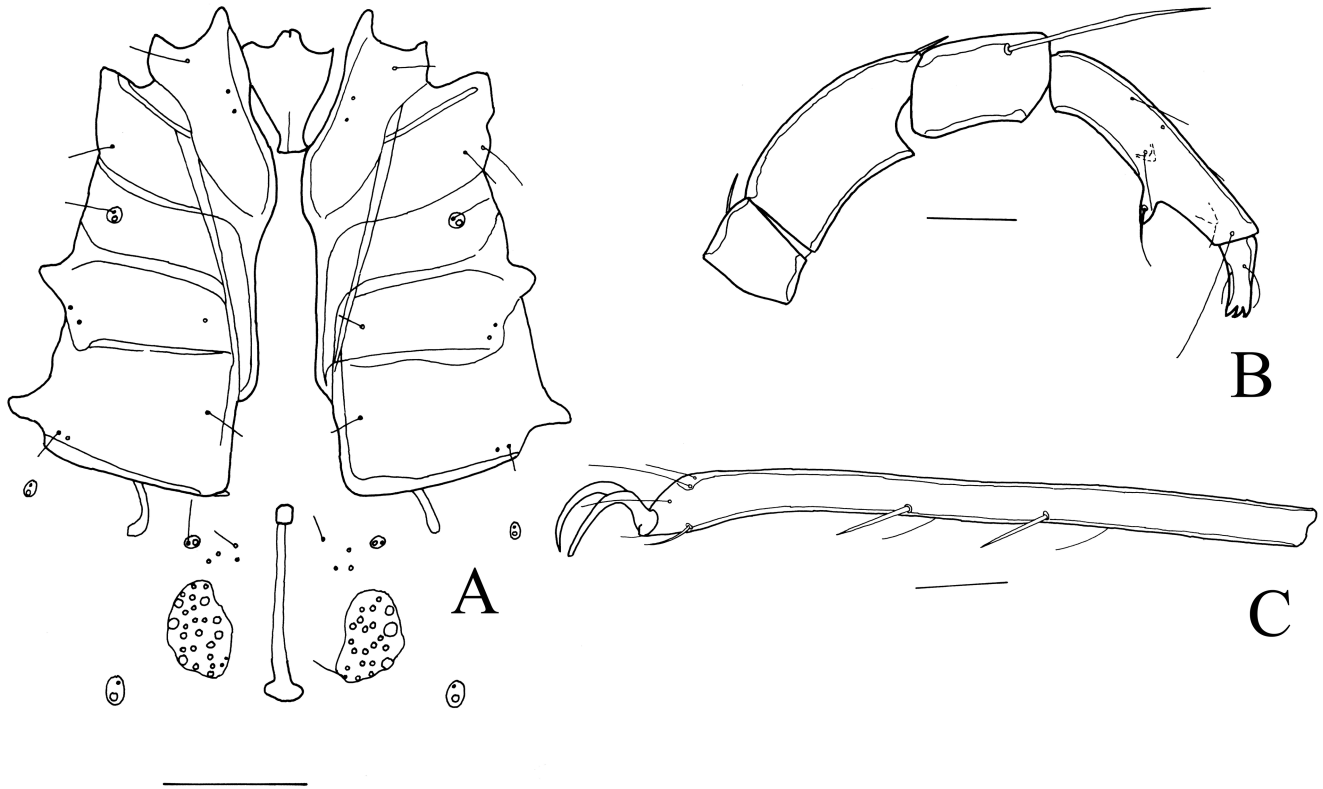
#### *Neumania* (*Allolemienia*) *falcifera* Cook, 1974

(Figure 17A-C)

New records. **The Gambia.** 0/1[mounted]/0, pool Prufu Swamp, Upper River Division, 10 Feb. 1998; 1/0/0, pool along Prufu Bolon stream, Basse, Upper River Division, 12 Feb. 1998. **Ghana.** 16/18/0, Lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013.

Description. Female: Integument smooth, idiosoma dorsally 884-1226 long and 648-995 wide, ventrally 810-1045 long. Apodemes of anterior coxae reaching to anterior part of Cx-IV. Posterior margin of Cx-IV with relatively long apodemes (Figure 17A), lateral extensions rounded. Venter without secondary sclerotization. Gonopore 267 long. Genital plates rounded, 130 long, somewhat longer than wide, each plate with 27-29 acetabula. Between Cxgl-4 and genital field four pairs of setae lying free in the integument. Length of P1-5: 42, 124, 72, 148, 46. P4 with a large ventral setal tubercle, more medially two more smaller setal tubercles present (Figure 17B). Length of I-leg-4-6: 243, 356, 352; grooved setae very long. Length of IV-leg-4-6: 356, 360, 324. Claws of legs relatively large, e.g., claw of IV-leg-6 50 long (Figure 17C). IV-leg-5 with one trifurcate seta, other trifurcate setae lost. Swimming setae lost, but probably IV-leg-5 and IV-leg-4 with four swimming setae.

Remarks. The male specimen from the Gambia differs somewhat from the holotype and only known specimen thus far. The large claw of II-leg-6 is 86-94 long (121 in the holotype),



**Figure 17** *Neumania (Allolemienia) falcifera* Cook, female. A – venter; B – palp; C – IV-leg-6. Scale bars: A = 200  $\mu\text{m}$ , B-C = 50  $\mu\text{m}$ .

and IV-leg-3 and IV-leg-4 have only one trifurcate ventral seta (versus IV-leg-3 with two or three and IV-leg-4 with three in the holotype). As nothing is known about the variation in these characters, I assign the specimen from West Africa for the time being to *falcifera*. The female has not been described previously.

Distribution. Uganda (Cook 1974), the Gambia, Ghana (this study).

***Neumania (Soarella) fusiformis* n. sp.**

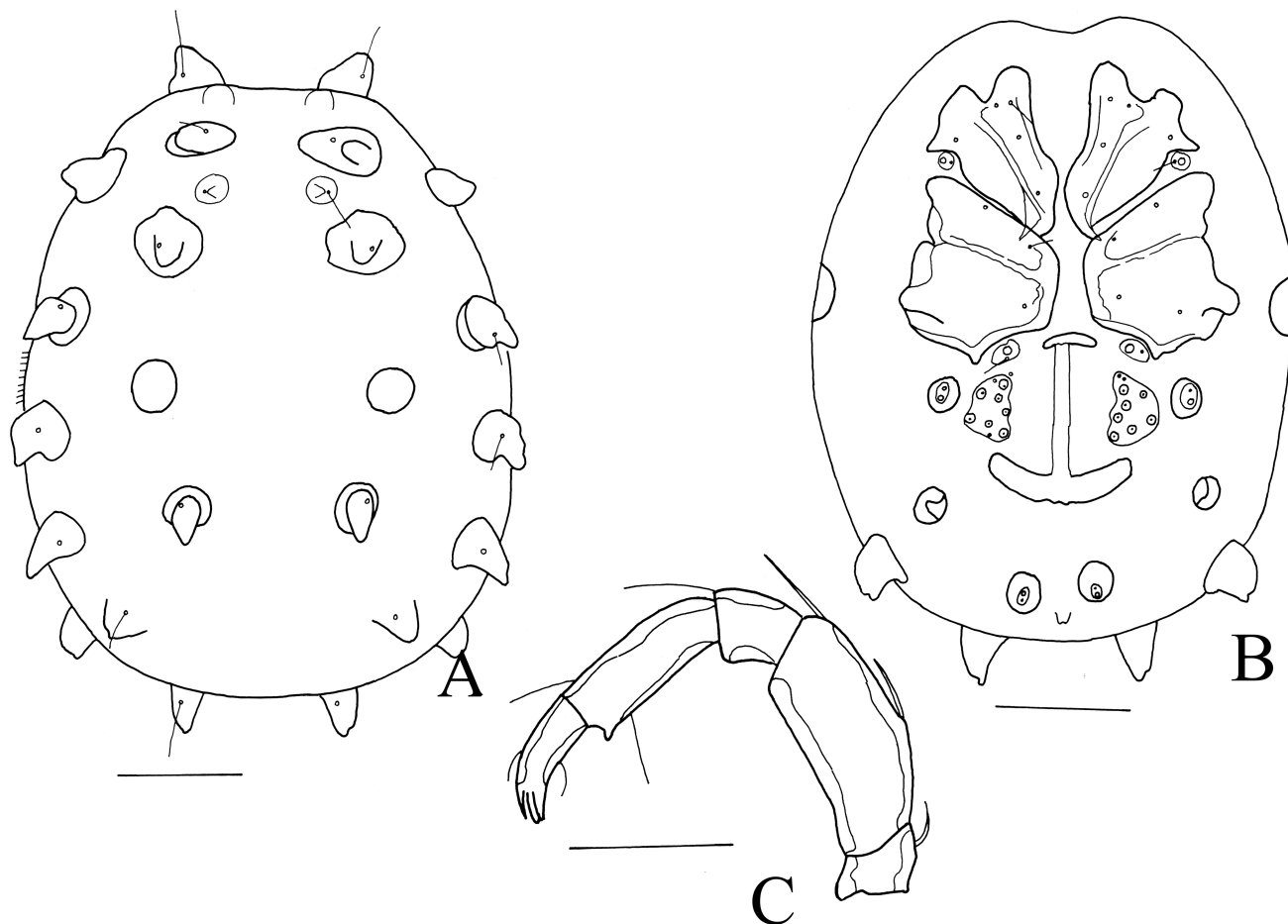
Zoobank: [OB11B4E8-7C64-47CF-85C5-90CC92994AF4](https://doi.org/10.24349/5d6U-DX5N)

(Figure 18A-C)

**Material examined.** Holotype female, plunge pool Kulugu River, Ghana, 6°51.365' N 0°25.101' E, 388 m a.s.l., 19 Feb. 2013 (RMNH).

**Diagnosis.** Apodemes of anterior coxae short, extending to Cx-III; post-genital sclerite large; excretory pore not on a tubercle.

**Description.** Female: Integument with relatively large spiny setae. Idiosoma dorsally 486 long and 381 wide, ventrally 470 long. Idiosoma with large spindle-shaped tubercles. Dorsum with a pair of small platelets (Figure 18A). Coxal field small, apodemes of anterior coxae short, extending to Cx-III. Genital field 158 wide, genital plates 58 long with seven pairs of acetabula. Pre-genital sclerite much smaller the post-genital sclerite, the latter relatively large, 114 wide (Figure 18B). Excretory pore not on a tubercle. Length of P1-5: 20, 69, 31, 56, 38. P4 anteroventrally with a short, blunt seta (Figure 18C). Length of I-leg-4–6: 60, 70, 74. Length of IV-leg-4–6: 107, 122, 96. IV-leg-3–6 ventrally with 2, 2, 3, 1 pectinate setae, respectively. Swimming setae: III-leg-4 and -5 with three, III-leg-3 with one, IV-leg-5 with two, IV-leg-4



**Figure 18** *Neumania (Soarella) fusiformis* n. sp., holotype female. A – dorsum; B – venter; C – palp. Scale bars: A-B = 100  $\mu$ m, C = 50  $\mu$ m.

with three, IV-leg-4 with one.

Male: Unknown.

**Etymology.** Named for the large spindle-shaped tubercles.

**Remarks.** The new species is somewhat similar to *N. tuberculata* Cook, 1966 and *N. ephyma* Cook, 1996, but differs in the short apodemes of the anterior coxae, and the excretory pore is not on a large tubercle.

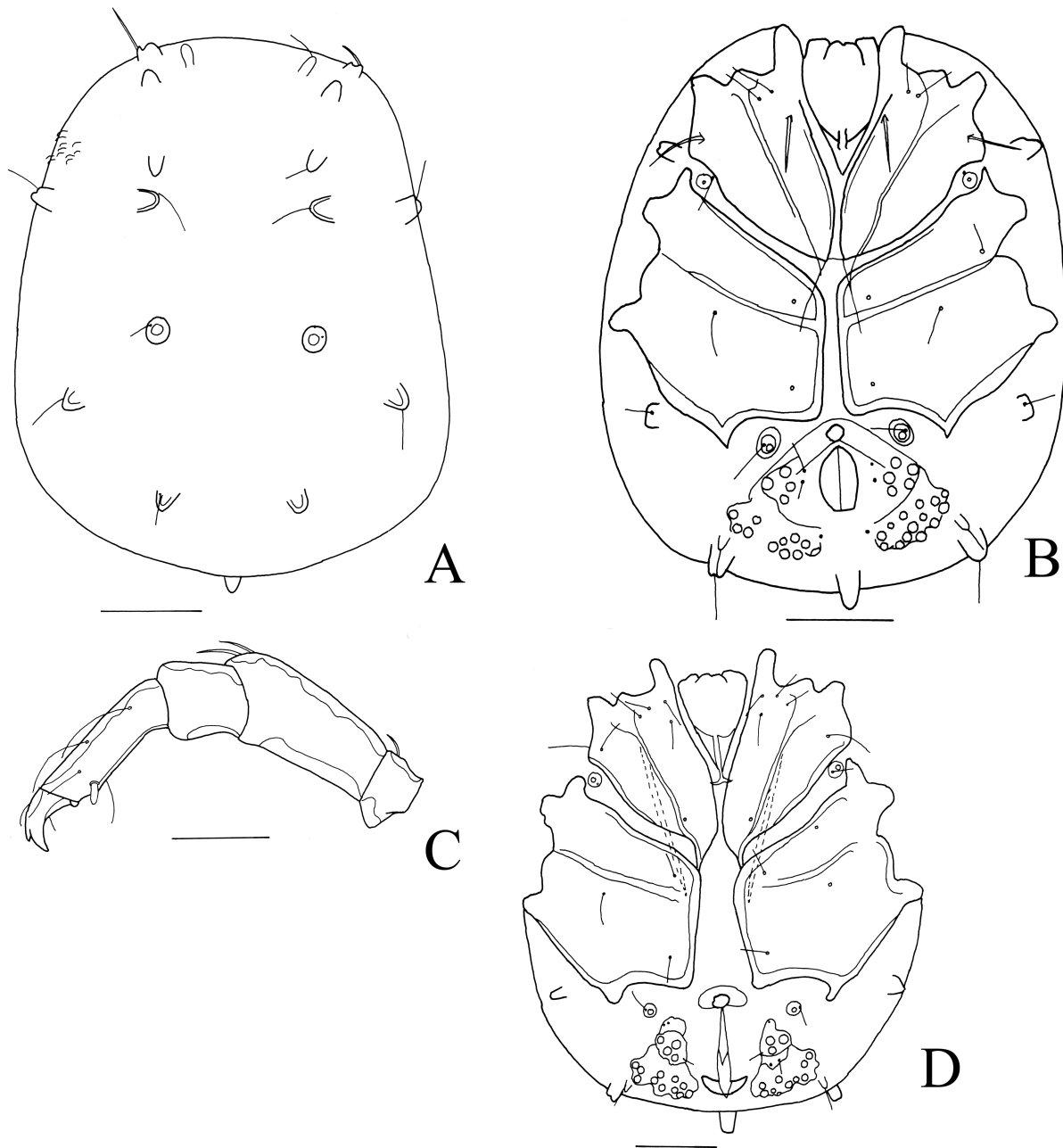
***Neumania (Soarella) ghanaensis* n. sp.**

Zoobank: [70EA4C7E-81B6-462A-9550-0F87411A49A8](https://doi.org/10.24349/70EA4C7E-81B6-462A-9550-0F87411A49A8)

(Figure 19A-D)

**Material examined.** Holotype male, Apkonu stream, downstream of falls, Logba Tota, Ghana, 6°53.054' N 0°28.024' E, 362 m a.s.l., 21 Feb. 2013 (RMNH). Paratypes (all RMNH): one female, same data as holotype; one female, tributary of Oguntwe, Ankasa NP, 5°16.563 N 2°38.733 W, 78 m a.s.l., 14 Feb. 2013; six females ([one young], unnamed stream between Apepem and Koju Amu, Atewa Hills, Ghana, 6°10.252' N 0°36.520' W, 424 m a.s.l., 27 Feb. 2013; one female, one deutonymph, Tagbo River, downstream of falls, Ghana, 7°00.708' N 0°34.326' E, 394 m a.s.l., 23 Feb. 2013.

**Diagnosis.** Male: Acetabula in two distinctly separated groups, anteriorly 4-5 pairs, posteriorly 11-14 pairs; one of the claws of P5 large. Female: Acetabula as in male, but genital



**Figure 19** *Neumania (Soarella) ghanaensis* n. sp., A-C holotype male, D paratype female. A – dorsum; B – venter; C – palp; D – venter. Scale bars: A-B, D = 100 100  $\mu$ m, C = 50  $\mu$ m.

field with a lateral extension.

**Description.** Integument covered with long, spiny setae. Glandularia, postocularia and excretory pore on relatively short tubercles (Figure 19A). Apodemes of anterior coxae extending to anterior part of Cx-IV. Posterior margin of Cx-IV with a short extension. Cx-III anterolaterally with an extension. Venter without secondary sclerotization. Male: Idiosoma 522 long and 429 wide, ventrally 514 long. Dorsum without platelets. Gonopore 60 long and 34 wide, genital field 206 wide. Acetabula in two groups, a group of 4 or 5 anterior acetabula distinctly separated from 11-14 posterior pairs (Figure 19B). Length of P1-5: 22, 92, 38, 82,

28. P2 relatively long, P4 relatively stocky, the latter segment anteroventrally with a blunt seta, dorsally with two long, curved setae. P5 with one large claw (Figure 19C). Length of I-leg-4–6: 124, 146, 148. Grooved or fluted setae of first leg larger than those of second and third legs. Length of IV-leg-4–6: 138, 186, 118. IV-leg-3, -4 and -5 ventrally with two, three and four pectinate setae, respectively. Swimming setae: IV-leg-4 and -4 three, IV-leg-3 one, III-leg-3 one (relatively short), III-leg-4 four, III-leg-5 three. I-leg-5 and II-leg-5 with one and two short swimming setae, respectively.

Female: Idiosoma dorsally 575 (518-624) long and 486 (462-563) wide, ventrally 567 (543-591) long. Dorsum with two small platelets, 16 in diameter. Genital field with two (fused) groups of acetabula, anteriorly 3-4 pairs of acetabula well separated from the posterior acetabula, posteriorly 10-11 pairs of acetabula; genital field with a lateral extension with three pairs of acetabula (Figure 19D). Length of P1–5: 22, 88, 42, 72, 26. P2 slender as in male, but P5 with the large claw. Length of I-leg-4–6: 139, 152, 134. Length of IV-leg-4–6: 162, 202, 158. Legs as in male, but IV-leg-5 with two or three swimming setae.

**Etymology.** Named after the country where the new species was collected.

**Remarks.** The new species is somewhat similar to *N. ephyma* Cook, 1966 from Liberia. The new species has smaller tubercles, and three of the dorsal tubercles are located medially (in *epphyma* all tubercles are located near the lateral idiosoma margin). Moreover, the lateral extension of the genital field is absent in *N. ephyma*.

### ***Neumania (Neumania) liberiensis* Cook, 1966**

(Figure 20)

New record. **Ghana.** 3/2/1, Afiaso stream, Kakum NP, 5°30.087' N 1°26.373' W, 114 m a.s.l., 12 Feb. 2013.

**Remarks.** The male matches the description of Cook (1966), apart from the apodemes of the anterior coxae. According to Cook, they extend to the anterior part of Cx-IV, the specimens from Ghana have longer apodemes, extending to the middle of Cx-IV. Cook (1966) was uncertain about the assignment of the female, but in my opinion this is correct. Females have the venter with less secondary sclerotization compared to the male, and the apodemes of the anterior coxae extend to the middle of Cx-IV. Some measurements are given below. Males: Integument smooth. Idiosoma dorsally 437-454 long and 421-441 wide, ventrally 429-470 long. Females: Idiosoma dorsally 514-591 long and 454-531 wide, ventrally 535-591 long.

Distribution. Liberia (Cook 1966), Ghana (this study).

### ***Neumania (Leptopterotrichophorus) manokensis* K. Viets, 1942**

New records. **Ghana.** 1/0/0, Ankasa River, Ankasa NP, 5°13.011' N 2°39.126' W, 60 m a.s.l., 13 Feb. 2013.

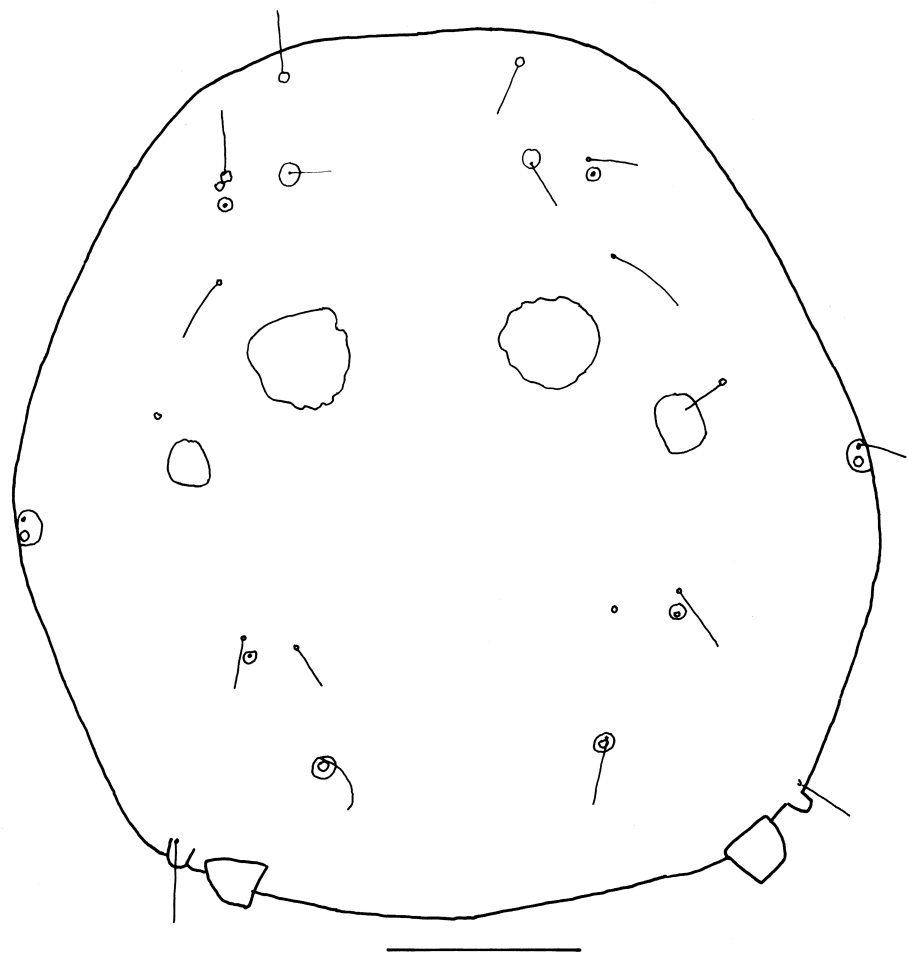
Distribution. Cameroon (K. Viets 1914), Liberia (Cook 1966), Ghana (this study).

### ***Neumania (Neumania) marginata* K. Viets, 1916**

New records. **The Gambia.** 0/5/0, pool Prufu Swamp, Basse, Upper River Division, 10 Feb. 1998; 0/1/0, pond ± 5 km W of Basse, along road Basse-Bansang, Upper River Division, 12 Feb. 1998. **Ghana.** 0/1[young]/0, shallow roadside pond, along road Axim-Elubo, 5°09.080' N 2°37.354' W, 46 m a.s.l., 27 Feb. 2011; 0/1/0, fish pond along road Elubo-Axim, E of entrance Ankasa NP, 5°09.637' N 2°38.682' W, 36 m a.s.l., 27 Feb. 2011; 0/7/2, First pond, Ankasa NP, 5°17.415' N 2°38.384' W, alt. 89 m a.s.l., 14 Feb. 2013; 0/3/0, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013; 0/2/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

**Remarks.** Walter (1935) reported this species from Niger and Burkina Faso. His illustration of the female shows a narrow strip of secondary sclerotization along Cx-IV. However, *N. marginata* has very broad and distinct secondary sclerotization along Cx-IV, almost completely filling the medial space between Cx-IV. In my opinion the specimens of Walter (1935) must be





**Figure 20** *Neumania (Neumania) liberiensis* Cook, dorsum male. Scale bar = 100  $\mu$ m.

assigned to *N. separata* Cook, 1966. The female of this species has a genital field which is very similar to that of *N. marginata*, but lacks the broad secondary sclerotization. Walter & Bader (1952) reported *N. marginata* from Kenya, but they illustrated the deutonymph only. Therefore, it is not clear to which species their material belongs.

Distribution. Cameroon (Viets 1916), South Africa (K.O. Viets 1962), Ruanda (Bader 1968), Burundi (Bader 1968), the Gambia, Ghana (this study).

***Neumania (Neumania) paucipora* (Koenike, 1895)**

New records. **Ghana.** 0/1/0, Ankasa Exploration Base stream, Ankasa NP, 5°16.413' N 2°38.810' W, 81 m a.s.l., 14 Feb. 2013.

Distribution. Tanzania (Koenike 1895, Daday 1910), Cameroon (Viets 1913/1914), Liberia (Cook 1966), Ghana (this study).

***Neumania (Neumania) reticulata* K. Viets, 1913**

New records. **Ghana.** 0/3/1, Black Volta River at Buipe, 8°45.674' N 1°27.320' W, 76 m a.s.l., 6 Mar. 2011; 0/1/0, Namini stream, Kakum NP, 5°23.396' N 1°23.294' W, 185 m a.s.l.,

12 Feb. 2013; 2/1/1, Ankasa River, Ankasa NP, 5°13.011' N 2°39.126' W, 60 m a.s.l., 13 Feb. 2013; 2/0/0, tributary of Ankasa River, Ankasa NP, 5°13.130' N 2°39.119' W, 96 m a.s.l., 13 Feb. 2013.

Distribution. Cameroon (Viets 1913/1914), Liberia (Cook 1966), Ghana (this study).

### ***Neumania (Lemienia) separata* Cook, 1966**

New records. **Ghana.** 12/7/8, shallow roadside pond, along road Axim-Elubo, 5°09.080' N 2°37.354' W, 46 m a.s.l., 27 Feb. 2011; 0/1/0, Fish pond along road Elubo-Axim, E of entrance Ankasa NP, 5°09.637' N 2°38.682' W, 36 m a.s.l., 27 Feb. 2011; 0/2/3, pool Damango, 9°03.983' N 1°48.419' W, 185 m a.s.l., 4 mar. 2011; 0/1/0, roadside pond W of entrance to Ankasa NP, 5°10.277' N 2°39.357' W, 37 m a.s.l., 14 Feb. 2013; 0/1/0, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013; 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Distribution. Liberia (Cook 1966), Niger, Burkina Faso (Walter 1935), Ghana (this study).

### ***Neumania (Soarella) thori* Viets, 1913**

New records. **Ghana.** 0/2/0, Amedzofe Falls, 6°50.656' N 0°26.868' E, 599 m a.s.l., 20 Feb. 2013; 0/1/0, plunge pool Tsatsudo Falls, 7°07.390' N 0°23.365' E, 179 m a.s.l., 22 Feb. 2013; 0/1/0, Laboun River downstream of falls, Kyabobo NP, 8°19.836' N 0°35.487' E, 342 m a.s.l., 24 Feb. 2013.

Distribution. Cameroon (Viets 1913/1914; Bader 1981), Ghana (this study).

## **Genus *Nyangalla* K. Viets, 1935**

### ***Nyangalla (Ecpolopella) acuticaudata* K. Viets, 1916 – nov. stat.**

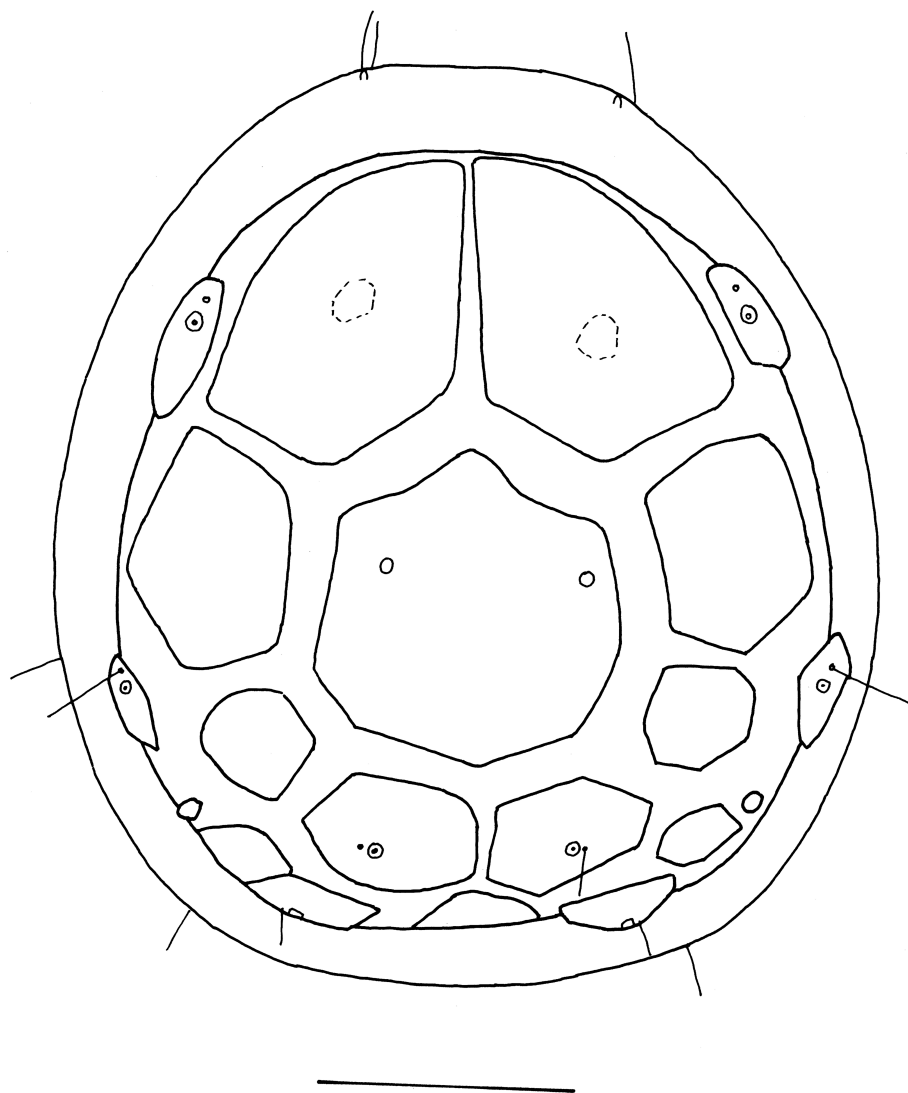
(Figure 21)

New records. **The Gambia.** 1/0/0, pool Prufu Swamp, Basse, Upper River Division, 10 Feb. 1998; 0/1/0, pond ± 5 km W of Basse, along road Basse-Bansang, Upper River Division, 12 Feb. 1998. **Ghana.** 1/0/0, pool 2 Ankasa NP, 5°17.250' N 2°38.092' W, 66 m a.s.l., 26 Feb. 2011; 0/1/0, shallow part Amansuri Wetland, 4°59.635' N 2°35.417' W, 26 Feb. 2011; 1/0/0, Fish pond along road Elubo-Axim, E of entrance Ankasa NP, 5°09.637' N 2°38.682' W, 36 m a.s.l., 27 Feb. 2011; 0/1/0, pool Damango, 9°03.983' N 1°48.419' W, 185 m a.s.l., 4 Mar. 2011; 2/0/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Description. Female: Idiosoma brownish, dorsally 705 long and 632 wide, ventrally 689 long. Dorsal shield consisting of four pairs of platelets and an unpaired central platelet, flanked by four pairs of smaller lateral platelets and one pair of very small platelets. Glandularia are present on the four pairs of lateral platelets, the central platelet and the pair posterior to the central platelet. The unpaired central platelet is 243 long. Venter, palp and legs as in *N. tessellata* (Daday, 1910). Male: Posterior margin of cauda with spiny setae.

Remarks. Previously this taxon was considered a subspecies of *N. tessellata*. As already mentioned by Viets (1916), the two taxa can be found on the same locality, and therefore, they cannot belong to the same species. Also, in Ghana the two taxa co-occur. Moreover, there are distinct differences between the two taxa. The female of *N. acuticaudata* has not been described previously. The female of the *N. tessellata* has a larger central platelet with two pairs of glandularia and the two pairs of platelets posterolateral and posterior to the central platelet are absent. The male of *N. tessellata* has posterior to the central platelet a separate platelet with a truncated posterior extension, in *N. acuticaudata* there is a no such separate platelet, but there is a pointed extension posterior to the central platelet. Given the large differences between the two taxa, in males as well as in females, and the co-occurrence of the two taxa, I propose to consider *N. acuticaudata* a full species.

Distribution. Cameroon (K. Viets 1916), Liberia (Cook 1966), the Gambia, Ghana (this study).



**Figure 21** *Nyangalla (Ecpolopella) acuticaudata* K. Viets, dorsum female. Scale bar = 200  $\mu$ m.

***Nyangalla (Ecpolopella) peltophora* (K. Viets, 1916)**

New records. **Ghana.** 0/2/0, Ankasa Exploration Base Stream, Ankasa NP, 5°16.413' N 2°38.810' W, 81 m a.s.l., 14 Feb. 2013.

Distribution. Cameroon (K. Viets 1916), Liberia (Cook 1966), Ghana (this study).

***Nyangalla (Ecpolopella) tessellata* (Daday, 1908)**

New records. **Ghana.** 0/1/0, pool 1 Ankasa NP, 5°17.407' N 2°38.378' W, 59 m a.s.l., 26 Feb. 2011; 0/2/0, pool 2 Ankasa NP, 5°17.250' N 2°38.092' W, 66 m a.s.l., 26 Feb. 2011; 1/1/0, Amansuri Wetland, 5°00.398' N 2°35.162' W, 12 m a.s.l., 26 Feb. 2011; 5/3/0, Fish pond along road Elubo-Axim, E of entrance Ankasa NP, 5°09.637' N 2°38.682' W, 36 m a.s.l., 27 Feb. 2011; 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 10 Mar. 2011; 6/13/0, same location, 27 Feb. 2013; 2/0/0, First pond, Ankasa NP, 5°17.415' N 2°38.384' W, 89 m a.s.l., 14 Feb. 2013; 0/2/0, roadside pond W of entrance to Ankasa NP, 5°10.277' N 2°39.357'

W, 37 m a.s.l., 14 Feb. 2013; 1/0/0, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013.

**Description.** The species has been described by Daday (1908) and Viets (1916). Therefore, I give only some measurements and additional characters. Male: Idiosoma 478-522 long (measured from anterior idiosoma margin till posterior margin of cauda), 445-478 wide. Posterior margin of cauda with spiny setae. Female: Idiosoma 656-810 long and 583-721 wide. Medial area between Cx-IV almost filled up completely by secondary sclerotization.

**Distribution.** Tanzania (Daday 1910), Cameroon (Viets 1916), Congo (Bader 1956), Liberia (Cook 1966), Ghana (this study).

## **Subfamily Unionicolinae Oudemans**

### **Genus *Unionicola* Haldeman, 1842**

#### ***Unionicola cooki* Bader, 1981**

New records. **Ghana.** 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 10 Mar. 2011.

**Distribution.** Cameroon (Bader 1981, Smit 1994), Ivory Coast (Hevers 2010), Ghana (this study).

#### ***Unionicola heversi* n. sp.**

Zoobank: [AA0F66D6-6FE2-48D7-8447-A149AD276899](https://doi.org/10.24349/5d6U-DX5N)

(Figure 22A-D)

**Material examined.** Holotype female, pool 1 Ankasa NP, Ghana, 5°17.407' N 2°38.378' W, 59 m a.s.l., 26 Feb. 2011 (RMNH).

**Diagnosis.** Cx-II and Cx-III with anterolaterally with a pointed extension; palp stocky, especially P4, this segment with two setal tubercles and anteromedially a stout pointed seta, P5 with large claws, ventrally with two claws but only visible in a skew position.

**Description.** Female: Idiosoma dorsally 745 long and 656 wide, ventrally 689 long. Anterior coxae with short apodemes, extending to Cx-III. Cx-II anterolaterally with a pointed triangular extension, Cx-III anterolaterally with a broader, pointed extension (Figure 22A). Posterior margin of Cx-IV with a short projection. Genital field with five pairs of acetabula on two pairs of platelets, all platelets with long posterior setae. Anterior platelets with two acetabula each, posterior pair with three acetabula each. Unfortunately, the genital field is distorted in the slide. Palp stocky, especially P4, the latter segment with two setal tubercles and a short, stout pointed seta anteromedially. P5 with large claws, ventrally with two claws but only visible in a skew position as these are lying behind each other (Figure 22B-C). Length of I-leg-4-6: 203, 227, 158. Long setae of first leg not fluted or grooved (Figure 22D). Length of IV-leg-4-6: 251, 316, 284. IV-leg-5 with three, IV-leg-4 with two swimming setae.

Male: Unknown.

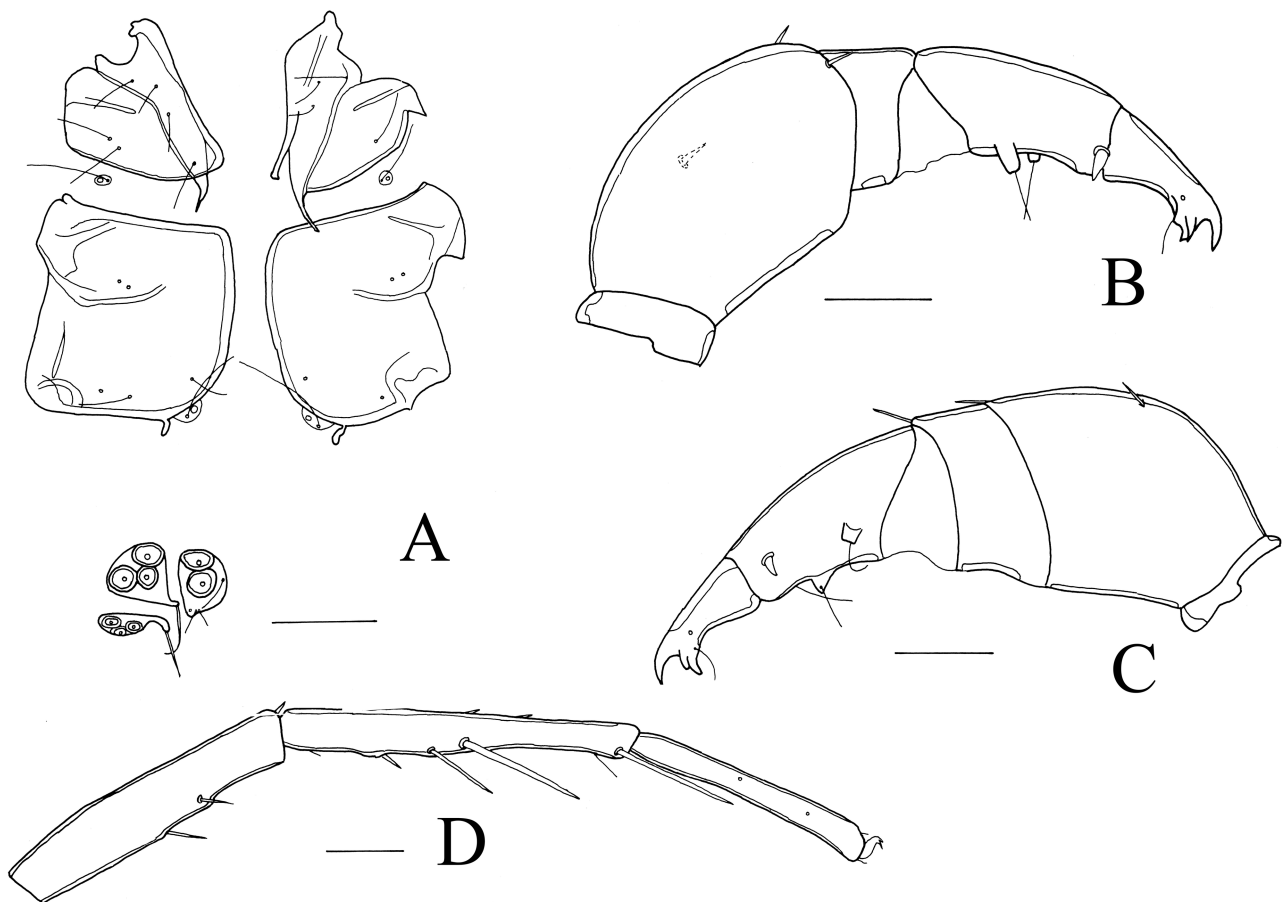
**Etymology.** Named after Jürgen Hevers for his excellent work on the genus *Unionicola*.

**Remarks.** The palp with its large claws is somewhat similar to palps of *U. dentifera* Cook, 1966 and *U. cooki* Bader, 1981, but these species have the coxae with very large anterolateral extensions.

#### ***Unionicola koenikei* K. Viets, 1913**

New records. **Ghana.** 0/2/0, Ankasa River, Ankasa NP, 5°13.011' N 2°39.126' W, 60 m a.s.l., 13 Feb. 2013.

**Distribution.** Cameroon (K. Viets 1913/1914), Burkina Faso (Walter 1935), Angola (Walter 1937), Liberia (Cook 1966), Ivory Coast (Hevers 2020), Ghana (this study). Outside Africa reported from Israel (Por 1968).



**Figure 22** *Unionicola heversi* n. sp., holotype female. A - venter; B – palp; C – palp; D – I-leg-4–6. Scale bars: A = 100  $\mu$ m, B-D = 50  $\mu$ m.

***Unionicola latilaminata* K. Viets, 1911**

New records. **Ghana.** 7/1/0, Afiaso stream, Kakum NP, 5°30.087' N 1°26.373' W, 114 m a.s.l., 12 Feb. 2013; 1/0/0, Ankasa Exploration Base trail stream, Ankasa NP, 5°16.415' N 2°38.751' W, 80 m a.s.l., 14 Feb. 2013; 0/1/0, Amedzofe Falls, 6°50.656' N 0°26.868' E, 599 m a.s.l., 20 Feb. 2013; 0/2/0, unnamed stream between Apepem and Kojo Amu, Atewa Hills, 6°10.252' N 0°36.520' W, 424 m a.s.l., 27 Feb. 2013; 1/1/0, unnamed stream upstream Sagyimase, Atewa Hills, 6°13.966' N 0°33.114' W, 671 m a.s.l., 28 Feb. 2913.

Distribution. Cameroon (K. Viets 1911, 1912), Liberia (Cook 1966), Ivory Coast (Hevers 2010), Ghana (this study). Outside Africa reported from Israel (Por 1968).

***Unionicola megalopsis* K. Viets, 1925**

New records. **Ghana.** 0/1/0, Afiaso stream, Kakum NP, 5°30.087' N 1°26.373' W, 114 m a.s.l., 12 Feb. 2013.

Distribution. Cameroon (K. Viets 1925), Ivory Coast (Hevers 2010), Ghana (this study).

## ***Unionicola minuta* K. Viets, 1916**

New records. **Ghana.** 0/1/0, Ankasa River, Ankasa NP, 5°13.011' N 2°39.126' W, 60 m a.s.l., 13 Feb. 2013.

Distribution. Cameroon (K. Viets 1916), Burkina Faso (Walter 1935), Ivory Coast (Hevers 2010), Ghana (this study).

## ***Unionicola pollicigera* K. Viets, 1921**

New records. **Ghana.** 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 10 Mar. 2011.

Distribution. Congo (K. Viets 1921), Ivory Coast (Hevers 2010), Ghana (this study). Some doubtful records published by Walter (1935, 1937), based on deutonymphs only.

## **Family Arrenuridae Thor**

### **Genus *Arrenurus* Dugès, 1834**

#### ***Arrenurus (Arrenurus) capensis* Thor, 1902**

New record. **Ghana.** 11/4/0, Lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013; 0/3/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara.

#### ***Arrenurus (Arrenurus) chappuisi* Walter, 1922**

New records. **Ghana.** 3/0/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Remarks. *Arrenurus chappuisi* is close to *A. okavango* Smit, 2012. I separated the two species based on the presence or absence of a two-lobed dorsal shield, and in lateral view the petiole is straight or upturned. With new material available of *A. chappuisi*, the slender idiosoma, and the more slender and longer petiole (both characters in dorsal view), are better characters to separate these two species

Distribution. Sudan, Congo (Bader 1968), Ghana (this study).

#### ***Arrenurus (Megaluracarus) chutteri ankasa* n. sp.**

Zoobank: [13821AE5-C70B-4DE4-BAF2-2758B7386E92](https://doi.org/10.13821/AE5-C70B-4DE4-BAF2-2758B7386E92)

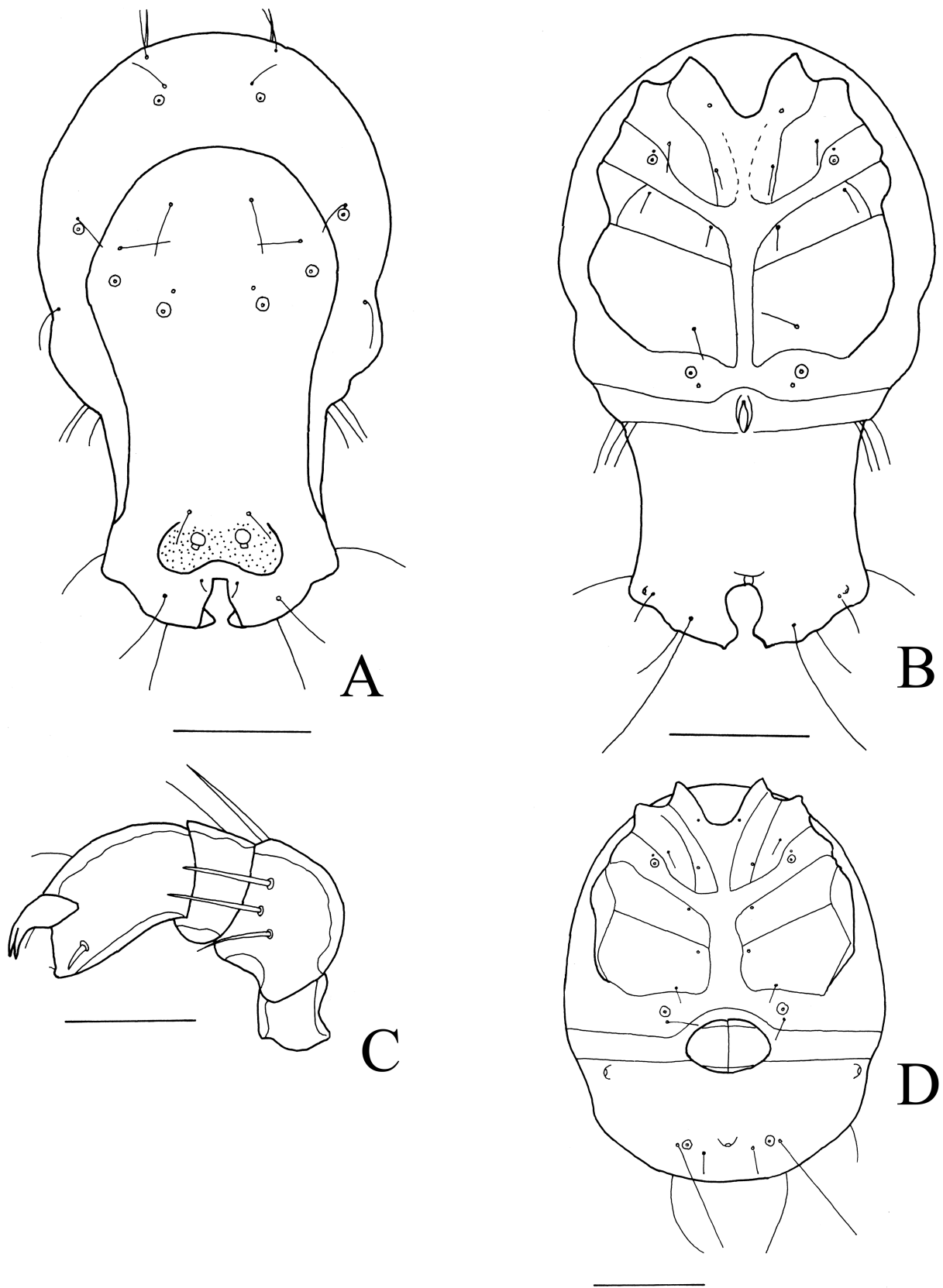
(Figure 23A-D)

**Material examined.** Holotype male, Second pond, Ankasa NP, Ghana, 5°17.424' N 2°38.286' W, 58 m a.s.l., 14 Feb. 2013 (RMNH). Paratypes: one male, one female, same data as holotype (RMNH).

**Diagnosis.** Cauda of male expanding laterally, posterior margin of cauda with a relatively wide median cleft which is widening posteriorly.

**Description.** Male: Idiosoma greenish, dorsally 838 (867) long and 502 (494) wide, ventrally 838 (851) long. Dorsal shield 360 wide. Anterior idiosoma margin convex. Lateral idiosoma margin bulging anterior to the position where the genital plates extend onto the lateral part of the idiosoma. Cauda expanding posterolaterally, in dorsal view lateral margins of cauda concave (Figure 23A). Posterior margin of cauda with a relatively wide median cleft which is widening posteriorly; lateral to cleft a pair of small setae. Dgl-4 lying in an area with spiny setae. Gonopore 52 long. Genital plates long, extending onto lateral margins of idiosoma (Figure 23B). Length of P1–5: 24, 56, 30, 60, 30. P2 medially with three setae (Figure 23C). Length of I-leg-4–6: 108, 110, 112. Length of IV-leg-4–6: 170, 138, 146. IV-leg-4 with a short spur, IV-leg-6 slightly bowed. Third and fourth legs with numerous swimming setae.

Female: Idiosoma dorsally 713 long and 567 wide, ventrally 721 long. Dorsal shield complete, 543 long and 413 wide. Anterior coxae extending beyond anterior idiosoma margin.



**Figure 23** *Arrenurus (Megaluracarus) chatteri ankasa* n. sp., holotype male A-C, paratype female D. A – dorsum; B – venter; C – palp; D – venter. Scale bars: A-B, D = 200  $\mu$ m, C = 50  $\mu$ m.

Medial margin of Cx-IV longer than medial margin of Cx-III. Medial distance of Cx-IV smaller than width of one genital valve. Gonopore field 148 wide, with anteriorly and posteriorly a small band of sclerotized patches; gonopore 92 long. Genital plates long and narrow, extending to lateral idiosoma margin (Figure 23D). Length of P1–5: 27, 56, 26, 66, 34. P2 medially with four setae. Length of I-leg-4–6: 104, 104, 92. Length of IV-leg-4–6: 130, 140, 118. Third and fourth legs with numerous swimming setae.

**Etymology.** Named after Ankasa National Park, the name is a noun in apposition.

**Remarks.** The male of the new species differs from *A. chutteri* K.O. Viets, 1966 and *A. chutteri longipes* Smit, 2012 in a much more laterally expanding posterior part of the cauda. The female of *A. chutteri* has shorter genital plates, not extending to the lateral idiosoma margin. The female of *A. chutteri longipes* has undulating genital plates.

### ***Arrenurus (Megaluracarus) chutteri longipes* Smit, 2012**

New records. **Ghana.** 2/0/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Distribution. Botswana (Smit 2012), Ghana (this study).

### ***Arrenurus (Micruracarus) circulodorsalis* n. sp.**

Zoobank: [6B1E9954-8274-4089-B1DA-00EFEF6F02AE](https://doi.org/10.24349/6B1E9954-8274-4089-B1DA-00EFEF6F02AE)

(Figure 24A–D)

**Material examined.** Holotype male, Lake Dahwenya, Ghana, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013 (RMNH). Paratypes: four females (one not sclerotized), same data as holotype (RMNH). Other material. **The Gambia.** 0/1/0, pond ± 5 km W of Basse, along road Basse – Bansang, Upper River Division, 12 Feb. 1998.

**Diagnosis.** Male: Dorsum with a small, rounded dorsal shield, idiosoma posteriorly with a large hollow, posterior idiosoma margin with a closed cleft, gonopore not visible in ventral or posteromedial view. Female: Genital plates extending halfway gonopore field and lateral idiosoma margin and widening laterally.

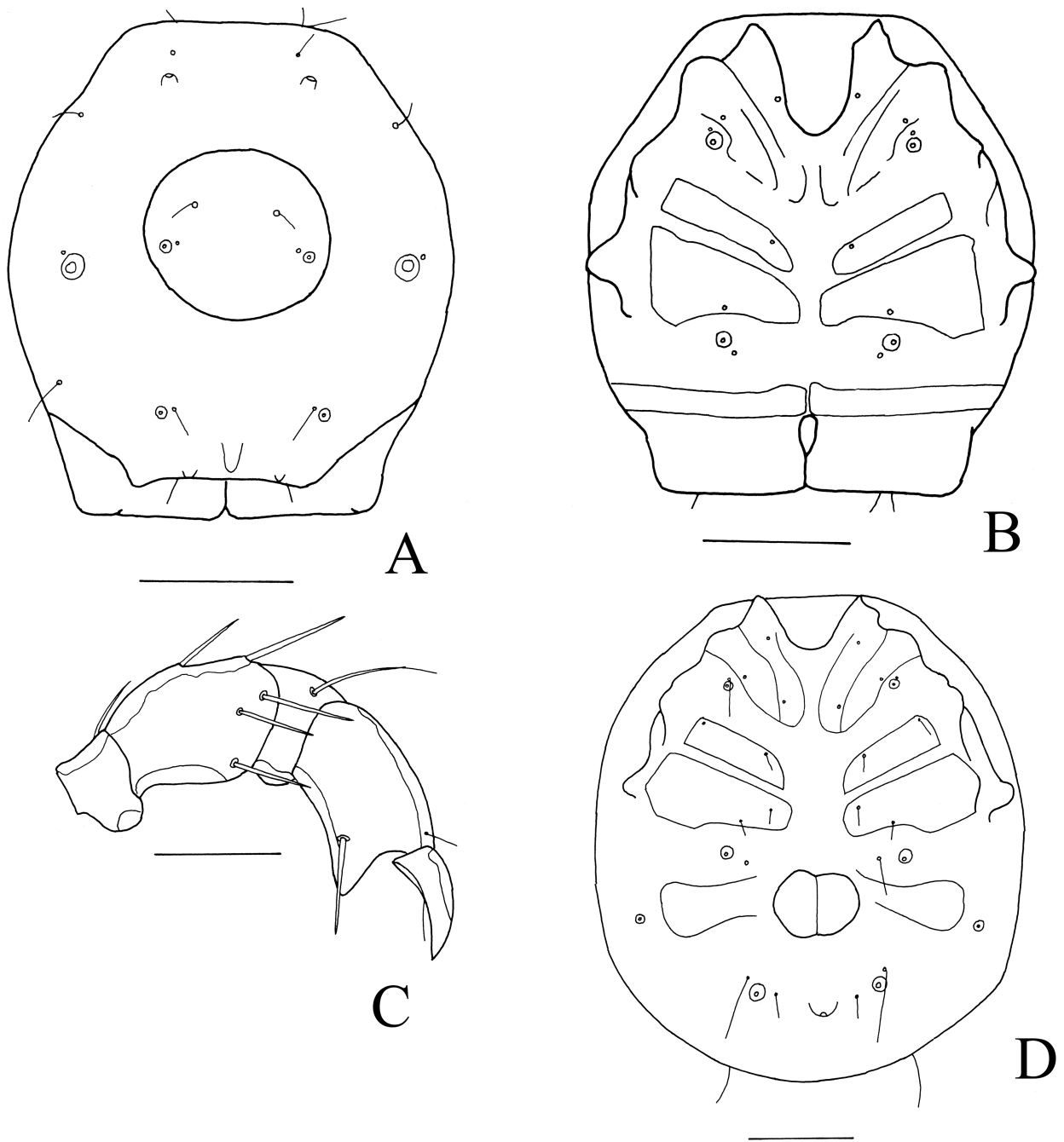
**Description.** Male: Idiosoma yellowish, dorsally 648 long and 583 wide, ventrally 624 long. Anterior idiosoma margin straight. Dorsal shield almost circular, 235 long and 251 wide, with the postocularia and Dgl-2. Dgl-1 shifted posteriorly, somewhat posterior to level of Dgl-2 (Figure 24A). No petiole present, although the structure illustrated at the posterior margin might suggest this, but this is just an interruption of the idiosoma pores. Idiosoma with a large hollow posteriorly, but this can be examined only in posteromedial view. Gonopore not visible, not in ventral view, nor in posteromedial view. Posterior idiosoma margin straight, with a closed cleft, which widens anteriorly (Figure 24B). Length of P1–5: 26, 60, 46, 72, 44. P2 medially with three setae (Figure 24C). Length of I-leg-4–6: 101, 114, 132. Length of IV-leg-6: 144, 98, 96. I- and II-leg-6 with numerous small setae. Legs with many swimming setae.

Female: Idiosoma dorsally 907 (932–948) long and 802 (794–810) wide, ventrally 899 (923–956) long. Dorsal shield complete, 656 (644–680) long and 506 (498–526) wide. Anterior idiosoma margin straight, posterolateral corners of idiosoma absent. Anterior coxae extending to or just beyond anterior idiosoma margin. Medial margin of Cx-IV longer than medial margin of Cx-III. Medial distance of Cx-IV longer than width of one genital valve. Gonopore field 166 wide and without sclerotized patches, gonopore 105 long. Genital field 567 wide, genital plates widening laterally, extending halfway gonopore field and lateral idiosoma margin (Figure 24D). Excretory pore lying halfway gonopore field and posterior idiosoma margin. Length of P1–5: 32, 72, 58, 80, 50. P3 medially with one seta. Length of I-leg-4–6: 110, 124, 122. I- and II-leg-6 with less small setae compared to male. Length of IV-leg-4–6: 170, 162, 136. Legs with many swimming setae.

**Etymology.** Named for the rounded dorsal shield of the male.

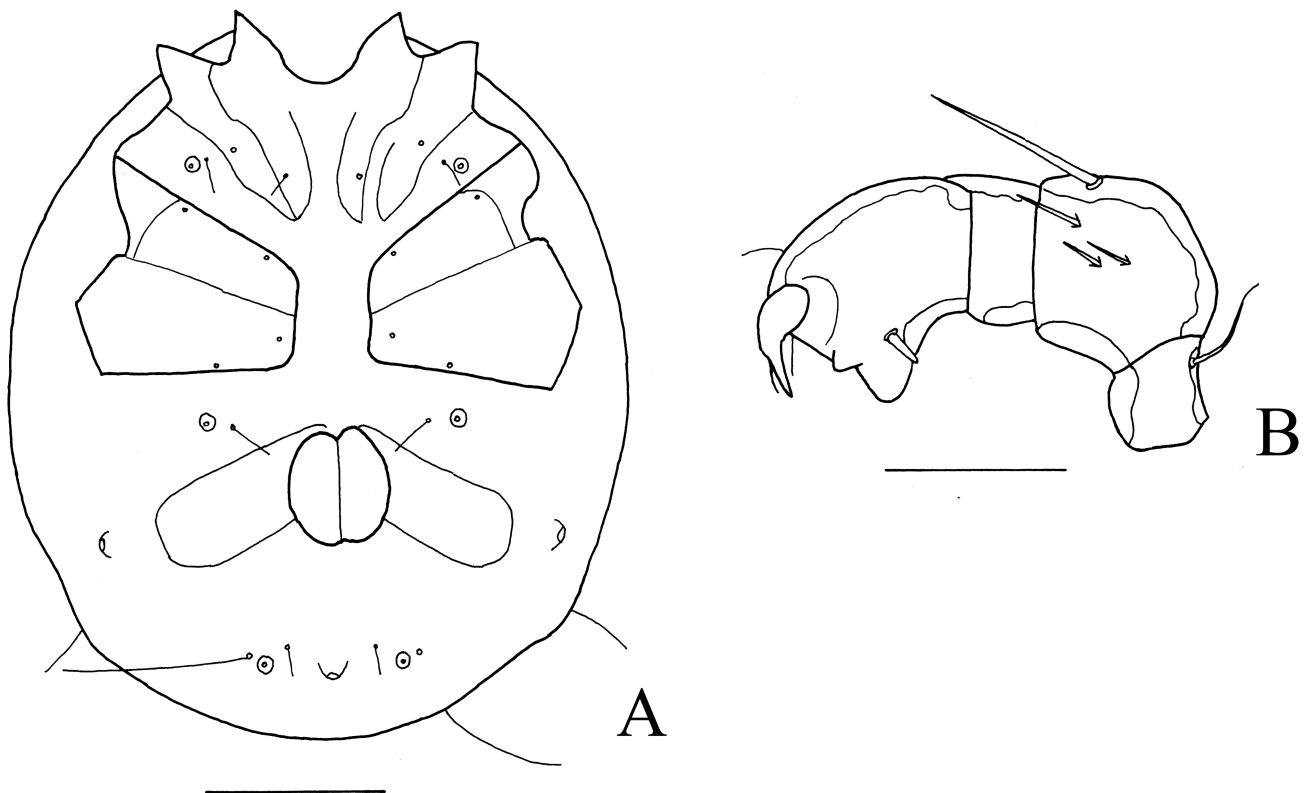
**Remarks.** The male is well characterized by its rounded dorsal shield, the absence of a petiole and the gonopore not visible in ventral or posteromedial view. No other Afrotropical





**Figure 24** *Arrenurus (Micruracarus) circulodorsalis* n. sp., holotype male A-C, paratype female D. A – dorsum; B – venter; C – palp; D – venter. Scale bars: A-B, D = 200  $\mu$ m, C = 50  $\mu$ m.

*Arrenurus* species shares this combination of characters. The female is well characterized by the shape of the genital plates.



**Figure 25** *Arrenurus (Megaluracarus) geniculatus* Koenike, female. A – venter; B – palp. Scale bars: A = 200  $\mu$ m, B = 50  $\mu$ m.

***Arrenurus (Micruracarus) damkoehleri* K. Viets, 1914**

New records. **Ghana.** 2/0/0, Second pond, Ankasa NP, 5°17.424' N 2°38.286' W, 58 m a.s.l., 14 Feb. 2013; 1/1/0, roadside pond W of entrance to Ankasa NP, 5°10.277' N 2°39.357' W, 37 m a.s.l., 14 Feb. 2013; 32/31/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Distribution. Cameroon (K. Viets 1913/1914, K.O. Viets 1972, Mali, Burkina Faso (Walter 1935), Liberia (as *A. haliki*, Cook 1966), Ghana (Smit 2012).

***Arrenurus (Megaluracarus) geniculatus* Koenike, 1898**

(Figure 25A-B)

New record. **Ghana.** 3/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Description. Female: Idiosoma colour greenish. Anterior idiosoma margin slightly concave, posterolateral corners of idiosoma indistinct. Idiosoma dorsally 778 long and 660 wide, ventrally 782 long. Dorsal shield incomplete, 429 wide. Anterior coxae extending beyond anterior idiosoma margin. Medial margin of Cx-IV slightly longer than medial margin of Cx-III. Medial distance of Cx-IV shorter than width of gonopore field. Genital field 421 wide, genital plates relatively broad, extending more or less halfway lateral idiosoma margin (Figure 25A). Length of P1–5: 20, 60, 34, 68, 33. P2 medially with three short setae; P4 stocky, anteroventrally rounded, anterior margin with a small extension (Figure 25B). Length of I-leg-4–6: 128, 118, 124. Length of IV-leg-4–6: 122, 130, 148. Legs with numerous swimming setae.

Remarks. The female of this species has not been described before. The small extension of the anterior margin of P4 is also present in the males of this study.

Distribution. Madagascar, Ghana (this study).

### ***Arrenurus (Brevicaudaturus) ghanaensis* Cook, 1979**

New records. **Ghana.** 0/1/0, Lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013; 0/1/0, pool Nsu Appiah, near Kakum NP, 5°22.895' N 1°25.012' W, 159 m a.s.l., 12 Feb. 2013; 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Distribution. Ghana (Cook 1979, this study).

### ***Arrenurus (Brevicaudaturus) neolaticodulus* Cook, 1966**

New records. **Ghana.** 1/2/0, First pond Ankasa NP, 5°17.415' N 2°38.384' W, 89 m a.s.l., 14 Feb. 2013.

Distribution. Liberia (Cook 1966), Ghana (Smit 2012).

### ***Arrenurus (Brevicaudaturus) odonatophilus* Münchberg, 1958**

New records. **Ghana.** 0/2/0, Second pond Ankasa NP, 5°17.424' N 2°38.286' W, 58 m a.s.l., 14 Feb. 2013; 5/8/0, roadside pond W of entrance to Ankasa NP, 5°10.277' N 2°39.357' W, 37 m a.s.l., 14 Feb. 2013.

Distribution. Congo (Münchberg 1958), Liberia (Cook 1966), Ghana (Smit 2012).

### ***Arrenurus (Brevicaudaturus) oldhami* Cook, 1979**

New records. **Ghana.** 0/1/0, roadside pond W of entrance to Ankasa NP, 5°10.277' N 2°39.357' W, 37 m a.s.l., 14 Feb. 2013.

Distribution. Nigeria, Ghana (Cook 1979, this study).

### ***Arrenurus (Rhinophoracarus) praeacutus* (K. Viets, 1916)**

New records. **Ghana.** 0/1/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Distribution. Cameroon, Ghana (Cook 1979, this study).

### ***Arrenurus (Micruracarus) tubifer* Walter, 1922**

New records. **Ghana.** 1/0/0, Lake Dahwenya, 5°46.760' N 0°03.049' E, 24 m a.s.l., 9 Feb. 2013; 1/2/0, Avu Lagoon, 5°59.244' N 0°42.476' E, 13 m a.s.l., 18 Feb. 2013; 2/2/0, Inlet Volta River at Kpong, 6°09.183' N 0°03.709' E, 25 m a.s.l., 27 Feb. 2013.

Distribution. Widespread in Africa south of the Sahara. First records for Ghana.

### **Genus *Thoracophoracarus* K. Viets, 1914**

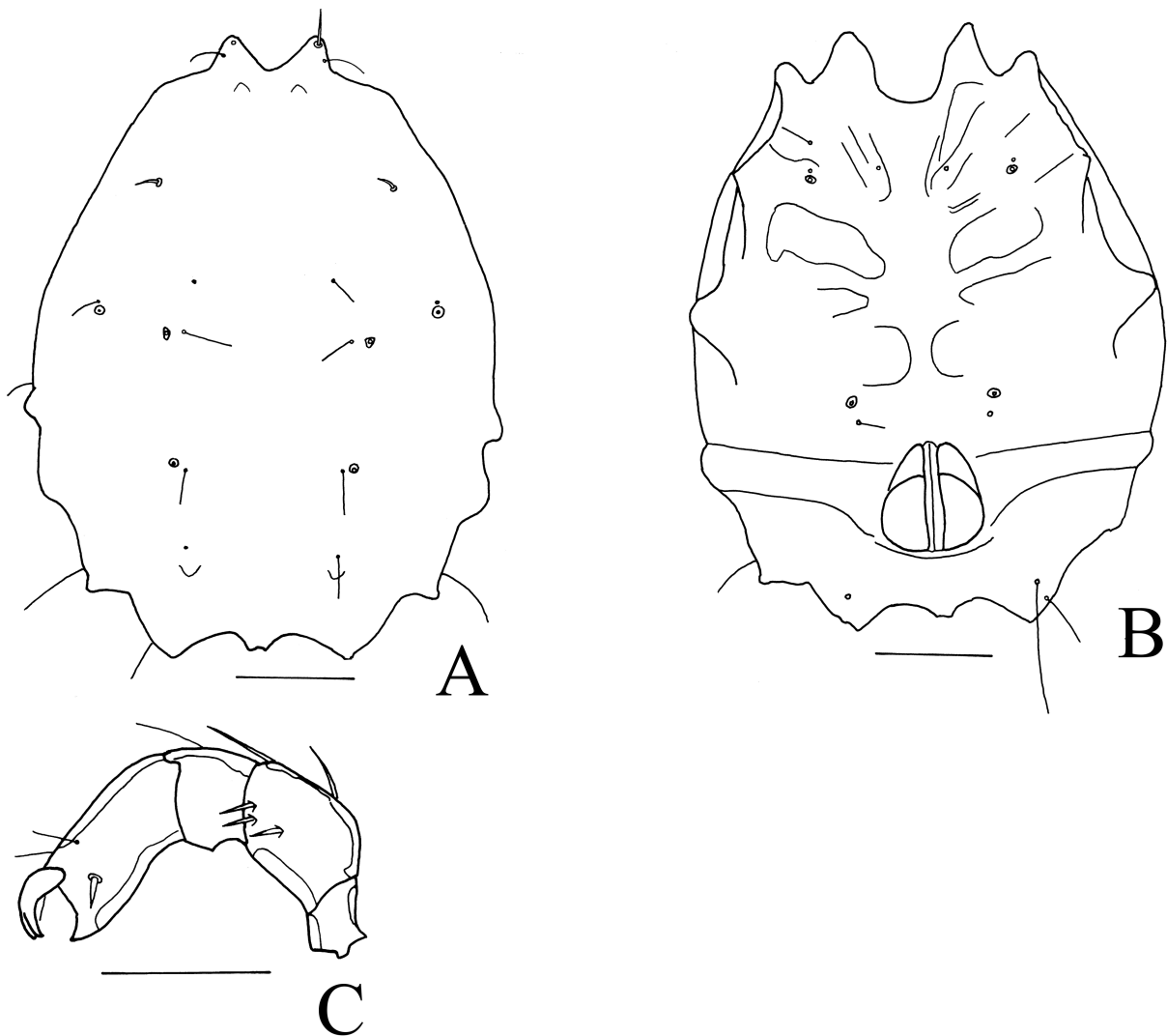
A genus with nine species known from Africa (Gerecke 2009). Furthermore, one species known from Chile and one from Asia (Smit 2020).

### ***Thoracophoracarus (Thoracophoracarus) kuehnei* K. Viets, 1916**

New records. **Ghana.** 0/1/0, plunge pool Tsatsudo Falls, 7°07.390' N 0°23.365' E, 179 m a.s.l., 22 Feb. 2013.

Remarks. With a straight posterior margin, a convex posterior margin and P2 with two setae, the specimen from Ghana matches the description given by Gerecke (2009) well.

Distribution. Cameroon (K.O. Viets 1972), Ghana (this study).



**Figure 26** *Thoracophoracarus (Thoracophorus) petioluriger* K. Viets, female. A – dorsum; B – venter; C – palp. Scale bars: A-B 100  $\mu$ m, C = 50  $\mu$ m.

***Thoracophoracarus (Thoracophorus) petioluriger* K. Viets, 1925**

(Figure 26A-C)

New record. **Ghana.** 0/1/0, unnamed stream upstream Sagyimase, Atewa Hills, 6°13.966' N 0°33.114' W, 671 m a.s.l., 28 Feb. 2013.

Description. Female: Idiosoma colour brownish. Idiosoma dorsally 514 long and 381 wide, ventrally 502 long. Anterior idiosoma margin strongly concave, excretory pore terminal lying in a concave posterior idiosoma margin. Glandularia tubercles in posterior half of dorsum large (Figure 26A). All suture lines of the coxae indistinct. Gonopore field 90 long, genital plates very indistinct and hardly discernible (Figure 26B). Length of P1–5: 18, 42, 30, 50, 22. P2 medially with three setae, P4 anteroventrally pointed (Figure 26C). Length of I-leg-4–6: 104, 104, 92. Length of IV-leg-4–6: 80, 84, 70. Swimming setae: III-leg-3 two, III-leg-4 four, III-leg-5 four, IV-leg-2 and -3 one, IV-leg-4 four, IV-leg-5 four.

Remarks. As stated by Gerecke (2009), attribution of males and females in arrenurids can be problematic due to the strong sexual dimorphism. This applies to the specimen of this

study also. Based on the strong concave anterior margin, assignment to *T. whartoni* Cook, 1966 would be most likely. However, due to the relative slender P4 and the large humps of the dorsum, I assigned this specimen to *A. petioluriger*. Females of the latter species, originally described as *T. mammosus* K. Viets, 1925, are known from two specimens only collected in Cameroon. Moreover, there are some differences with the description given by Gerecke (2009), i.e., the anterior margin is stronger concave and the dorsum has two more pairs of glandularia. Therefore, an emended description is given of the female of *petioluriger*.

Distribution. Cameroon (K. Viets 1925), Ghana (this study).

## Family Mideopsidae Koenike

### Genus *Djeboa* K. Viets, 1911

A genus with numerous species known from the Afrotropical region.

#### *Djeboa expansipalpis* (Cook, 1966)

New records. **Ghana**. 1[mounted]/0/0, stream Asikuma, Kakum NP, 5°26.995' N, 1°25.071' W, 12 Feb. 2013.

Distribution. Liberia (Cook 1966), Ivory Coast (Pešić *et al.* 2013), Ghana (this study).

#### *Djeboa ferruginea* K. Viets, 1914

New records. **Ghana**. 0/6[one mounted]/0, stream Asikuma, Kakum NP, 5°26.995' N 1°25.071' W, 12 Feb. 2013.

Distribution. Cameroon, Ghana, Ivory Coast, Zimbabwe (Pešić *et al.* 2013).

#### *Djeboa unimaculata* (Cook, 1966)

New records. **Ghana**. 1/0/0, stream Asikuma, Kakum NP, 5°26.995' N, 1°25.071' W, 12 Feb. 2013.

Distribution. Liberia (Cook 1966), Ivory Coast, Ghana (Pešić *et al.* 2013).

## Family Momoniidae K. Viets

### Subfamily Momonidinae Lundblad

#### Genus *Momonides* Lundblad, 1941

A genus with a disjunct distribution, with two species known from the Oriental region, one from the Palearctic region and one from the Afrotropical region.

#### *Momonides ghanaensis* Smit, 2012

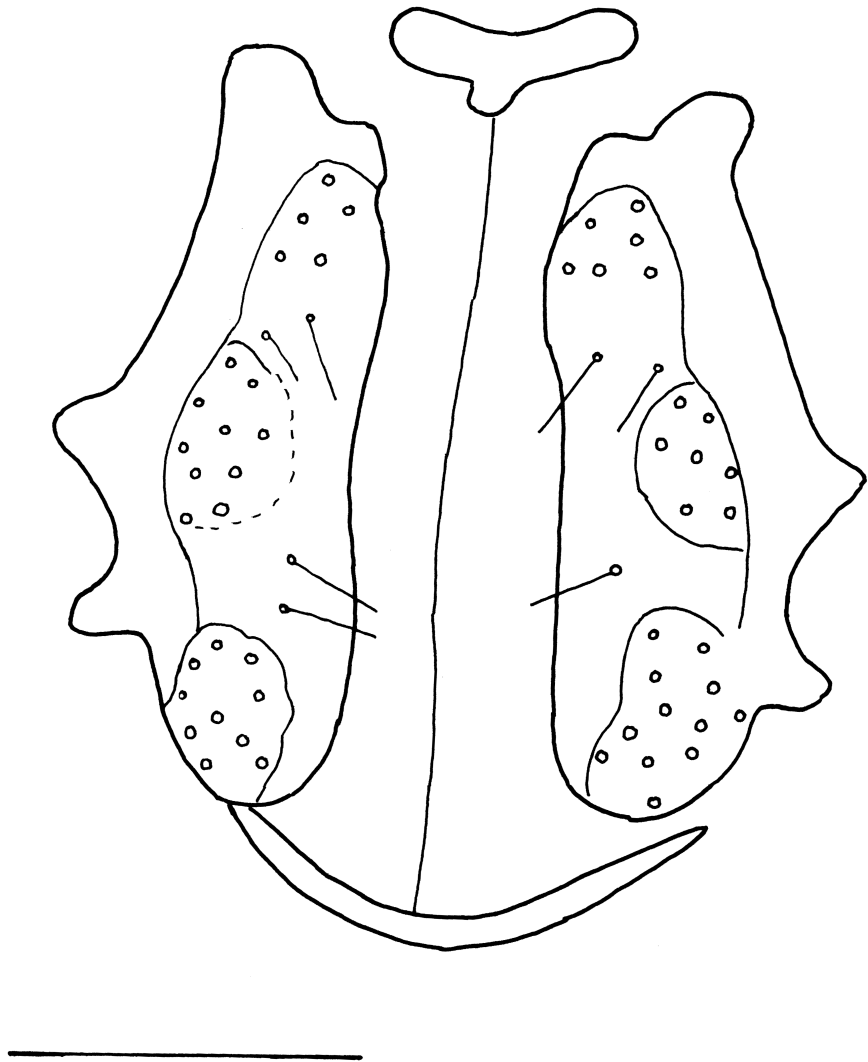
(Figure 27)

New records. **Ghana**. 1/1/0, unnamed stream between Apepem and Kojo Amu, Atewa Hills, 6°10.252' N 0°36.520' W, 424 m a.s.l., 27 Feb. 2013; 1/0/0, unnamed stream upstream Sagyimase, Atewa Hills, 6°13.966' N 0°33.114' W, 671 m a.s.l., 28 Feb. 2013.

Description. Female. Idiosoma dorsally 413 long and 405 wide, ventrally 429 long. Integument and lobed sclerites as described for male. Genital field with two genital plates, 88 long. Acetabula in three indistinct groups, with ± 25 pairs of acetabula (Figure 27). Pre-genital sclerite 44 wide, post-genital sclerite 56 wide, more slender than pre-genital sclerite. Length of P1–5: 30, 50, 31, 44, 36. Palp as in male. Length of I-leg-4–6: 88, 185, 98. Length of IV-leg-4–6: 118, 140, 122. Legs as in male. Male: Idiosoma dorsally 369–377 long and 365–369 wide, ventrally 421–429 long.

Remarks. Thus far known only from the holotype male, and the female is described here for the first time.

Distribution. Atewa Hills, Ghana (Smit 2012).



**Figure 27** *Momonides ghanaensis* Smit, female genital field. Scale bar = 50  $\mu\text{m}$ .

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