

Africa's smallest damselfly—a new *Agriocnemis* from Namibia (Odonata: Coenagrionidae)

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Abstract *Agriocnemis bumhilli* sp. n., a new damselfly from the Kwando River in northeastern Namibia is described. The new species is similar to *Agriocnemis angolensis* but characterized by unique male appendages, swollen abdominal segments 9 and 10, the complete absence of antehumeral stripes, and smaller size. The species is illustrated and a photograph is provided. For comparison, an illustrated key to the other members of *Agriocnemis* within south-central Africa is provided.

Keywords Damselfly · *Agriocnemis* taxonomy · Body size · Africa · Kwando River

Abbreviations

Measurements and morphology

Fw	Forewing(s)
Hw	Hindwing(s)
Pt	Pterostigma
Ax	Antenodal cross-vein(s)

This paper is dedicated to Prof. Dr. Michael L. May in honour of his work on Odonata taxonomy.

This is a contribution to the Festschrift for Michael L. May.

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Px	Postnodal cross-vein(s)
S1–10	First–tenth abdominal segment

Natural History Museums

NMNW	National Museum of Namibia Windhoek
RMNH	Netherlands Centre for Biodiversity Naturalis Leiden

The term cerci is used for male superior anal appendages the term paraproct for the male inferior anal appendages. The gender symbols (♂ for male, ♀ for female) are used when appropriate.

Introduction

The genus *Agriocnemis* Selys, 1877 consists of 41 species, which occur in Africa and Asia (Pinhey 1974, Schorr & Paulson 2012). The members of the genus are characterized by the position of the arculus far distal to the second Ax, and their small size (Pinhey 1974). Some species belong to the smallest known zygopterans. In his revision, Pinhey (1974) listed 16 species of *Agriocnemis* for the African continent and adjacent islands. *Agriocnemis aligulae* Pinhey, 1974 was later synonymised with *A. maclachlani* Selys, 1877 (d'Andrea & Carfi 1997, vide Dijkstra 2007a). Some of the various subspecies described by Pinhey (1974) remain dubious and one, *Agriocnemis pygmaea sania*, was raised back to species level, *A. sania* Nielsen, 1959 (Dumont 1974). In recent years, d'Andrea & Carfi (1997) described *A. dissimilis* from a single female, which, however, appeared to be a synonym of the Ugandan endemic *A. palaeforma* Pinhey, 1959 (Dijkstra 2007a).

Of the seven species of *Agriocnemis* known for the southern African region (Suhling et al. 2009), six occur in the Zambezi and Okavango River basins, namely *A. angolensis* Longfield, 1947, *A. exilis* Selys, 1872, *A. gratiosa* Gerstäcker, 1891, *A. pinheyi* Balinsky, 1963, *A. ruberrima albifrons* Balinsky, 1961

and *A. victoria* Fraser, 1928 (Martens et al. 2003, Kipping 2010, Pinhey 1984). Most of the species are to be found in the extensive swampy wetlands of permanent rivers such as the Okavango Delta and Linyanti swamps. The South African endemic *A. falcifera* Pinhey, 1959 is restricted to mountainous habitats.

In February 2006, A.M. collected a number of *Agriocnemis* species at the type locality Kwando River at Bum Hill (see Fig. 4). With many *A. exilis* and *A. victoria*, two males were collected that were noticed as unusual. In Suhling & Martens (2007: p. 92) the two specimens were illustrated erroneously on a photograph under *A. angolensis*. At this stage, it was already clear that the specimens had some characters unusual in *Agriocnemis*. Therefore, during a fieldtrip in January 2009, J.K. also visited the type locality with the aim of collecting more specimens. Here, we describe the new species formally based on seven males and four females.

Description

Agriocnemis bumhilli sp. n.

(Figs. 1, 2)

Suhling & Martens (2007: photograph p. 92)—*Agriocnemis angolensis* nec Longfield, 1947.

Etymology The species is named after its type locality, the community campsite Bum Hill on the banks of the Kwando

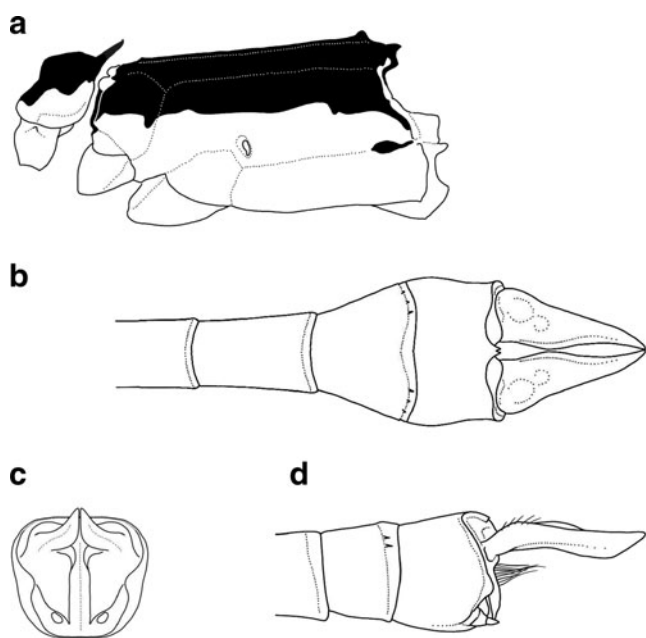


Fig. 1 a–d *Agriocnemis bumhilli* sp. n.—holotype male. **a** Prothorax and thorax, lateral view. **b** Distal portion of abdomen, dorsal view. **c** Appendages, posterior view. **d** Distal portion of abdomen, lateral view. Drawings by Ole Müller



Fig. 2 *Agriocnemis bumhilli* sp. n.—male, resting in dense vegetation at the Kwando River, Bum Hill, Caprivi Strip, 10 January 2009. Photograph by J. Kipping

River, Namibia. The name also nicely refers to one of the most prominent characters of the species, the swollen S9–10.

Material examined Holotype ♂: Namibia, Caprivi Region, Kwando River at Bum Hill community campsite, northwest of Kongola (17°46'53"S, 23°20'27"E, 969 m.a.s.l.), 10 January 2009, leg. J. Kipping, to be deposited in NMNW.—Allotype and paratypes (all from the same locality): 6 ♂, 4 ♀, same locality and date as holotype, allotype female in copula with paratype male (2 ♂ preserved in 100% ethylalcohol, all others acetone dried in plastic envelopes); paratype ♀ and 2 paratype ♂ to be deposited in NMNW, 2 paratypes in RMNH and others in coll. J. Kipping.—Other material: 2 ♂, 28 February 2006 leg. A. Martens, to be deposited in NMNW, 1 ♂, 7 December 2010, leg. F. Suhling, to be deposited in NMNW.

Description of holotype male

Acetone dried, preserved dry, in plastic envelope.

Head Labium whitish. Mandibles pale green. Labrum black with broadly pale ventral margin. Postclypeus black, the anteclypeus contrasting pale green. Genae and antefrons pale green. Frons, vertex and occiput black with bronze to green metallic sheen. Frontal band severed. Base of antennae and ocelli pale brown. Isolated postocular spots small, slightly elongated and bright blue. Postgenae pale green with contrasting black markings. Dorsal half of eyes in life black, sharply separated from pale green ventral half.

Thorax Prothorax dorsally black with green metallic sheen. Anterior collar black without markings. Lower part of the sides pale green. The prothoracic hindlobe bears only a broad and flat middle lobe with a thin pale line along

hindmargin. Lateral lobes not developed. Laminae black with pale green at distal end. Synthorax completely black with strong metallic sheen down to interpleural suture. No pale antehumeral stripes. Small black spot on metapleural suture. Sides pale green.

Legs Coxae and trochanters pale. Femora pale with a sharp brown stripe on exterior surface that broadens distally and forms a brown ring at the distal end. Tibiae all pale with a thin exterior dark stripe and contrasting dark setae. Tarsi pale with dark ring at distal ends of segments.

Wings Clear, venation dark brown. Fw with 7 Px, in Hw 6 Px. Pt in all wings pale framed by thick dark brown margins.

Abdomen with continuous broad black dorsal band and bronze sheen on S1–7. S1–3 pale green at sides changing to bluish on S4–7. S8–10 with purplish coloration. S9 and S10 remarkably swollen both in lateral and dorsal view but distal end of S10 not raised apically. Anal appendages purple orange. Superior appendages longer than S10. In lateral view broad, parallel sided in the distal half and pointed apically. In dorsal view broad at base and also becoming pointed apically. At the base of each of the superior appendages a downward directed flat and pointed process, the apical tooth of which reaches the inferior. A remarkable tuft of hairs on this process resembles a backward directed pointed structure. Inferior appendages small, blunt and with a small dark upward-directed tooth.

Measurements [in mm] Total length 18.4 (incl. anal appendages), abdomen length 14.6 (excl. anal appendages), head width 2.5, Fw length 9.4, Hw length 8.8, Pt in Fw 0.6.

Description of female

Collected in copula with a paratype male. Acetone dried, preserved dry, in plastic envelope.

Head Labium whitish. Mandibles bluish white. Labrum black with broadly pale ventral margin. Postclypeus black, the anteclypeus contrasting pale green. Genae pale green, antefrons mainly brownish black. Frons, vertex and occiput black with dull green metallic sheen. Base of antennae and ocelli pale brown. No postocular spots. Postgenae whitish without markings. Dorsal half of eyes in life black, sharply separated from pale green ventral half. Traces of pruinosity at sides of anteclypeus.

Thorax Prothorax dorsally black with green metallic sheen. Anterior collar black without markings. Lower part of the sides pale blue. The prothoracic hindlobe narrow, slightly

erect and not remarkably shaped. Lateral lobes not developed. Laminae black, pale blue at distal end. Synthorax completely black with strong metallic sheen down almost to interpleural suture. No pale antehumeral stripes. Small diffuse brown spot on second lateral suture. Sides pale bluish green. Slightly pruinose on prothorax.

Legs Coxae and trochanters pale. Femora pale with a sharp brown stripe on exterior surface that broadens distally and form a brown ring at the distal end. Tibiae all pale with a thin exterior dark stripe and contrasting dark setae. Tarsi pale with dark ring at distal ends of segments.

Wings Clear, venation dark brown. Fw with 8 Px, in Hw 6 Px. Pt in all wings pale framed by thick dark brown margins.

Abdomen with continuous broad black dorsal band and bronze brown sheen on all segments and pale blue at sides. S7–10 with a brown hue.

Measurements [in mm] Total length 18.5 (incl. anal appendages), abdomen length 14.2 (excl. anal appendages), head width 2.5, Fw length 11.1, Hw length 9.9, Pt in Fw 0.6.

Diagnosis

A dark *Agriocnemis* similar to *A. angolensis* and *A. exilis* in general coloration but with a darker thorax without a trace of antehumeral stripes. It is easily distinguished from all other species of the genus by the unique shape of the male appendages and the male swollen abdominal S9 and S10 (Fig. 1). Other *Agriocnemis* species never show such swollen last abdominal segments (Fig. 3). The complete absence of antehumeral stripes is also unusual in the genus.

Variation

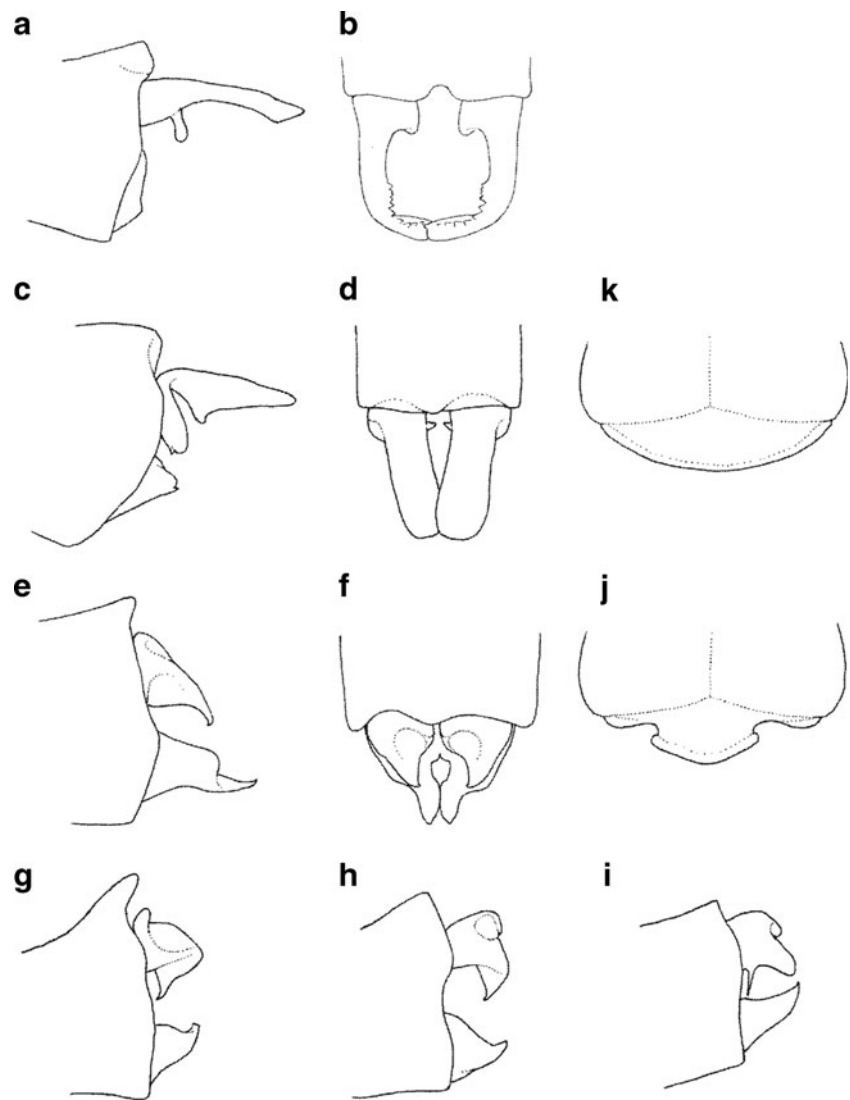
Male

Body size Total length ranges from 17.7 to 19.2 mm (incl. anal appendages). Length of abdomen range from 13.6 to 14.6 mm (excl. anal appendages). Length of Hw range from 8.5 to 9.1 mm.

Prothorax Two males show pale bluish markings on the anterior collar in form of a small dot at each side of the collar, in one male there is only a tiny dot on the left side. All the other males have complete black anterior collars.

Postgenae The rear of the head is white in all males. Some show a distinctive and sharp dark brown to black pattern, others just a diffuse brown hue.

Fig. 3 a–k Morphological characters of the other members of *Agriocnemis* in south-central Africa—male abdominal appendages. **a,b** *A. victoria* lateral (**a**) and dorsal (**b**) view. **c,d** *A. angolensis* lateral (**c**) and dorsal (**d**) view. **e,f** *A. gratiosa* lateral (**e**) and dorsal (**f**) view. **g** *A. ruberrima* lateral view. **h** *A. pinheyi* lateral view. **i** *A. exilis* lateral view. **j,k** male pronothum, dorsal view: **j** *A. pinheyi*; **k** *A. exilis*. Drawings by K.-D.B. Dijkstra



Frontal band The pale frontal band is always severed by a dark central line that links the dark coloration of the postclypeus with that of the frons. The width of this line varies from a narrow line to a broad band that is half as wide as the postclypeus.

Wings One male has a malformation with a remarkable short left Fw with only 8.0 mm in length and only 1 Px developed.

Female

Body size Total length range from 18.5 to 19.5 mm (incl. anal appendages). Length of abdomen range from 14.2 to 16.2 mm (excl. anal appendages). Length of Hw range from 9.9 to 10.4 mm.

Head Only one specimen shows small and pale blue post-ocular spots.

Diagnosis of *Agriocnemis* species of the region

A key to the *Agriocnemis* males of the Zambezi and Okavango River basins is presented. Please note, this key is included only for the designated region, outside this area it could lead to misidentification. Other similar species occur in South Africa and in the tropical forests and swamps north of the Zambezi basin.

- 1 Cerci much longer than paraprocts; cerci as long or longer than S10 (i.e., Fig. 3a–d) 2
- Cerci of equal length or shorter than paraprocts; cerci shorter than S10 (i.e. Fig. 3g–i) 4
- 2 Cerci narrow and forcipate, in dorsal view curved towards each other (Fig. 3a,b); thick black stripe along metapleural suture *A. victoria*
- Cerci broad, not forcipate; black stripe along metapleural suture reduced to a black dot at dorsal end 3
- 3 Antehumeral stripes absent; abdominal segments S9 and S10 swollen; cerci broad at base and tapering to a

- pointed apex (Fig. 1a–d). Pt of Hw not with broadened costa *A. bumhilli*
- Antehumeral stripes normally developed; last abdominal segments not swollen; cerci spatulate, in dorsal view parallel sided with rounded end (Fig. 3c, d); Pt of Hw with distinctly broadened costa *A. angolensis*
 - 4 Cerci shorter than paraprocts, slender paraprocts tapering to single points, at most 2x as long as cerci (Fig. 3e, f). Hw length more than 11 mm *A. gratiosa*
 - Cerci about as long as paraprocts; smaller species, Hw length usually less than 10 mm 5
 - 5 Apex S10 raised distinctly to an upright process (Fig. 3g)..... *A. ruberrima* [ssp. *A. r. albifrons* (N-Botswana, NE-Namibia) with frons whitish pruinose, S1–7 broadly black, S8–10 orange-red; ssp. *A. r. ruberrima* (NE-South Africa, coastal Mozambique) abdomen mainly orange-red, frons not pruinose]
 - Apex S10 hardly raised 6
 - 6 Hindlobe of prothorax incised at two sides, separating a fan-like middle section (Fig. 3j); cerci without ventral needle-like process (Fig. 3h) *A. pinheyi*
- Hindlobe of prothorax not incised (Fig. 3k); cerci with ventral needle-like process (Fig. 3i) *A. exilis*

Habitat and ecology

Agriocnemis bumhilli is known only from the type locality, although several surveys were carried also out in other parts of the Kwando River in Namibia and Botswana. Thus, knowledge of ecological preferences is limited. At Bum Hill, all the individuals were found exclusively at the margin of the main channel of the river where a narrow band of dense grassy vegetation was growing in and along the running water. *A. bumhilli* was found there together with a few individuals of *A. gratiosa* and *A. victoria*. At the adjacent backswamp, *A. victoria* was the most abundant Zygopteran, and also *A. exilis* and *A. ruberrima albifrons* were found in lower numbers in January and February. In December, only one male of *A. bumhilli* was recorded, while *A. ruberrima albifrons* was the most abundant *Agriocnemis* in the area. According to the few records the flight season of *A. bumhilli* is from the beginning of December to March.

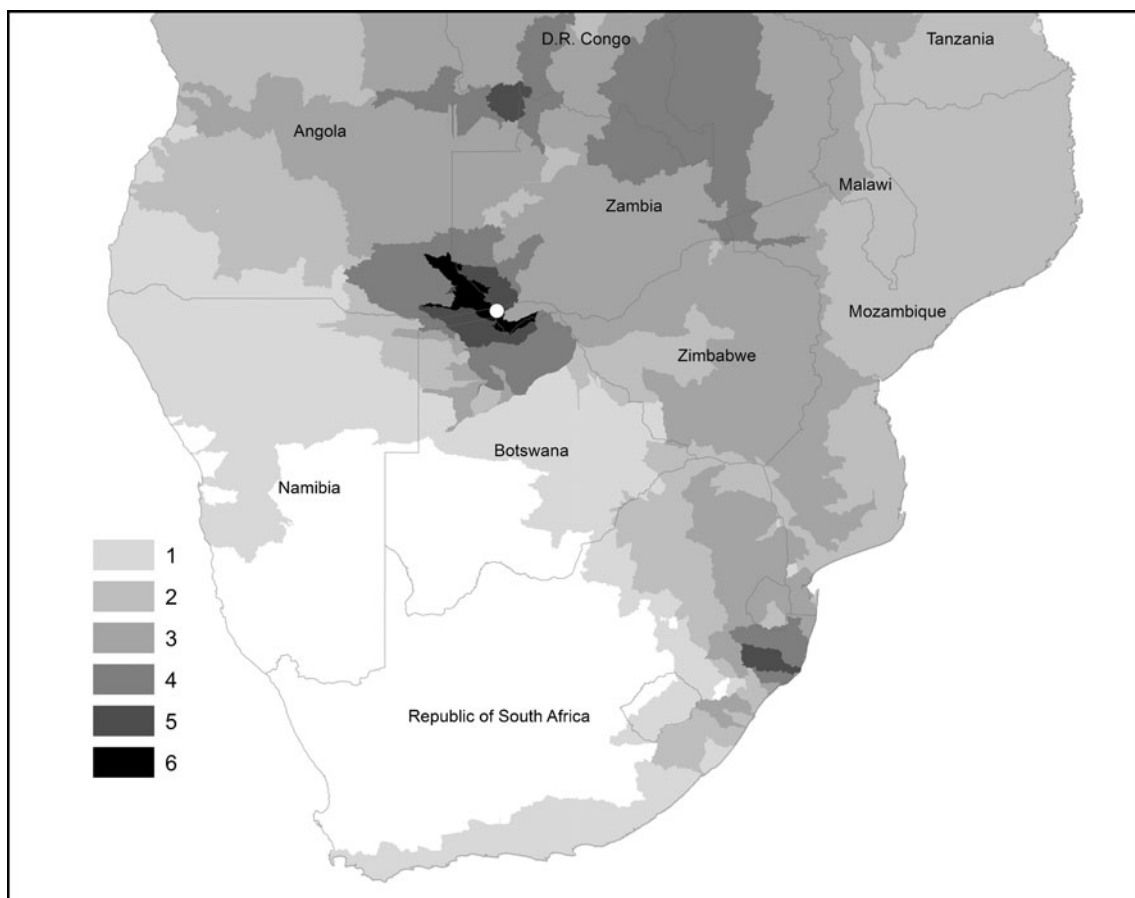


Fig. 4 Map of southern Africa showing the type locality of *A. bumhilli* sp. n. (white circle) and the density of species of the genus according to the inferred distribution maps created by the IUCN Red List Assessments (Dijkstra et al. 2011; Suhling et al. 2009)

Discussion

The new species is another example of the great diversity of anal appendages in the genus noted by Pinhey (1974). *Agriocnemis bumhilli* would fit into group 2 of the preliminary grouping of African *Agriocnemis* species by Pinhey (1974), and would stand together only with *A. angolensis*, which is also characterized by long and narrow cerci. But it differs notably from this species in some characters. *A. angolensis* has a very remarkable Pt in the hindwing with a widened and pruinose marginal edge, a feature unique in all African Odonata. In the male, the abdominal S9 and S10 of *A. angolensis* are not swollen and both sexes also have well developed antehumeral stripes. So, if following the proposed grouping of Pinhey (1974) the new species would consequently need its own group due to these very significant distinguishing features. This example shows that a grouping within the genus is pointless.

The body dimensions of the smallest collected male with a total length of only 17.7 mm, an abdominal length of 13.6 mm and Hw length of 8.5 mm makes *A. bumhilli* to the smallest member of the genus and of all African Odonata. In comparison to other species (vide Pinhey 1974) and to our own measurements of specimens collected within the region and at the type locality at least, this one male of the type series is probably one of the smallest Odonata specimen ever measured in Africa. Similar in small body size in worldwide aspect are some specimens of the Asian *Agriocnemis nana* (Laidlaw, 1914) with abdominal length of 14.2 mm and Hw length of 7.5 mm (coll. R. Garrison) and of *Agriocnemis minima* Selys, 1877 from Java with abdominal length 13.5 mm and Hw length of 8.5 mm.

So far, the Kwando River and swamps around Bum Hill with five species is the place with the highest diversity of *Agriocnemis* species in Africa known from a single locality overall. Going to the wider scale of the sub-basin catchments with *A. angolensis*, a sixth species occurs in the area. The map in Fig. 4 shows the species density of *Agriocnemis* in southern Africa. The map is based on inferred distribution maps created by the IUCN Red List Assessments (Dijkstra et al. 2011; Suhling et al. 2009). They combine point locality data and expert knowledge on the level of river sub-basins delineated by the HYDRO1k Elevation Derivative Database for Africa (USGS EROS).

All the species of the region belong to the group of open swamp species, most of them distributed widely on the African continent. But with *Agriocnemis angolensis*, *A. bumhilli* and *A. ruberrima*, the south-central ‘Zambeian’ Odonate fauna hold some species restricted to the biome. As in the genera *Aciagrion*, *Trithemis* and *Pseudagrion*, the Zambeian region with its geological complexity and climatic history form a recent speciation center also for swamp-dwelling *Agriocnemis* (vide Dijkstra 2007b; Dijkstra et al. 2011). When recognising the Pan-African scale, only the border

region of eastern DRC and Uganda have more *Agriocnemis* species in some sub-basins.

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