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## ***Lestinogomphus silkeae* sp. nov. from the Okavango and Zambezi Rivers (Odonata: Gomphidae)**

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### ABSTRACT

*Lestinogomphus silkeae* sp. nov. from the northern Okavango Delta in Botswana, the Kavango River in northern Namibia and the middle Zambezi River in Zimbabwe is described and illustrated (holotype ♂: Botswana, Xaro Lodge, 09 vi 2000, dep. at ZMBH). The shape of the male appendages distinguishes this species from all others in the genus. The new species is compared with the widespread type species of the genus, *L. angustus*.

### INTRODUCTION

The members of the genus *Lestinogomphus* Martin, 1912 are characterized by their small and slender body, the narrow base of the hindwing and especially the long cylindrical S10, which without its appendages is more than half as long as S9. Body coloration is mainly green to yellowish with indistinct brownish and blackish markings. The genus was erected by Martin (1912) with the type species *L. angustus* Martin, 1912. It is a small genus, currently with five species. The genus is exclusively afrotropical, and *L. angustus* is the most widespread species, occurring from Uganda (Clausnitzer 2001) southwards to KwaZulu-Natal (Samways 2008; Tarboton 2002).

Despite the small number of species, the taxonomy of the genus is confused (Dijkstra 2003). This is due to the fact that six species names are available, but only three species are based on well-diagnosed males - namely *L. congoensis* Cammaerts, 1969, *L. matilei* Legrand & Lachaise, 2001 and the recently redescribed *L. angustus* (vide Legrand & Lachaise 2001). The most useful feature to distinguish the species is the shape of the male appendages. By contrast, the early descriptions of *L. africanus* (Fraser, 1926) and *L. angustus* were based mainly on

coloration, and type specimens are in a very poor condition (R. Cammaerts pers. comm.). The confusion has been exacerbated by the mix-up of *L. africanus* and *L. angustus* with one another or with other species (e.g. Pinhey 1961: plate 4), and by the presence of some undescribed species (K.-D.B. Dijkstra pers. comm.). In his Mozambique checklist Pinhey (1981: 578, fig. 26) later gives a correct illustration of a male "*Lestinogomphus angustus* (Botswana)". Some authors have treated both species as synonyms or forms (Fraser 1949; Pinhey 1984). One more species was described from West Africa, *L. minutus* Gambles, 1968, from a single female specimen. Another species is *L. bivittatus* (Pinhey, 1961) from Angola, which also has been described from a single female as *Microgomphus bivittatus*. As the illustrations show it is clearly a *Lestinogomphus* female due to the long S10.

Regarding these complicated and confusing circumstances it seems difficult to describe a new species of this genus without revising the whole genus. I am aware of these problems but felt encouraged to provide this description by the opinion of my colleague K.-D.B. Dijkstra (pers. comm.): "*Lestinogomphus* is a disaster... But if we don't start with naming the diagnosible species in this genus, we'll never make any headway."

This paper provides the description of a species from the northern Okavango Delta in Botswana, from the Kavango River (= Okavango R.) in northern Namibia and from the Zambezi River (Victoria Falls) in Zimbabwe. The discovery is the result of my participation on the first Aqua-RAP Okavango Expedition of Conservation International to this region, which was carried out in June 2000 (Appleton et al. 2003).

This description was originally submitted to another journal, and should have been published in 2006 but never materialized. The new species was meanwhile included in Suhling & Martens (2007), with a short description and, in confidence in a punctual print of the original description, under the name '*Lestinogomphus silkeae* Kipping, 2006'. I want to emphasize that the mentioning of the species' main characters in Suhling & Martens (2007) is not the introduction of a new species. It is the aim of the present paper to make the name *L. silkeae* Kipping, 2010 available.

Abbreviations used in the text are:

NMBZ The Natural History Museum, Bulawayo, Zimbabwe

RMNH Nationaal Natuurhistorisch Museum Naturalis, Leiden, The Netherlands

ZMHB Museum für Naturkunde der Humboldt-Universität, Berlin, Germany

### ***Lestinogomphus silkeae* sp. nov.**

(Figs 1-3)

*Lestinogomphus* sp. nov. — Kipping (2003a: 99).

*Lestinogomphus angustus* Martin, 1912 — Kipping (2003b: 138). Misidentified.

*Lestinogomphus silkeae* Kipping, 2006 — Suhling & Martens (2007: 134). Not available.

## Etymology

The new species is named in honour of my wife Silke (1968-2003), who always encouraged me in my studies of African Odonata.

## Specimens examined

Holotype ♂, Xaro Lodge (18°25'49"S, 21°55'38"E), 13 km SE of Shakawe, Okavango Delta, Ngamiland District, Botswana, 09 vi 2000, leg. JK, deposited at ZMBH.— Paratypes: 1 ♂, same data as holotype, deposited at RMNH; 1 ♂, Kavango River at Kaisosi River Lodge (19°49'54"S, 17°52'25"E), E of Rundu, Namibia, 24 iv 2007, leg. R.W. Garrison, N. von Ellenrieder, deposited in coll. California Department of Food & Agriculture. Female unknown.

Specimens of *L. angustus* for comparison: Botswana – 1 ♂, Kasane, Chobe River, Chobe Safari Lodge, 21 iii 2002, leg. JK; 1 ♂, Kasane, Chobe River rapids, leg. JK; 2 ♂, 16 iii 2005, Kasane, Kubu Lodge, Chobe River, 20 iii 2005 leg. JK. Zimbabwe – 1 ♂, Victoria Falls National Park, Zambezi River, riverine forest, 24 v 2000, leg. JK. All in private coll. JK.

## Holotype male

Acetone dried, pinned. Fully mature, in good condition. Fits to the characteristics of the genus. A small and slender gomphid species. The very narrow Fw and Hw of almost the same shape. Anal field of Hw reduced, an anal triangle is absent. Anal margin set with small spines. S10 remarkably elongate, nearly as long as S8+9. Coloration pale green to yellow with brown markings.

**Head:** Frontal aspect of coloration as in Figure 1. Labium pale yellow with golden hairs. Mandibles pale green, apically brown with black teeth. Labrum pale blue-green, the upper and lower edge broad and distinct dark brown, connected by a clear medial brown line. Anteclypeus uniformly pale blue-green. Anterior frons of

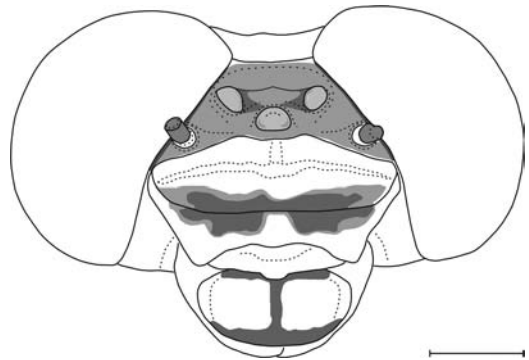


Figure 1: *Lestinogomphus silkeae* sp. nov. — head with labrum and frons coloration, front aspect. Scale bar: 1 mm.

the same color and a diffuse transverse brown band, a shallow smooth depression on both sides of the bulged middle section. A prominent crest without any spines. Upper frons uniformly pale blue-green. Vertex brownish with diffuse green markings between ocelli. Ocelli with darker margins. Lateral ocelli slightly smaller than median ocellus. A small group of hairs behind the lateral ocelli. Antennae dark brown, last segments missing, first segments pale green.

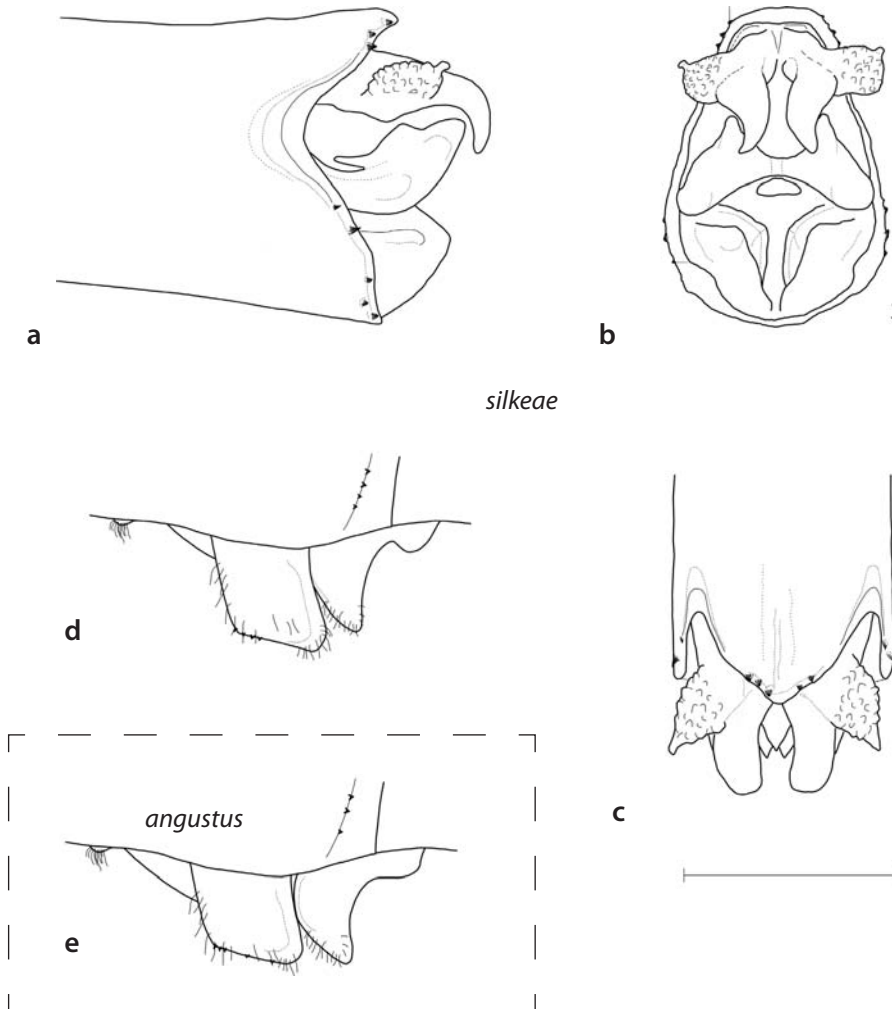


Figure 2: Male characters of *Lestinogomphus silkeae* sp. nov. — (a) anal appendages, lateral from left; (b) same, posterior; (c) same, dorsal; (d) accessory genitalia, lateral from left; (e) for comparison: same of *L. angustus*. Scale bar: 1 mm.

**Thorax:** Prothorax mainly concealed by head, pale green. Synthorax green with dark brown markings, becoming yellowish ventrally. Mesepisternum with a prominent median carina. A narrow green stripe along the carina only in the anterior third. The green antehumeral stripe is completely bordered by brown markings. A broad outer green antehumeral stripe is present. Mesepimeron and metepisternum green, a diffuse brown stripe along the humeral suture. Another diffuse brownish stripe along the mesometapleural suture is broken in the middle. Metepimeron yellow without markings. — Leg pairs similar. Coxae pale green, trochanters green-yellow, on inner side with dark spines. Femora yellow becoming dark brown in the distal third, on interior two ridges set with short blackish spines. Tibiae dark brown, slightly paler exterior, set with two rows of long black spines on inner and two rows of short black denticles on outer side. Tarsi and tarsal claws dark brown. — Wings clear. Venation blackish. Shape of Fw and Hw very similar. Pt membrane pale brown, slightly darker in the middle with thick black margins. Node in Fw at about 62 % of distance between base and Pt, in Hw at about 58 %. Discoidal cells uncrossed. Discoidal field starts with two cells to nodal level in Fw, with three cells in Hw. In Fw 11 and 13 Ax, in Hw 9 and 10 (distal Ax complete), in Fw 8 and 9 Px, in Hw 7 and 8. Arculus at second Ax in all wings. Pt reaches over 3.5 cells in Fw and Hw. Membranule and anal triangle absent. Anal margin with six small spines and one larger spine at distal end.

**Abdomen:** S1 pale green. S2 green with pale brown markings and prominent auricles. S1-2 slightly swollen. S3-6 very long and slender, S7 becoming wider distally. S3-7 greenish with a narrow brown band in the middle and a broad band distally. S8-9 shorter and wider, brownish, ventrally yellow. S10 1.84 times longer than S9, laterally compressed, pale brown with darker markings and a yellow stripe ventrally. At distal end with some black denticles. Anal appendages very short, reddish-brown, paraproct yellow-brown. Superior appendage down curved with a rounded tip and a swollen lateral process. This process with a distinct granular surface, the knob-like end backward directed. Inferior appendage shorter than superiors with a prominent forward directed pointed tooth (Figs 2a-c). — Accessory genitalia generally similar to *L. angustus* (Fig. 2e). Lamina small with short hairs. Anterior hamules broad at base, apically with a tuft of long hairs. More robust and stout as in *L. angustus*. Posterior hamules in lateral view broad, longer than genital lobe, posterior and outer ridge slightly concave. Color is brownish. Genital lobe in lateral view with a distinct sharp bend (Fig. 2d).

**Measurements [mm]:** Total length 39.5, abdomen length 29.4, Fw length 21.7, Hw length 20.31, Hw width 5.6, head width 5.52, Pt in Fw 2.67.

#### Variation in males

No significant variation in the three male specimens.

## Diagnosis

The main distinguishing feature is the shape of the male inferior appendages. In *L. silkeae* the thorn on the lower appendage is more slender, pressed down and forward directed, whereas in *L. angustus* the thorn has a massive base and is clearly upright. S10 is shorter and more robust in *L. silkeae*, the length : height ratio is 1 : 0.57, whereas in *L. angustus* it is 1 : 0.49 ( $n = 5$ ).

The male accessory genitalia differ in some features. The anterior hamule is stouter in *L. silkeae*. Posterior hamule is olivaceous in *L. angustus* but brownish in *L. silkeae*. In lateral view it is longer than the genital lobe in *L. silkeae* but in *L. angustus* both are of the same length. In *L. silkeae* sp. nov. the genital lobe has a very distinct sharp bend in lateral view. In contrast, in *L. angustus* the genital lobe is regularly rounded.

In general the body coloration of both species is very similar. *L. silkeae* is slightly darker and shows minor differences (Table 1). Here the clearest difference is along the middorsal carina. Green extends broadly on both sides and the whole length of the carina in *L. angustus*, but not in *L. silkeae*. The legs in *L. angustus* are much paler than in *L. silkeae*. Size measurements do not differ in both species.

## Notes on ecology, behaviour and distribution

The new species is currently known from the type locality (Fig. 3: #1), Xaro Lodge, right Okavango River bank, 13 km SE of Shakawe in the northern panhandle of the Okavango Delta, Botswana, and from Kaisosi River Lodge (Fig. 3: #2) on the Namibian part of the Okavango (Kavango) River on the border with Angola. A third known locality is Victoria Falls of the Zambezi River (Fig. 3: #3), where a male specimen was collected by E.C.G. Pinhey in May 1961, now deposited in NMBZ and originally labelled as "Victoria Falls, Rhodesia". This museum also possesses a possible but poorly preserved male from Musengezi River, Mzarabani, Zimbabwe, collected by the Natural History Museum expedition on 5 April 1990 (K.-D.B. Dijkstra pers. comm.).

The two males from Botswana were caught in dense riverine forest and garden-like habitats lining the Okavango main channel. The river here is surrounded by Papyrus reed beds and narrow remnants of gallery forest. These males and others (also females) were seen sun basking on broad leaves in small clearings. In contrast all individuals of *L. angustus* I have seen used the lower stratum of *Acacia* sp. or similar thorn shrubs as resting places. Despite intensive search the new species was not seen at the type locality and adjacent areas in February 2002, March 2005 and February 2006. At this early time of the year only a few individuals of *L. angustus* were found here. The second locality, Kaisosi River Lodge at the Kavango River in northern Namibia, is a similar large river in open surroundings with some very small remnants of gallery forest.

Table 1. Distinguishing features of *Lestinogomphus angustus* and *L. silkeae* sp. nov.

	<i>L. angustus</i> (n = 5 ♂)	<i>L. silkeae</i> (n = 3 ♂)
Inferior male appendages	With a clearly upright thorn in the middle	Small and slender thorn pressed down and directed forward
S10, length:height ratio	1 : 0.49	1 : 0.57
Male accessory genitalia	Posterior hamules of equal length to genital lobe, genital lobe rounded in lateral view	Posterior hamules longer than genital lobe, genital lobe with a sharp bend in lateral view
Labrum coloration	Reduced brown markings, in the middle only a small dot instead of a line	Upper and lower margin broad and clear brown, a clear central brown line from upper to the lower margin
Middorsal carina	Green extends broadly along the whole length of the carina	Green along the carina reduced
Femora coloration	Very pale, only a brown tinge distally	Yellow, dark brown in the distal third
Tibiae	Very pale, only dark stripes along the interior rows of spines	Dark brown, only a pale tinge exterior
Pterostigma	Reaches over 5 to 6 cells in all wings	Reaches over 3.5 cells in all wings
Mean head width [mm]	5.66	5.6
Mean total length [mm]	41.07	39.5
Mean Hw length [mm]	20.87	20.31
Mean Pt length in Fw [mm]	2.87	2.67

## DISCUSSION

The species described here by clear morphological features of male specimens is only the fourth within the genus *Lestinogomphus* to be described. The genus is in urgent need of revision (vide supra). Two species (*L. bivittatus* and *L. minutus*) were described only from single female specimens. *L. bivittatus* might occur in the region, but the type specimen deposited in the Dundo Museum, Angola, could not be checked due to political circumstances in Angola during recent years. It was described as *Microgomphus bivittatus* Pinhey, 1961, collected at Dundo, Angola (19 ix 1957), leg. E. Luna de Carvalho. I am aware of the possibility that both belong to the same species and this example shows very clearly the disadvantage



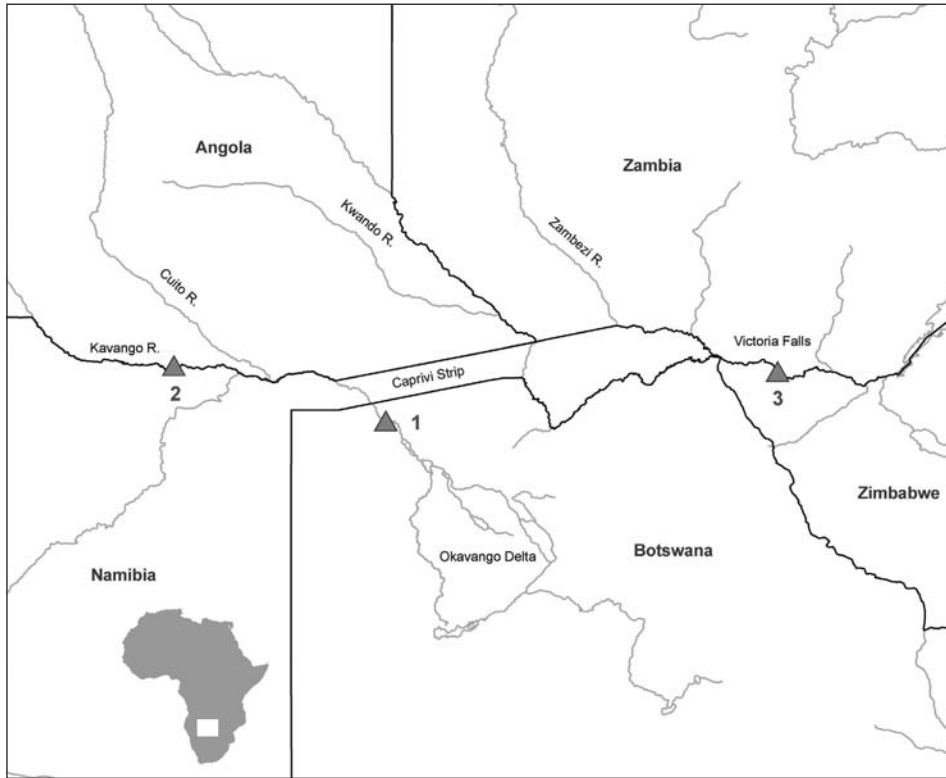


Figure 3: Records of *Lestinogomphus silkeae* sp. nov. — ▲ 1: type locality, Xaro Lodge, Shakawe, Okavango Delta, Botswana; ▲ 2: Kaisosi Lodge, Kavango River, Namibia; ▲ 3: Victoria Falls, Zambezi River, Zimbabwe.

of describing species by single females. But the type locality of *L. bivittatus* belongs to the Congo River basin, from the ecological point of view to the freshwater ecoregion of Moist Forest Rivers – Kasai, whereas that of *L. silkeae* belongs to the Okavango Floodplains (Thieme *et al.* 2005). As indicated by all available records in the Odonata Database of Africa and new findings of other gomphid species, for example *Neurogomphus cocytius* Cammaerts, 2004 or *Paragomphus cataractae* Pinhey, 1963, there is a stronger similarity between the Okavango and the Zambezi River catchment, and I expect other undescribed species to occur in Angola, in the Congo basin or even in the upper Okavango basin. The upper and middle catchment of the Okavango and Cuito Rivers in Angola belong to the least explored areas in whole sub-Saharan Africa.

So far at least two species of *Lestinogomphus* occur in southern Africa. Reliable records exist of the widespread *L. angustus* and the species described here. There is a strong possibility that other undescribed species are hidden behind old

published records of *L. angustus* and *L. africanus* or in museum collections. For example, Pinhey (1951: plate 11b) gives a rather bad illustration of a male from Victoria Falls, Zimbabwe, labelled as *L. africanus*, which could be either the new species described here or even another undescribed species. Unfortunately the type specimen of *L. africanus* had the last part of the abdomen missing, and now even the type specimen is missing and so no description of the anal appendages exist (V. Clausnitzer pers. comm.). So it is unclear what Pinhey (1951) meant by *L. africanus*.

It is remarkable that during a short time period and at a well accessible river section two new gomphid species have been found (Suhling & Marais 2010). Thus it is likely that, especially in remote areas of the Zambezi or upper Okavango River systems, other undescribed species of the family exist. Gomphids are generally hard to find in their adult stage, they are better recorded as larva or exuviae. But the genus *Lestinogomphus* is an exception in that males are often sitting in the lower stratum of shrubs close to the rivers and are easy to spot. This raises the question why the new species has only been found rarely despite the intensive search for it. One explanation I have is the different phenology of *L. angustus* and *L. silkeae*. The only available and reliable records of *L. silkeae* are from late April 2007, May 1961 and June 2000 (vide supra). All records of *L. angustus* from the region (northern Namibia and Botswana, altogether 52 datasets in the Odonata database of Africa) are from mid August to late April. An overlap probably only exists during a short period around April/May, at Kaisosi Lodge the two species were found flying at the same time (24 iv 2007, leg. N. von Ellenrieder and R.W. Garrison). During several visits at the type locality in February and March only a few *L. angustus* were found. Unfortunately the location has never been visited later in the year since 2000. At the Chobe River near Kasane, where *L. angustus* is rather common, dozens of males were netted during recent years without a new record of *L. silkeae*, but all the visits to this river were carried out in March only. Pinhey (1967) recorded *L. angustus* in February 1967 from Sepopa, which is situated about 50 km southeast of the type locality. This all indicates a difference in the flying season of the two species.

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