

## A new genus of pseudoscorpion from East Africa (Pseudoscorpiones, Atemnidae)

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### Summary

A new genus and species of atemnoid pseudoscorpion, *Nilotemnus comboni*, is described from Uganda. It is placed in the subfamily Miratemninae because of the five setae on the cheliceral hand. It is distinguished from all other Miratemninae by the carapace of both male and female lacking transverse furrows and the carapace not being granulate or papillate, but rather having a glossy, squamotesselate surface. The nearest relative is *Tullgrenius* Chamberlin, distributed in India and South-east Asia, based on the basally placed trichobothria IT, IST and EST of the palpal chela, the shape of the ejaculatory canal atrium and the elaborate folding of the medial diverticula of the male genitalia, and the mushroom-shaped cribriform plates of the median glands in the female genitalia. The reduced number of trichobothria on the movable finger is commented upon, and the biogeographical distribution is discussed.

### Introduction

During two visits to Uganda in May 2002 and August 2003 the author collected three specimens of a new species of the family Atemnidae belonging to the subfamily Miratemninae. Although the species obviously is related to *Tullgrenius* Chamberlin, it differs in some characters to an extent which makes it difficult to include it in that genus. A new genus has therefore been erected. Hitherto the family Atemnidae included 19 extant genera and 1 extinct genus from Baltic Amber, 5 belonging to the subfamily Miratemninae and 15 to the Atemninae. Eleven of the genera are known from the African continent, comprising 2 Miratemninae with 10 species and 9 genera of Atemninae with 65 species. In Uganda 4 genera represented by 7 species have so far been found, all of them also distributed elsewhere in Africa. Regarding the 5 genera in the Miratemninae, *Tullgrenius* is represented by 3 species in India and 1 each in Afghanistan and Cambodia; *Miratemnus* is an African genus with 5 species described partly from South Africa, and partly from Namibia, Zimbabwe and Kenya; *Diplothemnus* comprises 9 species, some of which are widely distributed, and found mainly in South Africa, Europe and Asia; *Brazilatemnus* and *Caecatemnus* are described from Brazil, each represented by one species.

### Methods

In investigating the specimens the same methods were used as described by Klausen (2005), apart from staining the genitalia with Chlorazol Black E in 96% alcohol. The very translucent and almost colourless structures of the male genitalia in particular made this procedure necessary. The names used for the different parts of the male genitalia follow Legg (1974) and Klausen (2005). As the

sister group of the new genus is *Tullgrenius*, the male and female genitalia of *T. indicus* Chamberlin are shown for comparison.

### Genus *Nilotemnus* gen. n.

*Type species: Nilotemnus comboni* sp. n.

*Etymology:* The name of the genus is derived from the Nilotic area in Uganda.

*Diagnosis:* The new genus can be distinguished from other Miratemninae by the carapace of both male and female lacking transverse furrows and the carapace not being granulate or papillate, but rather having a glossy, squamotesselate surface.

The new genus can be recognised by the following key:

1. Cheliceral hand with 4 setae ....subfam. Atemninae  
— Cheliceral hand with 5 setae (subfam. Miratemninae) .....2
2. Tergites divided by longitudinal stripe .....  
.....*Diplothemnus*, *Miratemnus*  
— Tergites undivided .....3
3. Posterior sternites and tergites with clavate setae, pseudotactile seta on tarsus IV absent. *Caecatemnus*  
— Sternites and tergites with pointed setae, pseudotactile seta on tarsus IV present .....4
4. Trichobothria IT, IST and EST of palpal chela normally placed, not proximally displaced to base of fixed finger .....*Brazilatemnus*  
— Trichobothria IT, IST and EST of palpal chela proximally displaced to base of fixed finger .....5
5. Carapace granulate or papillate, with two distinct transverse furrows .....*Tullgrenius*  
— Carapace glossy and squamotesselate, without transverse furrows .....*Nilotemnus*

*Description:* Cheliceral hand with 5 setae (Fig. 7), setae on carapace and tergites denticulate, tactile seta of tarsus IV about one-third removed from base as in other Miratemninae (Fig. 6). Configuration of trichobothria of chela closer to *Tullgrenius* than to any other atemnoid genus, i.e. trichobothria IT, IST and EST of palpal chela proximally displaced to base of fixed finger. Number of trichobothria on movable finger reduced to 2 or 3 (Figs. 2 and 3). Carapace without transverse depressions or grooves, and glossy owing to squamotesselate surface texture (Fig. 10).

Male genitalia with anterior wall of ventral diverticulum very wide and with hood-like appearance as in Miratemninae, with hooked branch on lateral apodemes, distal end of dorsal apodeme bifurcated and not merged as in Atemninae (Klausen, 2005) (Figs. 12 and 13). Distal wall of ejaculatory canal atrium semicircular. Medial diverticula of male genitalia extensively folded. Female genitalia (Fig. 14) with two median glands with cribriform plates almost mushroom-shaped, posterior-most gland very short with no stalk.

Both the male and female genitalia of *Nilotemnus* are more similar to *Tullgrenius* than to the other miratemninae genera. On the other hand the male genitalia differ from *Tullgrenius* (Fig. 15) in the

configuration of the hooked branches and the medial diverticula, but more importantly in the totally different configuration of the ejaculatory canal atrium.

*Nilotemnus comboni* sp. n.

*Types*: Holotype ♂, Uganda: Aboke, Lira District, outside St. Mary's secondary school, 2°20'N, 32°40'E, 16 May 2002, under bark of trunk of Uganda mahogany (*Kaya anotheca*) situated on open grass fields, leg. Finn Erik Klausen. Paratypes: 1♀, same data; 1♀, Uganda: Bujagali Falls, 15 km N of Jinja, 0°30'N, 33°10'E, 31 August 2003, under bark of trunk of Uganda mahogany (*Kaya anotheca*) by river bank of Victoria Nile, leg. Finn Erik Klausen. Holotype and paratypes will be deposited at the Zoological Museum, University of Oslo.

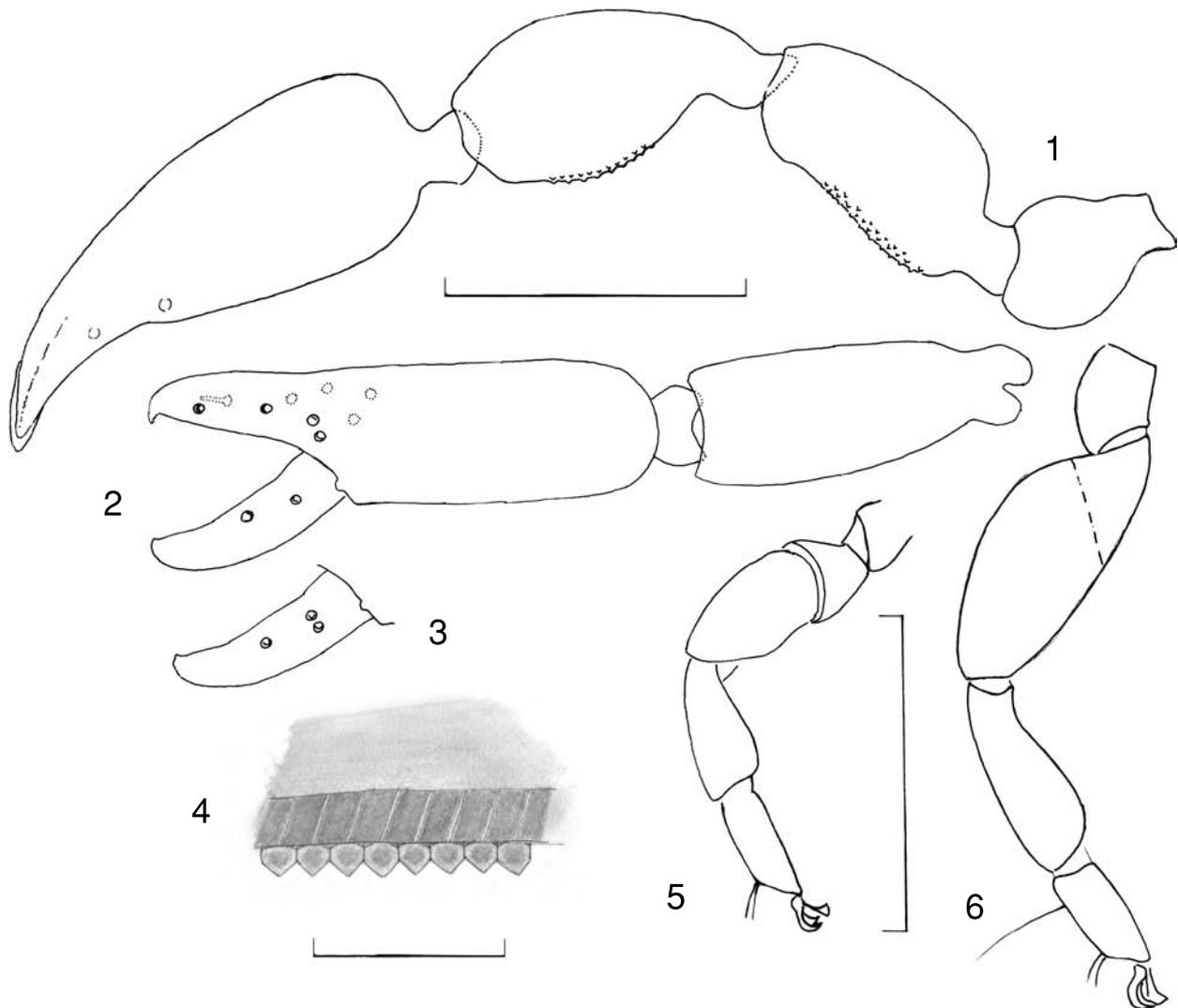
*Habitat*: The landscape is part of the Nilotic area in northern Uganda surrounding Lake Kyoga and Lake Kwania in the Nile river system. The area is at approximately 1100 m a.s.l. with a slightly undulating, mostly open savanna-like landscape with groups of trees, sometimes intersected by wetlands with reeds, mostly *Cyperus*

*papyrus*. Aboke is situated north of the lakes, Bujagali Falls south of the lakes, close to the northern border of Lake Victoria. The distance between the two localities is about 220 km.

*Etymology*: *Nilotemnus comboni* is named in honour of the catholic Sisters of the Comboni Order at St. Mary's Secondary School in Aboke. They have governed this school with courage and endurance during all the years when the northern Lira District of Uganda has been constantly terrorised by guerrilla groups.

*Diagnosis*: As for the genus.

*Description*: Carapace: As for genus, dark chocolate brown, almost without any sculpture, giving it a glossy appearance as in Atemninae. However, under the stereomicroscope a faint pattern can be observed (Fig. 10), like reduced or flattened papillae, not knob-like as in *Tullgrenius* and other miratemnine genera (Fig. 11); with 2 eyespots; with 4 setae at anterior border and 6–7 at posterior. Tergites: undivided, colour as carapace. Configuration of setae of tergites 1–XII: ♂: 8:10:8:L8L:L11L:L9L:L10L:L8L:L10L:T1T5T2T:2T5T1:2; ♀♀: 8:10:9:12:L13L:L12L:L14L:L13L:L14L:T4T6T3T:2T7T2:2; 8:9:10:L11L:L13L:L13L:L15L:L14L:L14L:T2T7T:



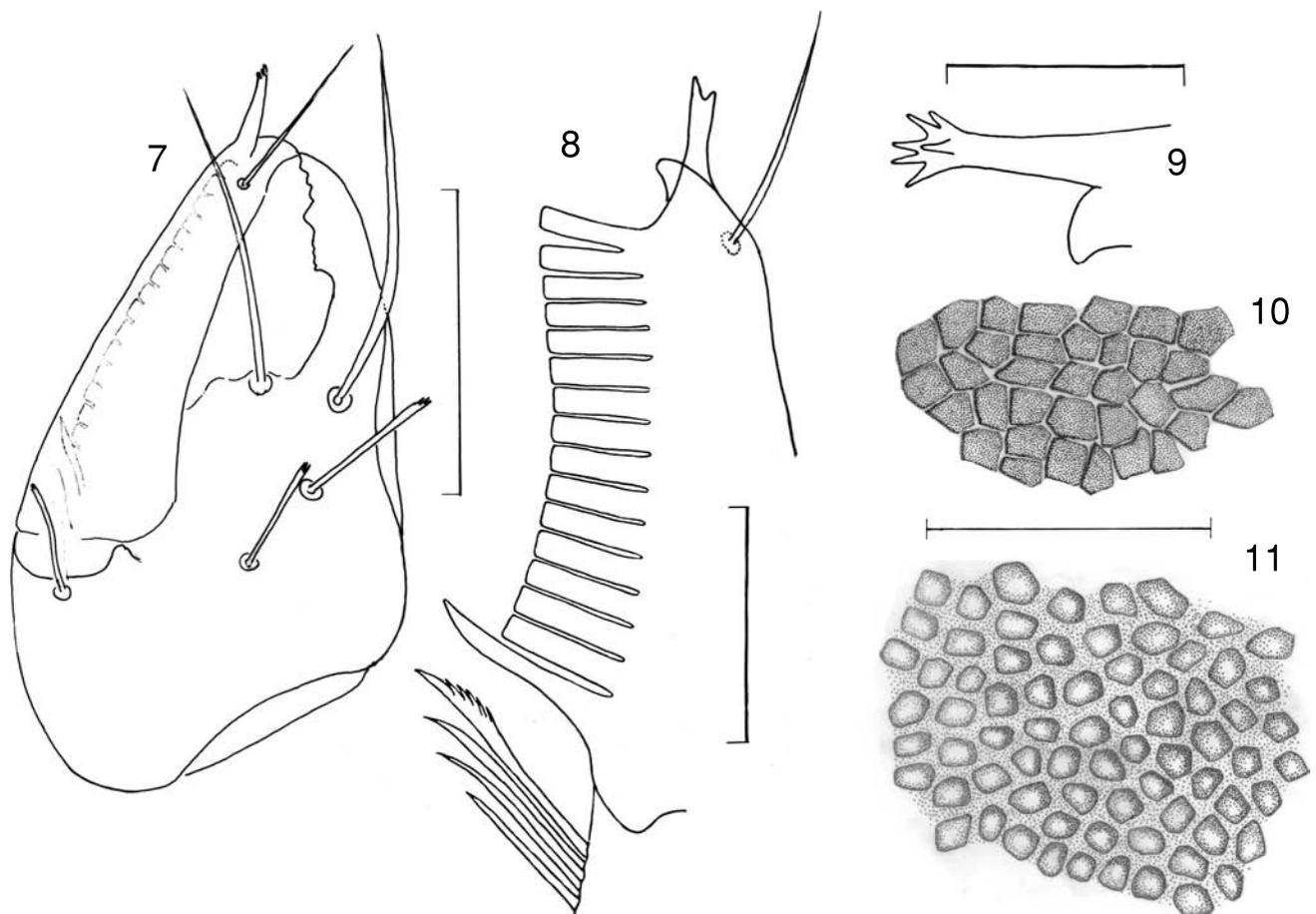
Figs. 1–6: *Nilotemnus comboni* gen. et sp. n., male (1–2, 4–6), female (3). **1** Right pedipalp, dorsal view; **2** Chela and patella of left pedipalp (Aboke), lateral view; **3** Movable finger of chela, female (Bujagali Falls); **4** Chelal teeth; **5** First leg; **6** Fourth leg. Scale lines=0.5 mm (1–3, 5–6), 0.05 mm (4).

2T6T2:2. Sternites: undivided. Configuration of setae of sternites IV–XII: ♂: 6:L8L:L8L:L8L:L8L:L9L:T2T4T2T:T1T4T2T:2; ♀♀: 12:L12L:L11L:L12L:L12L:L12L:T4T6T4T:T1T4T1T:2; 8:L9L:L10L:L11L:L12L:L12L:3T6T2T:T2T4T2T:2. Body length: ♂ 2.6 mm, ♀♀ 2.86 and 3.56 mm. Pedipalps (Figs. 1–3): colour as carapace. Trochanter and medial side of femur and patella rugose or papillate, dorsal tubercle of trochanter rounded, patella oblong, almost parallel-sided seen laterally, chela oblong. Chelal teeth: ♂ (♀♀): uniform, fixed finger with 22 (22, 27) teeth, movable finger with 25 (25, 29). Fixed finger with venom duct, length of duct: ♂ (♀♀): 0.13 mm (0.15 mm). Length/width, ratio: ♂ (♀♀): femur: 0.55 mm/0.24 mm, 2.29 (0.5–0.53 mm)/0.22–0.25 mm, 2.0–2.41; patella: 0.6 mm/0.27 mm, 2.2 (0.5–0.6 mm)/0.27–0.28 mm, 1.9–2.0; hand: 0.91 mm, 0.31 mm, 2.94 (0.91–0.92 mm)/0.31–0.34 mm, 2.71–2.94; finger: 0.35 mm (0.36–0.41 mm). Trichobothria (Figs. 2 and 3): trichobothria of fixed finger as for genus. Movable finger with reduced number of trichobothria, in ♂ and ♀ from Aboke ST and B are absent (Fig. 2), in ♀ from Bujagali Falls trichobothrium B seems to be missing but the other three are present (Fig. 3). First leg (Fig. 5): length/width, ratio: ♂ (♀♀): femur+patella: 0.32 mm/0.14 mm, 2.29 (0.34–0.35 mm)/0.15 mm, 2.27–2.33; tibia: 0.24 mm/0.1 mm, 2.4 (0.24–0.25 mm)/0.1 mm, 2.4–2.5; tarsus: 0.2 mm/0.07 mm, 2.86 (0.20–0.21 mm)/0.07 mm, 2.86–3.0). Fourth leg (Fig. 6): length/

width, ratio: ♂ (♀♀): femur+patella: 0.5 mm/0.2 mm, 2.5 (0.56–0.60 mm)/0.21–0.24 mm, 2.5–2.7; tibia: 0.36 mm/0.13 mm, 2.8 (0.36–0.41 mm)/0.13–0.14 mm, 2.8–2.9; tarsus: 0.24 mm/0.08 mm, 3.0 (0.24–0.25 mm)/0.08–0.10 mm, 2.5–3.0). Chelicera (Figs. 7–9): hand with 5 setae, flagellum with 4 setae, distalmost serrated, serrula exterior with 16–18 blades. Galea with 6 small finger-like projections. Male genitalia (Figs. 12 and 13): as noted for genus. Female genitalia (Fig. 14): as noted for genus.

### Discussion

Apart from the difference in size the female genitalia are more similar to those of *Tullgrenius* than those of other miratennines (cf. Figs. 14 and 16). This can be concluded by comparison with depictions of genitalia of different species of *Brazilatennus*, *Diploatennus* and *Miratennus* representing Miratenninae (Dumitresco & Orghidan, 1969; Mahnert, 1983; Muchmore, 1975; Vachon, 1938a, 1970) and of Atemninae represented by *Atemnus*, *Catatemnus*, *Cyclatemnus*, *Micratennus*, *Paratennoides* and *Titanatennus* (Mahnert, 1983; Vachon, 1938a, b). The male genitalia (Fig. 12) are obviously closer to those of *Tullgrenius* (Fig. 15) than to those of any other genus of Atemnidae as shown in Klausen (2005). These characters, together with the arrangement of the trichobothria of the fixed finger,



Figs. 7–11: 7–10 *Nilotemnus comboni* gen. et sp. n. 7 Left male chelicera, dorsal view; 8 Male flagellum, serrula exterior and galea of chelicera, ventral view; 9 Female galea of chelicera, ventrolateral view; 10 Surface structure of carapace. 11 *Tullgrenius indicus*, surface texture of carapace. Scale lines=0.1 mm (7, 10–11), 0.05 mm (8–9).

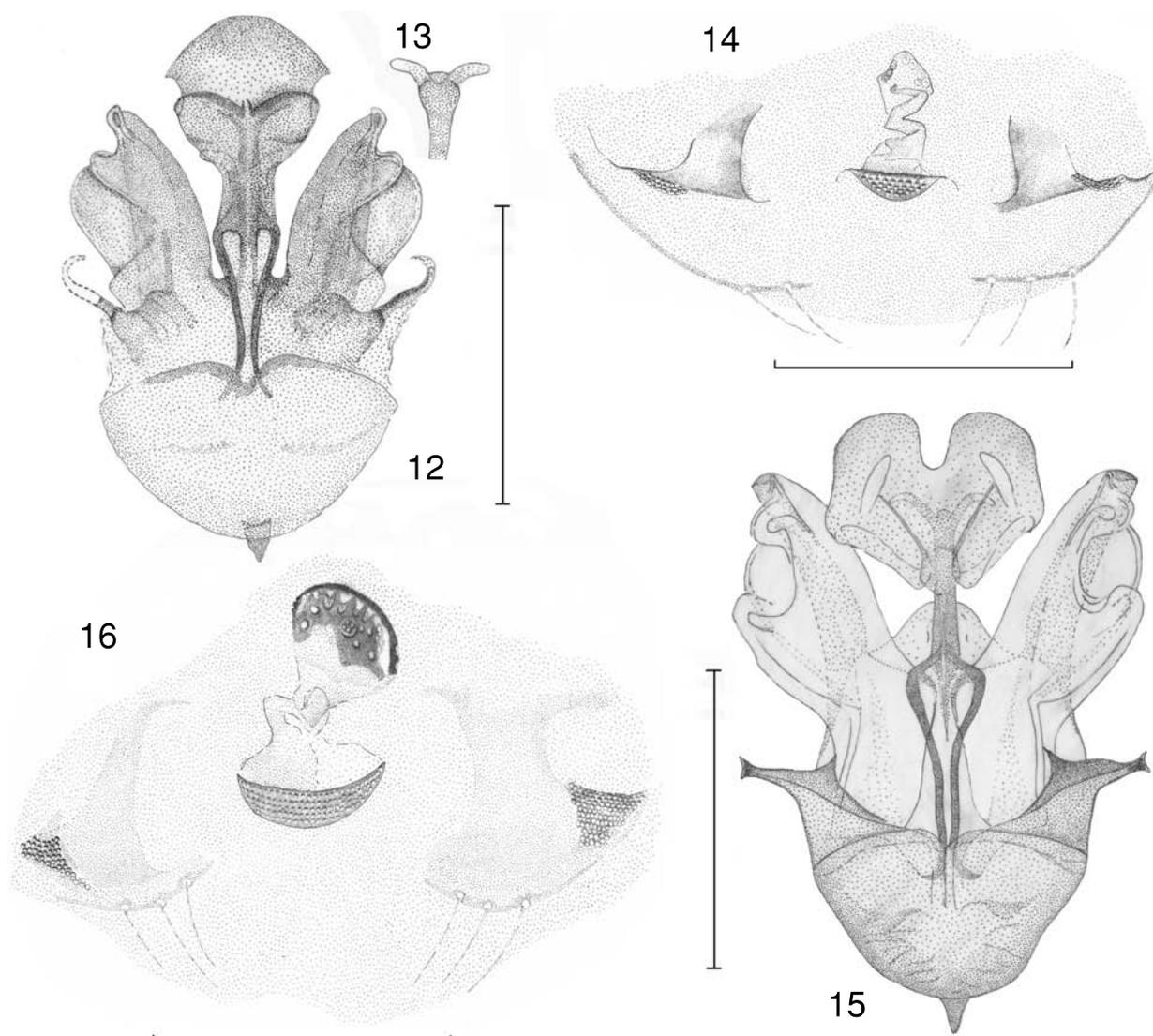
indicate that *Tullgrenius* and *Nilotemmus* have a common ancestor shared with no other atemnids.

The microstructure of the surface of the carapace differs from that of all other atemnids and I consider it as being a significant character state. The squamotesselate pattern of *Nilotemmus* is somewhere intermediate between the papillotesselate pattern of the miratemnids and the almost smooth surface of the atemnids. With respect to the papillotesselate pattern of the other families Withiidae, Cheliferidae and Chernetidae which are related to the Atemnidae (Harvey, 1992), this rugose pattern might be a plesiomorphic character.

It is interesting that the specimens from the two localities differ in the number of trichobothria on the movable finger. Confirmation of this pattern can probably only be done by investigating juveniles. Furthermore, as I have only 3 specimens of *N. comboni* at my disposal I cannot exclude the possibility that there might be specimens with the normal number of 4 on the movable finger. I have compared the configuration of the trichobothria with that of the *Tullgrenius* species as given by Sivaraman (1982). In this genus a reduction in

the number of trichobothria on the movable finger also frequently seems to occur. When Chamberlin (1933) described *T. indicus* he observed a missing trichobothrium T, although in Chamberlin (1931) his figure of the chela indicates the SB on the movable finger as being missing. Beier (1951) confirmed that it is SB which is absent. Murthy (1962) observed that trichobothrium SB was missing in *T. vachoni*. Murthy & Ananthakrishnan (1977) reported a reduced number of trichobothria on the pedipalps of the genus *Tullgrenius*, but they did not specify which. I have observed the same in several adult specimens of *T. indicus* taken in the southern part of India. Of 13 specimens investigated, 2 males out of 6 and 4 females out of 7 had 3 trichobothria on the movable finger; the rest had 4 trichobothria. No specimen had only 2 trichobothria on the movable finger. It was always SB that was absent. A reduction in number of trichobothria has not been reported from other genera in the family Atemnidae.

The habitat is in accordance with the typical preference of atemnid species, which is an open, savanna or park-like landscape. The trunks of the older African



Figs. 12–16: **12–14** *Nilotemmus comboni* gen. et sp. n. **12** Male genitalia, anterior view; **13** Distal end of dorsal apodeme, posterior view; **14** Female genitalia, dorsal view. **15–16** *Tullgrenius indicus*. **15** Male genitalia, anterior view; **16** Female genitalia, dorsal view. Scale lines=0.2 mm.

mahoganies develop a deeply fissured and cracked bark at the base when standing in the open. A surface texture like this is more or less typical for several species of trees in the open landscape of the tropics and subtropics. It seems to be the preferred microhabitat of most atemnid species which are found on trees. Accordingly, it is almost certainly not the species of the trees that is essential for *Nilotemnus comboni*, but rather the structure or topography of the bark of the trunk.

The occurrence in East Africa of a genus closely related to the genus *Tullgrenius*, recorded from India and South-east Asia, has zoogeographical implications as to the pattern of dispersal and the origin of the common ancestor. Pseudoscorpions are well known to be phoretic, i.e. clinging to other animals such as insects, mammals and birds as a means of transportation, although this is more common in other families than for atemnids (Beier, 1949; Muchmore, 1971; Poinar *et al.*, 1998; Vachon, 1940). Transportation on tree-trunks and other debris drifting in ocean currents is also known to disperse animals over long distances (Thiel & Gutow, 2005). However, it is unlikely that the common ancestor of these groups has managed to spread from Africa right across the vast Indian Ocean to the Asian continent, or the other way round. It is more likely that the dispersal has been over land. Thus the ancestor could have been dispersed along the present land connections in the Middle East from Africa to Asia. If so, this dispersal could have occurred at its earliest in the Miocene about 20 million years before present, when these land connections were formed. Another alternative is a splitting of the ancestral population by continental drift, when the Indian subcontinent tore away from East Africa in the Cretaceous. If so, this predicts a very early origin, at least 100 million years ago.

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