

Chordodes guineensis sp. n., a new species of horsehair worms from West Africa (Nematomorpha: Chordodidae)

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A new nematomorph species, *Chordodes guineensis* sp. n., is described from Kankan, Guinea. It is distinguished from other *Chordodes* species in the structures of the areolar layer of cuticle. Presumably, insects of the order Orthoptera are the natural hosts of *Ch. guineensis* sp. n.

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Two species of the genus *Chordodes* from Guinea are considered in this paper, one of them is described as new.

Chordodes guineensis sp. n. (Figs 1-2)

Holotype. ♀, West Africa, Guinea, Kankan, obtained from the inner abscess of a street dog (as reported by collector), 1980. Deposited in the collection of the Zoological Museum of Moscow University, specimen No. Ic1-100.

Paratypes. 3 ♀, 1 ♂ (fragment of posterior end), collected and deposited with the holotype, specimens No. Ic1-80: tubes 1, 2 and 4.

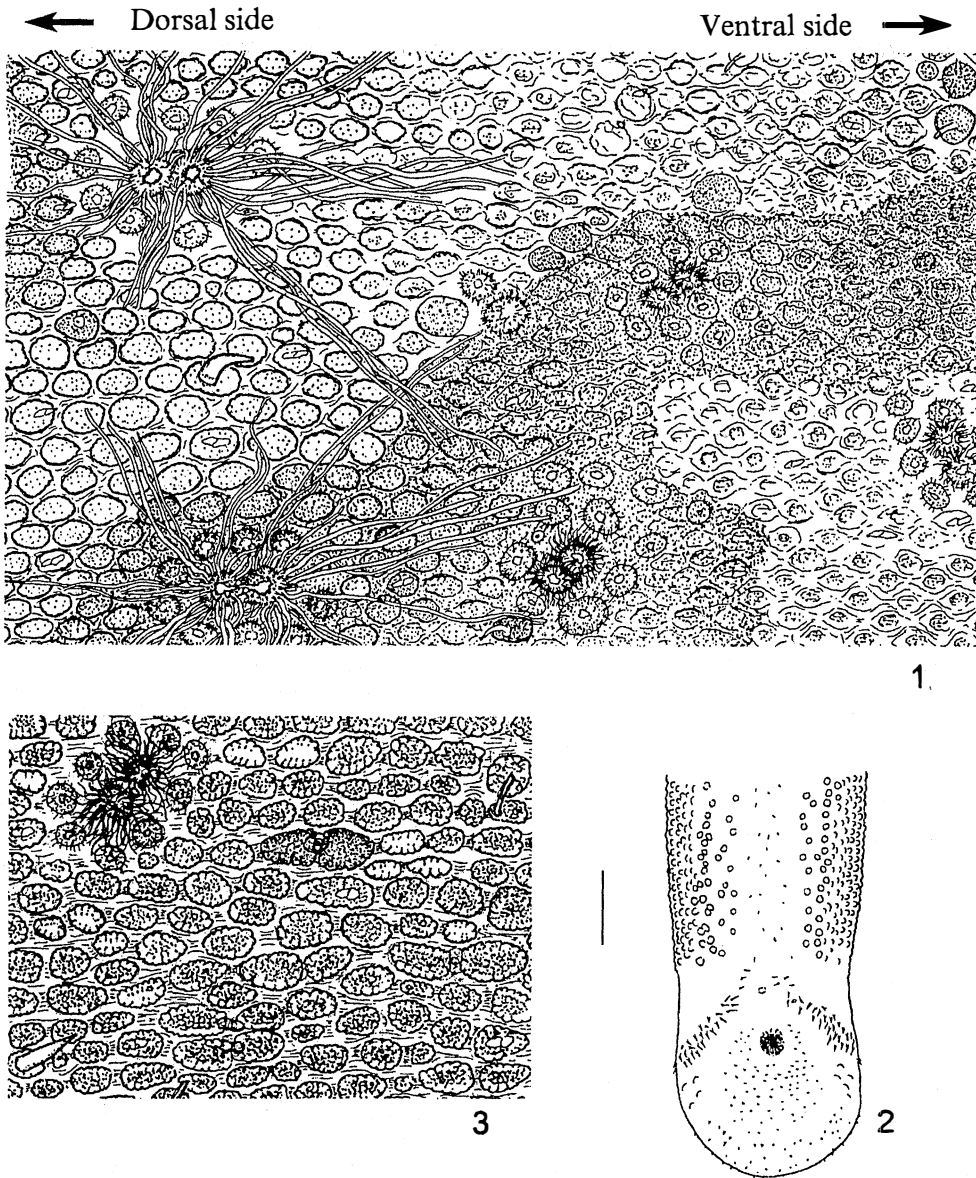
Measurements. Holotype: length 141 mm; maximum body diameter 730 µm; body diameter at 0.5 mm from anterior end 220 µm; diameter of posterior end 450 µm; weight 60 mg. Paratypes: length 102-133 mm; maximum body diameter 640-730 µm; body diameter at 0.5 mm from anterior end 220-300 µm; weight 40-48 mg.

Description. Slender worms, general coloration yellowish brown. Irregular darker spots scattered on body surface like camouflage spots on military uniform. Anterior end of body hemispherical. In female, posterior end of body only slightly curved ventrally, deformed in all specimens; cloacal opening situated atop of conical elevation or in centre of rounded posterior end. In male, posterior end of body curved ventrally, with cloacal opening at 190 µm from posterior end; body diameter at cloaca level 236 µm. In male, small acute spines situated around cloacal opening, and minute papilla-like protrusions scat-

tered over ventral surface of posterior body end. In addition, two submedian fields of acute setae present at both sides of cloaca.

At low magnifications, cuticle appears as coarse or grainy surface, since it is divided by grooves (so-called interareolar furrows) into areoles, elliptical areas with protruding centre. Most of cuticle surface covered with areoles of more or less similar structure: quite low projections of cuticle with granular substance inside (designated below as AI). AI size between 6 × 7 and 10 × 17 µm. Bottom of interareolar furrows with pattern of parallel wrinkles. Borders of darker spots not corresponding to interareolar furrows. Comparatively higher and darker areoles scattered against the background of AI. These high areoles (designated below as AII) arranged in groups, in pairs, or solitary. Groups of AII is the most remarkable feature of cuticle: usually each group contains two (rarely, three) protruding areoles in the centre. Usually, bases of these central AII are elliptical (10-12 × 10-14 µm) and separated, but rarely they are fused together. These central areoles in groups encircled with 6-17 AII of similar or slightly lesser height. From above, group of areoles appearing as combination of elliptical or round, dark areoles 10-12 × 10-14 µm in size. Robust spine 5 µm high, with 1 × 2 µm base always situated between central areoles in groups.

Central areoles in groups always bearing hair-like projections. On dorsal and lateral body sides, these projections 1.5-2 µm wide and up to 100-200 µm long; their basal parts situated around AII apex, leaving central part of apex uncovered. On



Figs 1-3. Chordodids from Guinea. **1, 2**, *Chordodes guineensis* sp. n.: **1**, female, areoles on the cuticle surface and changes in AI appearance from dorsal to ventral side; **2**, male, ventral view of posterior body end; **3**, *Chordodes* sp. from cockroach, female, areoles on the lateral surface of cuticle. Scales: 20 μm (1, 3), 100 μm (2).

lateral and ventral body sides, hair-like projections not longer than 20 μm ; their basal parts situated close, to each other and to centre of AII apical surface, completely hiding the latter. In all groups, AII encircling central areoles only with short spines up to 2 μm long.

Solitary or paired AII scattered throughout cuticle surface. Such AII from 8×11 up to $16 \times 18-22$ μm at base, bearing long hair-like projections atop or without armature.

Aside from different areoles, two types of spines present on cuticle surface: robust highly

refractive 15-16 μm high spines with basal diameter of 6-7 μm , and thin 10-12 μm high spines with basal diameter of 2 μm . Each robust spine devoid of canals or ducts inside, and its base situated in a small pit 8-10 μm in diameter. Thin spines provided with axial duct.

Paired vesicles 8-9 μm in length scattered under cuticle surface (between areolar and fibrous layers); usually they are stretched across longitudinal body axis. These tightly joined small double cavities look like a spindle-shaped vesicle under areolar layer.

Comparison. Several species of nematomorphs were described from Africa. As early as in the "Monographia dei Gordii" (1897), L. Camerano mentioned four species of *Chordodes*: *Ch. capensis*, *Ch. ferox*, *Ch. madagascariensis* and *Ch. pardalis*. In "Revisione dei Gordii" (1915), Camerano mentioned 13 African *Chordodes* species. *Ch. madagascariensis* and *Ch. pardalis* were originally described from Madagascar (Camerano, 1897), but later Sciacchitano (1937, 1958) reported *Ch. madagascariensis* from equatorial areas of continental Africa (what is now Democratic Republic of the Congo) and described a couple of new species from the collection of the Royal Museum of Belgian Congo in Tervuren. The classification of nematomorphs and general standards for their description are still unstable and not all the descriptions of these animals are adequate. Thus, the descriptions of some African species of *Chordodes* (*Ch. capillatus*, *Ch. clavatus*, *Ch. digitatus*, *Ch. tuberculatus*) by Linstow (1901, 1906) are not sufficient for their reliable differentiation from other species.

Both differences and similarities between the described *Ch. guineensis* sp. n. and other known species can be found. Several African *Chordodes* species can be readily excluded from comparison with Guinea specimens. In particular, such species as *Ch. bulengeri* Cam., *Ch. capensis* Cam., *Ch. hawkeri* Cam., *Ch. ibembensis* Sciac., *Ch. kakadensis* Sciac., *Ch. kolensis* Sciac., *Ch. maculatus* Sciac., *Ch. madagascariensis* Cam., *Ch. modigliani* Cam., *Ch. mobensis* Sciac., *Ch. pardalis* Cam., and *Ch. sylvestri* Cam. are characterized by the absence of long (>20-30 μm) hair-like projections on the areoles. Only short thinner projections are reported for some of these species. Because of the absence of these long projections, several non-African species also can be excluded from consideration: *Ch. aelianus* Cam., *Ch. bouvieri* Villot, *Ch. carmelitanus* Carvalho & Feio, *Ch. jandae* Cam., *Ch. festae* Cam., *Ch. punctulatus* Cam., *Ch. talensis* Cam., *Ch. timorensis* Cam., and *Ch. weberi* Villot

(Camerano, 1897, 1915; De Miralles, 1989). *Ch. guineensis* sp. n. can be distinguished from several *Chordodes* species, which have few very thick projections (like African *Ch. kivuensis* Sciac., South American *Ch. balzani* Cam. and *Ch. brasiliensis* Janda).

Long projections are situated on the paired areoles in *Ch. kallstenii* Jägerskiöld from Cameroon (Jägerskiöld, 1897). No areolar groups (more than 5-6 areoles) were described for this species, which differs in this feature from *Ch. guineensis*. *Ch. penicillatus* Cam. described from unlabelled museum collections differs from *Ch. guineensis* in very short, nearly round double subcuticular spaces and broad interareolar furrows. South American *Ch. peraccae* Cam. can be distinguished by the absence of robust spines, very broad interareolar furrows and semilunar shape of AI. *Ch. guineensis* resembles Chinese species *Ch. moutoni* Cam., but the latter is characterized by very narrow interareolar furrows and areoles in groups which are situated close to each other. *Ch. joyeuxi* Dorier from Vietnam and *Ch. longipilus* Kirjanova from Turkmenistan are two Asian species of *Chordodes* with long projections on areoles (Dorier, 1935; Kirjanova, 1949). Both these species have no darker areoles (single or in pairs) scattered over AI background between the groups.

Among African chordodids, *Ch. guineensis* is similar to *Ch. ferox* Cam. from the former French Congo and *Ch. gariazii* Cam. from the former Belgian Congo, but both these Congolese species are characterized by large areoles in groups (19-20 μm in diameter), and more massive robust spines (with the basal diameter of 16-18 μm and the height of 17-20 μm in the first species and up to 26-30 μm in the second one). At least in the structure of the male cuticle, *Ch. guineensis* resembles *Ch. iturensis* Sciac. However, unlike *Ch. guineensis*, female cuticle of *Ch. iturensis* Sciac. bears no areoles with long projections, interareolar furrows are broad, and AI shape is usually semilunar. *Ch. uncinatus* Sciac. and *Ch. bucavuensis* Sciac. also have very broad interareolar furrows. *Ch. rigatus* Sciac. and *Ch. sandoensis* Sciac. have very narrow interareolar furrows, whereas only simple areoles of round and semilunar shape and paired dark areoles are described for *Ch. ruandensis* (Sciacchitano, 1937). Thus, all these three species can be distinguished easily from *Ch. guineensis*.

The new species is close to *Ch. albibarbatus* Montg. described from Gabon River (Montgomery, 1898). The structure of the male and female posterior end, body colour of male and pattern

of spots are very similar in these species. However, in *Ch. albibarbatatus* the body is approximately twice as long as in species from Guinea. Unlike *Ch. guineensis*, areolar groups of *Ch. albibarbatatus* contain 22-32 areoles with central areoles twice as large as adjoining areoles in groups. *Ch. ornatus* Grenacher was described from Philippines. Both long and short projections atop of the central areoles were reported for this species (Grenacher, 1868), which is also characterized by the presence of highly protruding AI (15-16 μm). In *Ch. guineensis*, AI are much lower.

Discussion. Dr. Atayev reported that the specimens of *Ch. guineensis* were recovered from an abscess in mediastinum of a street dog killed in the city of Kankan in Eastern Guinea and used by the students of Veterinary College during their practice in anatomy. Overwhelming majority of chordodids are parasites of insects, mainly of different orthopterans. African species *Ch. madagascariensis*, *Ch. mobensis*, *Ch. kivuensis*, *Ch. maculates*, and *Ch. ibembensis*, all were described from mantids. Few *Chordodes* species were found in cockroaches: *Ch. pilosus*, *Ch. iturenensis*, etc. One species was described from dolichoceran orthopteran, *Chordodes pardalis* from conocephalid grasshopper *Aethiomerus* (Camerano, 1897; Sciacchitano, 1958). At the same time, several cases of occasional penetration by nematomorphs into the body of vertebrates (including humans) were described (e.g., Pikula et al., 1996). We presume that some insects of the order Orthoptera serve as natural hosts for *Ch. guineensis* sp. n. and the reported finding inside the dog, if creditable, is another case of occasional parasitism.

Remarkable darker spots on the lighter surface of *Ch. guineensis* sp. n. cuticle do resemble the camouflage military uniform. Such ornamentation of cuticle was reported for different *Chordodes* species. It is reasonable to presume that such ornamentation serves in the same way as camouflaged uniform, effectively making these large worms invisible on the bottom of streams during the free-living stage of their life cycle.

Chordodes sp. (Fig. 3)

Material examined: West Africa, Guinea, Kankan, 1 ♀; obtained from the body cavity of unidentified cockroach (*Periplaneta* sp.), 1980. Deposited in the collection of the Zoological Museum of Moscow University, specimen No. Ic1-80 (tube 5).

Measurements: length 121 mm; maximum body diameter 600 μm ; body diameter at 0.5 mm from anterior end 350 μm ; minimum diameter (260 μm) at 0.7 mm from posterior end; weight 66 mg.

Description. Slender worm of light yellowish colour. Anterior end conical in shape and light in colour. Posterior end curved ventrally. Cloacal opening in centre of 400 μm wide cloacal disc.

AI with festooned rims, 5×10 – 12×20 μm in size. Interareolar furrows quite broad, with numerous wrinkles on bottom. Parallel wrinkles creating annulate pattern on furrow bottom. Sometimes, a distinctive subcuticular structure visible under areolar surface: round dark spot 5 μm in diameter with central duct 2 μm in diameter. Sensilla-like structure visible inside duct. Double cavities visible between areolar and fibrous cuticle layers; these cavities 9-10 μm long and 3-4 μm wide, usually stretched across body axis.

Only one type of AII areolar groups present: central areoles with 15-20 μm long and 0.7-1 μm wide hair-like projections atop, encircled with adjoining AII bearing minute hair-like spines 6-7 μm long, with basal diameter less than 0.5 μm . Central and adjoining areoles similar in size: elliptical, 8-10 × 12 μm , or round, 10-12 μm in diameter.

Cuticle surface with two types of spines: robust ones, 15-20 μm high, with basal diameter of 5 μm and thinner, 7-8 μm high spines with basal diameter of 3 μm . Thinner spines with inner axial duct. In addition, pairs of dark AII scattered between AI. Just beneath interareolar furrow dividing AII in these pairs, a dark spot 6 μm in diameter with 2- μm central duct always situated under cuticular surface.

Comparison. Presently, precise position of this *Chordodes* from blattid host can not be ascertained. This specimen resembles *Ch. madagascariensis* Cam., which is also characterized by the presence of separately scattered pairs of protruding areoles with dark round spot under the point of their junction between areolar and fibrous layers of cuticle. Camerano (1897) described AI of *Ch. madagascariensis* as "non moriformi", i.e. without festoons on the rims. In *Ch. madagascariensis*, areoles are arranged in more dense, closely spaced groups.

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