SOME ORIBATEI FROM GHANA. I. SAMPLING LOCALITIES. II. SOME MEMBERS OF THE *ENARTHRONOTA* GRANDJ.

BY

John A. WALLWORK.

(Department of Zoology, University College of Ghana.)

INTRODUCTION.

This is the first of a series of papers dealing with the Oribatei mites of Ghana, and is based on collections from over thirty different sampling localities, made by the author in 1958 and 1959. The collections contain new genera and species, as well as representatives of genera and species described by BALOGH (1958 ; 1959) from other parts of West Africa and East Africa. Hitherto, no comprehensive survey of the oribatei of this country has been made, to the best of my knowledge.

The first section of this paper consists of a brief description of each of the sampling localities. Subsequent references to localities will contain only the place-name.

The second section contains descriptions of representatives of the following genera : *Malacoangelia* Berl., *Eohypochthonius* Jacot, *Sphaerochthonius* Berl., and *Cosmochthonius* Berl. Species descriptions have been compiled from a series of specimens, wherever possible. These specimens have been retained in my collections for the present, but it is hoped to send representatives to the British Museum in due course.

I. SAMPLING LOCALITIES.

An account of the vegetation zones of Ghana (previously the Gold Coast) has been given by TAYLOR (1952). The map of the zones compiled by TAYLOR has recently been re-issued in a slightly modified form (Government Survey Department, Accra, 1958), and references relate to this more recent publication, in the following descriptions. Reference to soil types is related to the provisional map of the great soil groups, published by the Soil and Land Use Survey (Accra, 1958).

Dr. R. F. CHAPMAN (now at Birkbeck College, University of London) very kindly

collected litter and soil samples for me in a number of localities. These are indicated* in the following list.

A. Coastal Savannah (Grassland).

1. Shai Hills. (5° 55′ N., 0° 3′ E.).

Soil types : tropical black earth ; savannah lithosol.

(a) Leaf litter under thicket (21-4-58).
(b) Soil under grass tussock (21-4-58).
(c) Litter under dense thicket (16-12-58).

2. Achimota. (5° 37′ N., 0° 15′ W.).

Soil type : savannah ochrosol.

(a) Leaf litter under thicket (22-1-59).
(b) Leaf litter and soil under grass tussock (15-3-59).
(c) Leaf litter under *Carica papaya* (18-5-59).
(d) Leaf litter under *Carica papaya* (25-10-59).

3. Accra Plains. (5° 41′ N., 0° 8′ W.).

Soil types : (a) savannah ochrosol ; (b) regosolic groundwater laterite.

(a) Dodowah Rd. (3 mi. N. Legon). Leaf litter under thicket (18-5-59).
(b) University College of Ghana Agricultural Research Station, Nungua. Leaf litter on sheep pasture. (31-5-58).

B. High Forest (SW. Rain Forest).

4. *Dompim. (5° 9′ N., 2° 4′ W.).

Soil type : forest oxysol.

(a) Leaf litter under dense secondary forest (17-5-59).

5. *Axim. (4° 51′ N., 2° 15′ W.).

Soil type : forest oxysol.

(a) Leaf litter under secondary forest (17-5-59).

6. *Nkwanta. (5° 26′ N., 2° 21′ W.).

Soil type : forest oxysol.

(a) Leaf litter under bamboo thicket (17-5-59).

C. High Forest (Moist Semi-Deciduous).
(*Celtis-Triplochiton* Association).

7. Essuboni Forest Reserve. (5° 49′ N., 0° 48′ W.).

Soil type : forest ochrosol.

(a) Leaf litter under secondary forest (18-3-58).
(b) Leaf litter under secondary forest (15-10-58).

8. Konongo. (6° 37′ N., 1° 12′ W.).
   Soil type : forest oxysol-ochrosol intergrades.
   (a) Cassava leaf litter (14-2-59).

9. Old Tafo. (6° 14′ N., 0° 22′ W.).
   Soil type : forest ochrosol.
   (a) Cacao leaf litter (14-2-59).

10. Anyinam. (6° 21′ N., 0° 32′ W.).
    Soil type : forest ochrosol.
    (a) Leaf litter from secondary forest (14-2-59).

11. Kibi. (6° 10′ N., 0° 33′ W.).
    Soil type : forest ochrosol.
    (a) Soil under grass tussock (15-2-59).

12. *Lake Bosumtwi (W. shore). (6° 30′ N., 1° 27′ W.).
    Soil type : forest ochrosol.
    (a) Leaf litter under secondary forest (28-3-59).

13. *Akotoasubiente Forest Reserve. (6° 30′ N., 2° 13′ W.).
    Soil type : forest ochrosol.
    (a) Leaf litter from secondary forest (28-3-59).

14. *Dominasi. (5° 21′ N., 1° 4′ W.).
    Soil type : forest ochrosol.
    (a) Leaf litter under secondary forest (30-3-59).

15. *Numia Forest Reserve. (6° 2′ N., 1° 23′ W.).
    Soil type : forest ochrosol.
    (a) Leaf litter under secondary forest (30-3-59).

D. High Forest (Moist Semi-Deciduous). (*Antiaris-Chlorophora* Association).

16. Nsawam (2 mi. N. on Bunso Rd.). (5° 51′ N., 0° 21′ W.).
    Soil type : forest ochrosol.
    (a) Leaf litter under thicket (5-12-58).

17. Nsawam (4 mi. N. on Bunso Rd.). (5° 51′ N., 0° 21′ W.).
    Soil type : forest ochrosol.
    (a) Leaf litter under thicket (5-12-58).

18. Aburi. (5° 51′ N., 0° 10′ W.).
    Soil type : forest lithosol.
    (a) Cacao leaf litter (1-3-59).

19. *Ofin Headwaters Reserve. (7° 4′ N., 1° 25′ W.).
    Soil type : forest ochrosol.
    (a) Leaf litter under secondary forest (28-3-59).

20. *Duayaw-Nkwanta. (7° 11′ N., 2° 5′ W.).
    Soil type : forest rubrisol-ochrosol intergrades.
    (a) Cacao leaf litter (28-3-59).

21. *Mabang. (7° 0′ N., 2° 18′ W.).
    Soil type : forest rubrisol-ochrosol intergrades.
    (a) Leaf litter in secondary forest (29-3-59).

22. *Awura Forest Reserve. (7° 13′ N., 1° 23′ W.).
    Soil type : forest ochrosol.
    (a) Grass tussock in secondary forest (14-4-59).

E. Guinea Savannah Woodland.

23. Accra-Senchi Rd. (37 mi. NE. Accra). (6° 0′ N., 0° 1′ E.).
    Soil type : forest ochrosol.
    (a) Leaf litter under thicket (4-4-58).

24. Accra-Senchi Rd. (45 mi. NE. Accra). (6° 0′ N., 0° 1′ E.).
    Soil type : forest ochrosol.
    (a) Leaf litter under thicket (4-4-58).

25. Akuse. (6° 7′ N., 0° 7′ E.).
    Soil type : acid gleisol.
    (a) Leaf litter under secondary forest (17-12-58).

26. Akuse-Somanya Rd. (3 mi. W. Akuse). (6° 7′ N., 0° 2′ E.).
    Soil type : tropical black earth.
    (a) Grass litter under bracket fungus (17-12-58).

27. *Gambaga Forest Reserve. (10° 35′ N., 0° 26′ W.).
    Soil type : savannah ochrosol.
    (a) Soil under grass tussock (10-1-59).

28. *Damongo. (9° 5′ N., 1° 49′ W.).
    Soil type : savannah ochrosol.
    (a) Leaf litter from dried stream bed (12-1-59).

29. *Tuna. (9° 32′ N., 2° 26′ W.).
    Soil type : groundwater laterite-ochrosol.
    (a) Soil under grass tussock (15-4-59).

30. *Bole. (9° 2′ N., 2° 30′ W.).
Soil type : groundwater laterite-ochrosol.
(a) Soil under grass tussock (15-4-59).

31. *Kintampo. (8° 4′ N., 1° 42′ W.).
Soil type : savannah ochrosol.
(a) Leaf litter under thicket (15-4-59).

32. *Buipe (nr. Morno). (8° 49′ N., 1° 32′ W.).
Soil type : savannah ochrosol.
(a) Leaf litter under thicket (18-4-59).

II. Some members of the Enarthronota.

Malacoangelia Berl. 1913.

Only one species of this genus, *M. remigera* Berl., is known. This was described by Berlese from a specimen collected in Java. Grandjean (1935) redescribed the species from specimens collected in Panama, and although he did not give a diagnosis of the genus he cited differences between this genus and *Hypochthonius*. These are : the shape, the presence of a lenticule, no fusion of aspis to ventral epimeral plate, the presence of hairs (e_1) and (e_2), the fusion of anal and adanal plates, the pleural hollows for legs III and IV, the form of the legs, and the superficial secretion.

Malacoangelia remigera Berl. (Fig. 1).

Collected in Ghana : 13 adults.
Average length : 351.7 μ (range : 333.7 μ — 362.1 μ).
Average width : 211.0 μ (range : 184.6 μ — 234.3 μ).

Measurements correspond fairly well to Grandjean's figures. Form and arrangement of hairs on propodosoma, notogaster, and venter, also agree with Grandjean's description, as do the hairs and solenidions on leg I.

One slight difference shown by the specimens from Ghana is in the form of the sensillus (Fig. 1). Barbs are arranged in two rows, with the outer (i. e. the row inserted on the convex surface of the organ) usually containing more barbs than the inner. Barbs on outer row usually 10-15 in number, distinct, becoming progressively longer from the base to subterminal portion of sensillus ; at mid-distance barbs are twice as long (about 8 μ) as those at base of sensillus. Inner row of barbs indistinct, usually 2-6 in number, much finer than those in outer row, and can be seen best if sensillus is dissected away from the body. Average length of sensillus (measured from lip of pseudostigmata) : 82.1 μ (range : 76.5 μ — 85.0 μ).

Distribution in Ghana : Essuboni Forest Reserve (6 adults) ; Dominasi (1 adult) ; Nkwanta (5 adults) ; Mabang (1 adult).

Malacoangelia remigera var. **symmetrica** n. var. (Fig. 2-3).

This differs from *M. remigera* Berl. in the form of the sensillus, which bears two distinct rows of barbs.

Collected in Ghana : 21 adults.

Average length : 314.2 μ (range : 298.2 μ — 347.9 μ).

Average width : 183.8 μ (range : 170.4 μ — 213.0 μ).

There is little or no size differential in barbs from base to sub-terminal portion of sensillus, i.e. barbs at mid-distance same length as those at base. Outer row contains 14-21 barbs, inner row 10-15 barbs. Tip of sensillus deeply bifid and curving strongly upwards (Fig. 2). Average length of sensillus (measured from lip of pseudostigmata) : 72.3 μ (range : 68.0 μ — 85.0 μ).

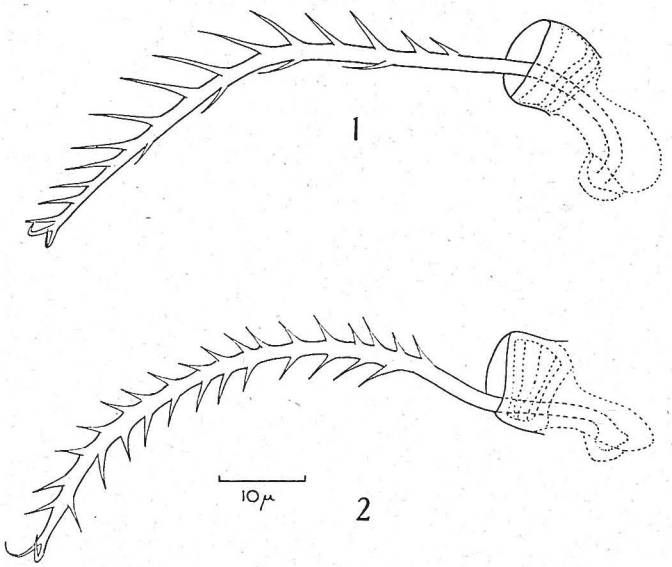


FIG. 1. *Malacoangelia remigera* (Berl.) Specimen from Ghana. Sensillus.
FIG. 2. *Malacoangelia remigera* (Berl.) var. *symmetrica* n. var. Sensillus.

Lenticule usually, but not always, symmetrical about its transverse axis ; occasionally convex, but more frequently biconcave (Fig. 3). Length increases with an increase in total body length of the animal. Number of transverse sutures also increases proportionately, and in some instances sutures are branched.

The remaining features of the body correspond to Grandjean's description of *M. remigera.* Terminal acanthoïde on the palpus, which GRANDJEAN states is " multiple ", bears three tines in the Ghanaian specimens.

Distribution in Ghana : Aburi (4 adults) ; Dominasi (3 adults) ; Essuboni Forest

Reserve (1 adult) ; Mabang (2 adults) ; Awura Forest Reserve (4 adults) ; W. shore of Lake Bosumtwi (5 adults) ; Nkwanta (1 adult) ; Nsawam (2 mi. N. on Bunso Rd.) (1 adult).

The collection included 5 gravid females, each carrying a single large elongate egg.

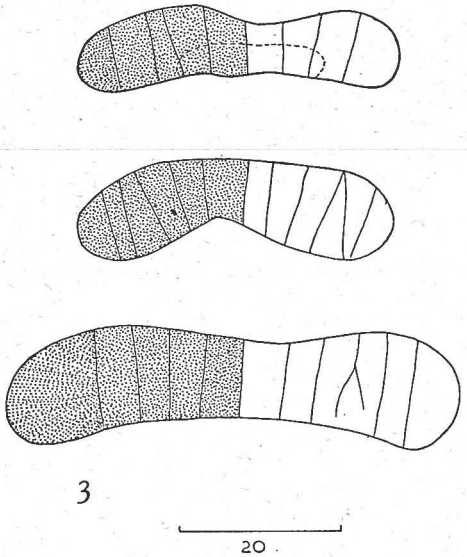


FIG. 3. *Malacoangelia remigera* (Berl.) var. *symmetrica* n. var.
Variations in the form of the lenticule. (All drawn to the same scale).

Eohypochthonius Jacot 1938.

JACOT created this genus with *Eohypochthonius (Hypochthonius) gracilis* Jacot as the type. It has the following characteristics ; notogaster with a single suture ; each genital plate divided by an oblique suture ; notogastral hairs (e_1) and (e_2) virtual ; other notogastral hairs long.

Eohypochthonius vilhenarum (Bal.) (= *Afrhypochthonius vilhenarum* Bal.)

This species, which BALOGH has used as the type for a new genus, *Afrhypochthonius* (Balogh 1958), is fairly common in Ghana. A total of forty-five adults and one tritonymph are present in my collections. Dr. L. VAN DER HAMMEN has very kindly compared some of my specimens with *E. gracilis* Jacot and *E. asiaticus* (Berl.) He has informed me that the differences between *E. vilhenarum* and *E. gracilis* are slight, while comparison with *E. asiaticus* was made difficult by the bad condition of the latter specimen. The measurements for the specimens of *E. vilhenarum* in my collection are as follows :

Average length : 328.5 μ (range : 319.5 μ — 340.8 μ).
Average width : 143.4 μ (range : 134.9 μ — 149.1 μ).

In general these specimens are slightly larger than *E. gracilis* (310 μ × 140 μ), but fall within the size range for *E. asiaticus* (330 μ × 160 μ). The sensillus bears seven pectinations (ten or eleven in *E. gracilis*) which become progressively shorter distally. Notogastral hairs long and spiniform ; (c_2) is 70 μ long, slightly longer than (c_1). (c_2) is slightly shorter than (c_1) in *E. gracilis*.

Ventrally, the labium is very similar to that of *Malacoangelia remigera* (see GRANDJEAN 1935). Maxilla has two well-developed posterior teeth and a very thin membranous anterior portion curving dorso-ventrally on each side to form a hood over the paraposterior hairs of the tongue. The paraxial pair of hairs on the tongue is differentiated, by means of very fine interlocking teeth, into a grill or seive, but this is not distinct in the present genus. Each hair also bears a well-developed tooth. The terminal acanthoïde on the palpal tarsus bears two tines.

Dr. VAN DER HAMMEN is of the opinion that there may be a slight difference in the shape of the genital covers between *E. gracilis* and *E. vilhenarum*. In my specimens the oblique suture divides each genital plate into two unequal parts, the anterior being long and narrow with rounded anterior margin, the posterior being almost square. Ten pairs of genital setae are arranged in a similar way to those of *M. remigera* (i.e. an inner row of six and an outer row of four).

All tarsi are monodactylate.

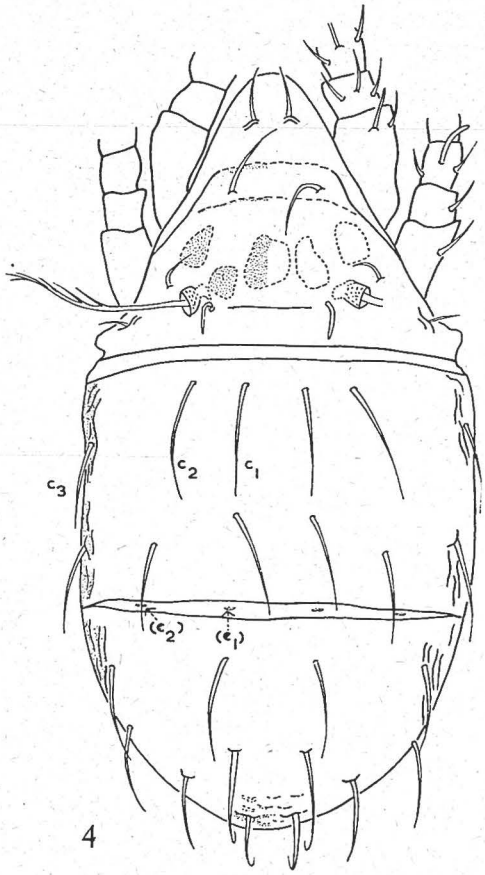
Tritonymph (Fig. 4-5). One tritonymphal specimen was collected and studied.

Length : 269.8 μ Width : 127.8 μ.

Colour pale brown, almost colourless. Integument with punctate and reticulate markings, as in adult. Surface of propodosoma with five large, almost circular, depressions, located antero-medially to the pseudostigmata. Notogaster with one suture ; surface of the integument in the postero-median region shows a series of raised rounded prominences. Form and arrangement of hairs on dorsal surface of body very similar to the adult ; (c_2) slightly longer than (c_1). Lamellar hairs inserted on a transverse ridge, which may be an artificial folding of the skin, incurred during the mounting process. Anterior margin of notogaster marked by a broad clear zone. Notogastral hairs (e_1) and (e_2) virtual, as in adult. Other features of the dorsum are shown in Figure 4.

Integument of ventral surface of body and legs punctate and reticulate, as dorsum. Mouth parts missing from the specimen studied. Epimeres I and II fused together, as are epimeres III and IV. The two epimeral plates so formed are separate from each other, as in the adult, although the dividing fissure is not so distinct in the nymph. Sternal thickening is distinct, although not heavily chitinised, extending from posterior margin of gnathosoma to anterior margin of genital aperture, pointed at its anterior and posterior extremities (Fig. 5). Epimeral setal formula is (3-1-3-3). Genital aperture rounded, relatively smaller than in adult. Two pairs of genital suckers. Genital plates entire, without oblique suture ; five genital setae seen on one plate, four on the other. Preanal plate not visible.

Anal and adanal plates fused, suture present, the former bearing two pairs of setae, the latter three pairs, as in the adult. The two pairs of circumanal hairs are long, the posterior pair projecting beyond the posterior margin of the abdomen for most of their length.



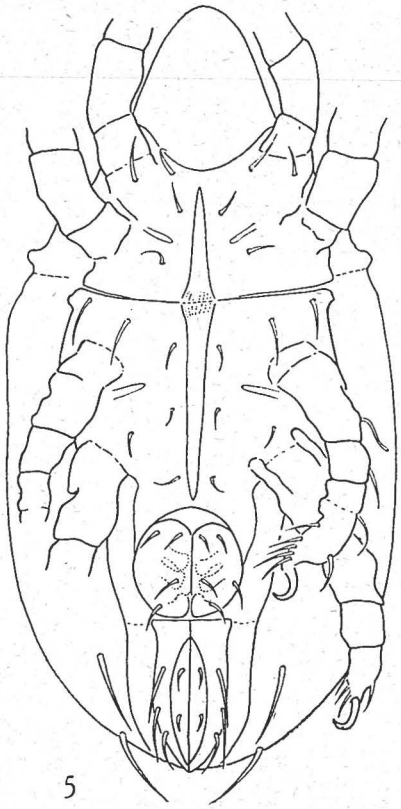


FIG. 4. *Eohypochthonius vilhenarum* (Bal.) Tritonymph. Dorsalview. c_1, c_2, c_3 = notogastra-hairs ; e_1, e_2 = virtual notogastral hairs. — FIG. 5. *Eohypochthonius vilhenarum* (Bal.) Tritol nymph. Ventral view.

All tarsi are monodactylate.

Distribution of *E. vilhenarum* in Ghana : Nsawam (2 mi. N. on Bunso Road) (12 adults) ; Konongo (1 adult) ; Ofin Headwaters Reserve (3 adults) ; Essuboni Forest Reserve (20 adults ; 1 tritonymph) ; Mabang (2 adults) ; Akotoasubiente Forest Reserve (5 adults) ; Nkwanta (2 adults). Several of the adult females examined were gravid and each contained only one large egg.

Sphaerochthonius Berl. 1910.

BERLESE'S original diagnosis of this genus is incorrect (see VAN DER HAMMEN 1959, p. 25). The characteristic features include the prominent compound notogastral hairs ; strongly convex propodosoma and hysterosoma ; one true suture on the notogaster ; all tarsi tridactylous in the adult with a strong median claw flanked by a pair of fine lateral claws.

Sphaerochthonius transversus n. sp. (Fig. 6-15).

Collected in Ghana : 25 adults and 2 nymphs.

Adult. Average length : 264.7 μ (range : 255.6 μ — 276.9 μ). Average width : 183.6 μ (range : 177.5 μ — 191.7 μ). Colour light brown. Propodosoma and hysterosoma strongly convex, propodosoma only half as wide as hysterosoma, measured at the widest points. Body and legs invested in a cerategument bearing a regular pattern of polygonal areolae. Brown granular secretions around margins of areolae and particularly at the angles (Fig. 6). Granules form dense coating over dorsal hairs, circumanal and adanal hairs, and some hairs on proximal leg segments. Cerategument covered with fine papillae to which these secretions adhere.

The most conspicuous feature of the dorsal surface is the presence of compound hairs, called " T-shaped " by other authors (see VAN DER HAMMEN 1959). They are usually (but not always) biramous, the two branches borne on a short thick common stem, from which they diverge sharply in opposite directions (Fig. 7). Each ramus is covered with several rows of elongate papillae to which brown granular secretions adhere. The number of rows of papillae is variable, thus the rostral hairs have a greater number than the lamellar hairs, and are broader thicker and darker than the latter. Rostral hairs about 40 μ in length, inserted on antero-lateral margins of rostrum ; anterior ramus slightly longer than posterior and curving slightly ventro-mediad over anterior margin of rostrum. Lamellar hairs (55 μ long) inserted about half-way along length of propodosoma near lateral margins ; aligned in an antero-posterior direction, slightly inclined towards the mid-line ; anterior ramus slightly longer than posterior. Interlamellar hairs (35 μ long) are uniramous, curving upwards from the base for a short distance and forwards and inwards over propodosoma ; inserted median to pseudostigmata. Sensillus is uniramous (Fig. 8), sometimes as broad and thick as rostral hairs, directed postero-laterad. Anterior and posterior exopseudostigmatic hairs inserted on lateral margin of propodosoma just in front of each pseudostigmata ; uniramous, curving dorsad.

Pseudostigmata (Fig. 8) cone-shaped, with a broad rim bearing a fairly conspicuous spur medially. A chitinised ridge connects the two pseudostigmata and marks the posterior limit of the propodosoma. Form and arrangement of notogastral hairs as shown in Figure 9. The full complement of hairs is not seen in this view, owing to the strong convexity of the notogaster. Length of the hairs is about 50 μ, although those near posterior margin are a little shorter. Hairs in segment I are

aligned in an antero-posterior direction ; most of those in segment II aligned transversely, a feature which gives this species its name. This alignment is not an artefact due to the mounting process, for it is observed in living specimens. All hairs are biramous, the anterior or inner ramus (depending on the alignment) half as long as the outer or posterior ramus. The single true dorsal suture lies beneath the

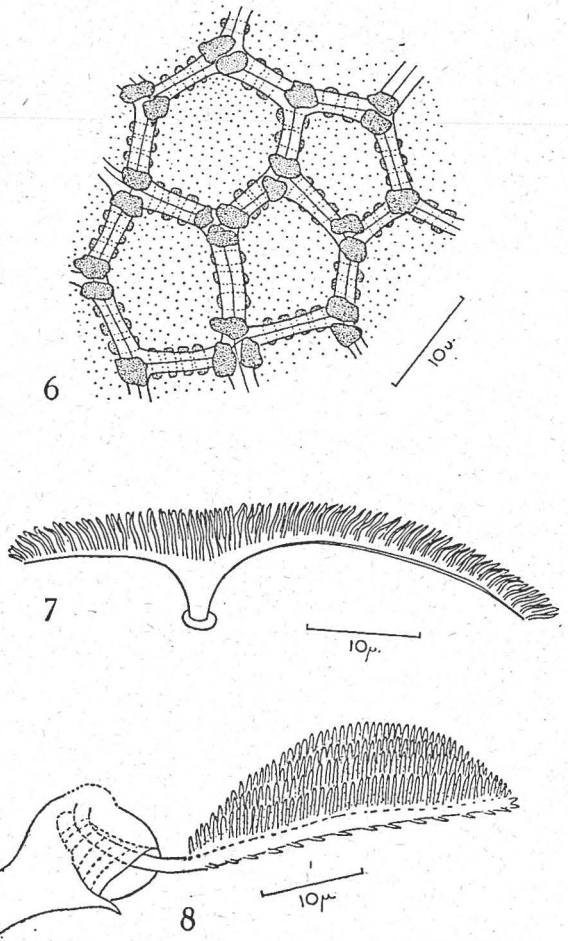


FIG. 6. *Sphaerochthonius transversus* n. sp. Adult. Microsculpture of dorsal integument. — FIG. 7. *Sphaerochthonius transversus* n. sp. Adult. Notogastral hair. — FIG. 8. *Sphaerochthonius transversus* n. sp. Adult. Sensillus.

cerategument just behind the notogastral hairs of segment I. Two dorsal ridges, situated close together, are present on the cerategument.

Form of the labium shown in Figure 11. Hypostome almost circular, carrying a pair of hypostomal setae near posterior margin. Maxillicoxae large, carrying one pair of median hairs and one pair of long, bilaterally feathered, anterior hairs, situated fairly close to the median hairs. Maxillae weakly toothed along antero-

median margins. The tongue carries three pairs of hairs, the middle and posterior pairs being long, extending forwards almost as far as the anterior tip of the maxilla. Palp consists of five articles, terminal acanthoïde bifid, sub-terminal acanthoïdes long and flagelliform. Some, at least, of the palpal setae are unilaterally feathered.

Epimeres I and II distinct and separate ; epimeres III and IV fused together on each side. Epimeral setae moderately long and fine ; setal formula is (3-2-3-4).

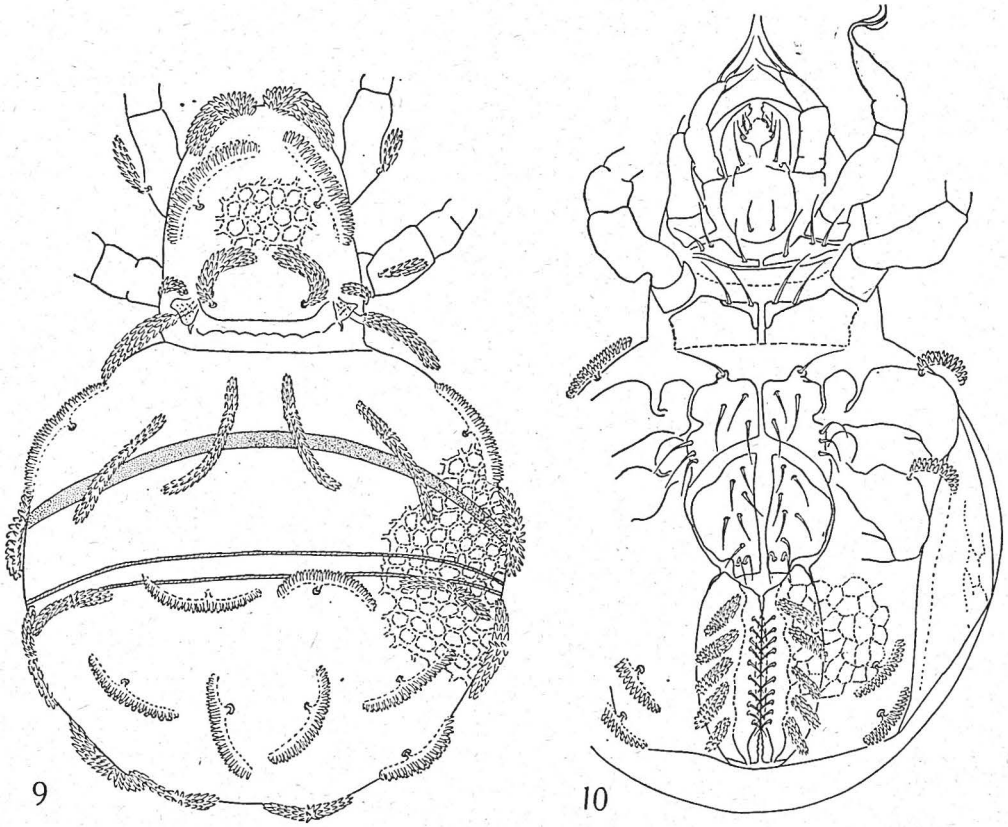


FIG. 9. *Sphaerochthonius transversus* n. sp. Adult Dorsal view. — FIG. 10. *Sphaerochthonius transversus* n. sp. Adult. Ventral view.

Genital and aggenital plates fused (Fig. 10 & 13) ; no aggenital setae, 8 pairs of genital setae. Preanal plate with straight anterior margin and convex posterior one ; completely hidden beneath the posterior extensions of the genital plates. Three pairs of genital suckers, the most posterior pair usually smaller than the others. Anal and adanal plates fused, suture visible ; adanal setae of the compound papillate type, biramous with very short inner ramus, five pairs. At least ten pairs of anal setae, inserted along median margins of anal plates, obscured anteriorally by overlying adanal setae, simple hairs, curving postero-medially. Four pairs of inter-

locking teeth at inner anterior and posterior extremities of anal plates. Each anal plate has a pointed projection posteriorally. Circumanal hairs biramous, rami equal or almost equal in length. Lateral plate large, triangular, with a series of granular striations which may form a broken polygonal pattern in some cases.

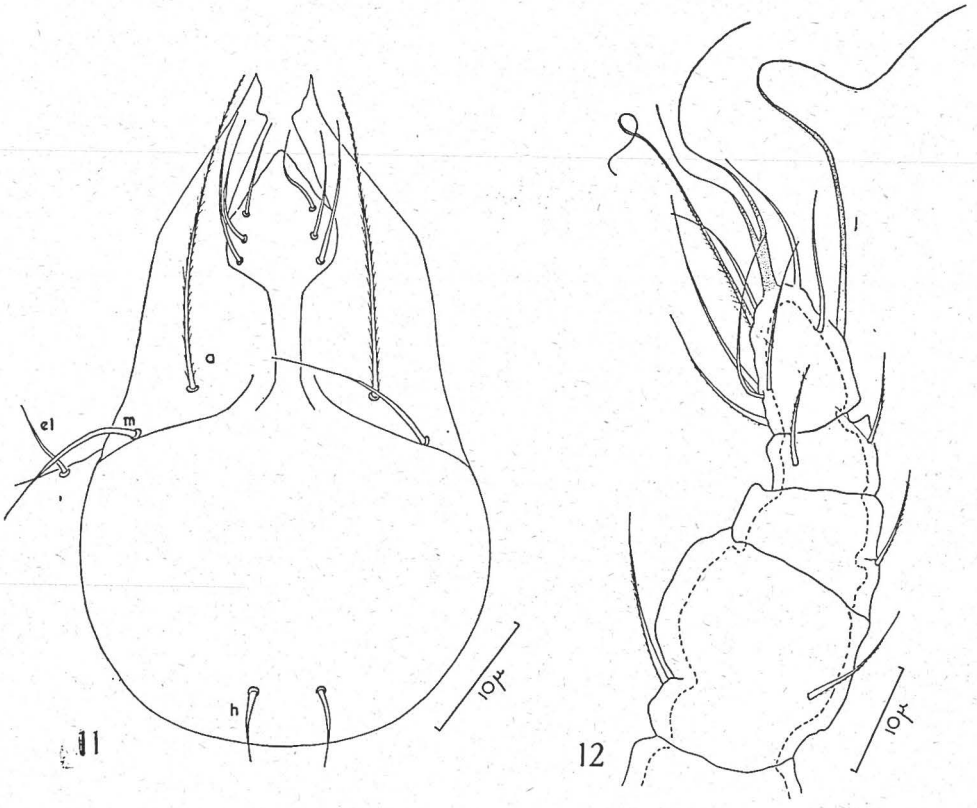


FIG. 11. *Sphaerochthonius transversus* n. sp. Adult. Labium. Ventral view. a, m, = maxillicoxal hairs ; h = hypostomal hair ; el = spine. — FIG. 12. *Sphaerochthonius transversus* n. sp. Adult. Palp. Lateral view.

All legs are tridactylate, with a strong median claw and a pair of fine lateral claws. All femora carry a uniramous compound hair ; genu I carries a similar hair. Form and arrangement of setae on leg I is shown in Figure 14.

Tritonymph. (Fig. 15). Two tritonymphs were collected with the adults.

Length : 227.2 μ. Width : 177.5 μ.

Colour very pale, almost transparent. Cerategument with polygonal areolae, as in the adult. Dorsal hairs of the compound papillate type ; rostral and lamellar hairs biramous, interlamellar hairs uniramous. Anterior ramus of lamellar hair twice as long as posterior one. Pseudostigmata bears characteristic median spur ;

sensillus as in adult. Notogastral hairs arranged as shown in Figure 15 ; only latero-median hairs of second row aligned transversely ; hairs of the median pair in this row uniramous, long and straight, directed posteriorally. Notogaster with two dorsal ridges, anterior one lying immediately above the true dorsal suture in a position which indicates that there is probably an intercalary sclerite, vertically aligned, in this region. Cerategument invests the ventral surface of the body and also the legs.

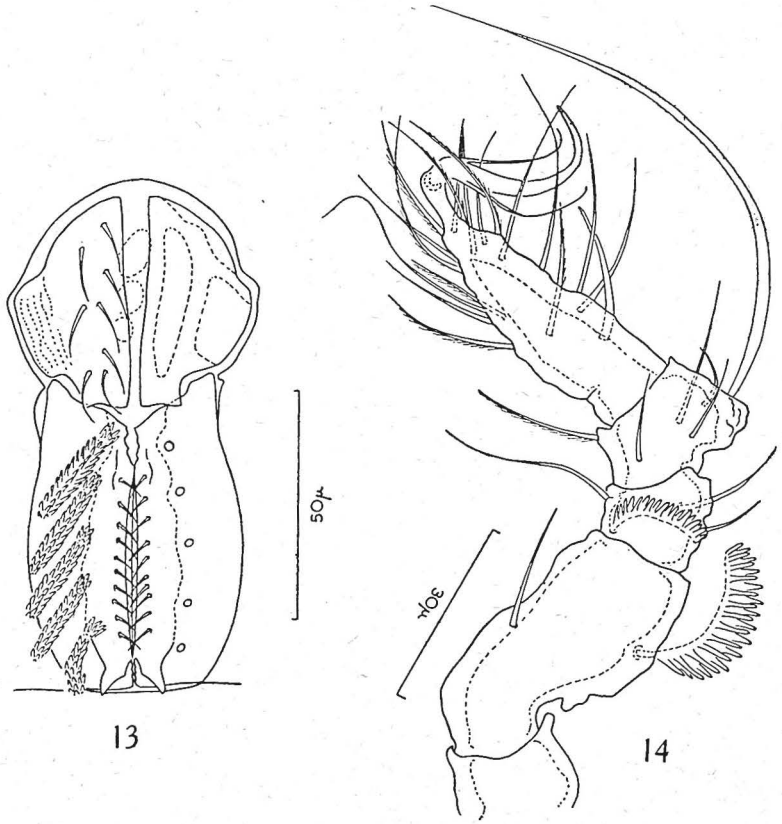


FIG. 13. *Sphaerochthonius transversus* n. sp. Adult. Genito-anal region.
FIG. 14. *Sphaerochthonius transversus* n. sp. Adult. Leg I. Lateral view.

Ventrally, rostrum broadly rounded, with a fine point medially. Immediately below this point is a semicircular chitinised loop. Palp and labium similar to those of adult ; epimeres and epimeral setae also have form and arrangement of adult structures. Lateral plate triangular, not as wide as in adult, inner margin thrown into a series of folds ; ornamented with polygonal areolae. Three pairs of genital suckers. Aggenital plates not as conspicuous as in adult, but fused to genital plates as in adult. Genital plates without well-developed posterior extension. Seven pairs of genital setae counted. Anal aperture almost square in outline ; anal and

adanal plates fused ; no posterior projection of anal plates. Five pairs of adanal setae, biramous, with very short inner ramus ; I counted six anal setae on one plate and seven on the other, in one specimen ; in the second specimen I noted seven pairs of anal setae.

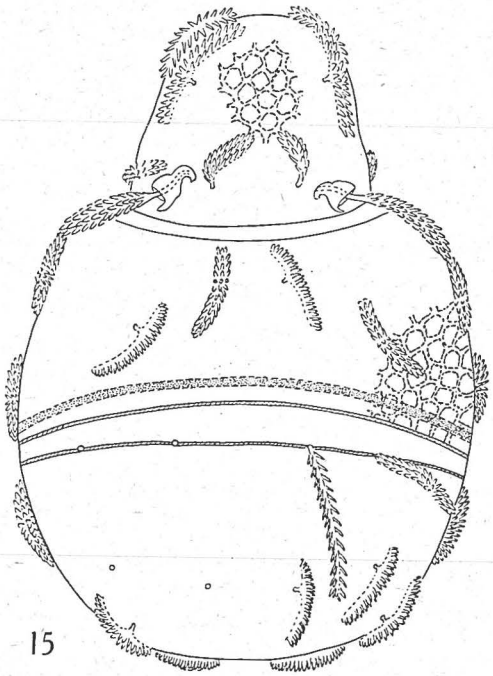


FIG. 15. — *Sphaerochthonius transversus* n. sp. Tritonymph. Dorsal view.

Legs are similar to those of the adult except that they are all monodactylate.

Distribution of *S. transversus* in Ghana : Shai Hills (leaf litter under thicket) (5 adults) ; Aburi (12 adults, 2 nymphs) ; Dominasi (3 adults) ; W. shore of lake Bosumtwi (2 adults) ; Essuboni Forest Reserve (3 adults).

Sphaerochthonius spec. (Fig. 16-19).

The collections of *Sphaerochthonius* spp. contain three individuals, two adults and one nymph, of a species which appears to be quite distinct from *S. transversus*. One of the most significant differences is the presence of three dorsal ridges in addition to the true dorsal suture in the adult, compared with only two in *S. transversus*. The nymph also has three dorsal ridges, the most anterior of which lies over the dorsal suture. This arrangement in the nymph is very similar to that described for the nymph of *S. gemma* (Oudms.) (see VAN DER HAMMEN 1959, p. 27). The adult of *S. gemma* has not been described, but the similarity between the nymphal forms indicates that the Ghanaian specimens may belong to this species. I have not designated these as a new species for this reason.

Adult. Length : 298.2 μ Width : 213.0 μ.

The main features of the dorsal and ventral surfaces are shown in Figures 16 & 17. The whole body is invested in a cerategument ornamented with polygonal areolae, as in *S. transversus*. Dorsal hairs are of the usual compound papillate type, with all except the interlamellar and anterior and posterior exopseudostigmatic hairs being biramous. Hairs on notogaster differ from those of *S. transversus*

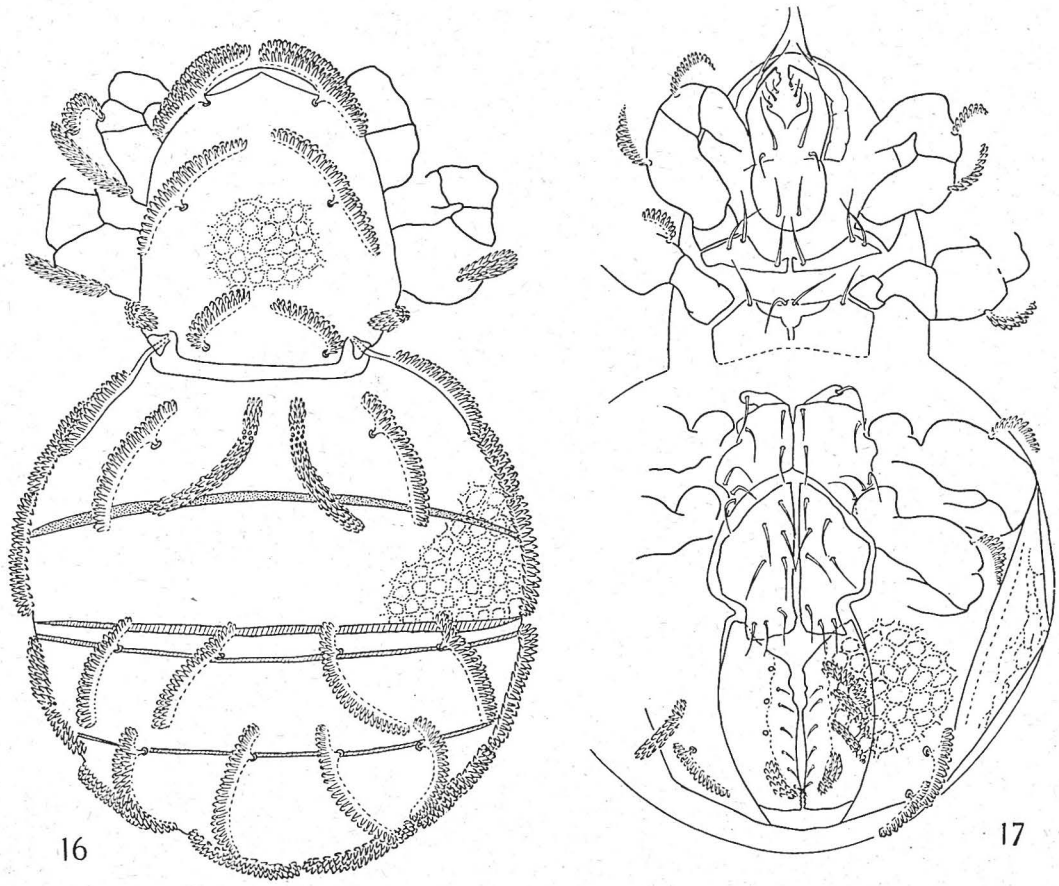


FIG. 16. — *Sphaerochthonius* spec. Adult. Dorsal view.
FIG. 17. *Sphaerochthonius* spec. Adult. Ventral view.

in that they are all aligned in an antero-posterior direction, and the anterior ramus is only one-third as long as the posterior one. Pseudostigmata have the same general form as in *S. transversus*, but there is no median spur. Cerategument of notogaster with three dorsal ridges, the most anterior being very prominent, the most posterior rather faint.

Ventrally, general form of labium and palps is similar to that of S. *transversus*. The anterior hair on the maxillicoxa is longer than in S. *transversus*, extending to

the tip of the maxilla ; the median hair is shorter ; the spine near the base of the palp (ell) is prominent, proximal half thickened and feathered. Epimeres I and II distinct, epimeres III and IV are fused together. Epimeral setal formula is (3-2-3-4). The apophyses on anterior margins of epimeres (III-IV), which carry the insertions of a pair of epimeral setae, are larger and more distinct than in *S. transversus*. Genital and aggenital plates fused, suture present but incomplete posteriorally ; genito-aggenital plate relatively larger than in *S. transversus*, with a greater development of the posterior extension of each plate (Fig. 18). Eight pairs of genital setae,

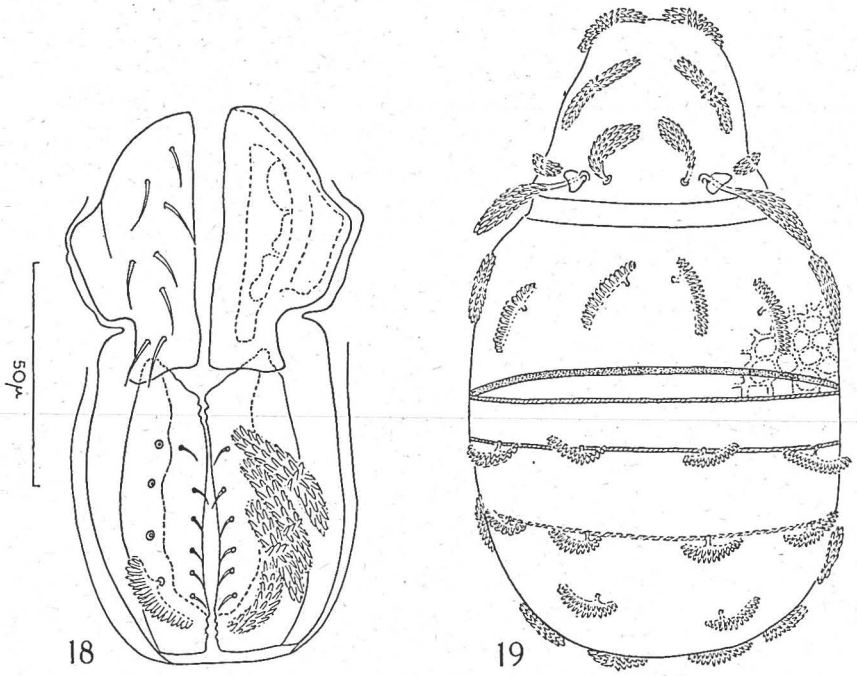


FIG. 18. *Sphaerochthonius* spec. Adult. Genito-anal region.
FIG. 19. *Sphaerochthonius* spec. Tritonymph. Dorsal view.

as in *S. transversus*. Anal and adanal plates fused, suture present, adanal setae of compound papillate type, biramous, with a very short inner ramus, four pairs. Anal setae simple, relatively shorter than in *S. transversus*, six pairs. Posterior margin of each anal plate with four teeth, medially, but no posterior projection of anal plate such as is found in *S. transversus*.

Legs similar to those of *S. transversus* ; all femora and genu I with compound uniramous setae.

Nymph (? Tritonymph). Length : 248.5 µ Width : 142.0 µ.

Cerategument with faint microsculpture of polygonal areolae. Hairs on dorsal surface of notogaster differ in arrangement from those of the adult (Fig. 19). The

hairs in segment I are aligned antero-posteriorally in the usual way, they are biramous, anterior ramus about one-half (one-third in the adult) as long as the posterior one. Remaining hairs on dorsum all aligned transversely, biramous, inner ramus one-half as long as outer. Notogaster with three dorsal ridges, the first two being quite prominent, the third is faint. The most anterior ridge overlies the true dorsal suture in a way which suggests that an intercalary segment is present, vertically aligned, and the anterior dorsal ridge represents the upper edge of it. The remaining dorsal ridges are not associated with any true sutures, and in fact only the one true suture is present.

A large part of the ventral surface, involving the epimeres and the genital region, was obscured by the legs which were curled up underneath the body. As this was a single specimen it was not dissected. The labium has the general form of the adult. Anal-adanal aperture roughly square in outline, four pairs of adanal setae similar to the adult. Only two pairs of anal setae were seen. Lateral plate covered with granular secretions beneath which is a faint microsculpture of polygonal areolae.

Legs densely covered with granular secretions ; all tarsi monodactylate.

Distribution in Ghana : Both adults and the nymph of this species were collected from leaf litter under thicket at the Shai Hills.

Cosmochthonius Berl. 1910.

The type species for this genus is *Hypochthonius lanatus* Mich. 1888. MICHAEL'S original description of the species and BERLESE'S subsequent diagnosis of the genus have been shown to be incorrect (see VAN DER HAMMEN 1959, p. 21), particularly as far as the number of claws is concerned. Further, MICHAEL'S drawing (1888, Pl. 49, fig. 15) shows four pairs of hairs in the second row on the notogaster, whereas WILLMAN'S drawing of *Cosmochthonius (Hypochthonius) lanatus* (1931, p. 101) indicates only two pairs. The usual number of hairs in this row appears to be three pairs in this genus. The long notogastral hairs of segments III and IV do not extend to the posterior limit of the notogaster in MICHAEL'S figure, whereas they do in WILLMAN'S.

A single specimen of *Cosmochthonius* is present in my collections. Despite the discrepancies in previous descriptions of *C. lanatus*, there is sufficient similarity between the Ghanaian specimen and the type to enable me to identify the specimen as a close relative of *C. lanatus*. Thus tarsus I is bidactyle, tarsi II, III, and IV, are tridactyle. Microsculpture of the integument is a reticulum of polygonal alveolae overlaid with short irregular striae forming a broken reticulate pattern. The diameter of each alveolus is about 8.5 μ, which corresponds very closely to Michael's measurement for *H. lanatus*. Total length of the body is less than the figure given by MICHAEL (330 μ), but within the range given by WILLMAN (290 μ — 320 μ). I have not been able to compare my specimens with others of *C. lanatus* and hesitate to identify it with certainty as this species. Instead I supply the following description.

Cosmochthonius spec. (*C. lanatus ?*). (Fig. 20).

Collected in Ghana : 1 adult.

Length : 291.1 μ. Width : 177.5 μ.

Colour yellowish-brown. Microsculpture of integument as described above. Rostral, lamellar, interlamellar, and exopseudostigmatic, hairs typically branched

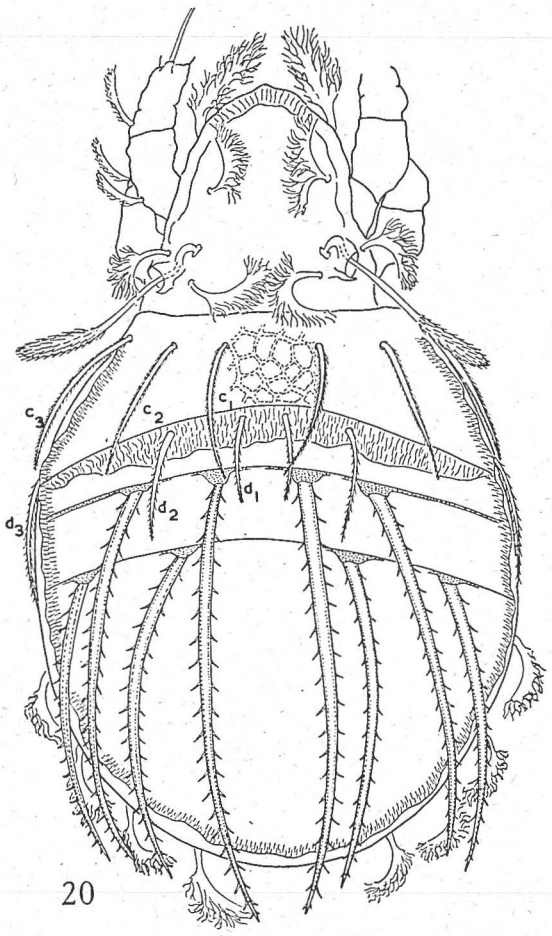


FIG. 20. — *Cosmochthonius* ? *lanatus* Adult. Dorsal view.
c_1, c_2, c_3, d_1, d_2, d_3, = notogastral hairs.

(Fig. 20), as are those on the postero-lateral margins of the notogaster. Lamellar hairs biramous, rami profusely branched, posterior one shorter than anterior, possibly representing an enlarged branch of the latter. Rostral, interlamellar, and exopseudostigmatic, hairs all appear uniramous, although it is possible that these are composed of two rami pressed close together. Pseudostigmata directed

posterolaterad, with median wall extending in this direction as a short curved spur. Sensillus narrow at the base, becoming increasingly thickened along its length, distal portion densely setose.

Notogastral hairs in segment III are the longest and consist of two pairs ; the shortest are the hairs in the median pair of segment II. Hairs of segment I are all the same length, bilaterally feathered, densely setose, the distance between (c_1) and (c_2) is the same as that between (c_2) and (c_3). Hairs on segment II are bilaterally feathered, but with fewer barbs than hairs of segment I. (d_1) is shorter than (d_2) which is shorter than (d_3). (d_1) is about half as long as (d_3).

Distance between (d_1) and (d_2) is half of that between (d_2) and (d_3). Hairs (c_3) and (d_3) are inserted on lateral margins of notogaster. Hairs on segments III and IV (two pairs in each segment) are long and thick, with fewer barbs than hairs of first and second segments. The hairs on segment III are equidistant. Median hairs in segment IV are separated by a distance slightly greater than that separating median from lateral hairs. Other features of the dorsal surface are shown in Figure 20.

Ventrally, labium and epimeres partly obscured by legs. Hypostome has an inverted bell shape, the single pair of hypostomal setae are fairly long, bilaterally feathered, curving slightly inwards. The single pair of anterior hairs on the maxillicoxae is remote from the single pair of medians ; both are bilaterally feathered. All epimeres are separate ; epimeral setal formula is (3-2-3-4). Genital plate large, broadly rectangular, slightly narrower posteriorally than anteriorally, anterior margin projecting forwards in a short point medially, posterior margin extending back over the preanal plate as a median rounded projection on each side. Ten pairs of genital setae, bilaterally feathered, curving upwards and backwards. Preanal plate completely hidden, anterior margin straight, posterior one convex. Three pairs of very small genital suckers. Adanal and aggenital plates long and narrow, separated by a short distance, so that they appear as an almost continuous plate. Anal aperture roughly square in outline, three pairs of anal setae, bilaterally feathered, with thickened main stem. Four pairs of adanal setae, bilaterally feathered, main stem becoming thicker and longer posteriorally.

Distribution in Ghana : Mabang (1 adult).

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