

On the deep-sea desmoscolecid fauna of the flat of Cap Vert (Nematoda : Desmoscolecida)

by W. DECRAEMER

Abstract

The deep-sea bottom samples from the flat of Cap Vert, tropical Atlantic Ocean, collected during the EUMELI cruises, contain eight desmoscolecid species, six of them belong to the subgenus *Quadricoma*. The dominant species *Tricoma (Quadricoma) maxima* is redescribed including SEM information on the head region. A new species *Tricoma (Quadricoma) magnafenestra* sp.nov. is characterised by a relative long body with 44 main rings, an end ring with large pores or phasmata and spike-like spinneret, a broad head with truncated anterior end with labial rim, males with 55 µm long spicules. Additional information is given on *T. (Q.) loricata*. The taxonomic status of *T. (Q.) media* is discussed; the species is considered as a *species inquirenda*.

Key words: Desmoscolecida, *Quadricoma*, deep-sea, taxonomy, morphology, ultrastructure

Résumé

Sur la faune abyssale de desmoscolécides de la terrasse du Cap Vert (Nematoda: Desmoscolecida)

Les échantillons abyssaux de la terrasse du Cap Vert dans l'Atlantique tropical, récoltés durant les campagnes EUMELI contiennent huit espèces de desmoscolécides dont six appartiennent au sous-genre *Quadricoma*. L'espèce dominante *Tricoma (Quadricoma) maxima* est redécrite avec apport de données sur l'ultrastructure de la tête vue au microscope à balayage. L'espèce nouvelle, *Tricoma (Quadricoma) magnafenestra* sp.nov., est caractérisée par: un corps long à 44 anneaux principaux, un anneau terminal à de grands pores (ou phasmata), un spinneret sous forme d'épine, une tête large à bord antérieur tronqué et pourvu d'une bordure labiale, enfin la longueur des spicules (55 µm) chez le mâle. Des données supplémentaires sont incluses pour *T. (Q.) loricata*. La position taxonomique de *T. (Q.) media* est discutée; cette espèce est considérée ici comme *species inquirenda*.

Mots-clés: Desmoscolecida, *Quadricoma*, abyssal, taxonomy, morphology, ultrastructure

Introduction

The mission EUMELI of the French national program "Flux Océaniques" was part of the "Joint Global Ocean Flux Study" international program. The aim of the EUMELI program was to identify chemical, physical and biological processes and to determine the flux of particles from surface to bottom in three selected zones of the east tropical Atlantic. Desmoscolecid specimens collected during the EUMELI 2, 3 and 4 cruises in the northeast tropical Atlantic Ocean between January 1991 and May 1992 were kindly put at my disposal by Dr. J. GALÉRON (CENTOB) and Dr. M. SIBUET (EUMELI program director). Eighteen deep-sea bottom samples, all from mesotrophic stations sampled during the three EUMELI missions, contained eight desmoscolecid species. Six species belong to the subgenus *Quadricoma* with *Tricoma (Quadricoma) maxima* (SCHEPOTIEFF, 1907) FILIPJEV, 1922 as the dominant species (Table 1). The *T. (Q.) maxima* specimens found are compared with data from the literature and with specimens from the Pacific Ocean deposited in the Nematode Collection of the ALFRED-WEGENER-Institut für Polar- und Meeresforschung Bremerhaven, Germany (NSIMB); additional information is given on the ultrastructure of the head. A new species *Tricoma (Quadricoma) magnafenestra* sp.nov. is described below. Additional information is provided for *T. (Q.) loricata* FILIPJEV, 1922 and the taxonomic status of *T. (Q.) media* (REINHARD, 1881) FILIPJEV, 1922 and *T. (Q.) suecica* ALLGÉN, 1930 are discussed. Two new species of *Tricoma (Quadricoma)* spec. 1 and spec. 2 with a habitus resembling *Quadricomoides labiosus* DECRAEMER, 1983 are described; detailed information of the head region based on transverse sections is provided for species 1. Both species remain unnamed because of the restricted number of specimens available and the opaque nature of the concretion layer covering the cuticle; this layer hinders detailed observation of the inner structures. Further, a single female specimen was found representing a new species of the genus *Paratricoma* GERLACH, 1964 (Fig. 7 E-G) and another female specimen (in rather poor condition) belongs to the genus *Desmoscolex* CLAPARÈDE, 1863, apparently representing a new species with 17 main rings and typical setal pattern.

Material and methods

All desmoscolecids were collected at mesotrophic stations situated at a mean depth of 3100 m on the flat of Cap Vert, 270 miles from the coast of Mauretania (Table 1). The samples were taken with a large surface grab (type USNEL RFA). Drawings were made with the aid of a camera lucida on a Reichert Polyvar microscope; SEM observations were made with a JEOL JSM 840 scanning electron microscope.

Type specimens are deposited in the nematode collection of the Koninklijk Belgisch Instituut voor Natuurwetenschappen (KBIN, slides RIT) and the Muséum National d'Histoire Naturelle, Paris (MNHN, slides BN).

Abbreviations used: apof. gub.= length of apophyse of gubernaculum; cs= length of cephalic setae; hd= head width x head length; L= total body length; mbd max= maximum body width including layer of secretion and foreign particles (=desmos, Greek for band); mbd min= maximum body width at level of interzone, without desmos; no sd= number of subdorsal setae; no sv= number of subventral setae; ph= length of pharynx; R= number of

main body rings; sd_n = length of subdorsal seta on main ring n; spicule= length of spiculum measured along the arc; tnr= length of end ring; tnrw= width of end ring (max = including desmos; min = without desmos); V= position of vulva as a percentage of total body length from anterior end. Indices of de Man (1880): a, b, c. All measurements are in μm .

Descriptions

Tricoma (Quadricoma) maxima (SCHEPOTIEFF, 1907)

FILIPJEV, 1922

Figs 1 & 2

T. (Q.) maxima was originally described as *Desmoscolex maximus* by SCHEPOTIEFF (1907) based on females found between algae from the Gulf of Naples. The new species was characterised by a long body (up to 1 mm), 39 main rings (illustrated as tricomoid with wide smooth interzones), a triangular head with truncated anterior end, an end ring with spike (about 50% of length of end ring) and a somatic setal pattern of 11 subdorsal setae and 16

Table 1 – List of desmoscolecid species collected during the EUMELI cruises

mission	sample	latitude	longitude	depth	species	specimens
EUMELI 2	KGS10	18.302	21.014	3128	<i>Tricoma (Quadricoma) maxima</i>	4 males, 1 female
	KGS13	18.336	21.017	3139	<i>Tricoma (Quadricoma) spec. 1</i>	2 males
	KGS14	18.324	21.032	3136	<i>Tricoma (Quadricoma) maxima</i>	1 male, 1 female
	KGS16	18.282	20.595	3128	<i>Tricoma (Quadricoma) maxima</i>	2 males, 2 females
					<i>Tricoma (Quadricoma) magnafenestra sp.nov.</i>	1 male
	KGS18	18.268	21.017	3118	<i>Tricoma (Quadricoma) maxima</i>	2 females
	KGS19	18.317	21.012	3123	<i>Tricoma (Quadricoma) maxima</i>	1 female
	KGS20	18.296	21.004	3124	<i>Tricoma (Quadricoma) maxima</i>	2 females
	KGS24	18.284	21.026	3117	<i>Tricoma (Quadricoma) maxima</i>	2 females
	KGS28	18.327	20.574	3138	<i>Tricoma (Quadricoma) spec. 2</i>	1 female
	KGS29	18.341	20.586	3134	<i>Tricoma (Quadricoma) maxima</i>	4 males, 7 females
					<i>Paratricoma spec. 1</i>	1 female
	KGS30	18.353	20.597	3137	<i>Tricoma (Quadricoma) spec. 2</i>	1 male
	KGS31	18.348	21.015	3152	<i>Tricoma (Quadricoma) maxima</i>	1 male, 1 female
	KGS39	20.295	18.298	1618	<i>Desmoscolex spec. 1</i>	1 female
					<i>Tricoma (Quadricoma) spec. 3</i>	1 male (without head)
				<i>Tricoma (Quadricoma) loricata</i>	1 female	
				<i>Tricoma (Quadricoma) loricata</i>	1 male, 1 female	
EUMELI 3	KGS51	18.308	21.054	3096	<i>Tricoma (Quadricoma) maxima</i>	1 male, 3 females
	KGS52	18.309	21.044	3106	<i>Tricoma (Quadricoma) maxima</i>	2 females
					<i>Tricoma (Quadricoma) magnafenestra sp.nov.</i>	1 female
	KGS53	18.312	21.033	3119	<i>Tricoma (Quadricoma) magnafenestra sp.nov.</i>	1 female
<i>Tricoma (Quadricoma) maxima</i>					3 males	
EUMELI 4	KGS65	18.301	21.054	3095	<i>Tricoma (Quadricoma) maxima</i>	2 males
	KGS66	18.3	21.05	3097	<i>Tricoma (Quadricoma) maxima</i>	1 male, 3 females

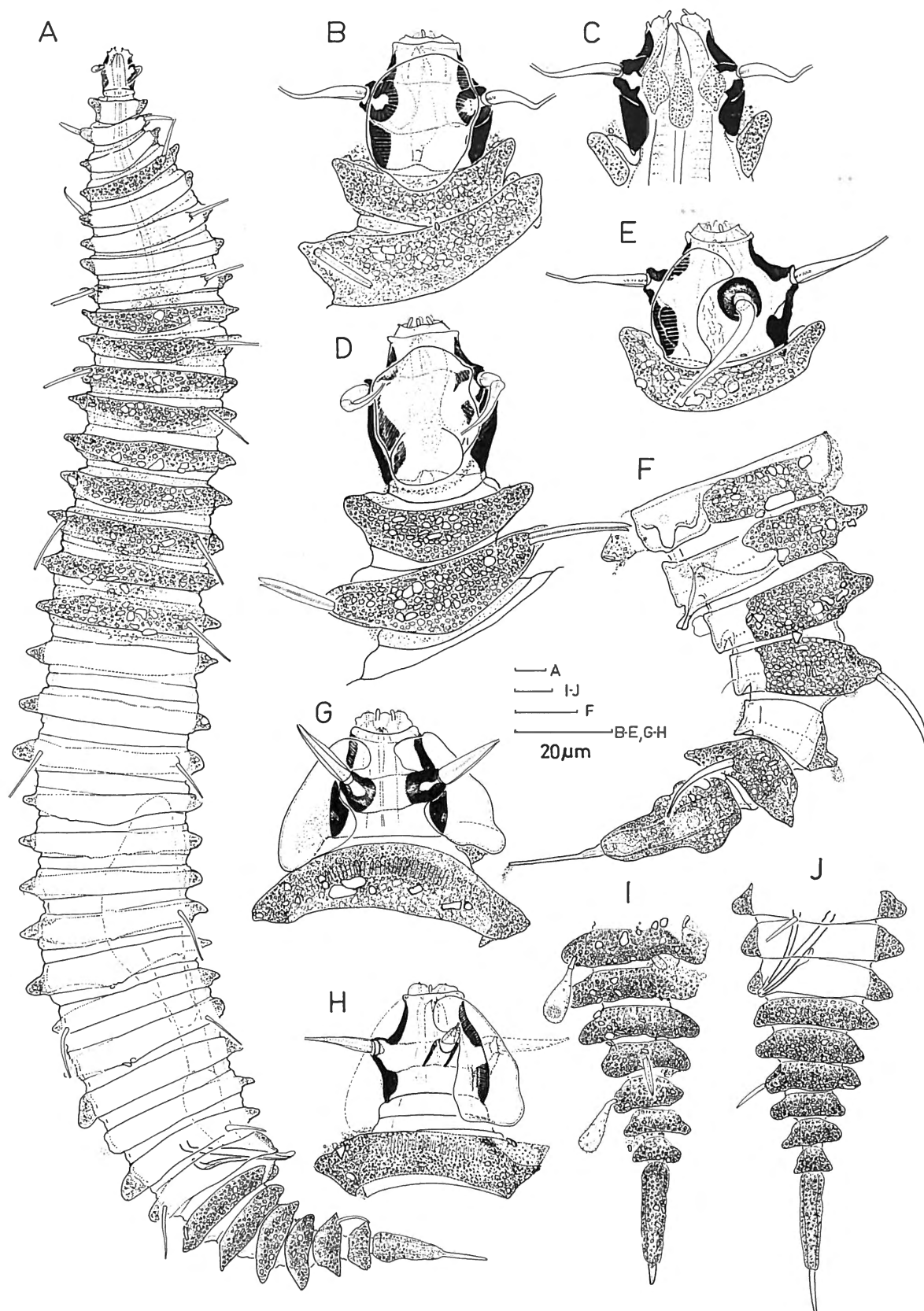


Fig.1. – *Tricoma (Quadricoma) maxima*. Male, specimens from EUMELI cruise. A: Entire specimen. B-C: Head region, respectively surface view and optical section, right body side, same specimen; C: small arrow points to lip border, arrow head to anterior head border. D: Head region of another male, surface view of right side. Male specimens from Pacific Ocean. G-H: Head region in surface view, respectively dorsal side (slide NSIMB 2301) and oblique view of ventral side (slide 243b). J: Posterior body region with tail in surface view (slide NSIMB 243b). Female specimen from EUMELI cruise. E: Head region, oblique latero-ventral surface view. F: Posterior body region, surface view. Female from Pacific Ocean. I: Tail, surface view (slide NSIMB 243b).

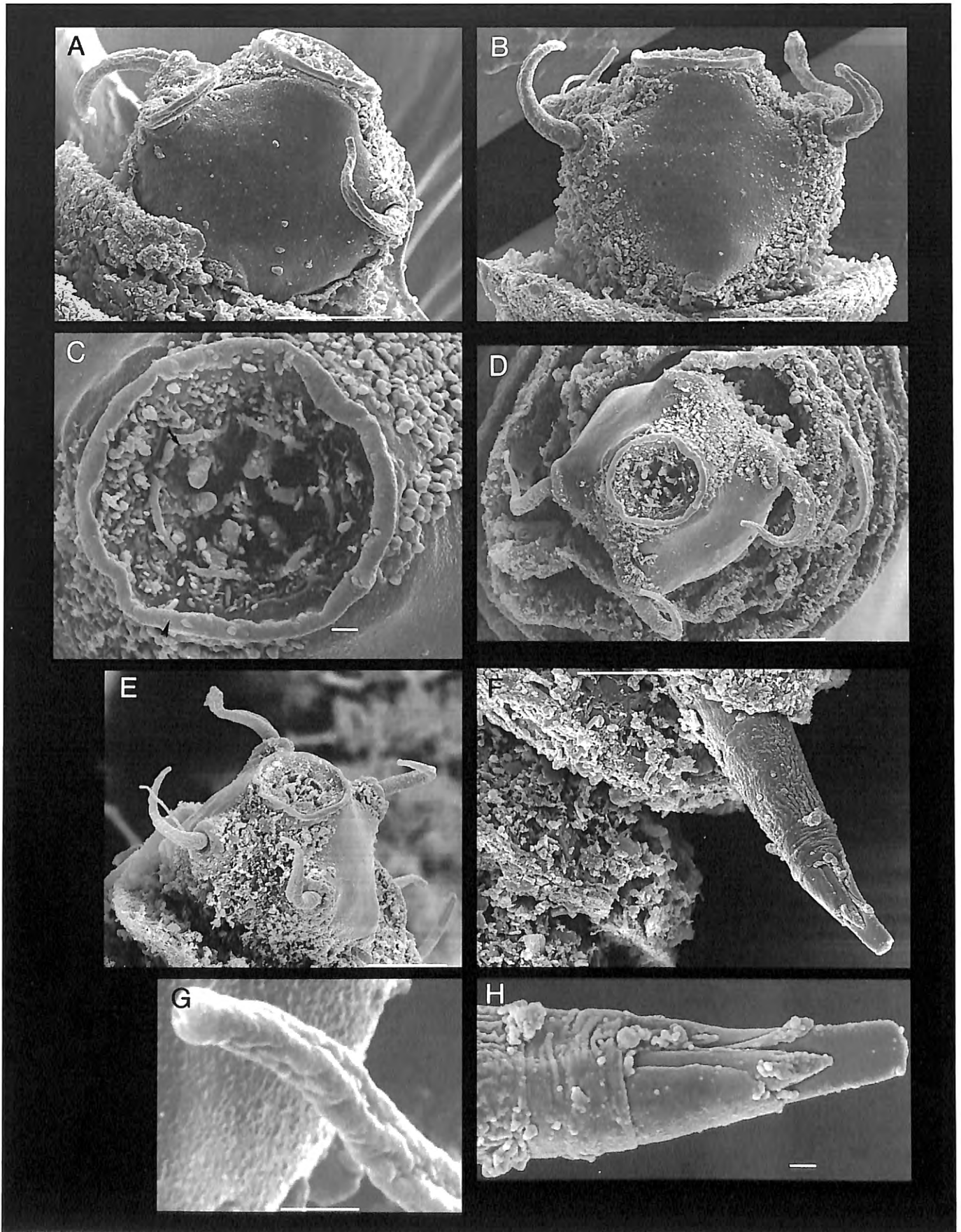


Fig. 2. *Tricoma (Quadricoma) maxima*. SEM of head. A-B. Lateral view, resp. of female and male. C-D. End-on views of female. E. Ventral view, male. F, H. SEM of cloacal tube with protruding spicule and gubernaculum. G. SEM of cephalic seta, female. Scale is 10 μm in A, B, D-F; 1 μm in C, G, H.

subventral setae as deduced from the original illustration (respectively 9 subdorsal and 15 subventral setae apparently from the same specimen in SCHEPOTIEFF, 1908: Taf. VII, Fig. 20). No detailed information was provided. FILIPJEV (1922) transferred *D. maximus* to a new genus *Quadricoma* FILIPJEV, 1922 because he thought that desmoscolecoid species with a large number of rings (> 33) had the rings non-differentiated (= without clear distinction between main rings and interzones) and he suspected the observation by SCHEPOTIEFF to be unprecise. ALLGÉN (1930) did not accept *Quadricoma* and synonymized it with *Tricoma*. LORENZEN (1969) followed ALLGÉN (1930). TIMM (1970), however, accepted the genus *Quadricoma* as a valid genus but redescribed the species as *Tricoma maxima* based on two males and one female (slides NSIMB 2301 & 243b) from the Pacific Ocean. The assignment of former specimens to *T. maxima* was based on the number of body rings (39 rings as in type specimens), large body size (L= 710-720 µm in male, 825 µm in female) and end ring with long spike-like spinneret as in the original description. The author observed a single discrepancy (narrow or no interzones vs wide interzones originally); the difference in position of the ocelli (opposite rings 6 - 8 in male; opposite ring 5 or rings 8 - 9 in female vs ring 11 originally) was not taken into account. Additional information was given on the setal pattern, the copulatory apparatus (length and shape), the amphids and number of tail rings. However, the head of a male specimen was illustrated in dorso-ventral view, without detailed information on the lip region. In present contribution, TIMM's specimens from the Pacific Ocean have been restudied and additional information is presented hereafter. TIMM (1978) described deep-sea specimens from Antarctica as *Tricoma aff. maxima* (SCHEPOTIEFF, 1907) because they showed some minor differences (body with 38 main rings vs 39 originally; fewer somatic setae: 5 subdorsal vs 9 and 8-9 subventral vs 15; a shorter end ring and spinneret). Because information on intraspecific variability is rare, the author could not adequately interpret the differences observed. Since the author did not provide details of the lip region nor of the inner structures, a study of the antarctic specimens is needed to solve the taxonomic problem. A study of TIMM's Antarctic specimens, USNM catalog numbers 50059-50066 representing four males and two females, revealed that male no 50059 belongs to a different *Tricoma* species with 75 main rings. The other specimens closely resemble *Tricoma (Quadricoma) maxima*. Additional to TIMM's observations, the gubernaculum appeared similar in structure to former descriptions (with a thin corpus and two curved dorsocaudally orientated apophyses) but shorter (43 µm); cephalic and somatic setae are also shorter; the end ring is shorter, provided with a short (9 µm) spinneret and anteriorly, with an incompletely separated main ring; the lip region has a less pronounced border and lip papillae appear minute. Based on the differences in lip region and setal pattern (an important diagnostic feature in Desmoscolecida) additional to minor important

morphometric differences, the Antarctic specimens are considered to belong to a closely related species. During three "EUMELI" missions (2, 3, 4), several specimens were found which closely resemble TIMM's specimens from the Pacific Ocean. They were found at nine out of thirteen sampling sites from mission 2 (winter 1991-92), herewith representing the most common desmoscolecoid species collected.

Specimens from Pacific Ocean described by TIMM (1970) (Fig. 1 G-J).

ADDITIONAL INFORMATION

Head about as long as maximal width, tapering slightly anteriorly to a truncated end. Cuticle thickened and sclerotized, except for labial region. Labial region with six pronounced lips, each provided with a short (1.5 µm) tube-like papilla, the whole surrounded by a protruding non-sclerotized border of the head. Cephalic setae, inserted on protruding peduncles about mid-way head region; oval in transverse optical section and with open tip. Amphids large, rounded, covering the lateral sides almost completely, anteriorly protruding partly on the dorsal and ventral sides of the head. Stoma short, apparently with three denticles at its base; pharynx narrow cylindrical, extending to the posterior border of ring 8; intestine cylindrical, filled with numerous globules. Female specimen with anterior part of digestive system disrupted in head region; inner organs difficult to observe due to poor condition of the specimen; vulva not observed. Male specimens with spicules provided with slightly marked head; gubernaculum largely parallel to spicules, provided with short apophyses, slightly hooked, but lying more or less in straight line with the corpus.

Specimens from EUMELI missions (Fig. 1 A-F)

MATERIAL: 8 males and 13 females, slides BN 385-390; 11 males and 13 females, slides RIT 596-600, 603-604. For data on sample sites, see table 1.

MEASUREMENTS: Table 2.

DESCRIPTION

Body long; cuticle with 37 main rings (38 rings in one male). Main rings *Quadricoma*-like anteriorly and in tail region but without a clear ring of inversion. In some specimens, the covering layer of secretion and foreign particles (= desmos) became detached, revealing the structure of the underlying cuticular ring which appeared provided with a mid-transverse row of fine hair-like setae, 6.5 µm long, and showing high peduncles of insertion of the somatic setae. Somatic setae, broad, oval shaped in cross section, wide at base and with open tip; on each

Table 2 – morphometric data of male specimens of *Tricoma (Quadricoma) maxima**

Sampling site	KGS55			KGS66	KGS65		KGS52	KGS56
	male 2	male 3	male 4	male 4	male 1	male 2	female 2	female 2
Body length	815	785	835	no tail	775	765	1000	645
No body rings	37	37	37		37	37	37	37
Spicule	72	72	66	67	69	63		
Gubernaculum	66	62	66	58		61		
Apoph. gub.	15.5	16	17			17		
Tail	169	162	164		154	161	197	167
End ring (= tmr):								
- length	84	71	74		64	72	75	81
- width :max	19	15.5	20		21	18	23	21
- width :min	9	11	10		10	11	10	10
- spinneret	30	26.5	28		27	28	32	34
Body width:								
- maximum	115	94	108		98	117	125	
- minimum	93	80	92		77	94	106	
Width lip region	12	13.5	14.5	13	12	13.5	13.5	14.5
Head:								
- width	25	24.5	24.5	27	24	24	28	28
- length	23.5	24.5	23.5	24	20	26	29	25
cs	18	19	16.5	21	18	17	21	21
no sd *	8 R	8R/L	9R	8R	7L	9L	8L/R	8R
no sv *	13 R	13R/L	13R	13R	13L	13L	10R/12L	12R
sd 2			17	22.5			21	21.5
sd 34							32	30.5
sv 2		18	17	21	18		22	
sv 36	28	26.5					32	28.5
tail/tmr	2.0	2.3	2.2		2.4	2.3	2.6	2.0
tmr/spinneret	2.8	2.7	2.6		2.4	2.6		
a	7.1	8.4	7.7		7.9	6.5		
b		5.1						
c	4.8	4.8	5.1		5.0	4.7		
spinneret/tmr (%)	35.7	37.3	37.8		42.2	38.9		
V							61.7	53.4

* R = right side; L = left side

side eight subdorsal setae and 13 subventral setae, arranged as follows (male 3 from KGS55): subdorsal, left and right sides: 2, 4, 7, 11, 16, 20, 26, 30 = 8; subventral, right: 2, 4, 6, 8, 10, 12, 14, 17, 20, 24, 27, 30, 36 = 13; subventral, left: 2, 4, 6, 8, 10, 12, 15, 18, 20, 24, 27, 30, 36 = 13; some setae may be broken off but their position is still detectable by the insertion mark. Inner structures obscured by the opaque nature of the covering layer of secretion and foreign particles and the condition of the fixed specimens. Head about as long as maximal width (measured laterally in between peduncles of cephalic setae), tapering slightly anteriorly to a truncated end. Cuticle thick and strongly sclerotized except for labial region, with irregular markings on surface. Head in front view more or less quadrangular (Fig. 2D). Labial region with six lips, each provided with a short (1.5 µm) tube-like papilla, the whole surrounded by a thin undulated (six-lobed) cuticular ring or lip border (Fig. 2 C, small arrow), and followed by a thickened, protruding non-

sclerotized head border (circular in front view Fig; 2 C, arrow head). Cephalic setae, inserted on protruding peduncles just anterior to mid-way head region; with open end (Fig. 2G). SEM microphotographs show the head covered with a thin layer of fine foreign particles, mainly dorsally and ventrally (Fig. 2D). Amphids large, rounded, covering the lateral sides almost completely. Stoma apparently with 3 denticles. Ocelli at level of main ring 9 in some specimens.

Males: Spicules 66-72 µm long, straight except for anteriorly curved head. Gubernaculum, about as long as spicules, 58-66 µm, with a thin corpus, widened towards two dorsocaudally orientated apophyses, 15.5-17 µm, nearly in straight line with the corpus except for anteriorly curved tip. Cloacal tube (Fig. 2 H) protruding from posterior border of main ring 31. Tail with six main rings (exceptionally seven); end ring, 64-84 µm long, consisting of a covered anterior part with a slight indentation at

mid-length and a fine, naked terminal spinneret, 35-42 % of total length of end ring.

Females: Reproductive system typical of genus; vulva situated between main rings 23 and 24. Tail with five main rings as in type specimens; end ring as in males.

DISCUSSION

The deep-sea specimens from the EUMELI missions largely agree with the specimens of the Pacific Ocean described by TIMM (1970), apart from some minor differences. The total number of main rings is 37 (exceptionally 38) instead of 39 (tail with 6 rings in male, 5 in female instead of 7 rings); protruding lips less pronounced; males have a somewhat longer spike-like spinneret, 35-42% of the end ring instead of 29% in both sexes (but the female specimen described by TIMM (1970) appeared to have a short spinneret instead of a long spike-like one as in male); somewhat longer spicules (63-72 μm vs. 52-58 μm).

Because of the lack of detailed information e.g. on head structure, the absence of male in the original description and the difference in location in regard to the type locality, there is no certainty that TIMM (1970) was dealing with the same species as SCHEPOTIEFF. The only point in favour is the combination of the number of rings and a large body size (about 1 mm). At present, within the genus *Tricoma*, the subgenera *Quadricoma* and *Tricoma* contain respectively eighteen and nineteen species with less than 50 rings in male or female, or in both sexes; *Quadricoma* has two species with a body length larger than 600 μm : *T. (Q.) maxima* (39 rings; L= 710-720 μm in male, 825 μm in female in TIMM (1970); L = up to 1 mm in female in SCHEPOTIEFF (1907) and *T. (Q.) brevichaeta* (38-39 rings; L= 585-905 μm in male, L= 690-965 μm in female); *Tricoma* has only one long species: *T. (T.) pedunculata* TIMM, 1970 (38 rings and L= 605 μm in male, 800 μm in female). *T. pedunculata* has been described upon a single male (no longer available see TIMM, 1970) and a single female specimen from deep-sea habitat; it was differentiated from the other species of the genus (including *T. maxima*) mainly by the high peduncles of the somatic setae. The presence of a single specimen (=holotype female) with the head region illustrated in dorso-ventral position and the restricted number of diagnostic features embroil an identification beyond doubt. However, the species with *Tricoma*-like rings clearly belongs to the subgenus *Tricoma*.

The specimens studied possess a clear inversion ring and a spike-like spinneret which justify their classification within the subgenus *Quadricoma*, a classification in agreement with FILIPJEV (1922). Within the subgenus *Quadricoma*, six species have 37 to 39 main rings (= *Q. brevichaeta** FREUDENHAMMER, 1975, *Q. cobbi* (STEINER, 1916) FILIPJEV, 1922, *Q. gascognensis**

DECRAEMER, 1984, *Q. maxima** (SCHEPOTIEFF, 1907) ALLGÉN, 1930, *Q. noffsingeriae* DECRAEMER, 1977 and *Q. scanica* (ALLGÉN, 1935) FILIPJEV, 1922; three of them indicated with * are from deep-sea habitats. *T. (Q.) maxima* and *T. (Q.) noffsingeriae* are closely related species, differing from the other species of the genus mainly by their head shape, lip region and the tube-like labial papillae. The specimens from the EUMELI expeditions most closely resembles *T. (Q.) maxima* in habitus, morphometric data and pharynx, although they possess the same number of body rings as in *T. (Q.) noffsingeriae*.

Tricoma (Quadricoma) magnafenestra sp.nov.

Fig. 3

MATERIAL

One male holotype, slide BN 391 and two female paratype specimens, respectively from station KGS52 (slide BN 392) and station KGS53 (slide RIT 596).

TYPE LOCALITY

Northeast tropical Atlantic Ocean, Station KGS16, latitude 18.282, longitude 20.595; depth - 3128m.

OTHER LOCALITIES

Northeast tropical Atlantic Ocean, station KGS52, latitude 18.309, longitude 21.044, depth 3106m and station KGS53, latitude 18.213, longitude 21.033, depth 3119m.

ETYMOLOGY

magnafenestra refers to the large pores (= phasmata) on the end ring.

MEASUREMENTS

Holotype male: L=680 μm ; hd= 21x19 μm ; cs= 14.5 μm ; sd38= 12 μm ; sv36= 13.5 μm ; pharynx= 96 μm ; tail= 146 μm ; end ring= 53 μm ; spinneret= 13 μm ; mbd= 95; (mbd)= 77 μm ; spicule= 55; gubernaculum= 35 μm ; tail/tmr= 2.7.

Paratypes female (n=2): L= 805 μm , 745 μm ; hd= 24,22 x 19,17 μm ; cs= 13, 13.5 μm ; sd 4= 7 μm ; sd 5= 7.5 μm ; sd41= 9.5 μm ; sv41= 10.5 μm ; pharynx= 99 μm , 105 μm ; tail= 147 μm , end ring= 56 μm , 55 μm ; spinneret= 14 μm , 12 μm ; mbd= 109 μm , 97 μm ; (mbd)= 93 μm , 78 μm ; tail/tmr= 2.6, 2.7; V= -, 60.3%.

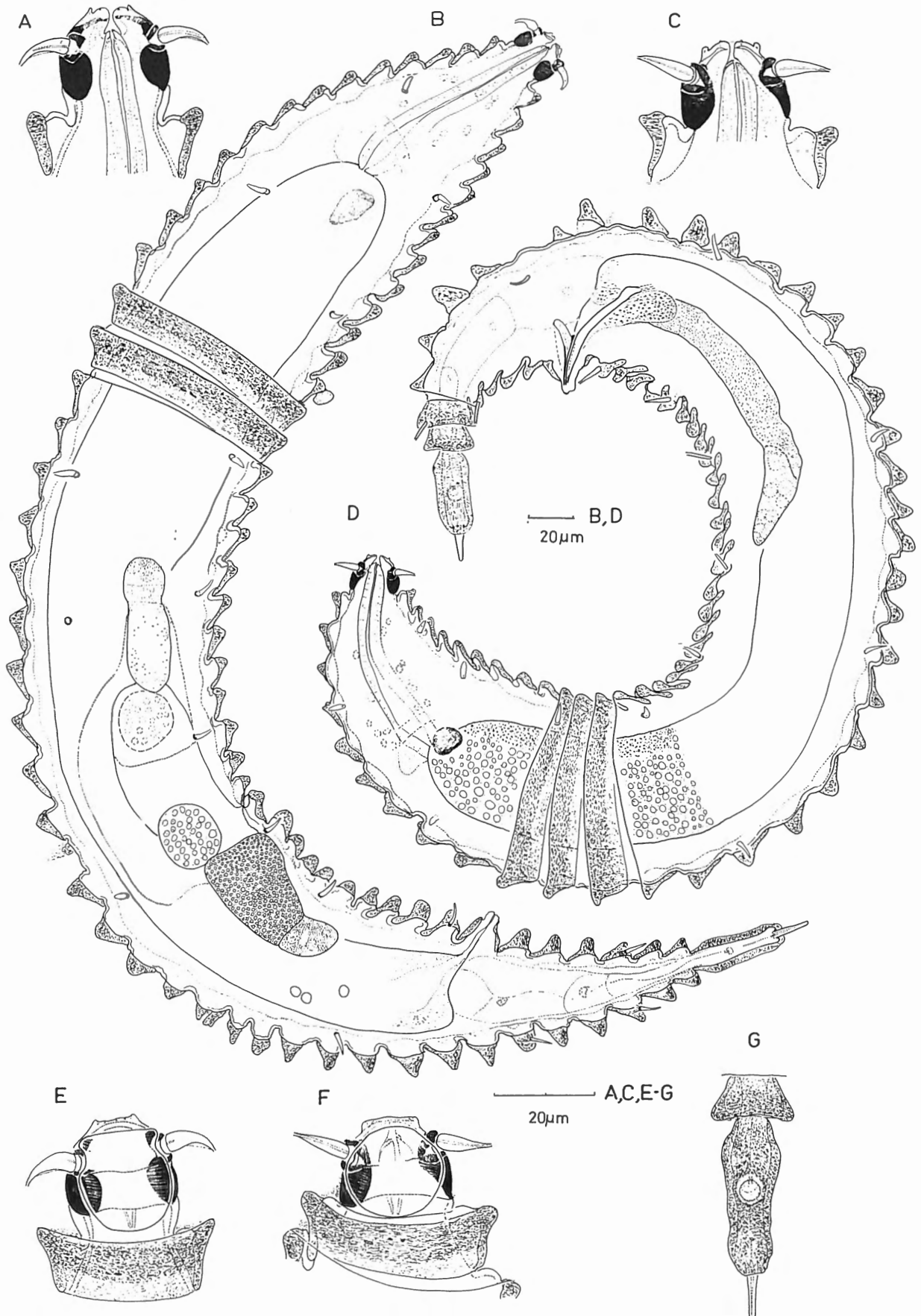


Fig.3. *Tricoma (Quadricoma) magnafenestra* sp.nov. Male, holotype. C, F head region, resp. in optical section and in surface view, left side. D. Entire specimen with some main rings and tail end in surface view. Female, paratype. A, E. Head region, resp. in optical section and in surface view, left side. B. Entire specimen with some main rings in surface view. G. Detail of end ring, surface view.

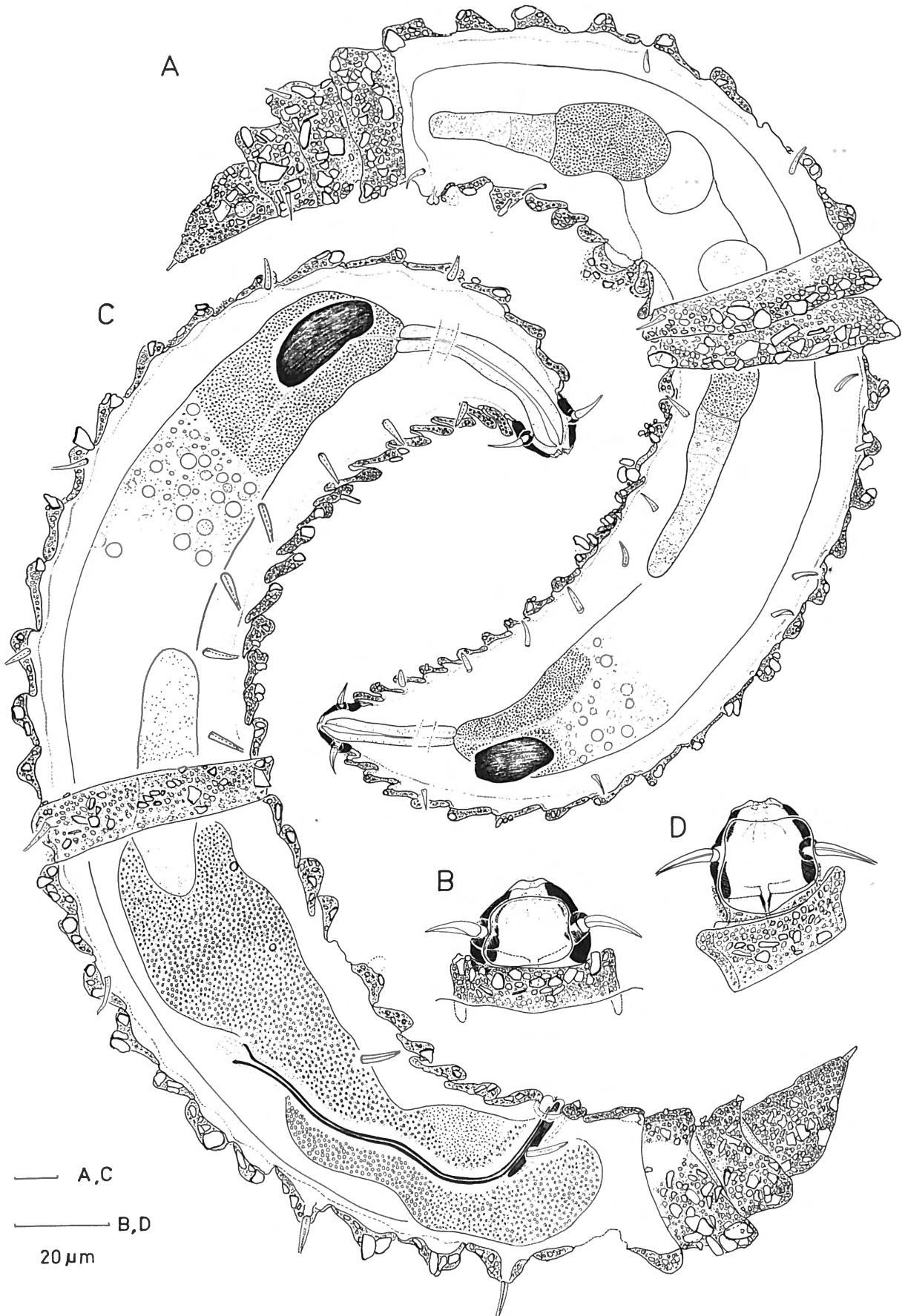


Fig. 4. *Tricoma (Quadricoma) loricata*. Specimens from Atlantic Ocean. Male. C. Entire specimen, with detail of some main rings in surface view. D. Head region, surface view, right side. Female. A. Entire specimen, with detail of some main rings in surface view. B. Head region, surface view of left side.

DESCRIPTION

Body relative long; cuticle with 44 *Quadricoma*-like main rings, with opaque layer of secretion and fine foreign particles; inversion at level of ring 32. Somatic setae short, oval shaped in cross section, relatively broad, tapered to a fine open tip; arranged as follows:

subdorsal, left and right sides: 4, 8, 15, 20, 26, 32, 38, 42 = 8; subventral, left: 3, 6, 10, 14, 18, 23, 27, 31, 36, 41 = 11; subventral, right: 3, 6, 10, 14, 18, 22, 27, 31, 35, 41 = 11.

Head somewhat wider than long, from level of peduncles of cephalic setae anteriorly tapered to a truncated end, 10 µm wide. Cuticle strongly thickened and sclerotized, except for a thin weak cuticle anteriorly, where ending on a rim surrounding the slightly protruding lip region and posteriorly, just in front of the first main ring where covered with desmos. Six minute labial papillae; cephalic setae, broad, tapered to a finer tip and provided with a cuticular flange; inserted on low peduncles in anterior head region. Amphids large, rounded, covering the lateral sides of the head almost completely; amphidial pore just posterior to border of sclerotized head region.

Stoma short and narrow, widened at base, embracing protruding end of pharynx with minute dorsal tooth and two subventral denticles; pharynx largely cylindrical, extending to main ring 7, and surrounded by nerve ring at level of main ring 6. Intestine with small and large spherical inclusions, ventral wall granular anteriorly; no posterior blindsac. Ocel at level of main ring 7 in male, opposite rings 8 and 9 in female (= 21.5x9 µm in diameter).

Male: Cloacal tube protruding from posterior border of main ring 36. Reproductive system typical of Tricominae, with two testes. Testes short, anterior one reaching to main ring 23; an ejaculatory gland on each side of the posterior region of the vas deferens. Spicules slightly ventrally curved, corpus about equally wide with slightly marked head; gubernaculum with thin corpus, parallel to spicules and two dorso-caudally orientated apophyses, 10 µm long. Tail with eight main rings; end ring 36% of total tail length, largely covered with secretion and foreign particles except for naked spine-like terminal spinneret, 13 µm long. Phasmata located about halfway the covered part of the end ring, appearing as a raised (tube-like) structure surrounded by desmos; its diameter at the surface is 6.5 µm, diameter half as wide on the surface of the cuticle. Three caudal glands present, extending shortly beyond cloacal opening.

Female: Anal tube at level of main ring 37. Vulva between main rings 25 and 26. Reproductive system typical of genus; both ovary extended; spermathecae present. Tail with seven main rings; end ring similar to male.

DIAGNOSIS

T. (Q.) magnafenestra sp. nov. is characterised by a long body (680-805 µm), 44 *Quadricoma*-like main rings,

terminal ring with a spine-like spinneret and large phasmata, a broad head with truncated anterior end with labial rim and slightly protruding lip region; males with 55 µm long spicules, slightly curved and gubernaculum with two dorso-caudally orientated apophyses.

RELATIONSHIP

Within the subgenus *Quadricoma*, six species have a comparable number of main rings as the new species: *T. (Q.) bahamaensis* TIMM, 1970 (43-44 rings in male and female), *T. (Q.) crassicoma* (STEINER, 1916) TIMM, 1970 (44 rings in adult), *T. (Q.) crassicomoides* TIMM, 1970 (44 rings in adult), *T. (Q.) lizardiensis* DECRAEMER, 1977 (44 rings in male, 45-46 in female), *T. (Q.) papillata* DECRAEMER, 1977 (43-44 rings in adult) and *T. (Q.) pontica* FILIPJEV, 1922 (42-45 rings in adult). *T. (Q.) magnafenestra* sp. nov. is comparable to *T. (Q.) bahamaensis* (Fig. 7 A-B) in morphometric data but differs in head shape, spicule shape and presence of large phasmata. The new species differs from *T. (Q.) crassicoma* and *T. (Q.) crassicomoides* in males by the much shorter spicules instead of very long spicules (55 µm vs. 110-107 µm and 137 µm, respectively); from *T. (Q.) pontica* and *T. (Q.) lizardiensis* mainly in head shape and morphometric data.

Tricoma (Quadricoma) loricata FILIPJEV, 1922

Fig. 4

nec Specimen from the Bahamas described by TIMM (1970) see DECRAEMER (1976).

Hitherto, *Q. (T.) loricata* has been recorded from sublittoral sample sites. Present record is the first one from a deep sea habitat.

MATERIAL

One male and two female specimens from station KGS39, slide RIT 602.

MEASUREMENTS

Male (n= 1): L= 685 µm; hd= 23x22 µm; cs= 15 µm; sd₂₈= 15 µm; pharynx= 81 µm; tail= 142 µm; end ring 51 µm; spinneret= 7 µm; mbd= 95 µm; (mbd)= 74 µm; spicule= 150 µm; gubernaculum= 24 µm; tail/tmr= 2.8; no sd= 8; no sv= 12; no body rings = 34.

Females (n=2): L= 695, 780 µm; hd= 25,24x24,23 µm; cs= 15, 17 µm; sd₄= 13, 14 µm; sd₃₂= 14, 18 µm; sv_{3/4}= 12.5, 12 µm; sv₃₂= 16.5, 17.5 µm; pharynx= 73, 85 µm; tail= 154, 179 µm; end ring= 68, 92 µm, spinneret= 6.5, 11 µm; mbd= 117, 124 µm; (mbd)= 100, 96 µm; tail/tmr= 2.3, 2.6; no sd = 8/9, 8; no sv= 10/12, 10; no body rings= 33, 33.

ADDITIONAL INFORMATION

The specimens largely agree with former descriptions. Cuticle with 33-34 *Quadricoma*-like main rings with opaque layer of secretion and fine and coarse foreign particles; inversion in direction of main rings at level of ring 23. Somatic setae arranged as follows in male: subdorsal, left side: 4, 7, 10, 13, 16, 20, 25, 30= 8, right side: 4, 7, 11, 14, 17, 20, 25, 28= 8; subventral, left side: 3, 6, 8, 10, 12, 14, 16, 19, 21, 25, 28, 31= 12, right side: 3, 6, 8, 10, 12, 14, 16, 19, 21, 24, 28, 32= 12; some setae are broken off but their insertion site remains distinct. Pigment spots yellowish, very large oval-shaped (41 by 17 μm in male; 34, 41 by 20, 14 μm in two females). Anal tube protruding from main ring 29. Tail with four main rings; end ring broad conical, covered with desmos except for a fine tube-like spinneret; phasmata not observed. One female specimen had the end ring composed of an incompletely separated last but one ring, giving the impression of a five tail rings (or a 34 main rings). Male with a typical reproductive system of two testis, anterior one reaching to ring 14; vas deferens finely granular, posteriorly flanked by a large ejaculatory gland. Spicules 150 μm long, corpus fine and curved posteriorly, capitulum short, widened; gubernaculum 24 μm long with strongly sclerotized part parallel to the spicules, no apophyses observed. All other features as in previous literature (see DECRAEMER, 1978).

DISCUSSION

Within the subgenus *Quadricoma* only five species are known with long fine spicules, curved posteriorly and extending over four to eleven main rings anteriorly beyond the cloacal opening. They can be separated in three groups based on the number of main rings and spicule length: (1) 34 main rings in *Q. loricata* (spicules = 104-145 μm) and *Q. media* (spicule = 127 μm), (2) 38-39 rings in *Q. scanica* (spicule= 84 μm , own measurement along arc; 63 μm in Lorenzen, 1969) and (3) 44 main rings in *Q. crassicoma* (spicule = 110-107 μm) and *Q. crassicomoides* (spicule = 137 μm).

Remarks on the taxonomic status of *T. (Q.) media* (REINHARD, 1881) FILIPJEV, 1922

Q. media was originally described from Odessa (Black Sea) by REINHARD (1881) as *Desmoscolex medius*. The original description was restricted to the number of body rings (34), the presence of four cephalic setae inserted on peduncles, the location of the anus in ring 29 and a detailed description of the number and location of the somatic setae, with 11 subventral setae and 8/9 subdorsal setae (dorsal and ventral side were inverted); illustrations and morphometric data were not presented. SCHEPOTIEFF (1908) gave the first illustration based on a specimen from Naples, herewith, showing the habitus, shape of head and end ring (previously described in SCHEPOTIEFF,

1907), and body length (= 350 μm calculated from figure, see FILIPJEV, 1922); the drawing of an entire specimen shows a somatic setal pattern of 9 subdorsal and 9 subventral setae. FILIPJEV (1922) classified the species within the genus *Quadricoma*; ALLGÉN (1930) synonymized *Quadricoma* with *Tricoma*. TIMM (1970) redescribed *Q. media* based upon a male specimen from Barletta, Italy (collection of Dr. S. GRIMALDI) and added an illustration of the head in surface view. He distinguished *Q. media* from *Q. loricata* in head shape (head narrowed at anterior end in *Q. loricata*) but remarked that further material is needed to separate both species.

When reviewing *Q. loricata* (see DECRAEMER, 1978) I also studied the Barletta specimen (Fig. 7 C-D) and considered it to belong to *Q. loricata* (including *Q. loricatoides* FREUDENHAMMER, 1975) showing only a minor difference in head shape (with slightly wider, rounded lip region than most *T. (Q.) loricata* specimens) and a tail with five main rings with the end ring having a short spinneret. TIMM (1970) also referred to a possible synonymy of *Tricoma suecica* ALLGÉN, 1930 nec *T. suecica* apud PALADIAN & ANDRIESCU (1963) with *Q. media* based on similarity in number of main rings, body length and length of somatic setae. FREUDENHAMMER (1975) considered *Q. suecica* as a *species inquirenda*.

Besides *T. (Q.) loricata* and *T. (Q.) media*, the subgenus *Quadricoma* has two other species with 33-34 main rings: *T. (Q.) avicapitata* TIMM, 1978 from the Hut Point (South Pole) and *T. (Q.) trigintatres* TIMM, 1970 from Corse and from the Black Sea. Male specimens of both species have short spicules and, *T. (Q.) avicapitata* has a totally aberrant (=asymmetrical) lip region, different from all known desmoscolecoid species.

Because of the brief original description without indication of the sexes, without illustrations and morphometric data, *Q. media* cannot be identified with certainty. Hereby, I consider *T. (Q.) media* as a *species inquirenda*.

***Tricoma (Quadricoma) spp. resembling Quadricomoides labiosus* DECRAEMER, 1983**

Figs 5 & 6

Four specimens of *Tricoma (Quadricoma)* with 36 main rings were found at three stations from about the same depth (KGS 13: 2 males, KGS 28: 1 female and KGS 30: 1 male), all sampled during EUMELI mission 2. They seem to belong to two related species which closely resemble the deep-sea species *Quadricomoides labiosus* by their habitus with very long body (1420-1515 μm), 36 *Quadricoma*-like main rings, a head with thickened, sclerotized cuticle from lip region to level of amphidial pore; uncovered anterior to peduncles of insertion of the cephalic setae and covered with secretion and foreign material posterior to the insertion (including the interzone prior to the first main ring); males with long spicules (77-82 μm) and gubernaculum (46-55 μm long, with a thin corpus parallel to spicules and dorso-caudally orientated apophyses, 12-15 μm long) and arrangement and number

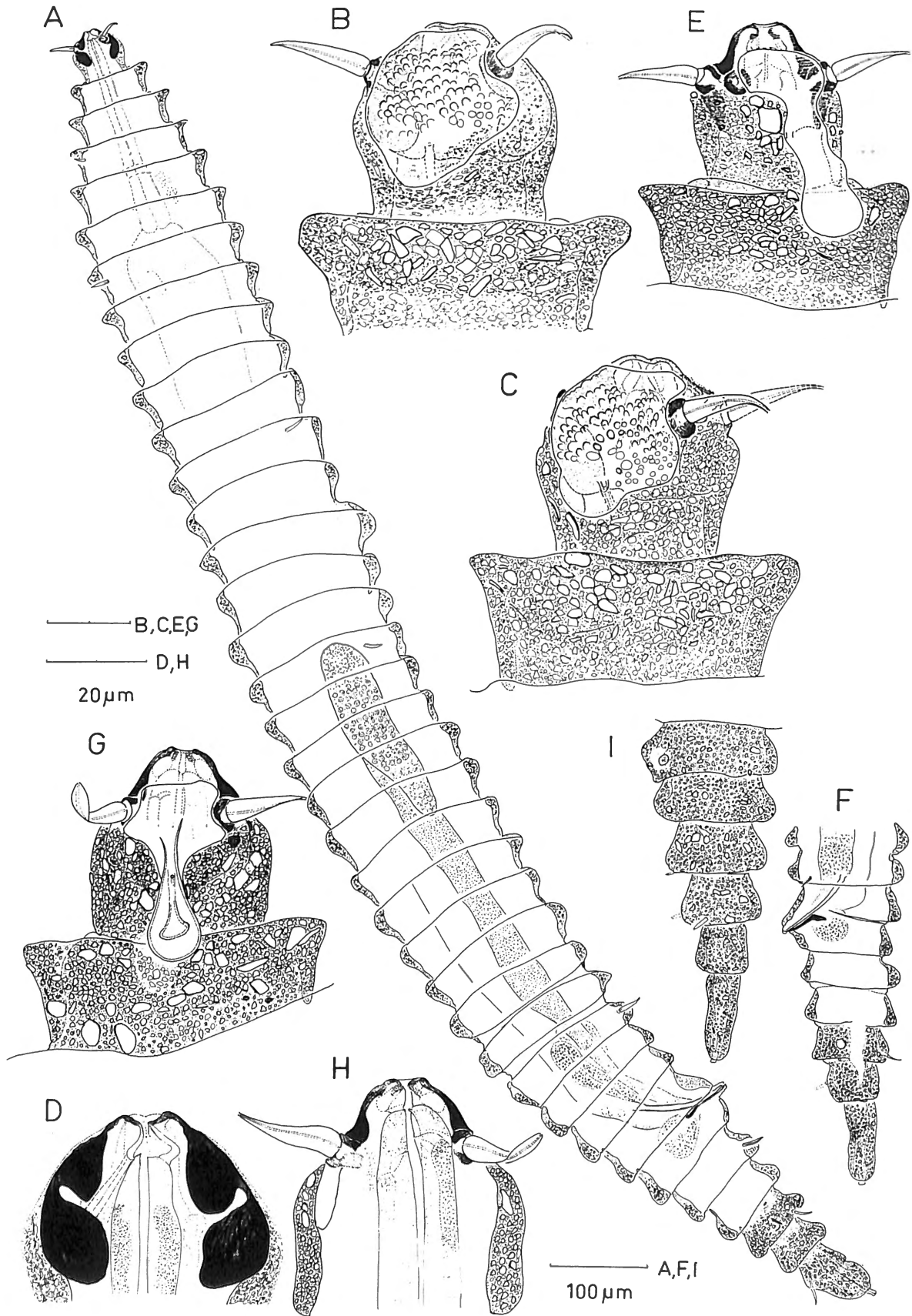


Fig. 5. *Tricoma (Quadricoma)* spec.1. Male. A. Entire specimen. B-C. Head region, surface view of right and left side. D. Head region, optical section, left side. *Tricoma (Quadricoma)* spec.2. Male. E. Head region, surface view of left side. F. Posterior body region. Female. G-H. Head region, right side in surface view and left side in optical section. I. Tail, surface view, oblique left side.

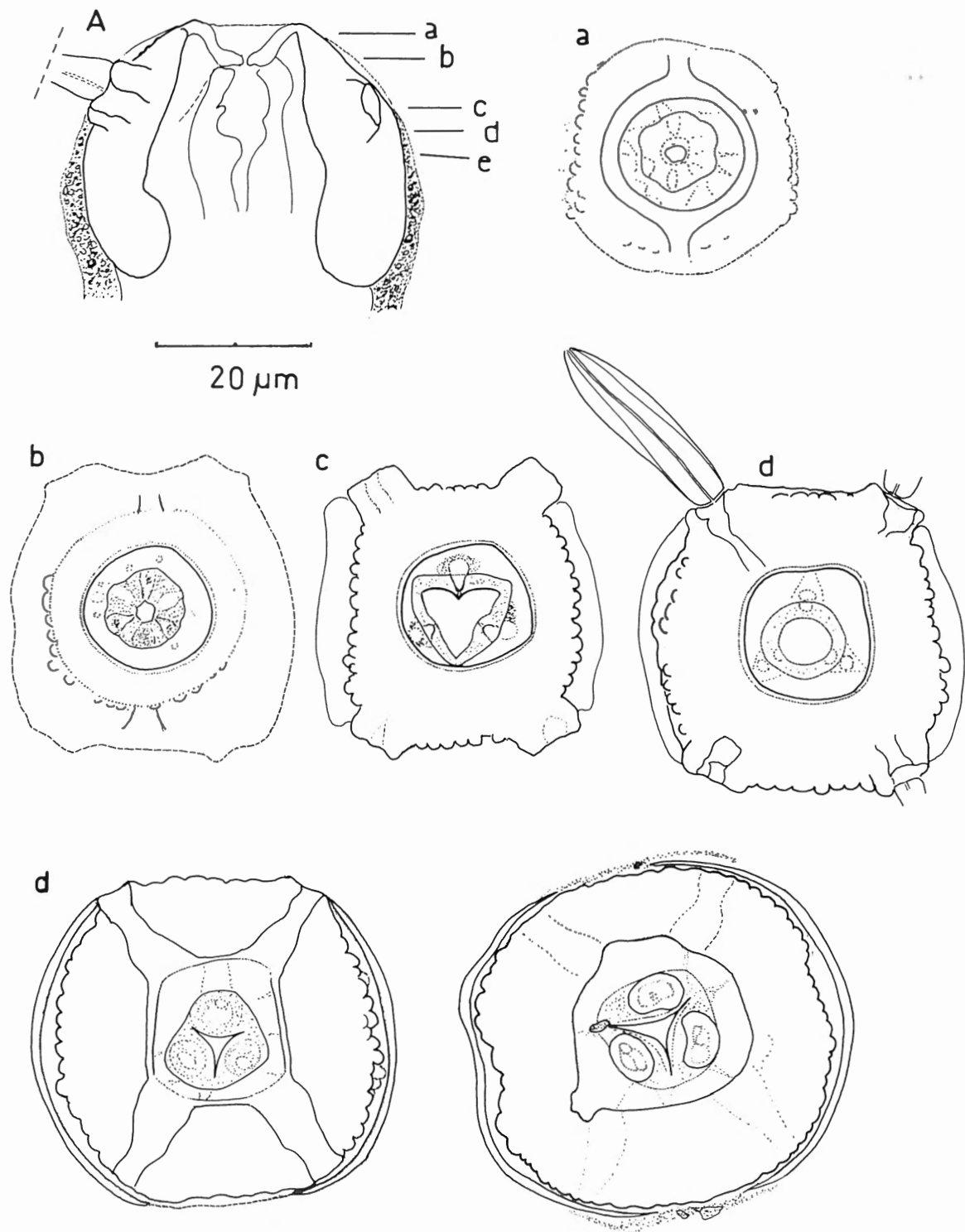


Fig. 6. *Tricoma (Quadricoma)* spec. 1. Male specimen, with indication of level of optical sections a-e. a. end-on view with indication of far anterior border of amphidial fovea. b. At level of anterior end of stoma. c. At base of stoma, minute dorsal denticle visible, debouching of pharyngeal glands. d. At level of insertion of cephalic setae. d-e. At level of anterior pharynx, e. with transverse section of enormous glands.

of somatic setae. The genus *Quadricomoides* is differentiated from *Quadricoma* by its triradial head and asymmetric pharyngeal bulb (DECRAEMER, 1976). Because the inner structures being masked by the opaque and coarse nature of the covering concretion rings, and of the restricted number of specimens from the EUMELI mission, they are described at present as two unnamed species. The identification at genus level was verified by a study of an *en face* view and of transverse sections of the head of a male specimen of *Tricoma (Quadricoma)* spec. 1 (Fig. 6).

***Tricoma (Quadricoma)* spec. 1** (Fig. 5 A-D, 6 A, a-e)

MATERIAL

Two males from sample site KGS13 (slide RIT 597); one male without tail had the head region sectioned for *en face* view and further detailed study.

MEASUREMENTS

Male (=1): L= 1515 μ m; hd= 43 x 50 μ m; cs= 27 μ m; sv2= 21 μ m; pharynx= 205 μ m; tail= 253 μ m; end ring= 79 μ m, spinneret = 8 μ m; 167 μ m; (mbd)= 137 μ m; spicule= 77 μ m; gubernaculum= 55 μ m; tail/tmr= 3.2.

DESCRIPTION

Body long, tapered at both ends; cuticle with 36 broad *Quadricoma*-like main rings with a thick layer of secretion and numerous coarse foreign particles (= a coarse desmos); inversion in direction of main rings within ring 27. Somatic setae with 7 subdorsal and 13 subventral setae on each side, arranged as follows on left side: subdorsal: 4, 6, 11, 16, 22, 26, 34 = 7; subventral: 2, 4, 6, 9, 11, 13, 16, 19, 21, 24, 27, 32, 34=13 (some setae are broken off but the insertion mark remains clear). Head broad, anteriorly tapered from peduncles of cephalic setae onward; its cuticle obviously thickened and strongly sclerotized, showing a conspicuously irregular (= dotted) surface, largely covered by the amphids (Fig. 5B, 6 c-e); posterior to the peduncles of insertion of the cephalic setae, cuticle covered with desmos, reaching to the first main ring. In labial region, cuticle thin and smooth. Cephalic setae, short, provided with a flange, inserted at mid-length of strongly sclerotized head region. Amphids confined to the head, their anterior border reaching subterminally (Fig. 6a); amphidial opening at posterior border of "sclerotized" part of cephalic region. In *en face* view, head about quadrangular in shape. No labial papillae observed because of slightly retracted lip region of the male specimen sectioned (Fig. 6 A). Stoma short with a small dorsal tooth, and two subventral denticles; from base of stoma, three retractor muscles visible. Pharynx cylin-

dric, anteriorly with well developed dorsal and two subventral glands, strikingly marked in transverse section (Fig. 6e); pharyngo-intestinal junction at the level of posterior border of main ring 5; intestine, largely cylindrical, with numerous globules; cloacal tube protruding between main rings 30 and 31.

Reproductive system typical of genus; anterior testis reaching to main ring 16. Spicules about straight; gubernaculum with thin straight corpus parallel to spicules and short antero-dorsally orientated apophyses (15 μ m). Tail with six rings with end ring (31% of total tail length), largely covered with desmos except for a 8 μ m long naked spinneret.

RELATIONSHIP

The two male specimens from station KGS 13 differ from *Tricoma (Quadricoma)* spec. 2 (see below) by a wider head end with obviously thickened cuticle, showing a conspicuously dot-like irregular surface (as in *Quadricomoides labiosus*) largely underneath the amphids, which are confined to the head vs a narrower anterior end with mediumly thickened cuticle and amphids clearly bipartite with narrower posterior part protruding over the first main ring. *Tricoma (Quadricoma)* spec. 1 together with the *Tricoma (Quadricoma)* spec. 2 (see below) differ from the closely resembling species *Quadricomoides labiosus*, in details of the head structure (more anteriorly tapered, without surrounding labial membrane and without a triradial symmetry with three labial sectors) and a shorter pharynx, apparently without a dorsal asymmetric bulb.

***Tricoma (Quadricoma)* spec. 2** (Fig. 5 E-G)

MATERIAL

One male and female, from sample site KGS30 (slide RIT 601) and from site KGS28 (slide BN 393) respectively.

MEASUREMENTS

Male (n=1): L= 1420 μ m; hd= 34 x 42 μ m; cs= 20 μ m; sv29= 19 μ m; sd34= 15 μ m; pharynx= 115 μ m; tail= 265 μ m; end ring= 91 μ m, spinneret = 5 μ m; mbd= 172 μ m; (mbd)= 145 μ m; spicule= 82 μ m; gubernaculum= 46 μ m; tail/tmr= 2.9.

Female (n=1): L= 1500 μ m; hd= 36x48 μ m; cs= 20 μ m; sd28= 13 μ m; sv 34= 14 μ m; tail= 272 μ m; end ring= 86 μ m; spinneret= 3.5 μ m; mbd= 174 μ m; (mbd)= 136 μ m; tail/tmr= 3.2; V= 53.2 %.

DESCRIPTION

Body long, tapered at both ends; cuticle with 36 broad *Quadricoma*-like main rings with a thick layer of secretion

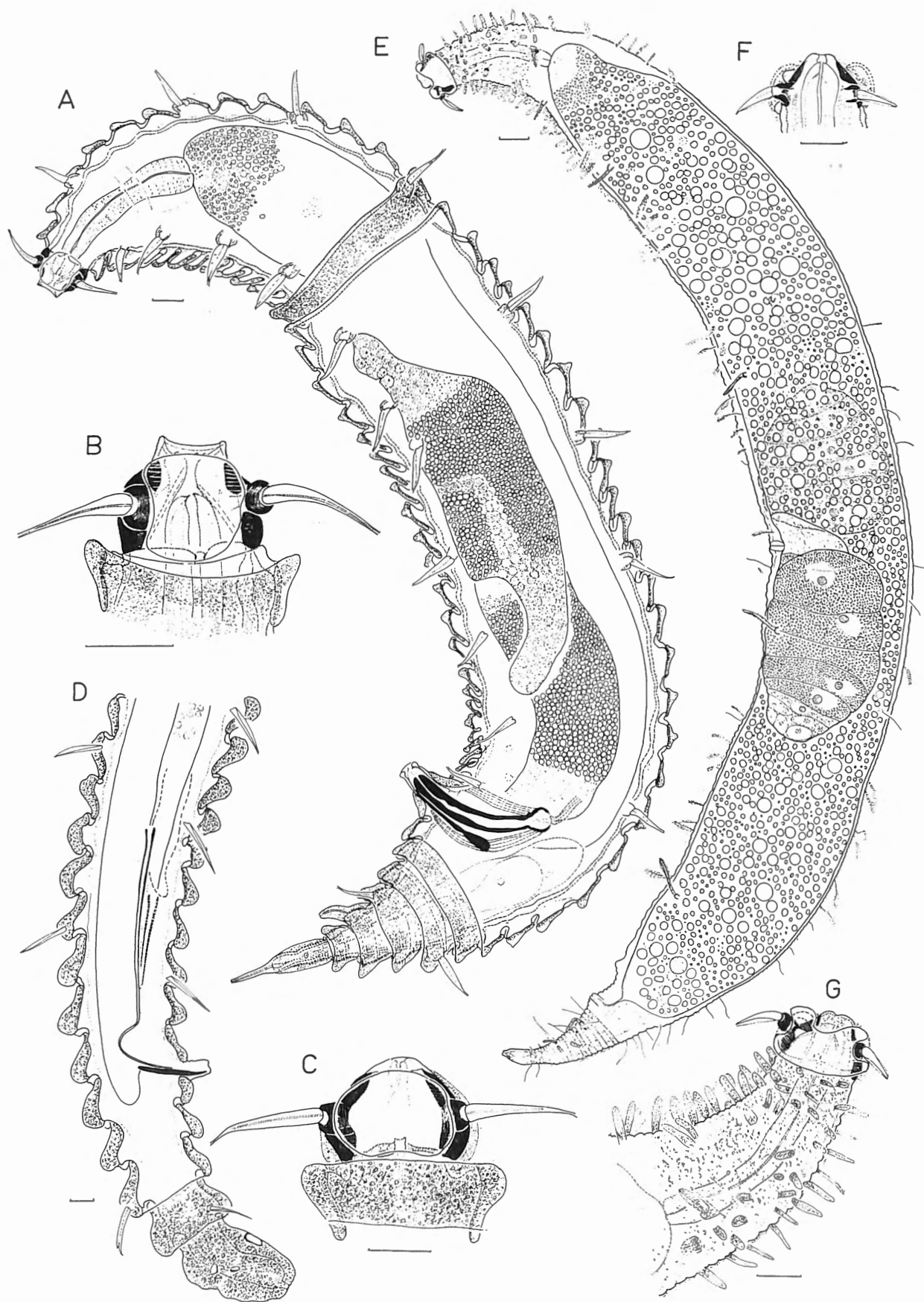


Fig.7. – *Tricoma (Quadricoma) bahamaensis*. Holotype male. A. Entire specimen. B. Head region, surface view. *Tricoma (Quadricoma) media*, specimen from Barletta (= *Tricoma (Quadricoma) loricata*). C. Head region. D. Posterior body region. *Paratricoma* spec. 1. Female. E. Entire specimen. F. Head, longitudinal optical section, right side. G. Anterior body region, surface view of left side. Scale is 10 μm .

and numerous coarse foreign particles; inversion in direction of main rings within ring 27 in male; ring 28 in female. Somatic setae with 7 subdorsal setae (in male and female) and 9-10 subventral setae in male, 13 in female and arranged as follows on left side in male: subdorsally: 3, 6, 12, 18, 24, 27, 34=7, subventrally: 2, 4, 6, 10, 16, 20, 24, 29, 34=9; in female: subdorsally: 4, 7, 13, 15, 18, 25, 28=7, subventrally: 2, 4, 6, 8, 11, 14, 17, 20, 23, 26, 29, 31, 34=13. Head anteriorly tapered from peduncles of cephalic setae onward, with mediumly thickened, sclerotized cuticle; cuticle posterior to peduncles covered with desmos extending to the first main ring. Cephalic setae, short, provided with a flange, inserted at mid-length of sclerotized head region. Amphidial fovea clearly bipartite with narrower posterior part protruding over the first main ring; amphidial opening at posterior border of sclerotized cephalic region. Stoma short with a small dorsal and two subventral denticles; pharynx cylindrical; intestine with numerous globules.

Male: Reproductive system typical of genus; spicules about straight; gubernaculum with thin straight corpus parallel to spicules and a short antero-dorsally orientated apophyses (12 µm). Cloacal tube between main rings 30 and 31. Tail with six main rings; end ring 34% of total tail length, completely covered, except for a minute (5 µm) spinneret.

Female. Vulva between main rings 20 and 21; reproductive system typical for genus. Tail with 5 main rings; end ring 31% of total tail length; anal tube protruding from ring 31.

RELATIONSHIP

See *Tricoma (Quadricoma) spec. 1.*

Conclusions

The subgenus *Quadricoma* is the most common taxonomic group present in the samples collected from mesotrophic stations in the northeast Atlantic during the EUMELI cruises, hereby representing about 1/3 rd of the species known. At present, *Quadricoma* consists of eighteen species (see species list below), five species are recorded exclusively from deep-sea habitat (*T. (Q.) avicapitata*, *T. (Q.) brevichaeta*, *T. (Q.) gascognensis*, *T. (Q.) magna*, *T. (Q.) magnafenestra* sp. nov.) and three species are known from sublittoral and from deep-sea bottom samples (*T. (Q.) loricata*, *T. (Q.) maxima*, *T. (Q.) pontica*).

List of species belonging to the subgenus *Quadricoma*, redescription of species or additional data are recorded

Table 3 – Key to the identification of *Quadricoma* species; all measurements in µm

species	no main rings		spicule	body length	
	male	female		male	female
I: 33-34 main rings					
<i>trigintatres</i>	33	33	72-78	530-650	625-700
<i>avicapitata</i>	34	33	31	350	304-363
<i>loricata</i>	33-34	33-34	104-135	540-880	525-930
II: 36-39 main rings					
<i>magna</i>		36			1220-1430
<i>gascognensis</i>	37 (36)		51-53	810-900	
<i>cobbi</i>	37	37	35-54	191-595	745
<i>noffsingeriae</i>	37	37	30-42	435-485	495-545
<i>scanica</i>	37-39	39	84-115	330-564	330-475
<i>brevichaeta</i>	38-39	38-39	35-61	550-905	660-965
<i>maxima*</i>	39	39	52-72	710-835	645-1000
III: 42-46 main rings					
<i>freudenhammeri</i>		41			800
<i>pontica</i>	42-45	42-45	32-40	340-598	355-760
<i>bahamaensis</i>	43-44	43-44	58	520-675	400
<i>papillata</i>	43-44	44(43)	25-28	305-335	395-555
<i>crassicoma</i>	44	44	100-107	475-575	328-645
<i>crassicomoides</i>	44	44	137	615-695	490-745
<i>magnafenestra</i>	44	44	55	680	745-805
<i>lizardiensis</i>	44	45-46	46	530	420

* *Tricoma aff maxima* in TIMM (1978) not included

between brackets. The species indicated with * are known by the type population only.

type species: *Quadricoma loricata* FILIPJEV, 1922 [TIMM, 1970; DECRAEMER, 1978]

syn. *Tricoma loricata* (FILIPJEV, 1922) ALLGÉN, 1930

syn. *Q. granulata* KREIS, 1934 op. TIMM (1970)

syn. *Q. loricatoides* FREUDENHAMMER, 1975 op. DECRAEMER (1978)

other species:

- **avicapitata* TIMM, 1978

- **bahamaensis* TIMM, 1970

- *brevichaeta* FREUDENHAMMER, 1975

syn. *Quadricoma iberica* FREUDENHAMMER, 1975 op. DECRAEMER (1983)

- *cobbi* (STEINER, 1916) FILIPJEV, 1922 [TIMM, 1970; DECRAEMER, 1978]

syn. *Tricoma cobbi* STEINER, 1916

- *crassicoma* (STEINER, 1916) FILIPJEV, 1922 [TIMM, 1970]

syn. *Tricoma crassicoma* STEINER, 1916

- *crassicomoides* TIMM, 1970 [DECRAEMER, 1978]

- **freudenhhameri* DECRAEMER, 1977

- **gascognensis* DECRAEMER, 1984

- **lizardiensis* DECRAEMER, 1977

- **magna* TIMM, 1970

- *magnafenestra* sp. nov.

- *maxima* (SCHEPOTIEFF, 1907) FILIPJEV, 1922 [SCHEPOTIEFF, 1908; ALLGÉN, 1942; TIMM, 1970; TIMM, 1978]

syn. *Desmoscolex maximus* SCHEPOTIEFF, 1907

syn. *Tricoma maxima* (SCHEPOTIEFF, 1907) ALLGÉN, 1930

- *media* (REINHARD, 1881) FILIPJEV, 1922 [SCHEPOTIEFF, 1907, 1908; ALLGÉN, 1942; TIMM, 1970]

syn. *Desmoscolex medius* REINHARD, 1881

syn. *Tricoma media* (REINHARD, 1881) STAUFFER, 1924

syn. *Tricoma suecica* ALLGÉN, 1930 op. TIMM (1970) nec specimen from Barletta in TIMM (1970) which is *Q. loricata*

spec.inq. op. nov.

- *noffsingerae* DECRAEMER, 1977

- *papillata* DECRAEMER, 1977

- *pontica* FILIPJEV, 1922 [TIMM, 1970; TIMM, 1978]

- *scanica* (ALLGÉN, 1935) FILIPJEV, 1922 [LORENZEN, 1969; TIMM, 1970]

syn. *Desmoscolex scanicus* ALLGÉN, 1935

syn. *Tricoma scanica* (ALLGÉN, 1935) LORENZEN, 1969 op. TIMM (1970)

syn. *Neoquadricoma arctica* KREIS, 1963 op. TIMM, (1970)

syn. *Tricoma nematoides* sensu SCHEPOTIEFF (1908) nec

GREEFF (1869) op. LORENZEN (1969)

syn. *Tricoma nematoides* sensu LORENZEN (1969) nec

GREEFF (1869) op. LORENZEN (1969)

- *trigintatres* TIMM, 1970

syn. *Tricoma suecica* sensu PALADIAN & ANDRIESCU (1963) op. TIMM (1970)

The identification to species level of the representatives of the subgenus *Quadricoma* can be facilitated by using the number of main rings as prime character for making an early easy differentiation into smaller groups (Table 3).

In desmoscolecids species with a low number of main

rings (< 50 rings), as in this subgenus, the intraspecific variability in number of main rings is rare; when present, the maximum range is two to three rings; one ring difference may be observed between ventral and dorsal side within a single animal. Further characterization of the species within group I (= 33-34 main rings) is based on the spicule length, the body length and head shape; in group II (= 36-39 main rings) on body length and spicule length, length of the cephalic setae (e.g. stumpy in *T. (Q.) gascognensis*) and head shape, and in group III (= 42-46 main rings) on spicule length, number of rings, length of cephalic setae (short in *T. (Q.) crassicoma*), head shape and presence of copulatory setae in male (in *T. (Q.) papillata*).

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W. DECRAEMER

Koninklijk Belgisch Instituut voor Natuurwetenschappen,
Vautierstraat 29,
B-1000 Brussel,
Belgium
decraemer@kbinirsnb.be