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longirostris (Southern, 1914)

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Article

Tricoma (Tricoma) disparseta sp. nov. (Nematoda: Desmoscolecidae), a New Free-Living Marine Nematode from a Seamount in the Northwest Pacific Ocean, with a New Record of *T. (T.) longirostris* (Southern, 1914)

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Abstract: During a survey of marine biodiversity in the deep-sea off northeastern Guam, two marine desmoscolecoid nematodes belonging to the subgenus *Tricoma* were discovered. *Tricoma (Tricoma) disparseta* sp. nov. was described based on specimens collected from sponge and starfish habitats on a seamount at depths ranging from 1300 to 1500 meters. *T. (T.) disparseta* sp. nov. is distinguished by having 59 to 62 main rings, 9 to 10 subdorsal setae, and 14 to 18 subventral setae on each side. Notable features include the differentiation in length and insertion between subdorsal and subventral setae, and a curved, hooked gubernaculum. The specimen of *T. (T.) longirostris* observed in this study closely resembles previously reported specimens, characterized by 78 main rings, a long and narrow head shape, 8 to 9 subdorsal setae, 14 to 15 subventral setae, and a gubernaculum with a knobbed apophysis. The morphological characteristics and detailed illustrations of two *Tricoma* species from the Northwest Pacific Ocean were documented using differential interference contrast microscopy (DIC) and scanning electron microscopy (SEM). Furthermore, pictorial keys and comparative tables are presented for species exhibiting 50 to 64 main rings, aiding in their identification and differentiation.

Keywords: marine nematodes; *Tricoma*; morphometrics; taxonomy; Northwest Pacific Ocean

1. Introduction

Deep-sea ecosystems, which span approximately 65% of the Earth's surface, are home to a substantial portion of global biodiversity [1,2]. Among the diverse organisms inhabiting these environments, nematodes stand out as the most prolific metazoans, representing over 90% of the benthic deep-sea population [1,2]. Recent research underscores the high species diversity within deep-sea nematode communities [3], highlighting that water depth plays a crucial role in influencing species abundance [4–6]. This depth-dependent variation is closely linked to nutrient availability and sediment characteristics [6]. However, investigating the diversity of deep-sea nematode communities poses significant taxonomic challenges, primarily due to the limited number of individuals available for each genus or species [3,7].

Within this diverse nematode community, the Desmoscolecida are particularly notable for their presence in deep-sea habitats. Despite their relatively low species richness, Desmoscolecida exhibit high diversity [8]. The genus *Tricoma*, established by Cobb in 1894, represents one of the major taxa within the Desmoscolecida. It encompasses two subgenera: *Tricoma (Tricoma)* and *Tricoma (Quadricoma)*, with ongoing debates regarding their precise taxonomic classification. The subgenus *Tricoma* alone comprises 87 recorded species globally, with 23 of these species occurring at depths greater than 200 meters, thus representing 26% of the total [9]. Species belonging to the subgenus

Tricoma are characterized by several distinct morphological features: their desmen are typically rounded or triangular in shape, they lack a pronounced reversal ring, and their head, when viewed in optical section, appears more or less triangular. Additionally, the terminal ring is predominantly cylindrical, further distinguishing them from related taxa [10].

During a survey of free-living marine nematode biodiversity in international waters around Guam in the Northwest Pacific Ocean, two species, *Tricoma* (*T.*) *disparseta* sp. nov. and *T.* (*T.*) *longirostris* (Southern, 1914), were discovered on the surface of a sponge and in sediment in the deep-sea seamount region. Seamounts, which are underwater topographic elevations of the seafloor, play a crucial role in marine biogeography [11]. These structures are known to create unique hydrological conditions, such as enhanced semi-closed circulation patterns and increased vertical mixing, which result in the formation of circulation cells above their summits [12–15]. These circulation cells enhance the local production of primary and secondary organisms and help retain larvae and pelagic production in the water column, thereby improving food resources for benthic fauna [13]. Consequently, seamounts support high biodiversity and serve as important habitats for a variety of macro- and megabenthic taxa [12,15,16]. To date, six species of the subgenus *Tricoma* have been recorded from the Northwest Pacific [9]. This study presents a detailed description of the two *Tricoma* species discovered in the seamounts off northeastern Guam, Northwest Pacific. The descriptions are supported by illustrations and photographs obtained through scanning electron microscopy (SEM) and differential interference contrast microscopy (DIC). Additionally, a comparative character table and a pictorial key are included for species with 50 to 64 main rings, offering a visual and tabulated guide for their identification and comparison.

2. Material and Methods

2.1. Field Sampling and Sample Processing

In September 2023, the oceanographic research vessel *ISABU*, operated by the Korea Institute of Ocean Science and Technology (KIOST), carried out a deep-sea exploration in the seamount region northeast of Guam (Figure 1; Table 1). Samples were collected from the seafloor at depths ranging from 1,300 to 1,500 meters using a suction sampler attached to a remotely operated vehicle (ROV). The collected substrate, containing meiofauna and macrofauna, was processed in the field by applying osmotic shock with tap water for 10 minutes to separate the organisms from the silt. The samples were then filtered through sieves with mesh sizes of 1 mm and 63 μm to separate microfauna from macrofauna and were fixed in a 5% formaldehyde solution for long-term preservation.

Table 1. Sampling locations of the two *Tricoma* species collected from the Northwest Pacific Ocean.

Stations	Date	Latitue (DMS)	Longitude (DMS)	Depth(m)	Remarks	Specimens
St.1BKC90103	September 1, 2023	'15°38'15.16"S	'151°59'50.35"E	1425.52	Starfish habitat	MNB011
St.2BKC80403	September 6, 2023	'17°02'47.346"S	'149°52'50.484"E	1366.6	Starfish habitat	MNB004,MNB005, MNB006, MNB007, MNB009, MNB010
St.3BKC80502	September 7, 2023	'17°05'45.41"S	'149°55'07.67"E	1510.1	Sponge	MNB001, MNB002, MNB003, MNB008

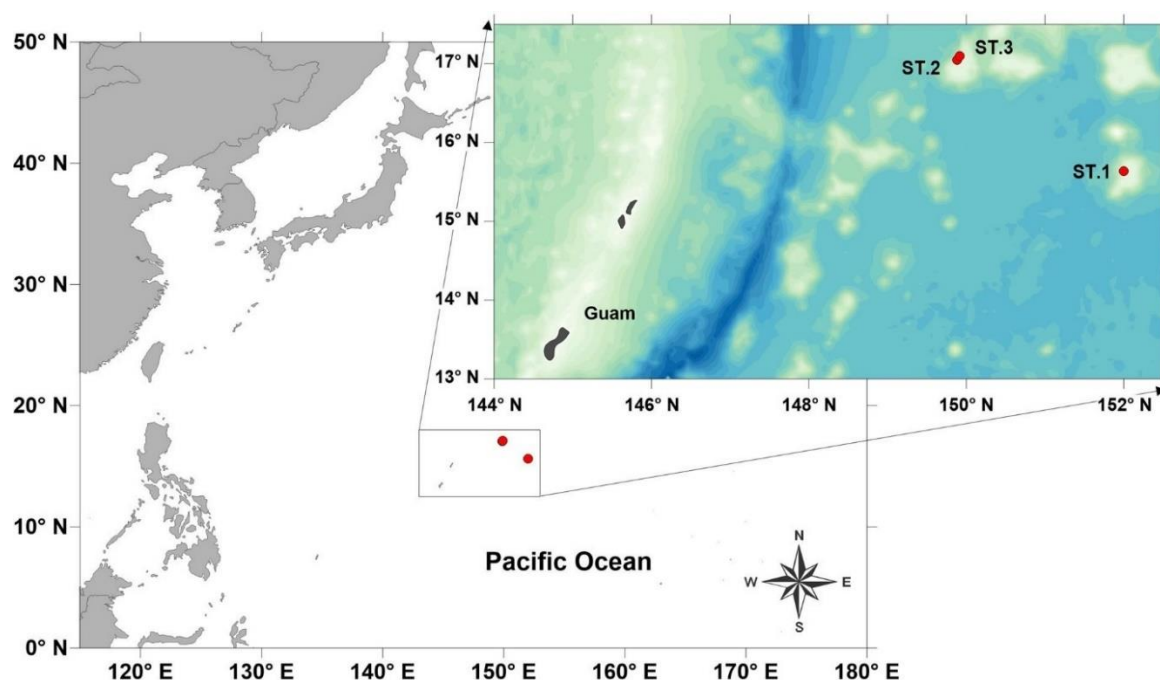


Figure 1. A map depicting the locations where samples were collected.

2.2. Laboratory Processing and Microscopic Analysis

In the laboratory, meiofauna was separated from detritus and sediments by flotation in Ludox HS40 and screened through a 63 μm mesh sieve. Target nematodes were manually selected using a Pasteur pipette under a dissecting microscope and transferred to a 3% glycerin solution. The solution was evaporated at room temperature over 10 days until only pure glycerol remained. Specimens were mounted in glycerol between two cover slips using the standard wax ring method. Observations and measurements were conducted using an Olympus BX53 microscope equipped with cellSens Standard software. Photographs were taken with a LEICA DM2500 LED microscope equipped with a LEICA K5C color CMOS camera (Wetzlar, Germany), and image quality was enhanced using Adobe Photoshop 2023. Drawings were produced using a 100x objective lens with immersion oil and a microscope with Nomarski differential interference contrast (DIC) from an Olympus BX53 microscope (Tokyo, Japan), equipped with a drawing tube. Line drawings were created using tracing techniques with a Wacom Cintiq 22 tablet and Adobe Illustrator.

2.3. Scanning Electron Microscopy (SEM) Analysis

For SEM analysis, specimens were initially fixed in 5% formaldehyde solution, rinsed three times with distilled water for 10 minutes each, freeze-dried, and mounted on aluminum stubs using pins. A thin layer of gold/palladium was applied using a high-vacuum sputter coater. SEM imaging was performed with a field emission SEM (JSM-7200F) at KOPRI, providing detailed visualization of specimen morphology.

Abbreviations used in the text are as follows:

- a: body length divided by maximum body diameter,
- b: body length divided by pharynx length,
- c: body length divided by tail length,
- V (%): vulva distance from the anterior end as a percentage of total body length.

3. Results and Discussion

Taxonomic Account

Order Desmoscolecida Filipjev, 1929

Family Desmoscolecidae Shipley, 1896

Subfamily Tricominae Lorenzen, 1969

Genus *Tricoma* Cobb, 1894

Subgenus *Tricoma* Cobb, 1894

Tricoma (Tricoma) disparseta sp. nov. (Figures 2–7, Table 2)

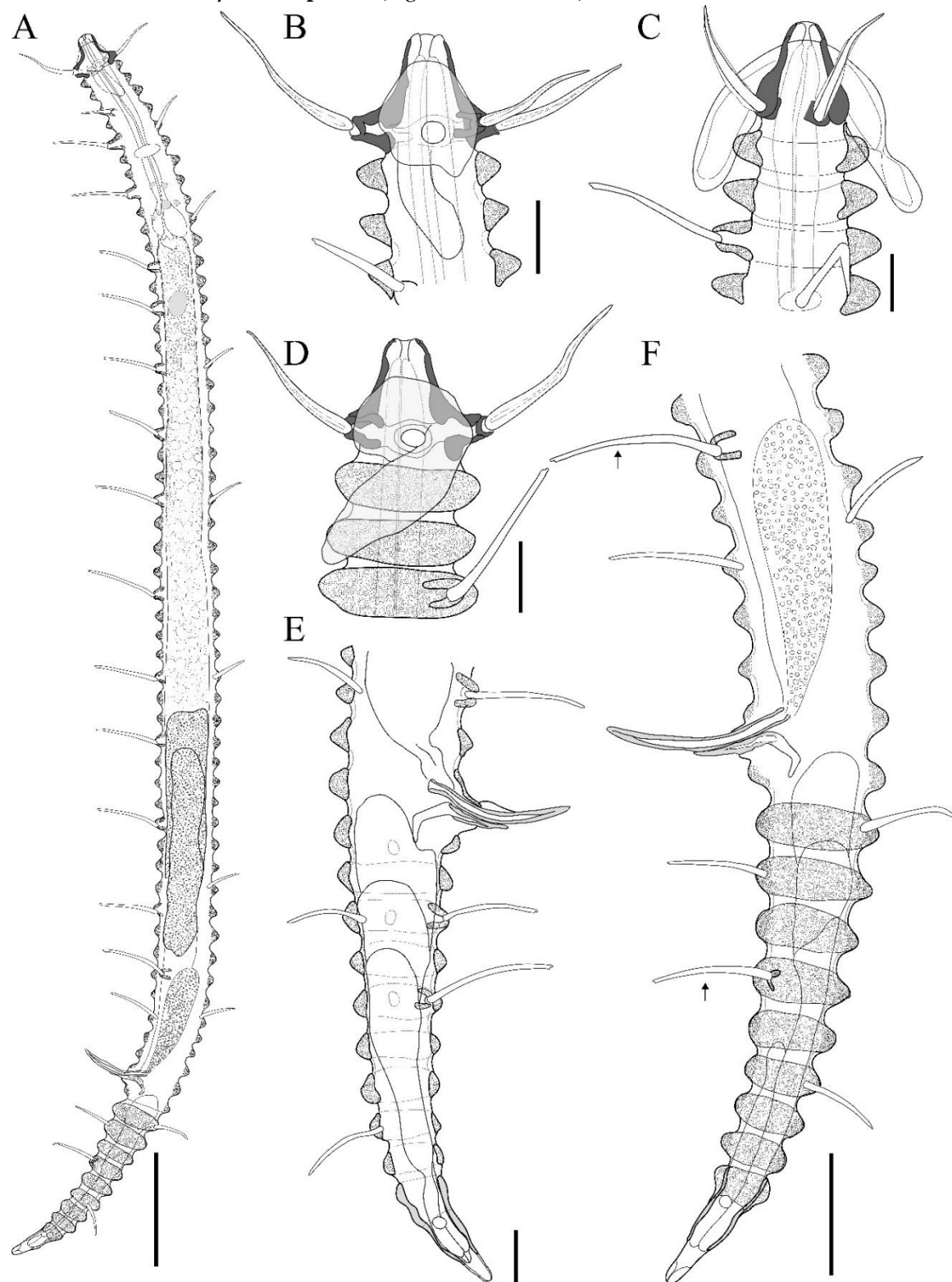


Figure 2. *Tricoma (Tricoma) disparseta* sp. nov. Holotype male (MNB001). A, habitus, lateral view; B, head region, left side; C, head region, ventral view (Paratype MNB006); D, head region, right side (Paratype MNB005); E, spicules and tail region, right side (Paratype MNB005); F, posterior region showing slightly laterally inserted subventral setae. Scale bars: 50 µm in A; 10 µm in B-E; 20 µm in F.

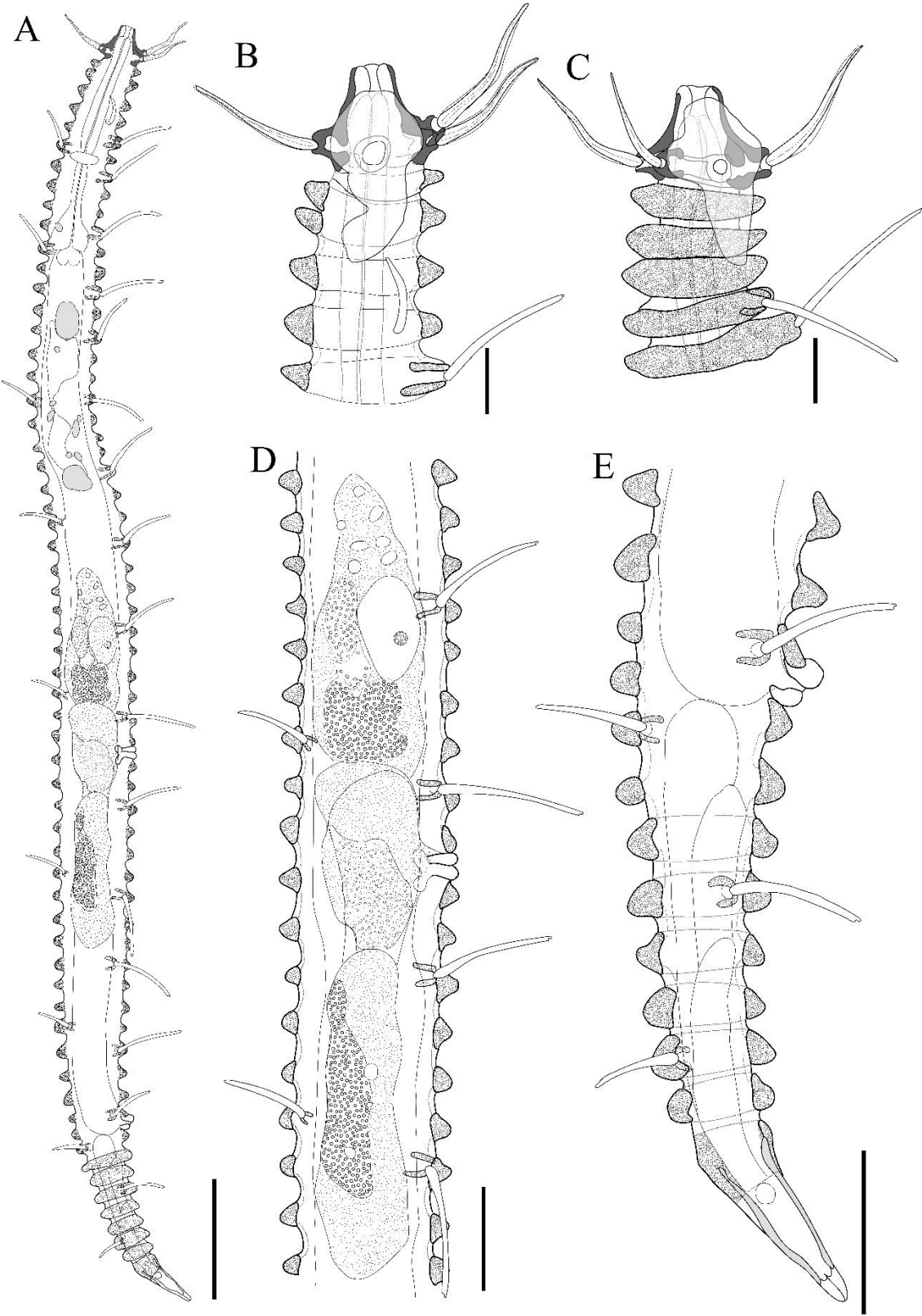


Figure 3. *Tricoma (Tricoma) disparseta* sp. nov. Allotype female (MNB007). A, habitus, lateral view; B, head region, right side; C, head region, right side (Paratype MNB008); D, reproductive systems; E, tail region, right side. Scale bars: 50 μm in A; 10 μm in B-C; 20 μm in D-E.

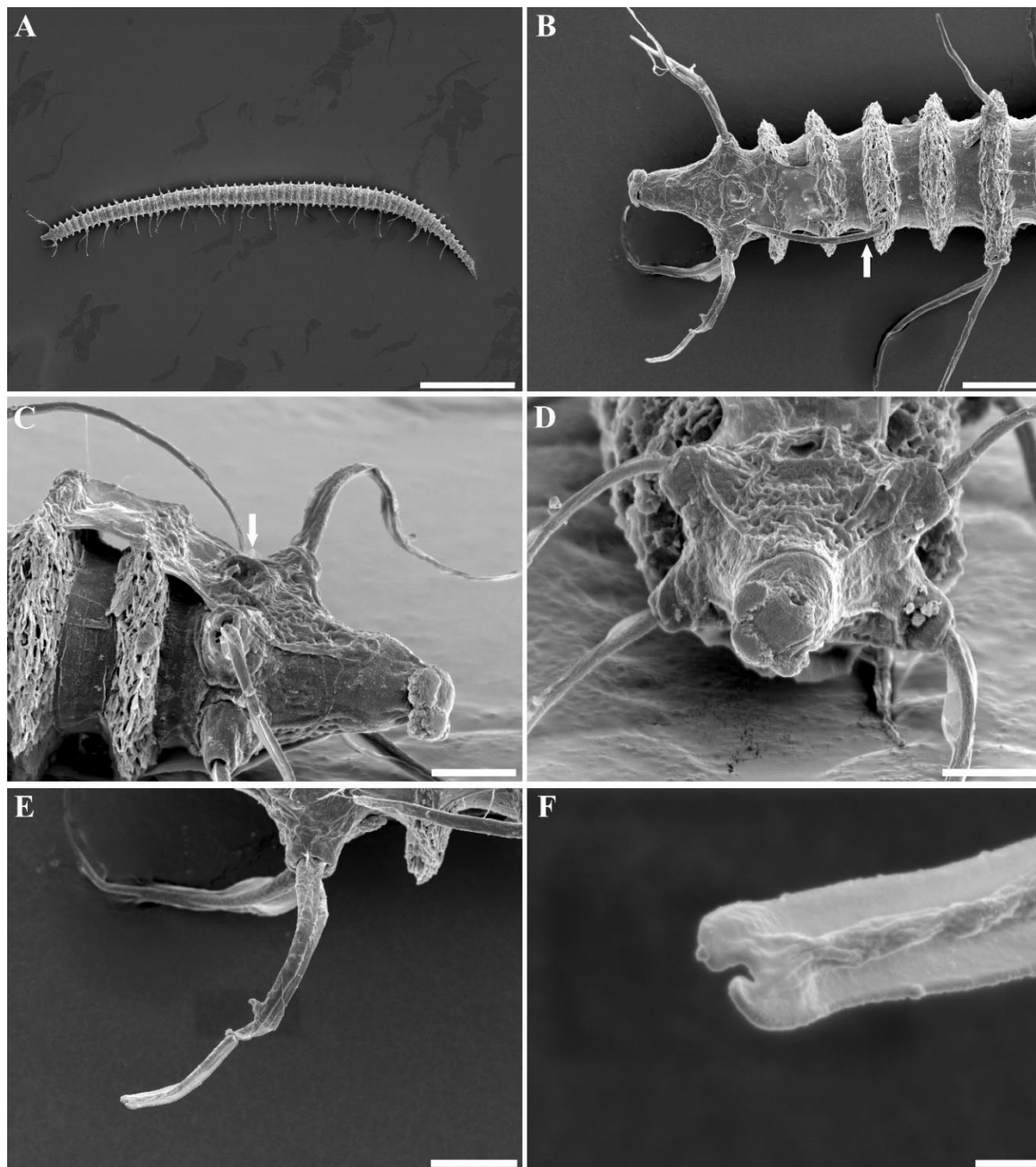


Figure 4. *Tricoma (Tricoma) disparseta* sp. nov. SEM photomicrographs, male. A, entire view of the body, lateral view; B, anterior region showing laterally inserted subventral setae (white arrow); C, head showing the amphideal fovea, with an white arrow indicating the amphideal pore, dorsal view; D, head region, anterior view; E, cephalic setae enclosed by a thin membrane; F, distal end of cephalic setae, split and enclosed by a thin membrane. Scale bars: 100 μ m in A; 10 μ m in B; 5 μ m in C-E; 500 nm in F.

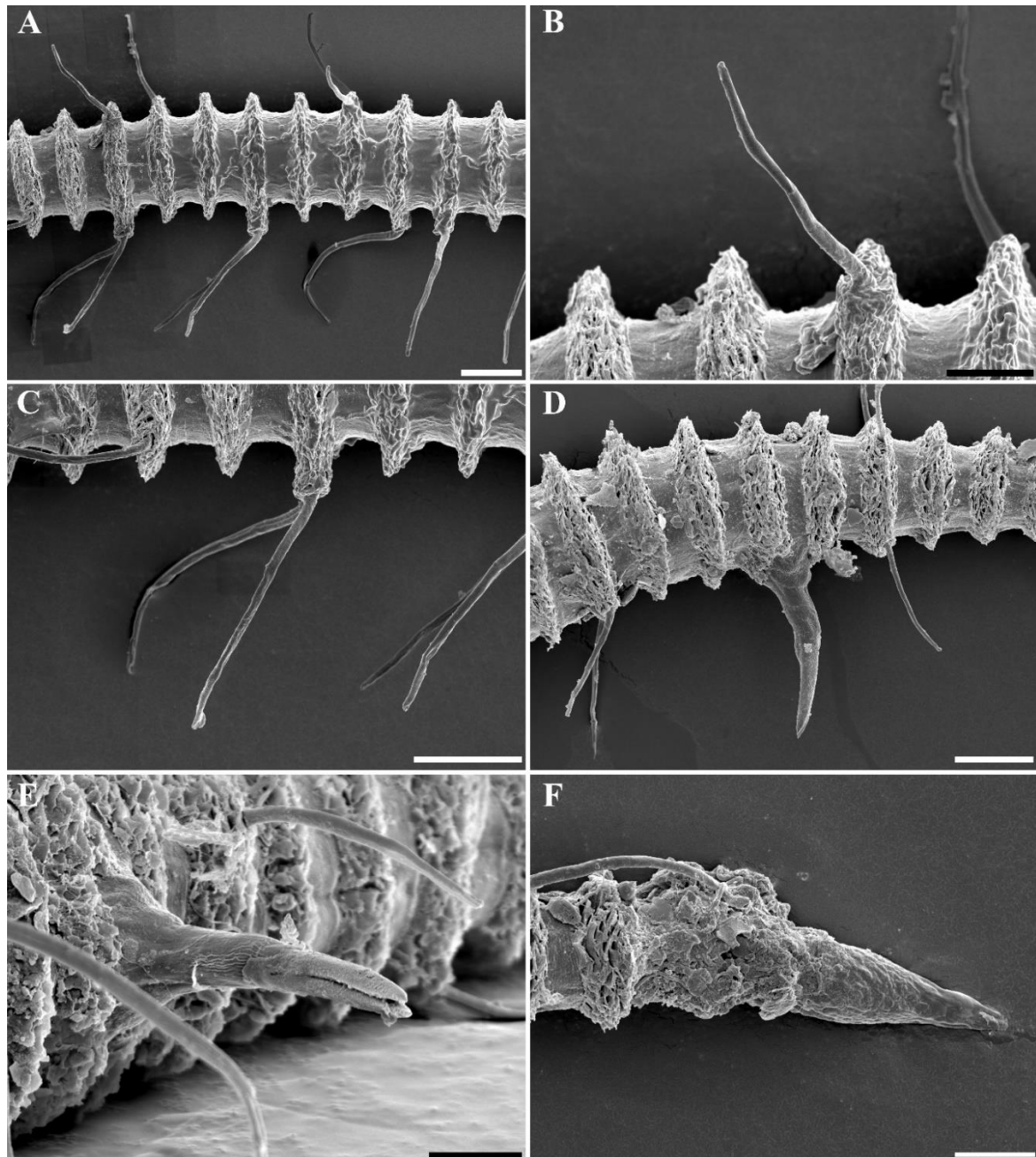


Figure 5. *Tricoma (Tricoma) disparseta* sp. nov. SEM photomicrographs, male. A, cuticular layer showing the height difference between the dorsal and ventral peduncles; B, subdorsal setae; C, subventral setae appearing with curved tip; D, spicules region, lateral view; E, spicules region, anterior view; F, terminal ring. Scale bars: 10 μm in A, C, D; 5 μm in B, E, F.

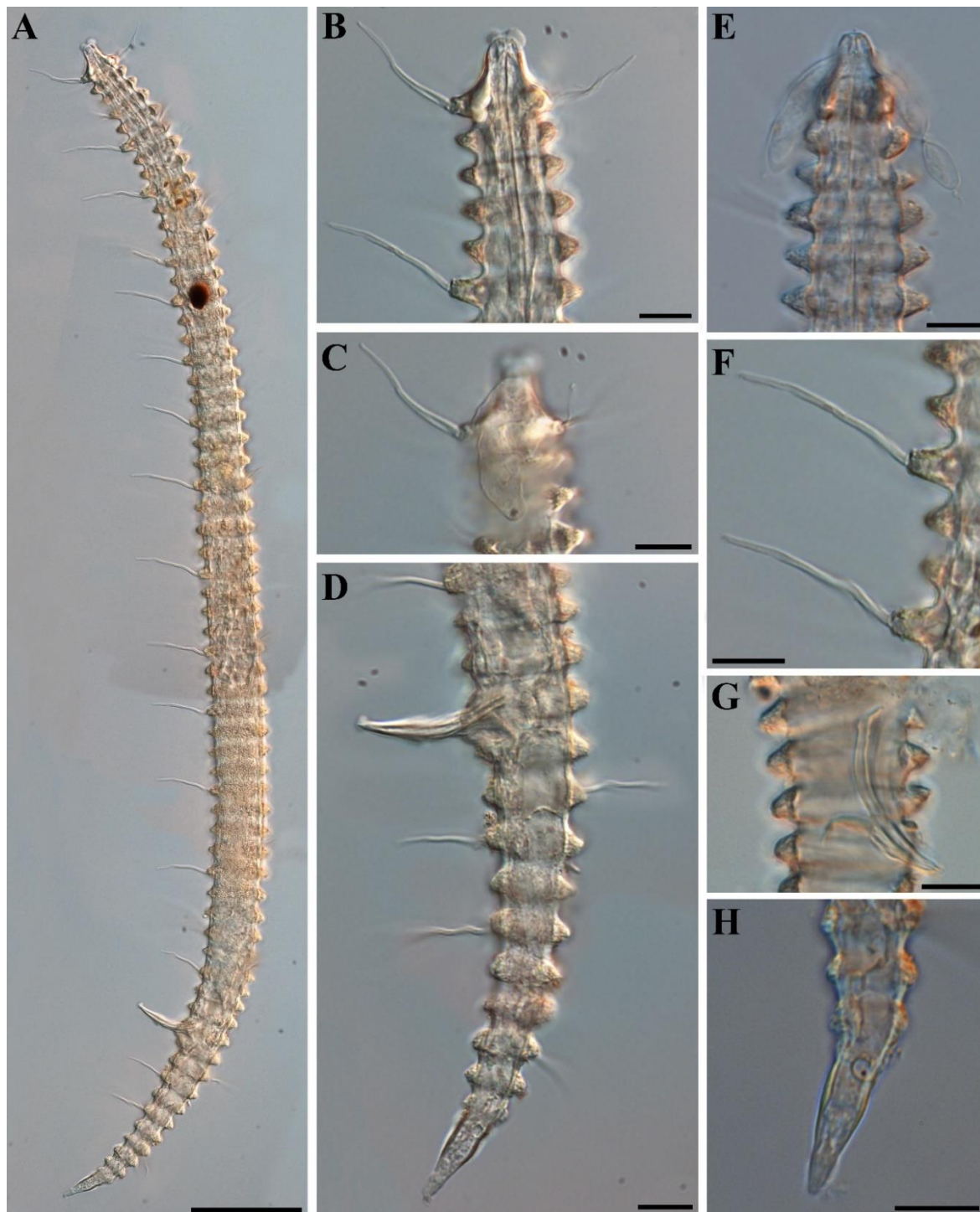


Figure 6. *Tricoma (Tricoma) disparseta* sp. nov., DIC photomicrographs, Holotype male (MNB001). A, entire view of body; B, anterior region; C, amphideal fovea; D, posterior region; E, head region, ventral view (Paratype MNB006); F, somatic setae; G, spicules and gubernaculum of the specimen treated with lactic acid, which was additionally used to increase transparency for the observation of internal reproductive organs (Paratype MNB003); H, terminal ring showing phasmata (Paratype MNB004). Scale bars: 50 μ m in A; 10 μ m in B-H.

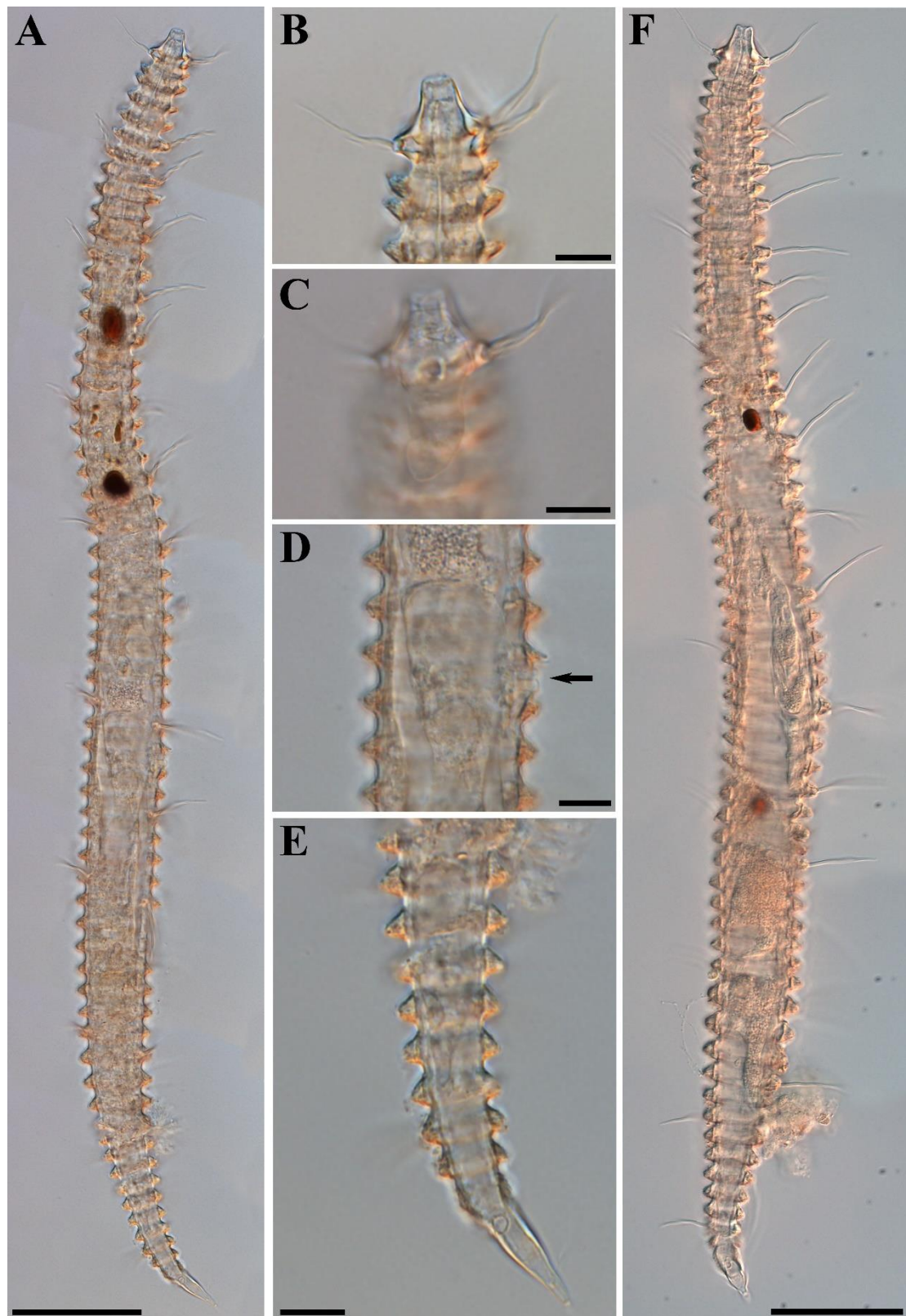


Figure 7. *Tricoma (Tricoma) disparseta* sp. nov., DIC photomicrographs, Allotype female (MNB007). A, entire view of body; B, head region; C, amphideal fovea; D, midbody region showing naked vulva; E, posterior region; F, entire view of body showing somatic setae (Paratype MNB008). Scale bars: 50 μ m in A, F; 10 μ m in B-E.

Table 2. Morphometric measurements of *Tricoma (Tricoma) disparseta* sp. nov. (in micrometers, μm).

	Holotype male	Paratype male 1	Paratype male 2	Paratype male 3	Paratype male 4	Allotype female	Paratype female 1	Paratype female 2	Paratype female 3
Total body length	571	613	527	551	556	543	490	575	543
Number of body ring	v:60 d:61	59	60	60	v:60 d:61	v:60 d:61	v:62 d:61	60	61
a	19	18	15	18	16	16	12	14	18
b	6	6	6	6	6	6	7	7	6
c	6	6	6	6	6	7	7	7	6
Head length	16	17	15	18	17	16	15	17	15
Head diameter at the level of cephalic setae	21	20	20	19	21	19	21	21	19
Body diameter at the level of cardia	24	27	25	26	29	28	28	27	25
Maximum body diameter	30	35	34	31	34	35	42	41	31
Cephalic setae length	25	22	28	24	23	22	25	23	22
Amphideal fovea length	25	26	23	26	27	27	27	22	27
Ocelli diameter	8	5	8	7	4	10	7	7	4
Ocelli length	11	5	7	7	13	14	9	4	5
Anterior end to ocelli	123	114	171	108	118	119	148	170	107
Pharynx length	95	97	93	96	94	92	73	88	86
Number of subventral setae (left/right)	17/18	16/17	17/16	18/14	18/17	17/17	17/18	16/16	17/17
Length of the longest subventral setae	32	36	30	34	35	35	34	38	31
Length of the shortest subventral setae	17	18	17	15	17	16	23	22	15
Number of subdorsal setae (left/right)	9/10	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9
Length of the longest subdorsal setae	20	20	19	18	21	19	22	19	18
Length of the shortest subdorsal setae	17	18	17	15	17	12	17	13	13
Spicule length	31	29	32	30	29	-	-	-	-
Gubernaculum length	18	18	16	16	18	-	-	-	-
Anterior end to vulva	-	-	-	-	-	305	301	324	302
Body diameter at level of vulva	-	-	-	-	-	32	37	31	27
V(%)	-	-	-	-	-	56	61	56	56
Anal body diameter	25	29	26	24	27	23	26	26	25
Tail length	96	95	89	92	92	82	71	79	84
Number of tail's body ring	10	9	10	10	10	9	9	8	9
Terminal ring length	23	27	24	26	23	26	24	25	26
Desmos covering terminal ring	7	8	8	7	6	9	9	10	8
Phasmata	2.5	2.5	2.5	2.5	2.9	2.7	2.5	2.8	2.6

Differential diagnosis: *Tricoma (Tricoma) disparseta* sp. nov. is characterized by a distinctive set of features that set it apart from other species. The species possesses 59 to 62 tricomoid main rings, contributing to its unique morphology. The head is triangular, with a width 1.1 to 1.4 times greater

than its length, providing a notable outline. It has slender cephalic setae, which are flanked by a narrow membrane and inserted on raised peduncles, enhancing its sensory capabilities. The somatic setae are composed of 9 to 10 subdorsal setae and 14 to 18 subventral setae on each side. The subventral setae are significantly longer than the subdorsal setae and are inserted at a relatively higher point. These setae exhibit a groove distally, with a step-shaped tip, distinguishing them from other setae. The spicules have a smaller capitulum proximally, while the gubernaculum is notably bent into a hooked shape, adding to the unique sexual morphology. The tail comprises 8 to 10 main rings and terminates in a conical ring. The anterior 26 to 40% of the tail is covered by desmen, and it is marked by rounded phasmata.

Material examined: The holotype male (MNB001), paratype males (MNB002, MNB003, MNB004, MNB005, MNB006), and allotype female (MNB007), along with paratype females (MNB008, MNB009, MNB010), preserved in glycerin on HS slides, are deposited in the nematode collection at the specimen conservation room of the East Sea Research Institute, Korea Institute of Ocean Science & Technology (KIOST), Korea.

Type locality and habitat: The specimens were collected from the seamount area at Deep-Sea Station 2 (17° 02' 47.346" S, 149° 52' 50.484" E) and Station 3 (17° 05' 45.41" S, 149° 55' 07.67" E), situated in the northeastern part of Guam. The collection took place on 6-7 September 2023, conducted by J.M. Lee. Nematodes were retrieved from a sponge and starfish habitat in the deep sea using a suction sampler mounted on a remotely operated vehicle (ROV) at depths of 1,366.6 and 1,510.1 meters.

Etymology: The specific name *disparseta* is derived from the Latin words *dispar* (meaning "unequal") and *seta* (meaning "bristle"), highlighting the marked disparity in length between the subdorsal and subventral setae.

Measurements: All measurement data are provided in Table 2.

Description: Males. The body length ranges from 527 to 613 μm , making it relatively small and slender, tapering towards both ends (Figures 2A, 4A, 6A). The maximum body diameter at the mid-body level measures 30-35 μm .

The holotype male cuticle consists of 60 tricomoid rings ventrally and 61 dorsally, while the paratypes exhibit between 59 to 61 tricomoid rings. The cuticular layer shows secondary annulation, and the desmen are covered with secretions and fine foreign material (Figure 5A).

The head has a diameter of 19-21 μm , being 1.1 to 1.4 times wider than it is long. It tapers anteriorly from the peduncles of the cephalic setae, ending in a truncated shape that is 4-5 μm wide (Figures 2B, 4D, 6B). The anterior margin of the head cuticle is significantly thickened and sclerotized, forming a distinct rim-shaped border, except in the labial region (Figure 2D).

The labial region does not protrude, and each of the six lips bears small labial papillae. The cephalic setae measure 22-28 μm in length, making them longer than the width of the head. They are inserted on relatively high peduncles that project in front of the posterior head border. These setae taper from a broad cylindrical base toward the tip, with grooves running along their entire length, and are surrounded by a thin membrane that is difficult to observe from a lateral view (Figure 4E). The distal ends of the cephalic setae, enclosed within this delicate membrane, appear to be bifurcated (Figure 4F).

The amphids are large and vesicular, exhibiting an unusual shape that covers the lateral sides of the head. They curve slightly at their base, forming a cylindrical structure. The amphid pore is prominent and positioned at the posterior end of the head (Figure 4C). The amphids extend anteriorly toward the labial region and posteriorly to the main ring 2 or 3 (Figures 2C, 6C, 6E).

The stoma is small and cylindrical, approximately 3 μm deep. The esophagus is also cylindrical, measuring 93-97 μm in length, which constitutes about 16-18% of the total body length. It is surrounded by a nerve ring at the level of main rings 5 and 6. The esophagus-intestinal junction is located between main rings 10 and 11, corresponding to a body diameter of 24-29 μm . The ocelli are large and dark yellowish, measuring 4-8 μm in width and 5-13 μm in length. They are positioned opposite main ring 14 in the holotype and rings 12-14 or 20-24 in the paratypes. Smaller pigment spots are present along the pharynx.

Somatic setae are arranged in two distinct groups on the subdorsal and subventral sides of the body (Figure 5A). The subdorsal setae are slender and approximately half the length of the subventral setae, being mounted on relatively low peduncles (Figure 5B). In contrast, the subventral setae are longer and display a stepped appearance at the tip in optical sections (Figure 6F), and they are inserted into relatively high peduncles (Figure 5C). The subventral setae of the most anterior main ring 3 and those around the cloacal region are shorter than the other setae, gradually increasing in length toward the middle of the body. While the difference in length between the subdorsal and subventral setae in the anterior and caudal regions of the body is not substantial, it becomes approximately twofold in the central region. The somatic setae are arranged in 9 to 10 subdorsal setae and 14 to 18 subventral setae on each side, measuring 15–36 μm and 15–21 μm in length, respectively. The anterior-most pair of setae on main ring 3 is positioned laterally (Figure 2B, C). Additionally, the subventral setae located second in front of the cloacal opening and the terminal subventral setae are inserted slightly laterally (Figures 2F, 4B). In most specimens—excluding paratype male 2—the subventral setae situated on rings 44–46 (the second setae anterior to the cloacal opening) were the longest, measuring 32–36 μm . Observing the length of the setae can be challenging depending on the specimen's position or angle, which may lead to measurement errors. The somatic setae are inserted almost directly into the peduncle cuticular rings, and some setae may be severed or damaged. The arrangement of the somatic setae in the holotype male is as follows:

subdorsal	left side:	5,10,17,23,31,41,47,53,58	= 9
	right side:	6,10,15,19,23,33,39,46,53,59	= 10
subventral	left side:	3,5,8,12,14,17,20,23,27,31,34,38,42,45,47,53,55	= 17
	right side:	3,5,8,11,14,16,20,23,26,29,32,36,39,42,45,47,52,55	= 18

The arrangement of the somatic setae in the paratype males are as follows (numbers in brackets indicate different positions in the paratype):

subdor sal	left side:	5(4),9(10),17,24(22,23),32(31),41(39),48(45,46,47),52(51,53),58(57)	= 9
	right side:	5,9(10),18(17),23(25),31(30),39(38),48(46),53(51,52),58(57)	= 9
subven tral	left side:	3,5,8(7),11(9),13(12),16(14),18(17,19),21(20,22),24(23,25,26),28(27),32(30,31),36(33,34,35),40(38,39),43(41,42),46(45),48,53(52),55(54)	= 18(16, 17)
	right side:	3,5,8(7),11,14(13),17(16),20(19),24(22,23),27(26,28),32(29,30),35(34),39(37,38),42(41),45(44),48,53(52),55	= 17(14, 16)

The reproductive system typically contains two testes. The spicules measure 29–32 μm in length and are slightly curved, tapering distally to a pointed tip, with a relatively small capitulum at the proximal end (Figures 5D, E, 6D). The gubernaculum is hook-shaped, measuring 16–18 μm in length. Its distal side runs parallel to the spicules and exhibits a noticeable curvature, forming a hook shape in the proximal third and at the distal end. The distal portion of the gubernaculum is sclerotized and tapered, culminating in a pointed apex (Figures 2E, 6G).

The tail consists of 9–10 main rings, measuring 89–96 μm in length. The terminal ring is conical and features a slightly thicker cuticle, with the exception of the terminal spinneret. The anterior 26–33% of the terminal ring is covered with debris, while the distal end remains bare and clean (Figures 2F, 5F, 6H). Circular phasmata, measuring 2.5–2.9 μm in diameter, are located beneath the desmos of the terminal ring.

Females. They closely resemble males in most respects, apart from their sexual characteristics (Figures 3B, C, 7B, C). The body length ranges from 490 to 575 μm , with a maximum diameter of 31 to 42 μm . The cuticle of the allotype female consists of 60 tricomoid rings ventrally and 61 dorsally, while the paratypes possess 60 to 62 tricomoid rings. These rings are adorned with secretions and fine foreign material (Figures 3A, 7A). The somatic setae are arranged in 9 pairs of subdorsal setae and 16 to 18 subventral setae on each side (Figure 7F).

The arrangement of the somatic setae in the allotype female is as follows:

subdorsal	left side:	6,11,18,23,32,42,47,53,59	= 9
	right side:	6,11,18,24,32,40,47,53,59	= 9
subventral	left side:	4,5,8,10,12,15,19,22,25,29,33,37,41,45,49,52,55	= 17
	right side:	4,5,7,10,13,15,18,22,25,29,33,37,41,44,48,51,55	= 17

The arrangement of the somatic setae in the paratype females are as follows (numbers in brackets indicate different positions in the paratype):

subdorsal	left side:	7(6),11,17(18),24(23),32,40(42),47(48),53,59(58)	= 9
	right side:	6,11,18(19),23(24,26),32(33),40,48(47),54(53),59(58)	= 9
subventral	left side:	4(3),5,8,11(12),14(15),16,19(20),22(23),25(26,27),29(30,31),33(34,35),37(38,39), 41(42),44(45),49(48),55(51,53),57(56)	= 17(16)
	right side:	4(3),5,7(8),9(10,11),12(13),14(15),16(18),20(21),22,25(24),29(28),34(33),38(37), 42(41),45,49(48),52(51),57(56)	= 18(16,17)

The reproductive system is didelphic, with both branches fully extended. The vulva is situated in the bare medioventral part of the body wall, positioned between main rings 39 and 40 in the allotype (between rings 38 and 40 in the paratypes) (Figures 3D, 7D). The uteri may contain large and small amorphous inclusions, or may be devoid of them.

The tail consists of eight to nine main rings, measuring 71–84 µm in length. The terminal ring measures 24–26 µm in length and 10–12 µm in maximum width (Figure 3E). The terminal ring is conical, with the anterior 31–40% covered by desmos, while the remaining region is bare (Figure 7E). Circular phasmata, with a diameter of 2.5–2.8 µm, are located beneath the desmos of the terminal ring.

Discussion. The subgenus *Tricoma* was first described by Cobb in 1894, and to date, 87 species have been documented worldwide. However, only a limited number of researchers have extensively reported on these species. Decraemer (1978, 1979, 1983, 1987, 1996), Decraemer & Tchesunov (1996), and Soetaert & Decraemer (1989) collectively described 35 species, while Timm (1970, 1978) contributed the documentation of an additional 15 species [17–26]. Together, these contributions account for approximately 57% of the known species within the subgenus. In 1978, Decraemer made a significant contribution by describing 12 new species, one subspecies, and five previously recorded species from the Great Barrier Reef in Australia. This finding highlights the high level of species diversity within *Tricoma* in a single region. Despite the distinctive ringed body shape that sets *Tricoma* apart from other taxa, there has been relatively little research focused on comparative traits within the subgenus. Consequently, taxonomic studies on *Tricoma* have been limited over the past two decades, with few updates since Decraemer & Tchesunov reported two new species in 1996 [23]. Recently, however, four new species and two previously unrecorded species have been discovered in the East Sea of Korea, leading to the compilation of a literature-based species list for the subgenus *Tricoma* [9].

In 1975, Freudenhammer proposed a key for comparing characters within the subgenus *Tricoma*, categorizing it into three groups: Group A, species with prominent features in the setae; Group B, species with characteristics in the desmen, such as spines, hook-like appendages, or a tiled structure without foreign material; and Group C, species lacking distinctive features in either the setae or the desmen [27]. Group C was further subdivided into three subgroups based on the number of main rings: 36 to 40 desmens, 50 to 64 desmens, and 67 to 140 desmens. However, Decraemer (1978) later revised this classification, organizing species into six groups based on the number of main rings: 30 or fewer, 30 to 49, 50 to 60, 61 to 75, 76 to 100, and more than 100 [17]. This classification provides a more nuanced framework for grouping *Tricoma* species according to their main ring count, serving as a valuable taxonomic tool for preliminary species identification, despite the considerable variability in main ring numbers observed within the subgenus.

The newly described *Tricoma (Tricoma) disparseta* sp. nov. exhibits 59 to 62 main rings, placing it within the category of species characterized by 50 to 64 main rings, according to Freudenhammer’s classification system. This range of main rings is considered a key diagnostic feature within the subgenus *Tricoma*. Currently, twenty species are classified under this category, which serves as an essential criterion for distinguishing between closely related taxa. The species included in this group are: *Tricoma (Tricoma) absidata* Timm, 1970; *T. (T.) absidata lizardiensis* Decraemer, 1979; *T. (T.) atlantica*

Freudenhammer, 1975; *T. (T.) bipapillata* Decraemer, 1987; *T. (T.) capitata* Decraemer, 1987; *T. (T.) coralicolla* Decraemer, 1987; *T. (T.) denticulata* Timm, 1970; *T. (T.) dimorpha* Decraemer, 1978; *T. (T.) dimorpha papuensis* Decraemer, 1987; *T. (T.) fisher* Timm, 1970; *T. (T.) goldeni* Decraemer, 1978; *T. (T.) longirostris* (Southern, 1914); *T. (T.) oblita* Blome, 1982; *T. (T.) paratimmi* Decraemer, 1987; *T. (T.) perpavula* Timm, 1970; *T. (T.) secunda* Blome, 1982; *T. (T.) spinosoides* Chitwood, 1951; *T. (T.) spuria* Inglis, 1968; *T. (T.) steineri* de Man, 1922, and *T. (T.) ulleungensis* Lee, Lee & Rho, 2023.

In this study, we provide a pictorial identification key and a comparative table of diagnostic morphological characters for species groups possessing 50 to 64 main rings (Figure 10, Table 3). The diagnostic features highlighted in these tools primarily focus on the morphology of the anterior head and posterior tail regions, with particular emphasis on the spicules and gubernaculum, which are crucial taxonomic traits for differentiating closely related nematode species. The morphological comparison table draws on data from the original species descriptions, providing a comprehensive summary of the key morphological traits that distinguish members of this species group. This approach facilitates a clear presentation and comparison of each species' unique features. For *T. (T.) spuria*, the information is derived from detailed reobservations of the type specimen, as documented by Decraemer (1981).

The newly discovered species, *Tricoma (Tricoma) disparseta* sp. nov., was found in sediment washings from habitats associated with sponges and starfish on a seamount located in the northeastern region of Guam. This species is distinguished by the presence of 59 to 62 main rings, a triangular head bearing elongated cephalic setae, and amphids that extend posteriorly to main ring 2 or 3. The somatic setae are arranged in 9 to 10 subdorsal setae and 14 to 18 subventral setae on each side, with the subventral setae being notably longer and inserted at a higher point than the subdorsal setae. Moreover, the species is characterized by a gubernaculum that curves into a distinctive hooked shape, further differentiating it from other congeners.

Within the subgenus *Tricoma*, only one specie, *T. (T.) coralicolla* Decraemer, 1987, among the 20 species with 50 to 64 main rings, exhibits a significant difference in the length of subdorsal and subventral setae. *T. (T.) disparseta* sp. nov. closely resembles *T. (T.) coralicolla* in this regard, particularly due to its subventral setae being approximately twice as long as the subdorsal setae, and the peduncles of the subventral setae being more prominently developed. *T. (T.) coralicolla* was originally discovered in overgrown dead coral habitats in Papua New Guinea. Despite the limited sample size, only two specimens (one male and one female), preventing a thorough assessment of variability in main ring count or seta pattern, *T. (T.) disparseta* sp. nov. can be clearly distinguished from *T. (T.) coralicolla* by the following characteristics: (1) total body length (490–613 µm vs. 185–220 µm in *T. (T.) coralicolla*); (2) number of main rings (59 to 62 vs. 56 to 58 in *T. (T.) coralicolla*); (3) arrangement and number of somatic setae (9 to 10 subdorsal setae and 14 to 18 subventral setae compared to 9 subdorsal setae and 11 to 12 subventral setae in *T. (T.) coralicolla*); (4) the extension of amphids to the 2nd or 3rd main rings (in contrast to *T. (T.) coralicolla*, where the amphids reach only the margin of the head); and (5) a gubernaculum with a distally curved, hooked shape, as opposed to the gubernaculum of *T. (T.) coralicolla*, which features two dorso-caudally oriented apophyses. These distinguishing features highlight the unique morphological traits of *T. (T.) disparseta* sp. nov., despite its superficial resemblance to *T. (T.) coralicolla* in seta morphology.

Tricoma (Tricoma) longirostris (Southern, 1914) (Figures 8 and 9, Table 3)

Desmoscolex longirostris Sourhern, 1914, p. 62, Figure 29A-D.

Tricoma longirostris: Steiner, 1916, p. 33.

Tricoma glutinosa Steiner, 1916 p. 340, Figure 13; Freudenhammer, 1975, p. 25; Decraemer, 1983, p. 16.

Tricoma septentrionalis Timm, 1978, p. 233, Figure 4EH; Decraemer, 1983, p. 16.

Material examined: The examined material comprised one male specimen (MNB011), which was mounted in anhydrous glycerin between two coverslips on an HS slide. This specimen is deposited in the nematode collection housed in the specimen conservation room of the East Sea Research Institute at the Korea Institute of Ocean Science & Technology (KIOST), Korea.

Type locality and habitat: The designated location is a seamount area in the deep sea, situated at coordinates 15° 38' 20.93" S, 151° 59' 50.35" E, in northeastern Guam. The specimen was collected

on September 1, 2023, by J.M. Lee. The nematodes were retrieved from sediment in the deep sea using a suction sampler mounted on a remotely operated vehicle (ROV) at a depth of 1425.52 meters.

Description: Male. The body measures 808 μm in length and is relatively slender and elongated, tapering towards both ends. The maximum body diameter at the mid-body level is 30 μm . The cuticle is composed of 78 tricomoid rings, with the desmen covered in secretion and fine foreign material (Figures 8A, 9A).

The head is narrow and triangular in shape when viewed from the side, measuring 28 μm in width and 26 μm in height (Figure 8B). It tapers anteriorly from the peduncles of the cephalic setae, ending in a truncated manner, with the truncated end measuring 5 μm wide (Figure 8B). The edge of the head cuticle is thickly hardened, except in the labial region, and it gradually thickens towards the peduncle of the cephalic setae.

The labial region is inconspicuous, bearing six small labial papillae. The cephalic setae measure 24 μm in length, tapering to a fine, open tip, and are inserted on high peduncles. Each seta features a cuticular groove along its side and is enclosed by a thin membrane, which is challenging to observe from a lateral view.

The amphids are rounded and vesicular in shape, measuring 22 μm in width and 20 μm in height (Figure 9C). They cover the entire head region except for the labial area and extend to the posterior border of the head.

The stoma is small and cylindrical, measuring approximately 3 μm in depth. The esophagus is also cylindrical, with a length of 101 μm . It is surrounded by a nerve ring at the level of main rings 5. The esophagus-intestinal junction occurs between main rings 9 and 10, with a corresponding body diameter of 29 μm . The ocelli are very large and brownish, measuring 8-9 μm in width and 23-24 μm in length. They are positioned opposite main rings 12-13 and 14-16, respectively. Additionally, smaller pigment spots are present along the pharynx.

The somatic setae are slender and taper towards the tip, inserted into peduncles surrounded by concretions (Figure 9E). They gradually increase in length towards the middle of the body, with an overall length ranging from 14 to 22 μm . The subventral setae on the most anterior main ring (4 or 5) measure 8-11 μm , while those around the cloacal region range from 10 to 14 μm , both being shorter than the other setae. The somatic setae consist of 13 or 14 subventral setae and 8 subdorsal setae on each side, measuring 8-22 μm and 14-21 μm , respectively. The anterior-most pair on main rings 4 or 5 is sublaterally inserted. The somatic setae are nearly directly inserted into the peduncle cuticular rings, and some of the setae may be severed or damaged.

The arrangement of the somatic setae in the male is as follows:

subdorsal	left side:	7,14,20,28,40,50,57,67	= 8
	right side:	7,15,21,28,38,51,59,70	= 8
subventral	left side:	4,7,12,17,22,29,36,43,49,54,62,68,72	= 13
	right side:	5,7,11,16,19,24,30,36,43,48,54,61,68,71	= 14

The reproductive system is characteristic of the genus. The distal end of the vas deferens is flanked by fine granular ejaculatory glands. The spicules measure 28 μm in length, are arcuate, and taper distally, featuring a proximal capitulum (Figure 9D). The gubernaculum, measuring 16 μm in length, is a distally sclerotized structure that runs parallel to the spicules. The dorso-caudally proximal part, marking the end of the sclerotized area, is distinguished by the presence of a conspicuous knob (Figure 8C).

The tail consists of 12 main rings, measuring 125 μm in length. The terminal ring is conical, with a length of 38 μm and a slightly thicker cuticle. The anterior 39% of the terminal ring is covered with debris, while the distal end remains bare. Circular phasmata, measuring 3 μm in diameter, are located on the desmos of the terminal ring (Figures 8D, 9F).

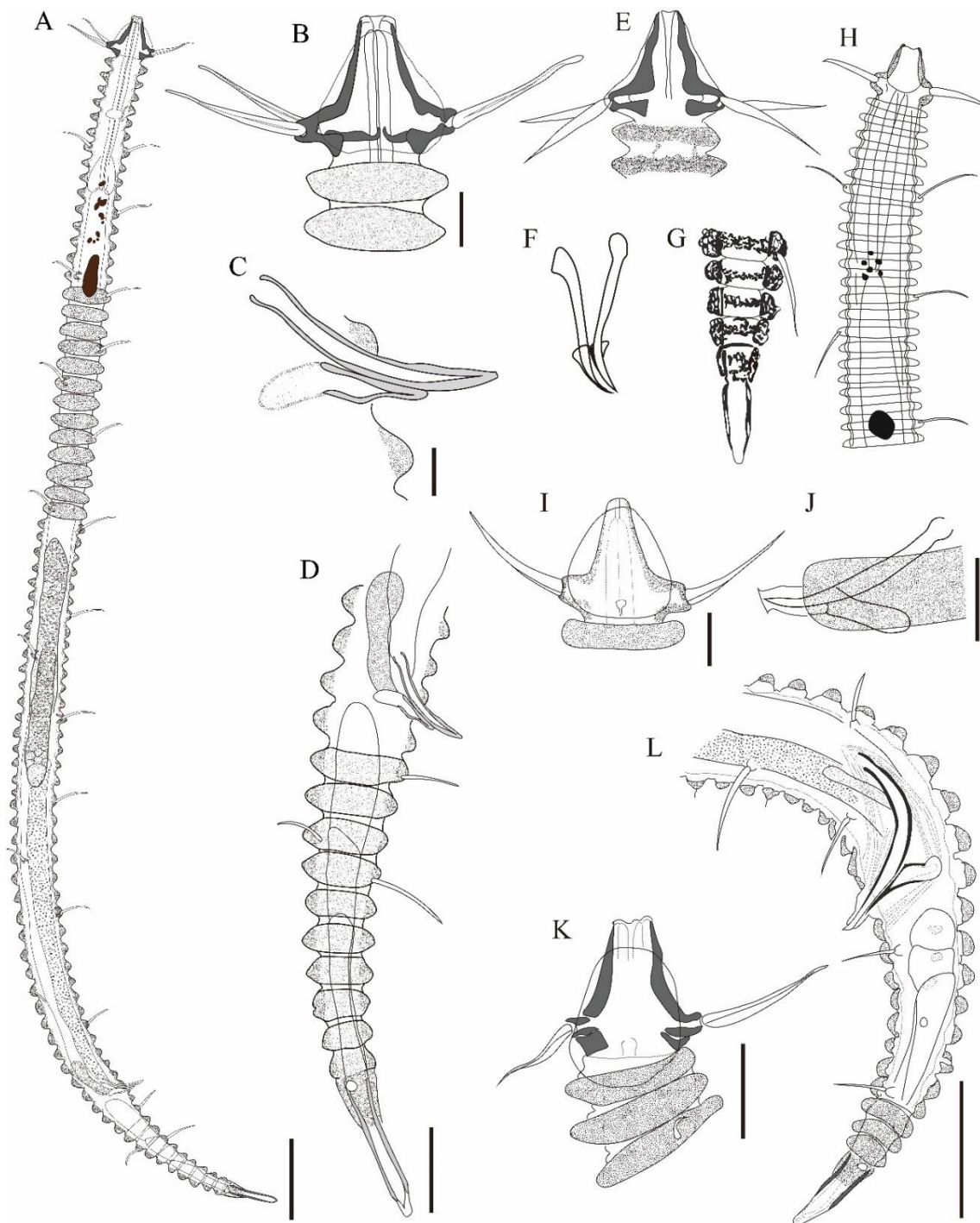


Figure 8. *Tricoma (Tricoma) longirostris* (Southern, 1914), newly discovered in this study, male (A-D). A, habitus, lateral view; B, head region, lateral view; C, spicules and gubernaculum; D, spicule and tail region. *T. (T.) longirostris* (Southern, 1914) from the original description, male (E-G). E, head, dorsal view; F, spicules and gubernaculum; G, tail region (after Southern, 1914). *T. (T.) glutinosa* Steiner, 1916, male (H). H, anterior end (after Steiner, 1916). *T. (T.) septentrionalis* Timm, 1978, male (I-J). I, head region; J, specular apparatus (after Timm, 1978). *T. (T.) longirostris* (Southern, 1914), male (K-L). K, head, surface view; L, copulatory apparatus and tail (after Decraemer, 1983). Scale bars: 50 μ m in A; 30 μ m in L; 15 μ m in K; 12 μ m in I-J; 10 μ m in B-D.

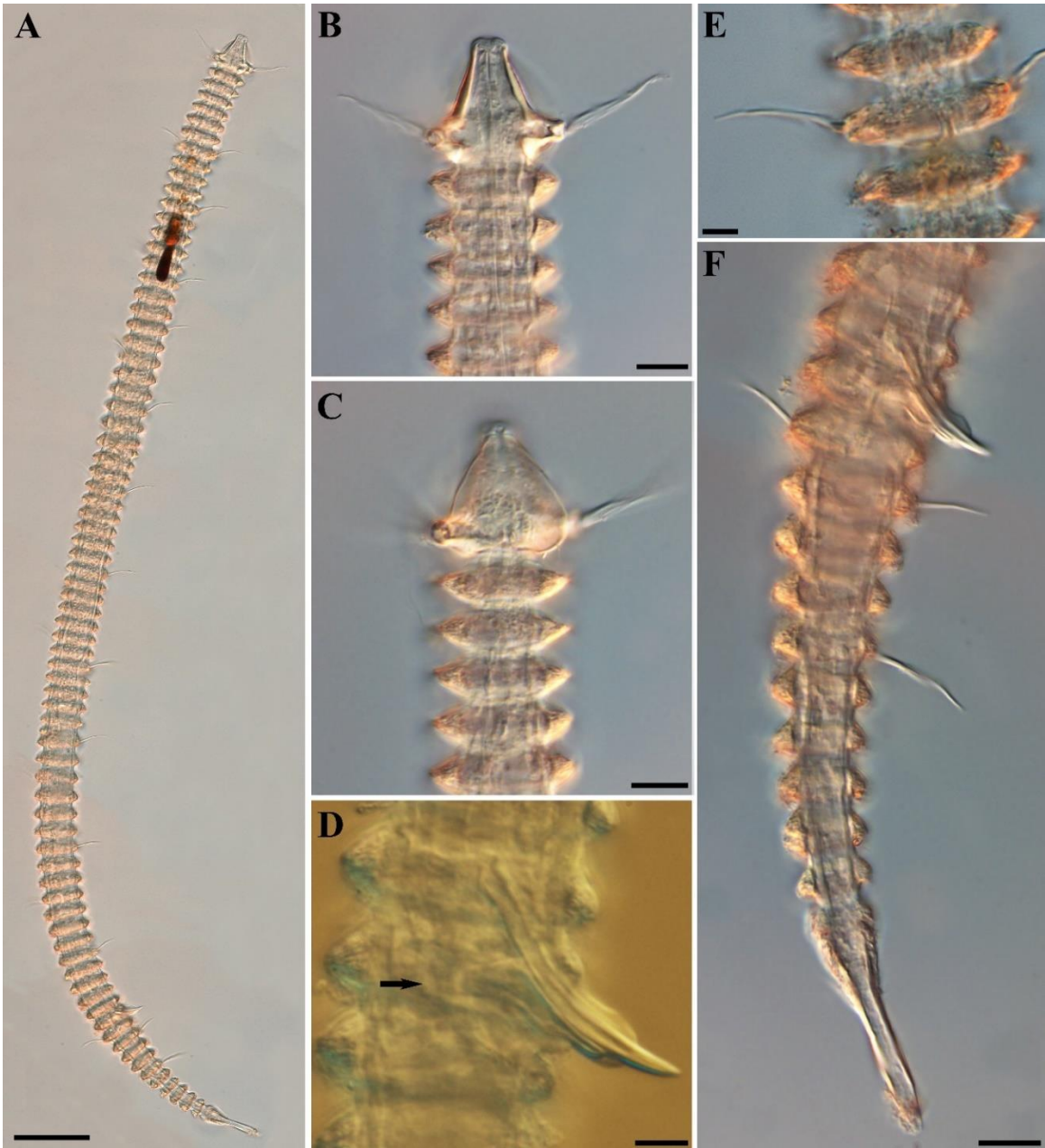
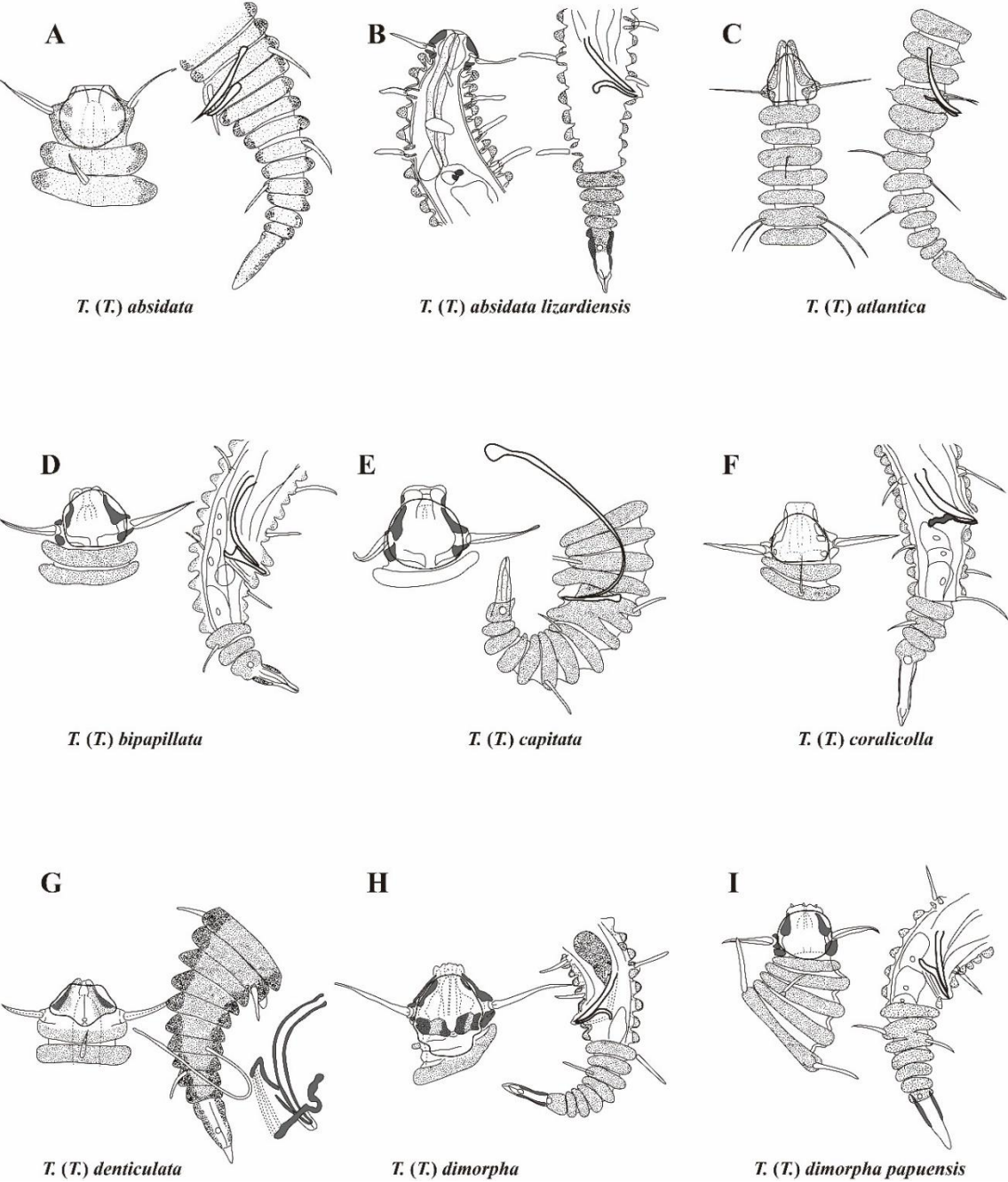


Figure 9. *Tricoma (Tricoma) longirostris* (Southern, 1914), DIC photomicrographs, male. A, entire body view; B, head region; C, amphideal fovea; D, spicules and gubernaculum showing a knobbed apophysis; E, common forms of somatic setae; F, tail region. Scale bars: 50 μm in A; 10 μm in B-F.

Group with 50-64 main rings



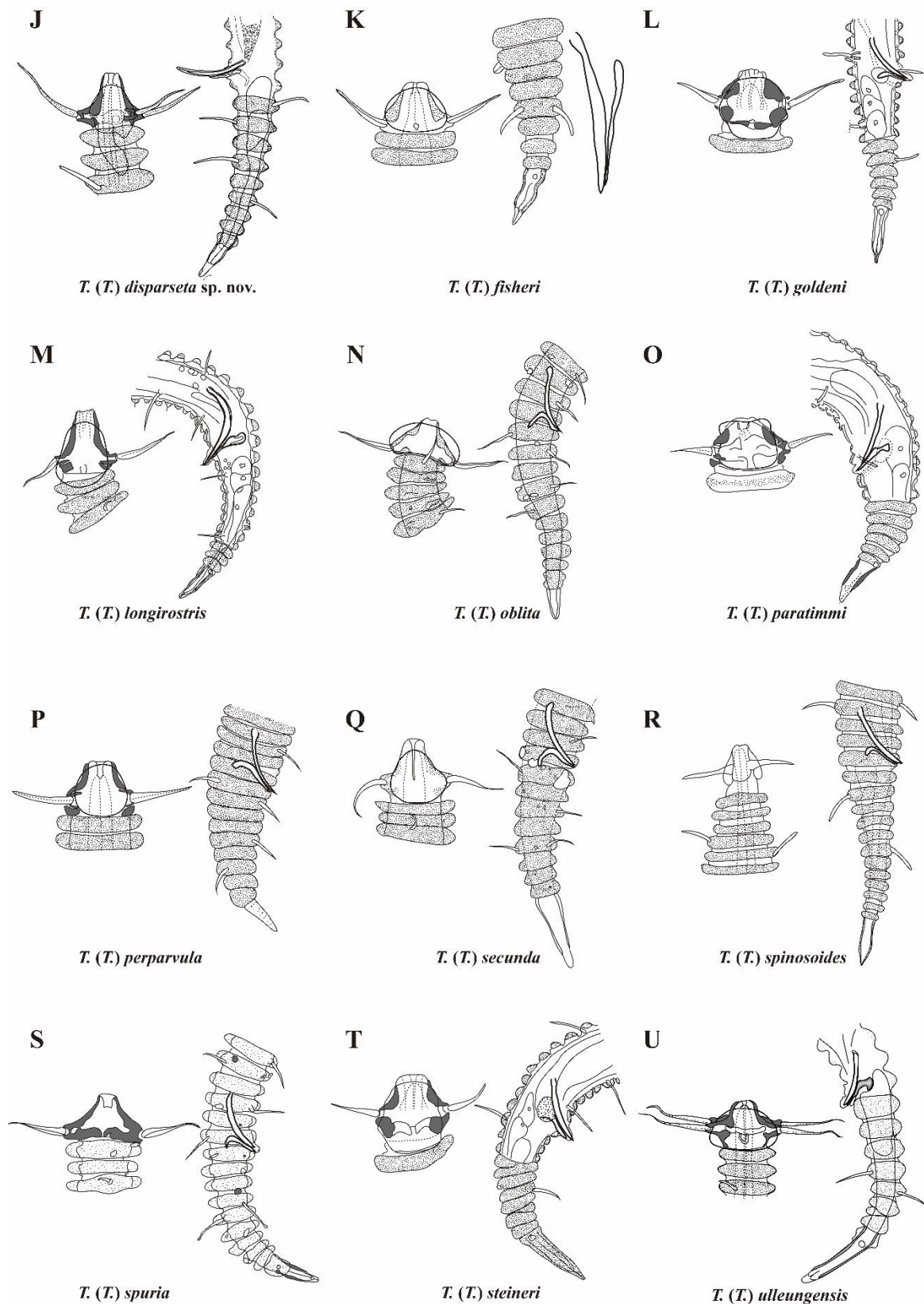


Figure 10. Pictorial key to the species group with 50 to 64 main rings in the subgenus *Tricoma*. Source of figures: A, Timm (1970); B, Decraemer (1979); C, Freudenhammer (1975); D, Decraemer (1987); E, Decraemer (1987); F, Decraemer (1987); G, Timm (1970); H, Decraemer (1978); I, Decraemer (1987); J, *T. (T.) disparseta* sp. nov.; K, Timm (1970); L, Decraemer (1978); M, Decraemer (1983); N, Blome (1982); O, Decraemer (1987); P, Timm (1970); Q, Blome (1982); R, Chitwood (1951); S, Decraemer (1986); T, Decraemer (1979); U, Lee, Lee & Rho (2023).

Female. Unknown.

Distribution: *Tricoma (Tricoma) longirostris* Southern, 1914) has been documented in a variety of geographic locations, including the Atlantic coast of Ireland [28], the west coast of Africa [29], Antarctica [26], the Mozambique Channel [20], the Bay of Bengal in Indian waters [30], and most recently in the Northwest Pacific Ocean (this study). This broad distribution suggests a high level of adaptability to diverse marine environments across different climatic zones.

Discussion. *Desmoscolex longirostris* was first described by Southern (1914) based on two male specimens from the Atlantic coast of Ireland (Figure 8E-G). Southern's description lacked details on the somatic setae pattern and characterized the species by its wedge-shaped head [28]. Later, Steiner (1916) transferred this species to the genus *Tricoma*, noting that Southern's description was insufficiently detailed to make a definitive assessment [29]. Steiner also described a new species, *Tricoma glutinosa* Steiner, 1916, based on two male specimens from the west coast of Africa (Figure 8H). He distinguished it from *T. longirostris* based on similarities in general habitus and head shape but noted significant differences in the number of main rings (77 vs. 70), body length (250 μm vs. 650 μm), and gubernaculum morphology. However, Freudenhammer (1975) observed that Steiner's description of male individuals of *Tricoma glutinosa* exhibited characteristics typical of the species but considered it a 'species inquirenda' pending further investigation [27]. Subsequently, in 1983, Decraemer noted that the gubernaculum of *T. longirostris* had been depicted in an oblique ventral position, potentially obscuring the complete structure [20]. She also suggested that the two male specimens of *T. glutinosa* might correspond to *T. longirostris*, given the observed variability in the number of main rings and body length between the specimens (Figure 8K, L). In addition to these findings, four male specimens of *T. septentrionalis* collected in Antarctica by Timm in 1978 were also reclassified by Decraemer as *T. longirostris* (Figure 8I, J) [20]. More recently, Ansari, Lyla, and Ajmal Khan (2015) reported *T. longirostris* from the Bay of Bengal continental shelf in Indian waters, based on 35 specimens [30].

A summary of the diagnostic characteristics of various populations tentatively identified as *T. (T.) longirostris* is provided in Table 4. However, apart from the number of main rings, tail rings, and body length, other morphological features are either insufficiently detailed, inconsistent, or exhibit variability. A review of the diagnostic traits described in the available literature suggests that *T. (T.) longirostris* can be recognized by its slender body with 63 to 78 main rings, a long and narrow head shape, the specific arrangement of the somatic setae, and a gubernaculum featuring a stout, knobbed apophysis.

The current specimen of *T. (T.) longirostris* was discovered in sediment collected from a deep-sea seamount in northeastern Guam. Although only a single individual was found, it exhibits key diagnostic features consistent with *T. (T.) longirostris*, including 78 main rings, a long and narrow head, 8 subdorsal and 13 to 14 subventral setae, relatively large pigment spots, and a gubernaculum with a knobbed apophysis. However, this specimen displays slightly shorter cephalic setae relative to the head diameter, which differs from typical observations of the species. Additionally, while Decraemer (1983) described males with spine-like preanal structures, these were not observed in the present specimen [20].

Table 3. Comparison of diagnostic morphological characters among species groups with 50-65 main rings in the subgenus *Tricoma*. Morphometric values are rounded. Values marked with a dash (-) indicate unknown measurements.

Species	Characters													
	males			females			cepha							
	body length	body rings	setae pattern (subdorsal/subventral)	body length	body rings	setae pattern (subdorsal/subventral)	head diameter	head length	lic setae length	spicules length	gubernaculum length	Vulva (ring)	number of tail ring (males)	number of tail ring (females)
<i>T. (T.) absidata</i> Timm, 1970	485-520	57-60	11,12/19,19	510-550	59-60	11,12/17,19	22	16	18-19	42-45	-	27	9-10	9-10
<i>T. (T.) absidata lizardiensis</i> Decraemer, 1979	525-710	55-57	13,13/17,19	540-710	56-60	13,13/21,23	25-29	16-21	21-27	42-48	24-28	24-27	9	8
<i>T. (T.) atlantica</i> Freudenhammer, 1975	450	58	7,7/11,11	490	50	-	18-20	20-22	20-22	26	-	28-29	9	9
<i>T. (T.) bipapillata</i> Decraemer, 1987	185-205	48-55	9/14-15	-	-	-	11-12	8-9	10-11	25-32	12-13	-	7-9	-
<i>T. (T.) capitata</i> Decraemer, 1987	225	55-56	9/12-13	215-260	53-57	9/11-14	11-14	9.5-11	11-14	52	12	34-35	9	6-8
<i>T. (T.) coralicolla</i> Decraemer, 1987	185	56-57	9/12	220	58	9/11	11-13	11	12-14	14	10	33	8	8
<i>T. (T.) denticulata</i> Timm, 1970	645-800	63-64	10/15-17	760	65-66	-	32-39	19-26	20-22	96-104	50-56	43	11-12	9
<i>T. (T.) dimorpha</i> Decraemer, 1978	305-600	52-65	12-13/16-17	400	62-67	13/17	15-20	11-16	15-21	16-27	16-19	27-29	10-12	12-13
<i>T. (T.) dimorpha papuensis</i> Decraemer, 1987	175-210	48-55	9/10-11	180-265	48-56	8-13/11-15	9.5-12	8-11	9-12	14-17	8.5-10.5	26-33	8-11	5-10
<i>T. (T.) disparseta</i> sp. nov.	527-613	59-61	9-10/14-18	490-575	60-62	9/16-18	19-22	15-18	22-28	29-32	16-19	38-40	9-10	8-9
<i>T. (T.) fisheri</i> Timm, 1970	300-360	58-61	8-9/10-17	275-425	58-61	8-11/13-16	18-20	10-14	13-17	26-38	13-29	31-32	8-9	7-8
<i>T. (T.) goldeni</i> Decraemer, 1978	310-320	55-59	12/15-16	-	-	-	14	11	12-13	21-22	13	-	11-12	-
<i>T. (T.) longirostris</i> (Southern, 1914)	650	70	-	-	-	-	32	31	-	-	-	-	-	-
<i>T. (T.) oblita</i> Blome, 1982	477-506	60-63	8-9/15-16	513	63	10/18	25-27	-	21-22	27	11-13	37-38	9-10	-
<i>T. (T.) paratimmi</i> Decraemer, 1987	385-420	61	11-12/16-17	390-450	53-56	8-13/15-17	13-14	20-22	11-16	28-30	17-20	27-29	9	5-6
<i>T. (T.) perparvula</i> Timm, 1970	275	61-62	7,9/13,13	-	-	-	14	11	11	24	9	-	9	-
<i>T. (T.) secunda</i> Blome, 1982	328	56-57	9,9/10, 13	-	-	-	18	-	16	22	8	-	9	-
<i>T. (T.) spinosoides</i> Chitwood, 1951	400	61	10/17	380	-	10/14	-	-	-	26	13	26	-	12
<i>T. (T.) spuria</i> Inglis, 1967	710	62	11/21	735	62	10-11/18-19	27-28	18-21	29	46	31	33	10	9
<i>T. (T.) steineri</i> de Man, 1922	408	66	13/16	432-460	-	-	13.6	12	-	27	-	-	12	-
<i>T. (T.) ulleungensis</i> Lee, Lee & Rho, 2023	409-415	54-55	6-7/10-12	462-567	55-57	6-7/9-10	24-26	14-16	19-22	22-24	11-13	31	8-9	8-9

Table 4. Comparison of diagnostic features among different populations identified as *Tricoma* (*Tricoma*) *longirostris*. Values marked with a dash (-) indicate unknown measurements.

Characters	Southern (1914)	Steiner (1916)	Timm (1978)	Decraemer (1983)	Ansari et al. (2015)	This study
Specimens	2 males	1 male	4 males	2 males	16 males, 19 females	1 male
Body length in male	650	250	780-847	300-420	600-900	808
Body length in female	-	-	-	-	700-1,000	-
Number of body ring	70	77	71-77	63-72	70-78	78
Width of body	39	14	32-39	19-21	44-57	30
Length of head	31	-	25	12-16	-	26
Width of head	32	-	27	15-19	-	28
Cephalic seta	-	-	28-32	17-21	21-23	23
Esophagus ring	-	-	-	11	-	10
Spicule length	-	-	30	32-35	19-23	28
Length of gubernaculum	-	-	-	14-15	-	16
Number of tail rings	-	10	10-11	11-12	-	12
Tail length	-	43	112-119	60-84	-	125
Somatic setae pattern (subdorsal/subventral)	-	-	8-9/12-15	9/12-13	-	8,8/13,14
Length of terminal ring	-	-	22-58	16-23	-	38
locality	Clew bay, Atlantic coast of Ireland, 24 fms, bottom of sand and shells,	Prampram, Gold coast, The west coast of Africa, 9 m	Mcmurdo sound, Antarctica, Hut point, 4457 m, Scott Base, 540 m,	Mocambique Channel	Bay of Bengal continental shelf, southeast coast of India, 30-176 m, sandy silt sediment	Northeastern of Guam, Pacific Ocean, 1425.52 m, sediment

4. Conclusions

This study expands our knowledge of marine desmoscolecoid nematodes in the deep-sea environments of the Northwest Pacific Ocean, specifically off northeastern Guam. Two species belonging to the subgenus *Tricoma* were documented, including the newly described *Tricoma* (*Tricoma*) *disparseta* sp. nov. This new species, collected from sponge and starfish habitats at depths ranging from 1300 to 1500 meters, is distinguished by several unique morphological features, such as 59 to 62 main rings, asymmetrical somatic setae distribution with 9 to 10 subdorsal setae and 14 to 18 subventral setae on each side, and a distinctive curved, hooked gubernaculum. These characteristics set *T. (T.) disparseta* apart from other congeners, highlighting its adaptation to deep-sea habitats. The other species observed in this study, *T. (T.) longirostris*, exhibits morphological features consistent with previously described specimens, such as 78 main rings, a long and narrow head, and a gubernaculum with a knobbed apophysis. The comprehensive documentation of these two species through differential interference contrast microscopy (DIC) and scanning electron microscopy (SEM) provides detailed morphological illustrations and insights into their structural variations. The inclusion of pictorial keys and comparative tables for species with 50 to 64 main rings serves as a valuable taxonomic tool, facilitating the identification and differentiation of closely related species within the subgenus *Tricoma*. These findings contribute to our understanding of the diversity and distribution of deep-sea nematodes and underscore the importance of continued exploration and documentation of marine biodiversity in these remote and understudied habitats.

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