



New records of five *Daptonema* species (Nematoda: Xyalidae) from Indian waters

K.G.M.T. Ansari*, P.S. Lyla and S. Ajmal Khan

Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India.

*Correspondence e-mail: ansari.cas@gmail.com

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Original Article

Abstract

Free-living marine nematodes were collected from the continental shelf region of southeast coast of India during the Cruise no. 260 of FORV *Sagar Sampada*. As many as, 4235 specimens were enumerated belong to one hundred and ninety two nematode species were identified up to species level. Family Xyalidae is the most dominant family and it consist of eighteen species from the study area. Among these, eleven species were identified under the genus of *Daptonema*. Five of these species *Daptonema biggi*, *Daptonema hirsutum*, *Daptonema normandicum*, *Daptonema psammoides* and *Daptonema tenuispiculum* which happen to be first record from Indian waters are described.

Keywords: Free-living marine nematodes, *Daptonema*, continental shelf, India.

Introduction

Free-living marine nematodes constitute as much as 60-90% of the benthic meiofauna (Sajan *et al.*, 2010). While the importance of parasitic nematodes has been recognized for many decades, this is not the case for free-living marine nematodes, especially those of aquatic environments (Heip *et al.*, 1985). An important feature of nematode population is

the large number of species present in any habitat, often an order of magnitude higher than for any other taxon (Platt and Warwick, 1980; Schratzberger *et al.*, 2007); short life span, high fecundity (Vranken and Heip, 1983), represent several tropic levels (herbivores, bacterial feeders and carnivores) and at least some species can be easily cultured (Heip *et al.*, 1985).

To date very few studies have been undertaken on qualitative and quantitative aspects of meiobenthos in Indian waters (Ansari *et al.*, 1980; Harkantra *et al.*, 1980; Ansari and Gauns, 1996; Sulthan Ali *et al.*, 1998; Nanajkar and Ingole, 2007; Sajan and Damodaran, 2007; Anila Kumary, 2008; Sajan *et al.*, 2010; Singh and Ingole, 2011; Ansari *et al.*, 2012a, 2012b). Although the nematodes comprise a large fraction of marine benthic communities, only little information is available on their taxonomy in Indian waters (Timm, 1961, 1967a; Sulthan Ali, 1983; Chinnadurai, 2004; Lilly Cooper, 2005; Chinnadurai and Fernando, 2006a, 2006b; Sivalakshmi, 2007; Annapurna *et al.*, 2012; Ansari *et al.*, 2012c). In this backdrop, the present study was undertaken on the free-living marine nematodes of the southeast continental shelf region and this paper describes five nematode species from the genus *Daptonema* recorded for the first time in Indian waters.

Material and methods

Study area

The study area extends from 10° 34.03' to 15° 14.48' N lat. and from 79° 52.13' to 80° 53.87'E long. in the continental shelf region of the southeast coast of India (Fig.1). Totally 35 sediment samples were collected from the seven transects in the present study (off Singarayakonda, Tammenapatanam, Chennai, Cheyyur, Cuddalore – SIPCOT, Parangipettai and

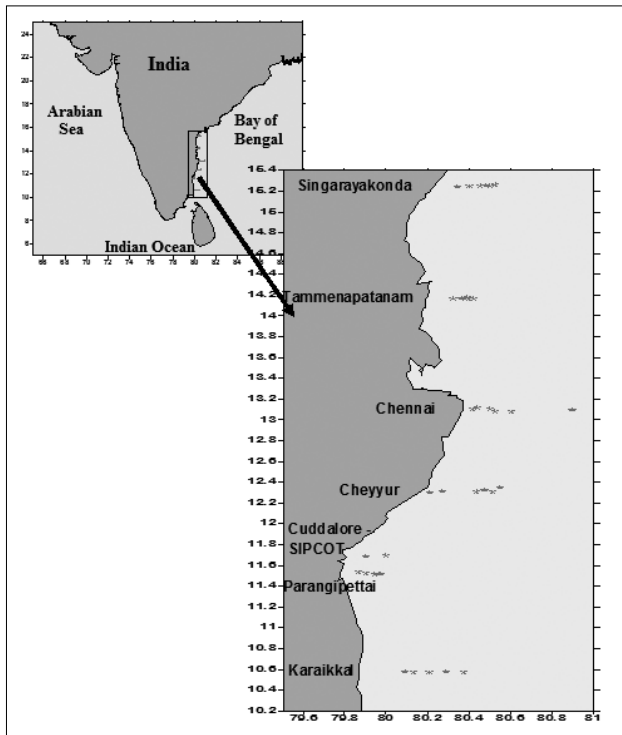


Fig.1. Depths sampled at various transects of southeast coast of India

Karaikkal) at the depths of 30-50 m, 51-75 m, 76-100 m, 101-150 m, 151-175 m and above 176 m.

Sampling

The samples were collected onboard FORV (Fishery and Oceanographic Research Vessel) "*Sagar Sampada*" during Cruise No. 260 (from 7th to 28th December 2008). Two sediment samples were collected using a Smith McIntyre grab (having a bite area of 0.2m²) at each depth range. Immediately after the grab was hauled to the deck, sub-samples were taken from undisturbed grab samples using a glass corer from the middle of grab sample (Platt and Warwick, 1983). The samples were fixed in buffered formalin at a concentration of 4%. Replicate core samples were processed separately in the laboratory and data were pooled for analyses. The samples were washed through a set of 0.5 mm and 0.053 mm sieves. The sediment retained in the 0.053 mm sieve was decanted

to extract meiofauna following the method (Pfannkuche and Thiel, 1988). Sorting of meiofauna from sediment was done by flotation technique (Armenteros *et al.*, 2008). The meiofaunal organisms were stained with Rose Bengal. Sorting and enumeration were under a stereomicroscope (Meiji, Japan). The sorted nematodes were mounted onto glass slides, using the formalin-ethanol-glycerol method followed by Vincx, 1996. Identification of nematodes was done to the highest taxonomic level possible using the compound microscope (Olympus CX 41 under higher magnification of 1000x) following the standard pictorial keys of Platt and Warwick (1983, 1988), Warwick *et al.* (1998) and the NeMys Database by Steyaert *et al.* (2005).

Results

Totally 4235 nematode specimens were isolated and 192 species were identified belonging to 96 genera and 33 families from the southeast coast of India. Family Xyalidae is the most dominant family followed by Desmodoridae (17 species) and Comesomatidae (16 species). It consists of eighteen species, among these, eleven species were coming under genus *Daptonema* and five of these (*Daptonema biggi*, *Daptonema hirsutum*, *Daptonema normandicum*, *Daptonema psammoides* and *Daptonema tenuispiculum*) were found to be new distributional records for the Indian waters. Detailed systematic account, material examined, brief description, feeding type, habitat and geographical distribution besides remarks of the above five species are presented here.

Systematic Account

Phylum	: Nematoda Rudolphi, 1808
Class	: Adenophorea von Linstow, 1905
Order	: Monhysterida Filipjev, 1929
Family	: Xyalidae Chitwood, 1951
Genus	: <i>Daptonema</i> Cobb, 1920

1. *Daptonema biggi* (Gerlach, 1965)

Material examined : Single male collected from Singarayakonda 75 m depth (15.12.2008).

De Man ratio	: a	b	c
Male	: 30.51	3.29	8.56

Description

Body length 1mm. Maximum diameter 33 μ m. Cuticle transversely striated. Six long (5-6 μ m) and four short (3-4 μ m) cephalic setae and somatic setae short, scattered. Large circular amphids (4 μ m). Buccal cavity unarmed simply conical with three poorly cuticularised teeth. Elongated pharyngeal region (303 μ m) but has no distinct bulb. Tail conical (4.4a.b.d.) only

distal eighth cylindrical with terminal setae ($3\mu\text{m}$). Spicules $32\mu\text{m}$ L-shaped, bifurcate distal tip, proximally cephalate. Gubernaculum tubular ($13\mu\text{m}$), no apophysis (Figs. 2 & 3).

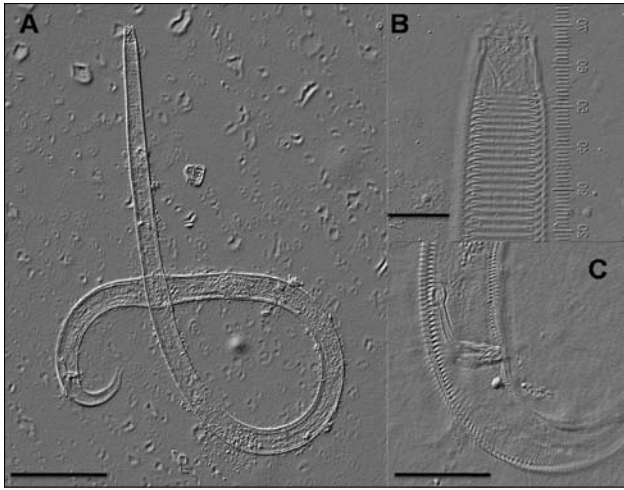


Fig.2. DIC (Differential Interference Contrast) microscopy photomicrograph of *Daptonema biggi* A) entire male, scale bar - $120\mu\text{m}$ B) male head, scale bar - $38\mu\text{m}$ C) male tail, scale bar - $45\mu\text{m}$

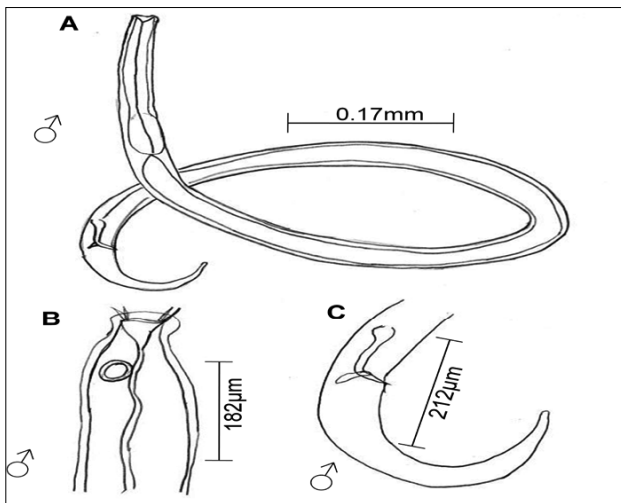


Fig. 3. *Daptonema biggi* A) entire male B) male head, C) male tail

Female: Not found

Feeding type: The specimen showed large buccal cavity that is unarmed with teeth. According to the classification of buccal cavity by Wieser (1953), this species is a non-selective deposit feeder (1B).

Habitat: Silty sediments.

Distribution

India: Singarayakonda.

Global: England (Warwick *et al.*, 1998); North Sea and Spitsbergen (Hansson, 1998). Remarks

The specimens examined conformed well to the earlier description of Warwick *et al.* (1998) except for the larger body size. The total body length described was 0.5-0.9mm and tail length 3.5-5a.b.d. The body length of the specimen studied at present was found larger being 1mm and the tail length 4.4a.b.d. This is the first record of the species from the Indian waters.

2. *Daptonema hirsutum* (Vitiello, 1967)

Synonym: *Theristus (Mesotheristus) hirsutus* Vitiello, 1967

Material examined: Single male collected from Tammenapatanam >176 m depth (16.12.2008).

DeMan ratio	:	a	b	c
Male	:	25.25	5.56	7.21

Description

Body length 1.2 mm. Maximum diameter $49\mu\text{m}$. Cuticle transversely striated. Six long ($150-160\mu\text{m}$) and six short ($13-14\mu\text{m}$) cephalic setae and cervical setae between amphids and cephalic setae ($14\mu\text{m}$). Large circular amphids ($19\mu\text{m}$). Buccal cavity unarmed simply conical with three poorly cuticularised teeth. Elongated pharyngeal region ($222\mu\text{m}$) but has no distinct bulb. Tail distal quarter cylindrical (5.7a.b.d.) with terminal setae ($8\mu\text{m}$). Spicules $44\mu\text{m}$, proximally cephalate, recurved bifurcate distal tip. Gubernaculum with distinct dorsal apophysis (Figs. 4 & 5).

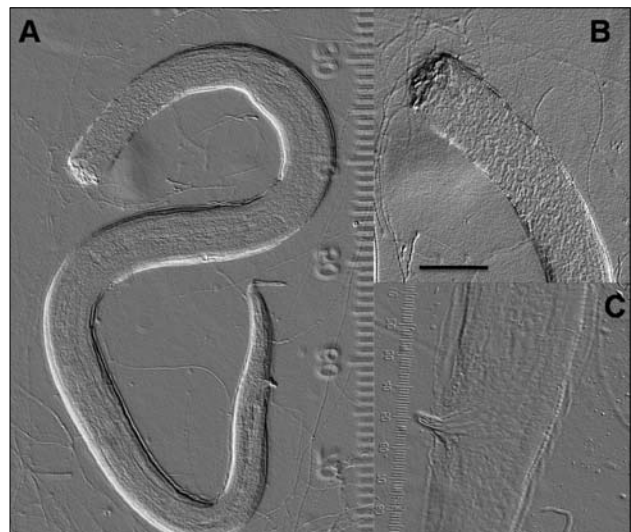


Fig.4. DIC microscopy photomicrograph of *Daptonema hirsutum* A) entire male, scale bar - $90\mu\text{m}$ B) male head, scale bar - $42\mu\text{m}$ C) male tail, scale bar - $38\mu\text{m}$

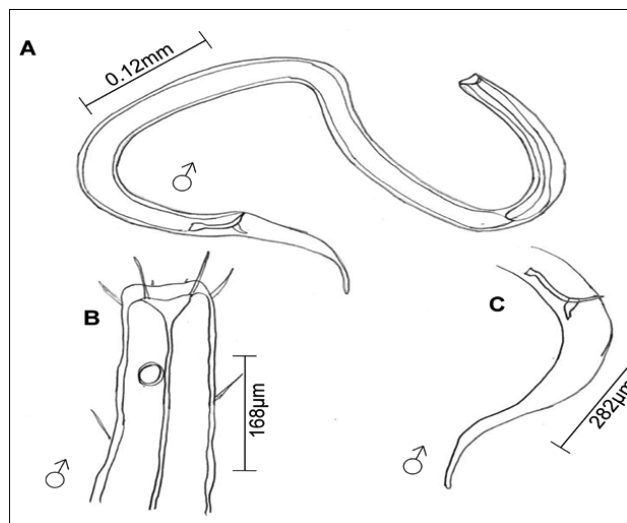


Fig. 5. *Daptonema hirsutum* A) entire male B) male head, C) male tail

Female: Not found

Feeding type: The specimen showed large buccal cavity that is unarmed with teeth. According to the classification of buccal cavity by Wieser (1953), this species is a non-selective deposit feeder (1B).

Habitat : Silty sediments.
 Distribution
 India : Tammenapatanam.
 Global : England (Warwick *et al.*, 1998) and English channel (Hansson, 1998).

Remarks

The specimens examined conformed well to the earlier description of Warwick *et al.* (1998) except for the smaller body size. The total body length described was 1.9-2.1mm and tail length 5a.b.d. The body length of the specimen studied at present was found smaller being 1.2mm and the tail length 5.7a.b.d. This is the first record of the species from the Indian waters.

3. *Daptonema normandicum* (De Man, 1890)

Synonym : *Theristus normandicus* (De Man, 1890)
Monhystera normandica De Man, 1890
Cylindrotheristus normandicus metanidroiensis Gerlach & Riemann, 1973
Monhystera normandicus nidrosiensis Allgen, 1933
Theristus normandicus tenuicaudatus Allgen, 1959

Theristus paranormandicus Timm, 1952
Theristus flevensis Gerlach, 1949
Penzancia normandicus Allgen, 1935

Material examined : 28 males and 14 females collected from Cheyyur 30-50 m, 51-75 m, 76-100 m, 151-175 m, >176 m depths (18.12.2008); Chennai 30-50 m, 76-100 m depths (17.12.2008) and Tammenapatanam 30-50 m, 76-100 m depths (16.12.2008).

De Man ratio :	a	b	c
Male	32.72±0.87 (31.98-33.26)	4.44±0.63 (4.02-4.88)	7.87±0.88 (7.14-8.32)
Female	33.12±0.44 (32.84-33.66)	4.92±0.24 (4.66-5.04)	8.02±0.21 (7.76-8.24)

Description

Body length 1.1-1.7 mm in male and 1.2-1.5 mm in female. Maximum diameter 33-47 µm in male and 32-42 µm in female. Cuticle transversely striated. 14 cephalic setae, four submedian pairs only slightly sub equal. Somatic setae up to 11-14µm in anterior oesophagus region. Large circular amphids (6-8 µm). Buccal cavity unarmed simply conical with three poorly cuticularised teeth. Elongated pharyngeal region (218-242 µm in male and 228-253 µm in female) but has no distinct bulb. Tail distal third cylindrical (5.9-6.3a.b.d. in male and 5.5.-6a.b.d. in female) with terminal setae short. Spicules 32-43 µm measured as curve, strongly cephalate proximally bifurcate distally. Gubernaculum with small dorsal apophysis. Ovaries paired, equal, opposed and reflexed. Vulva present at 59- 65% of body length (Figs. 6&7).



Fig.6. DIC microscopy photomicrograph of *Daptonema normandicum* A) entire male, scale bar - 170µm B) male head, scale bar - 37µm C) male tail, scale bar - 59µm

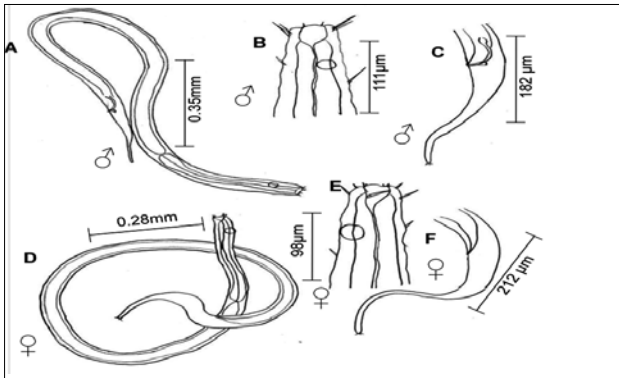


Fig. 7. *Daptonema normandicum* A) entire male B) male head, C) male tail, D) entire female, E) female head, F) female tail

Feeding type: The specimens showed large buccal cavity that is unarmed with teeth. According to the classification of buccal cavity by Wieser (1953), this species is a non-selective deposit feeder (1B).

Habitat: Sandy and silty sandy sediments.

Distribution: India - Cheyyur, Chennai and Tammena patanam.

Global - West Ireland (Hansson, 1998); England (Warwick *et al.*, 1998); European waters (De Smet *et al.*, 2001; Medin, 2011); France Channel, Belgium and Norway (Hansson, 1998); Skagerrak, Kieler Buchat, Zuidersee, Oresund and Kattegatt (Hansson, 1998) and Mediterranean (Gerlach and Riemann, 1974; Hansson, 1998).

Remarks

The specimens examined conformed well to the earlier description of Warwick *et al.* (1998) except for the larger body size. The total body length described was 1.2-1.3mm and tail length 5.1-6a.b.d. The body length of the specimen studied at present was found larger being 1.1-1.7mm and the tail length 5.9-6.3a.b.d. in male and in female 1.2-1.5mm body length and tail length 5.5-6a.b.d. In both the sexes, the width of amphid was found lesser than the previous description. This is the first record of the species from the Indian waters.

4. *Daptonema psammoides* (Warwick, 1970)

Synonym : *Theristus (Trichotheristus) psammoides* Warwick, 1970

Trichotheristus rusticus Kreis, 1929

Trichotheristus psammoides (Warwick, 1970)

Material examined: 4 males and 2 females collected from Cheyyur 51-75 m 76-100 m depths (18.12.2008) and Singarayakonda 76-100 m depth (15.12.2008).

De Man ratio :	a	b	c
Male	51.61±0.12 (51.46-51.72)	5.24±0.09 (5.12-5.34)	5.60±0.18 (5.42-5.81)
Female	50.24-50.36	4.71-4.82	5.80-5.98

Description

Body length 1.6-2.0 mm in male and 1.4-1.8 mm in female. Maximum diameter 33-38 µm in male and 32-35 µm in female. Cuticle transversely striated. Six longer (22-26 µm) and four slightly shorter (16-20 µm) cephalic setae with numerous small setae can be seen. Somatic setae scattered generally over body surface but most numerous in pharyngeal region and tail. Large circular amphids (5-8 µm). Buccal cavity unarmed simply conical with three poorly cuticularised teeth. Elongated oesophagus (359-383 µm in male and 322-325µm in female) but has no distinct bulb. Tail distal third cylindrical (5.9-6.3a.b.d.in male and 5.5-6.1a.b.d. in female) with terminal setae short. Spicules 46-48µm measured as curve, arcuate, cephalate proximally, distinctly hooked distally. Gubernaculum with small rounded dorsal apophysis, a pair of rounded lateral projections distally. Ovaries paired, equal, opposed and reflexed. Vulva present at 59- 64% of body length (Figs. 8&9).

Feeding type: The specimens showed large buccal cavity that is unarmed with teeth. According to the classification of buccal cavity by Wieser (1953), this species is a non-selective deposit feeder (1B).

Habitat: Sandy, silty sediments.

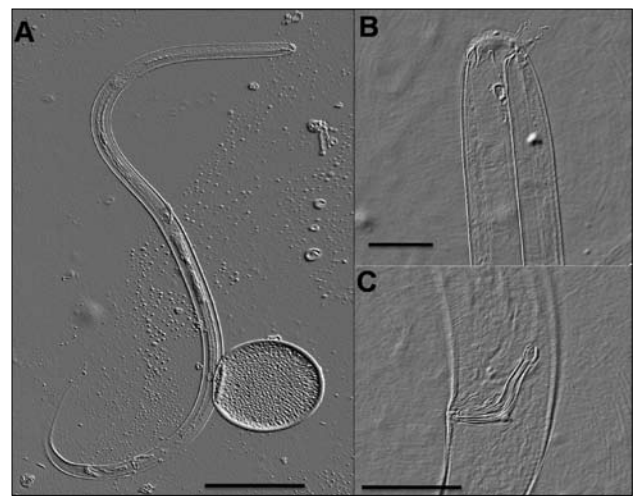


Fig.8. DIC microscopy photomicrograph of *Daptonema psammoides* A) entire male, scale bar - 205µm B) male head, scale bar - 48µm C) male tail, scale bar - 110µm

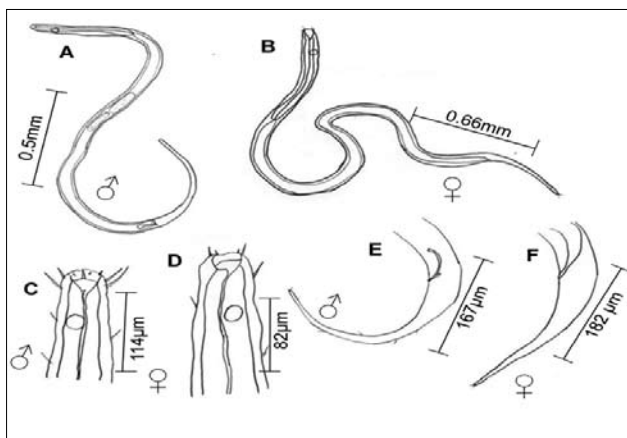


Fig. 9. *Daptonema psammoides* A) entire male B) entire female, C) male head, D) female head, E) male tail, F) female tail

Distribution

India: Cheyyur and Singarayakonda.

Global: England (Warwick *et al.*, 1998); European waters (De Smet *et al.*, 2001) and English Channel (Hansson, 1998).

Remarks

The specimens examined conformed well to the earlier description of Warwick *et al.* (1998) except for the larger body size. The total body length described was 1.1-1.4mm and tail length 3.9-5.5a.b.d. The body length of the specimen studied at present was found larger being 1.6-2mm and the tail length 5.9-6.3a.b.d. in male and in female 1.4-1.8mm body length and 5.5-6.1a.b.d. tail length This is the first record of the species from the Indian waters.

5. *Daptonema tenuispiculum* (Ditlevsen, 1918)

Synonym : *Monhystra tenuispiculum* Ditlevsen, 1918
Theristus tenuispiculum (Ditlevsen, 1918)
Monhystra demani Stekhoven, 1931
Monhystra melademani Gerlach & Reimann, 1973

Material examined : 24 males and 24 females from Cheyyur 76-100 m, 101-150 m, 151-175 m depths (18.12.2008); Chennai 51-75 m, 151-175 m depths (17.12.1008); Tammenapatanam 76-100 m, 101-150 m, 151-175 m depths (16.12.2008) and Singarayakonda 76-100m depth (15.12.2008).

De Man ratio :	a	b	c
Male	: 35.08±0.77 (34.64-35.82)	5.11±0.53 (4.72-5.55)	6.63±0.68 (6.02-7.12)
Female	: 39.12±0.94 (38.28-41.06)	5.21±0.54 (4.66-5.64)	7.01±0.61 (6.44-7.52)

Description

Body length 1.7-2.2mm in male and 1.6-2.1mm in female. Maximum diameter 46-53µm in male and 43-55µm in female. Cuticle transversely striated. Six longer (24-31µm) and four slightly shorter (14-18µm) cephalic setae. Somatic setae sparse. Large circular amphids (8-9µm). Buccal cavity unarmed simply conical with three poorly cuticularised teeth. Elongated pharyngeal region (332-343µm in male and 312-345µm in female) but has no distinct bulb. Tail distal quarter cylindrical (8.4-9.3a.b.d.in male and 8.5-9.1a.b.d. in female) with terminal setae short. Spicules 41-48 µm, proximally

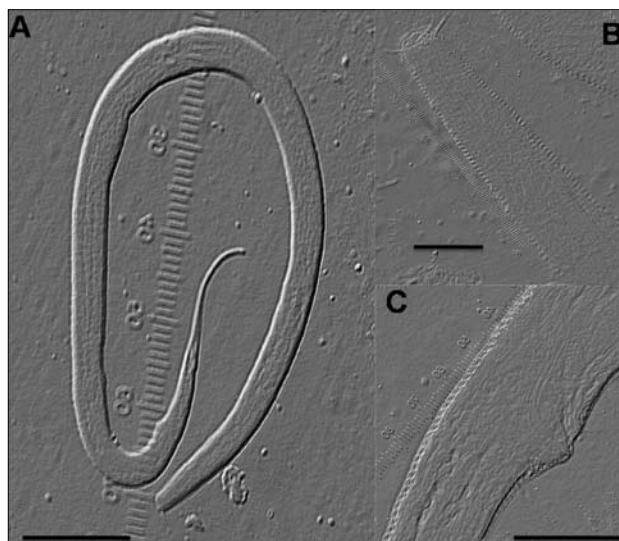


Fig. 10. DIC microscopy photomicrograph of *Daptonema tenuispiculum* A) entire male, scale bar - 170µm B) male head, scale bar - 37µm C) male tail, scale bar - 59µm

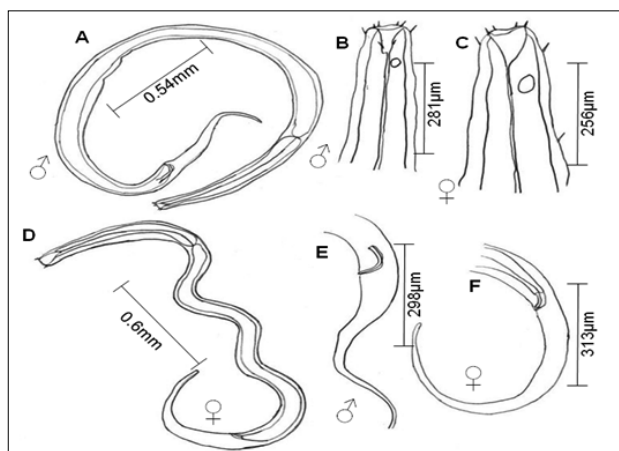


Fig. 11. *Daptonema tenuispiculum* A) entire male B) male head, C) female head, D) entire female, E) male tail, F) female tail

cephalate, weakly S-shaped (Fig. 10 & 11) . Gubernaculum with no apophysis, distally rounded. Ovaries paired, equal,

opposed and reflexed. Vulva present at 64-68% of body length (Z.6).

Feeding type: The specimens showed large buccal cavity that is unarmed with teeth. According to the classification of buccal cavity by Wieser (1953), this species is a non-selective deposit feeder (1B).

Habitat: Sandy, silty sediments.

Distribution

India: Cheyyur, Chennai, Tammenapatanam and Singarayakonda.

Global: England (Warwick *et al.*, 1998); European waters (De Smet *et al.*, 2001); North Sea (Gerlach and Riemann, 1974; Vincx, 1989; Hansson, 1998); Belgium, Norway, Mediterranean, Oresund, Zuidersee, Baltic Sea and Spitsbergen (Hansson, 1998).

Remarks

The specimens examined conform well to the earlier description by Warwick *et al.* (1998) except for the larger body size. The total body length described was 0.9-1mm and tail length was 4.1-6.1a.b.d. The body length of the specimen studied at present was found larger being 1.7-2.2mm and the tail length 8.4-9.3a.b.d. in male and female 1.6-2.1mm body length and tail length 8.5-9.1a.b.d. This is the first record of the species from the Indian waters.

Discussion

In the present study, the occurrence of five species (*D.biggi*, *D.hirsutum*, *D.normadicum*, *D.psammoides* and *D.tenuispiculum*) of free-living marine nematodes belonging to the family Xyalidae under order Monhysterida is reported for the first time in Indian waters from the continental shelf region (southeast coast of India). So far, around 225 species of nematodes have been reported from different regions on the Indian coasts (Timm, 1961, 1967a, 1967b; Gerlach, 1962; Rao and Ganapathi, 1968; Krishnamurthy *et al.*, 1984; Rao, 1986; Sinha *et al.*, 1987; Sulthan Ali *et al.*, 1998; Nanajkar and Ingole, 2007; Sajan and Damodaran, 2007; Anila Kumary, 2008; Eldose, 2008; Mondal, 2009; Annapurna *et al.*, 2012; Ansari *et al.*, 2012a, 2012b, 2012c). However none of these five species of *Daptonema* have been reported earlier from Indian waters and 6935 free-living marine nematode species were recorded globally from the NeMys Database by Steyaert *et al.* (2005). Globally, studies on free-living marine nematodes are paying attention because of higher abundance, lesser sample

size and their importance (aquatic pollution indicators and aquatic toxicological studies). Therefore, these new recorded species might be useful for future research in Indian waters.

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