



Description of a new species of *Epacanthion* (Thoracostomopsidae, Nematoda) from Brazil and a modified key for species identification*

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* In: Brökeland, W. & George, K.H. (eds) (2009) Deep-sea taxonomy — a contribution to our knowledge of biodiversity. *Zootaxa*, 2096, 1–488.

Abstract

Epacanthion agubernaculus sp. nov. (Thoracostomopsidae, Nematoda) is described from sediments of Campos Basin, Atlantic Southeast, Brazil. The main features are: the long spicules, the absence of gubernaculum, and the presence of three pairs of setae in the tail region. Only one male was found for description, but the main features are strong enough to consider it clearly as a new species. An updated and modified key for species identification is proposed.

Key words: free-living marine nematodes, deep sea, Campos Basin

Introduction

The family Thoracostomopsidae Filipjev, 1927 belongs to Enoplida because of the presence of a smooth cuticle, metanemes, and a non-spiral amphideal fovea. This family is composed of three subfamilies: Thoracostomopsinae Filipjev, 1927, Trileptiinae Gerlach & Riemann, 1974 and Enoplolaiminae De Coninck, 1965 (Lorenzen 1994). The differential features of the subfamilies consist of the presence or absence of teeth and mandibles in the buccal cavity, except that members of Thoracostomopsinae bear a long and eversible spear (Smol & Coomans 2006).

There are few recent taxonomic studies on the Thoracostomopsidae (Lorenzen 1981; Greenslade & Nicholas 1991). Lorenzen (1981) listed 16 genera belonging to this family. Greenslade & Nicholas (1991) revised the family, described two new genera from Australia, and recognized 21 valid species of *Epacanthion* Wieser, 1953 (Wieser 1953a).

According to Mawson (1956), the main differential feature of *Epacanthion* is the structure of the mandible. However, Gerlach (1956) considered the structures of the head to be more robust features for the genus diagnosis. In the most recent revision of this genus, Greenslade & Nicholas (1991) provided an identification key following the proposals of Mawson (1956) and Gerlach (1956), and also utilized the features of the male reproductive system, such as spicules and gubernaculum.

The genus *Hyalacanthion* Wieser, 1959 is generally similar to *Epacanthion*, so Inglis (1966) proposed it to be a synonym of *Epacanthion* because of the similarity in the mandible structures.

The 21 valid species of *Epacanthion* have the cephalic capsule strongly sclerotized, cephalic setae inserted slightly above the cephalic capsule, three teeth present, and three strongly sclerotized mandibles that are formed by two solid longitudinal columns, united by a thin membrane. The structure of the mandibles is the most important feature for the genus diagnosis. According to Nicholas & Greenslade (1991), *Epacanthion*

is closely related to *Enoploides* Ssaweljev, 1912 and *Mesacanthion* Filipjev, 1927, but differs from these two genera by the absence of a solid connection between the mandibular bars. Wieser (1953b) described the mandibles of *Epacanthion* as intermediate in structure between those of *Enoploides* and *Mesacanthion*.

In a previous evaluation of material collected in the Campos Basin, members of two genera of the family Thoracostomopsidae were found: *Mesacanthion* and *Epacanthion*. A new species of the latter genus is described here.

Material and Methods

The Campos Basin is located on the continental shelf and slope off Rio de Janeiro, Brazil, between 21° 30' and 23° 30' S. The area and the field methodology are described by Botelho *et al.* (2007).

Nematodes were extracted by manual elutriation, as described by Boisseau (1957). After the sorting process, the nematodes were slowly transferred to glycerin (De Grisse 1969). The methodology described by Cobb (1917) was used to mount the permanent slides. Measurements and drawings were made with an OLYMPUS CX 31 optical microscope, with the aid of a drawing tube. Photographs were taken with a C-5050ZOOM Olympus digital camera.

The holotype was deposited at the National Museum of Rio de Janeiro (MNRJ), Brazil.

Abbreviations used in the text:

abd: anal body diameter

cbd: corresponding body diameter

L: body length

mbd: maximum body diameter

ph: length of pharynx

t: tail length

a: L/mbd

b: L/ph

c: L/t

c': t/abd

The name of the body regions followed Coomans (1979). All the measurements are expressed in micrometers. All curves are measured along the cord.

Taxonomy [after Smol and Coomans (2006)]

Enoplida Chitwood & Chitwood, 1937

Enoplina Chitwood & Chitwood, 1937

Enoploidea Dujardin, 1845

Thoracostomopsidae Filipjev, 1927

Enoplolaiminae De Coninck, 1965

***Epacanthion* Wieser, 1953**

Diagnosis of Thoracostomopsidae (according to Smol & Coomans 2006). Lips high. Only dorsolateral orthometanemes with robust scapulus but no caudal filament. Inner labial sensilla robust and setiform (papilliform only in *Fenestrolaimus* Filipjev, 1927), outer labial and cephalic setae robust and long. Epidermal glands with particularly well-differentiated outlet. Inner layer of cuticle forms a gland with particularly well-differentiated outlet. Inner layer of cuticle forms a cephalic capsule on to which pharyngeal muscles are attached. Cephalic organs often present and of variable shape. Amphids small and situated posterior to the

cephalic capsule or absent. Spacious buccal cavity with three mandibles and three teeth (one dorsal and two ventrosublateral) or with one long eversible spear. Female reproductive system didelphic–amphidelphic with antidiromously reflexed ovaries (a single posterior ovary in *Mesacanthion monhystra* Gerlach, 1967). Caudal glands penetrate into the precaudal region.

Diagnosis of Epacanthion Wieser, 1953 [according to Smol & Coomans (2006)]. Enoplolaiminae. Cuticle usually smooth. Head broadly wedge- or cone-shaped. Lips high, mostly striated. Inner labial setae long and inserted at the base of lip flaps; outer labial and cephalic setae situated at middle or anterior end of cephalic capsule. Cervical setae often present, can be numerous in males, and are sexually dimorphic. Mandibles consist of two plate-shaped columns separated by a thin sheet of cuticle (space between columns not solid) and only connected anteriorly by a bar (an intermediate stage between *Enoploides* and *Mesacanthion*); mandibular teeth small with gland which opens at tip. Pharynx relatively long and cylindrical; cardia pyriform. Females didelphic–amphidelphic with reflexed ovaries at left side of the intestine. Males diorchic with both testes at left side of the intestine; gubernaculum without apophyses present or absent. Spicules mostly long (≥ 2.5 anal diameters long) or short; gubernaculum without apophysis present or absent. Preanal supplement present or absent. Three caudal glands, cells pre-caudally. Tail narrowly conical or attenuated.

According to Greenslade & Nicholas (1991), there are 21 valid species:

- *Epacanthion brevispiculosum* Mawson, 1958
- *Epacanthion brevispiculum* Mawson, 1956
- *Epacanthion bütschlii* (Southern, 1914)
- *Epacanthion durapelle* (Kreis, 1929)
- *Epacanthion enoploidiforme* (Gerlach, 1953)
- *Epacanthion exploratoris* Greenslade & Nicholas, 1991
- *Epacanthion flagellicaudum* Gerlach, 1956
- *Epacanthion galeatum* Boucher, 1977
- *Epacanthion georgei* Inglis, 1971
- *Epacanthion gorgonocephalum* Warwick, 1970
- *Epacanthion mawsoni* Warwick, 1977
- *Epacanthion microdentatum* Wieser, 1953
- *Epacanthion multipapillatum* (Wieser 1959)
- *Epacanthion murmanicum* (Ssaweljev, 1912)
- *Epacanthion nadjae* Sergeeva, 1974
- *Epacanthion oliffi* Inglis, 1966
- *Epacanthion oweni* Keppner, 1986
- *Epacanthion pellucidum* (Ssawejev, 1912)
- *Epacanthion polysetosum* (Jensen, 1986)
- *Epacanthion saveljevi* (Filipjev, 1927)
- *Epacanthion stekhoveni* Greenslade & Nicholas, 1991

***Epacanthion agubernaculus* sp. nov.**

Material studied: One male.

Type material: Holotype MNRJ 329. Station 53 (Figure 1).

Type locality: Southern part of Campos Basin (Rio de Janeiro, Brazil) at 1950 m depth, in silt-clay sediments.

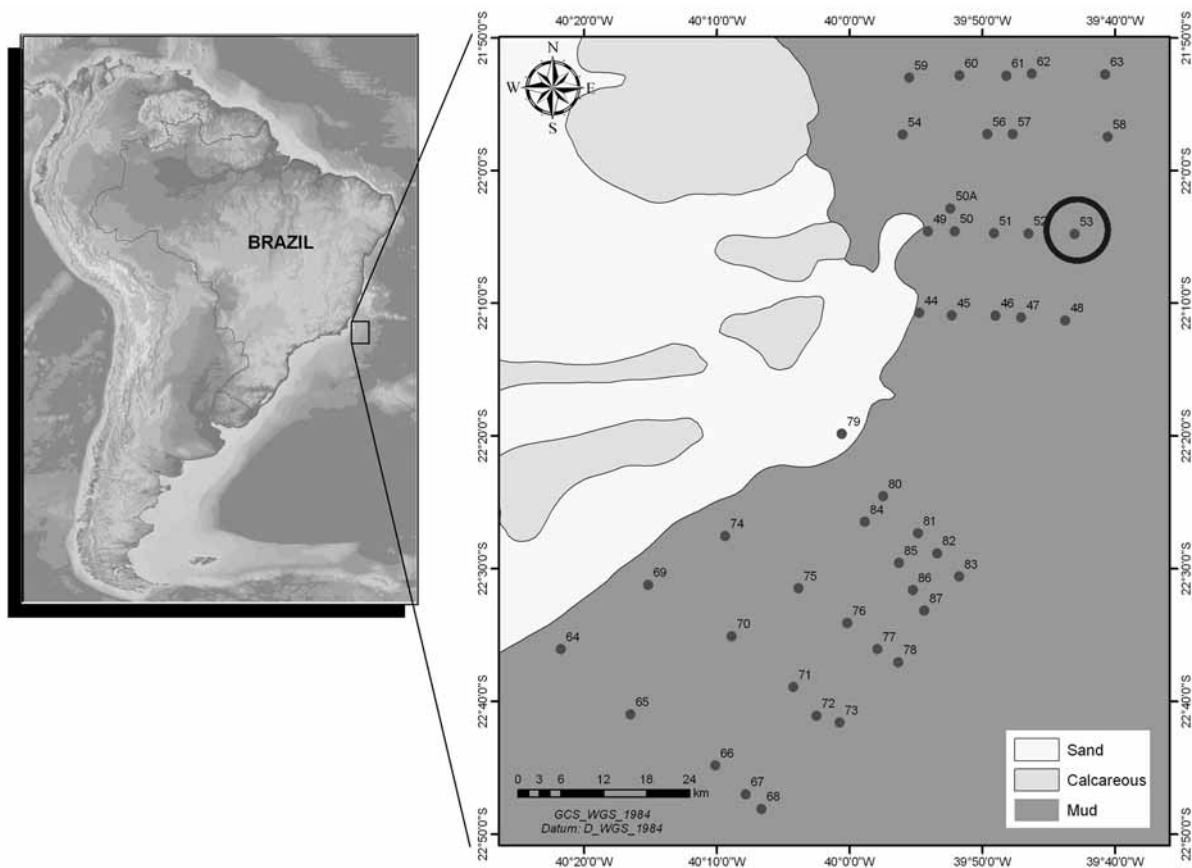


FIGURE 1. Study area showing sampling stations.

Etymology. The Latin "agubernaculus" refers to the absence of a gubernaculum (a = without + gubernaculum = gubernaculum).

Description (Holotype). (Figs 2 and 3) Cylindrical body ($L=2045.2 \mu\text{m}$) tapering towards both extremities. Smooth cuticle. Cephalic capsule strongly sclerotized ($43.2 \mu\text{m}$). Sensilla arranged in two circles (6+10): six inner labial setae ($10.8 \mu\text{m}$), six outer labial setae ($31.7 \mu\text{m}$) and four cephalic setae ($11.4 \mu\text{m}$) in the second row. The second circle is inserted slightly above the base of the cephalic capsule ($3.6 \mu\text{m}$ apart). Several setae of varying lengths present in the cervical region. Somatic setae ($35.4 \mu\text{m}$) on the body, with no distinct pattern. High lips composed of three strongly sclerotized mandibles ($20.4 \mu\text{m}$ long and $4 \mu\text{m}$ wide) of two longitudinal solid bars united by a thin membrane, mandibles curved in the base of the buccal cavity where three equal teeth are found ($4.8 \mu\text{m}$ long and $20.4 \mu\text{m}$ wide), one dorsal and two ventrosublateral. One gland present in the base of each tooth. Amphideal fovea indistinct. Pharynx strongly muscular ($516 \mu\text{m}$ long), corresponding to 87.6% of the anterior region. Nerve ring ($55.13 \mu\text{m}$) located forward of the middle portion of the pharynx ($178.5 \mu\text{m}$) and occupying 67.3% of the corresponding body diameter. Cardia triangular. Reproductive system diorchic, testes located at the left of the intestine (in tandem), extending to the anterior region of the body, anterior testis $233.5 \mu\text{m}$ long and posterior testis $171.1 \mu\text{m}$ long. Spicules long ($186 \mu\text{m}$), transversely striated, with four points of sclerotizations concentrated in the proximal portion and in the middle of the spicules. The distance between the sclerotization points ranged from $79 \mu\text{m}$ to $121 \mu\text{m}$. Gubernaculum absent. One tubular precloacal supplement, finely sclerotized ($18 \mu\text{m}$ long and $1.8 \mu\text{m}$ wide) and placed near the proximal region of the spicules, $104.4 \mu\text{m}$ distant from the cloaca. Tail conico-cylindrical ($139.2 \mu\text{m}$ long). Three pairs of setae (range $3.6\text{--}13.8 \mu\text{m}$ long) in the conical portion, no setae in the cylindrical tail region. Caudal glands not observed.

$L= 2045.2$; $a= 25.18$; $b=3.9$; $c=14.6$; $c'=2.7$

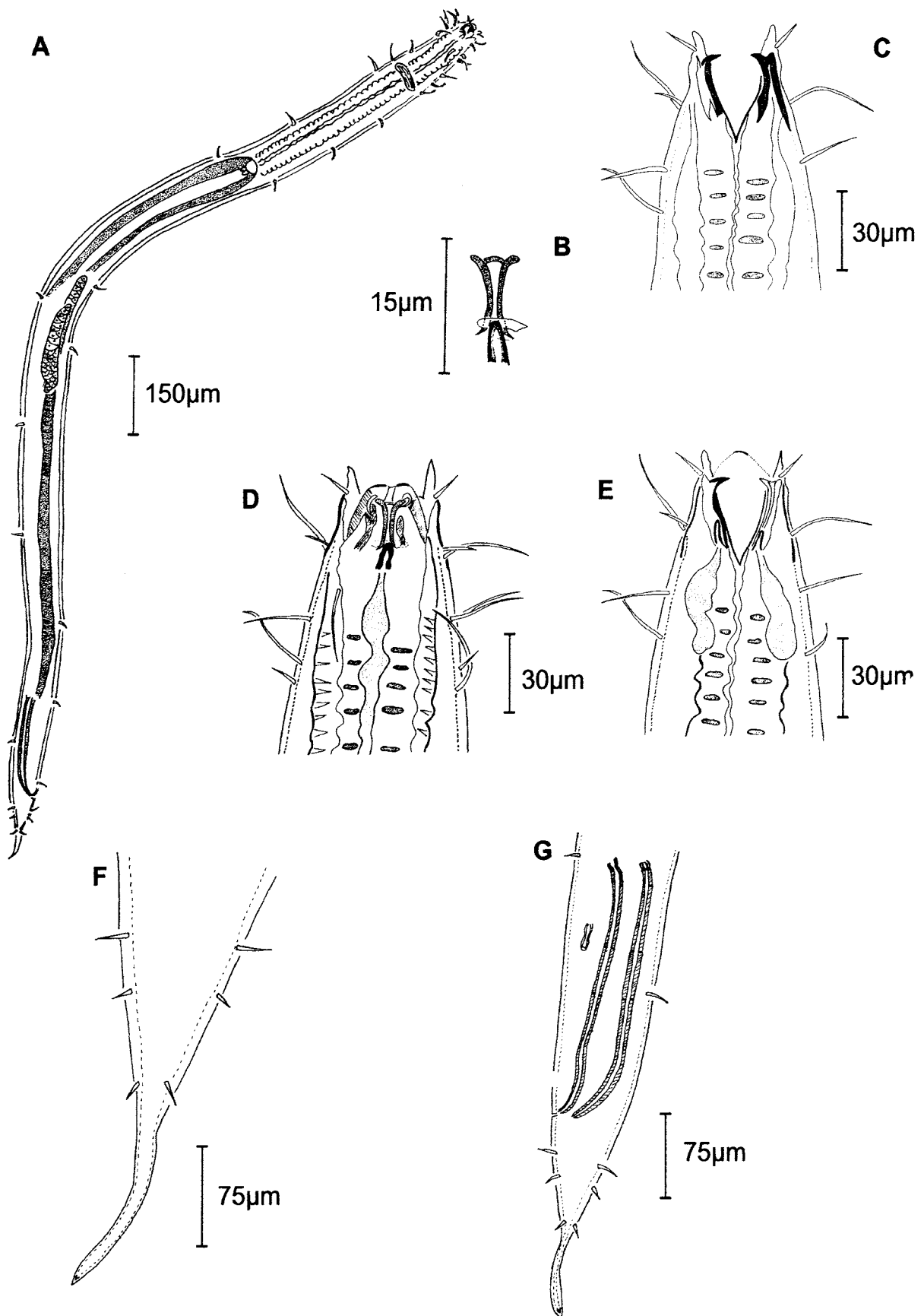


FIGURE 2. Male. A. Total body, B. Mandible detail, C. Head and the buccal cavity with mandibles, D. Anterior region, mandibles and Teeth, E. Anterior region with the esophageal glands, F. Setae in the tail region, G. Spicules, tail and supplements.

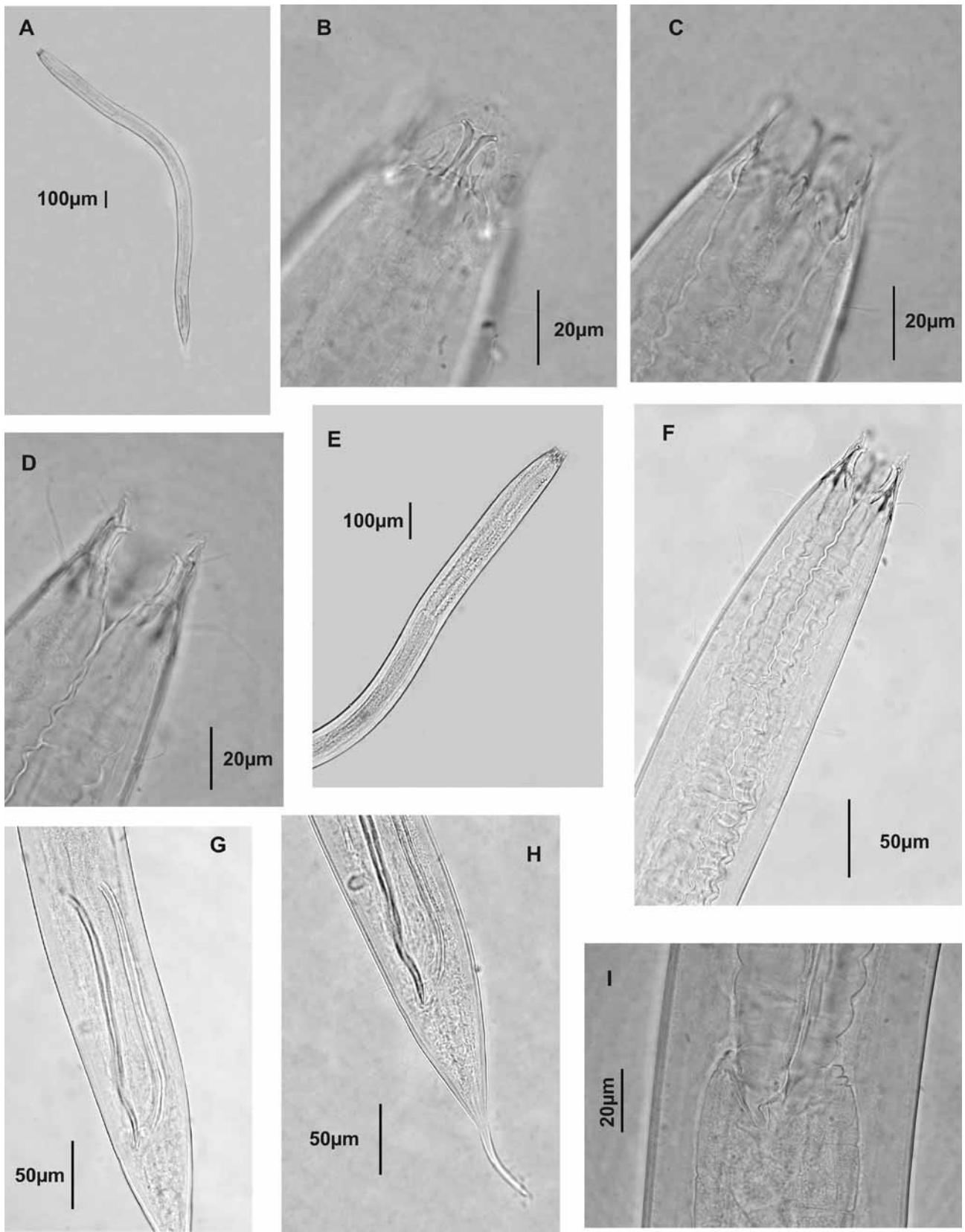


FIGURE 3. Male. A. Total body, B. Mandibles, C. Teeth (Mandibles), D. Buccal cavity, E. Pharynx regions, F. Somatic setae, G. Spicules, H. Tail, I. Cardia region.

Discussion

The genus *Epacanthion* belongs to the subfamily Enoplolaiminae De Coninck, 1965, mainly because of the presence of three mandibles and three teeth in the buccal cavity. According to Smol & Coomans (2006), this subfamily needs to be revised because of the complex structure of the buccal cavity as well as deficiencies in published descriptions of the cephalic organs. The function of these organs is not well understood, although some attempts to explain their role have been made. For example, Wieser (1953c) suggested a possible relationship between the function of this structure and the predatory activity of nematodes, as it has a powerful buccal armature. In this study, as well as nearly all of the species descriptions for *Epacanthion*, the cephalic organs could not be observed. For other genera, such as *Paramesacanthion* and *Enoploides*, few descriptions include the observation and position of the cephalic organs in the cephalic capsule (Wieser 1953b; Warwick 1970; Bussau 1995). The reason for the neglect of this complex structure in both older and modern species descriptions may be due to the difficulty in adequately observing it.

The new species is similar to *Epacanthion bütschlii* and *E. durapelle* with respect to one pharyngeal gland opening through each tooth, the shape of the spicules, and the position of the precloacal supplement. The three species differ in the lengths of the spicules: in *E. bütschlii* and *E. durapelle* the spicules are longer than 200 μm , whereas the new species has small spicules, 186 μm long.

E. agubernaculus sp. nov. shows the same arrangement of labial and cephalic sensilla as found in *E. bütschlii*, *E. enoploidiforme*, *E. gorgonocephalum*, *E. multipapillatum*, *E. pellucidum*, and *E. polysetosum*. However, the setae differ in length among the species.

Currently, the diagnosis of *Epacanthion* includes species with both short and long spicules, but in the past the length of the spicules was considered one of the most differential attributes (Wieser 1959). Wieser (1959) determined that only specimens of spicules longer than 2.5 μm should be included in the genus. Only the new species, *E. brevispiculosum*, *E. bütschlii*, and *E. durapelle* have spicules in this category. However, other species presently ascribed to this genus, such as *E. brevispiculum*, have spicules smaller than the limit proposed by Wieser (1959).

Even though *E. agubernaculus* sp. nov. belongs to the group of species with long spicules, we consider the absence of a gubernaculum to be a distinctive feature in the species of this group. This is also a characteristic shared with *E. oliffi*, a species with short spicules.

The Brazilian species also has three pairs of setae in the conical region of the tail, and the pairing of setae is now reported for the first time among the species of *Epacanthion*.

Although the description of *E. agubernaculus* sp. nov. is based on a single specimen, several morphological features, such as the absence of a gubernaculum and the pairing of caudal setae in the anterior region, are sufficient to establish it as a new species.

Key to species of *Epacanthion*

- 1 Spicules without gubernaculum..... 2
- Spicules with gubernaculum..... 3
- 2 Spicules long (more 100 μm), one pre-anal supplement *E. agubernaculus*
- Spicules short (less 100 μm), without pre-anal supplement..... *E. oliffi*
- 3 Spicules short, 2-5 or fewer anal diameters long..... 4
- Spicules long, 3 or more anal diameters long 14
- 4 Pre-anal supplement present 5
- Pre-anal supplement absent 12
- 5 Nine to 14 small, setose pre-anal supplements..... 6
- Only one pre-anal supplement..... 7
- 6 Distance between tips of apical teeth about equal to length of mandibular columns, which are short, stout and parallel..... *E. multipapillatum*
- Mandible with tips of apical teeth much closer together than length of mandibular columns, which are slender and diverge at apex *E. oweni*

7	Distance between tip of apical mandibular hooks either clearly much greater or much less than length of mandibular columns	8
-	Distance between apical mandibular hooks apparently about same as length of mandibular columns	<i>E. brevispiculum</i>
8	Distance between tip apical mandibular hooks much greater than length of mandibular columns.....	9
-	Distance between apical mandibular hooks much less than length of mandibular columns.....	10
9	Spicules 1–2 anal diameters (59 μ m), gubernaculum a triangular plate, dorsal onchia much smaller than other two, 12 pairs of cervical setae in male, 4 in female	<i>E. mawsoni</i>
-	Spicules 0–75 anal diameters (34 μ m), gubernaculum reduced, onchia apparently unequal, male with 12 cervical setae (female unknown)	<i>E. pellucidum</i>
10	Spicules 2–5 anal diameters (80 μ m), gubernaculum present (37 μ m) lip not striated.....	<i>E. microdentatum</i>
-	Spicules 1 anal diameter (90 μ m), lip flaps striated	11
11	Small species (1.5–2.0 mm long), male head hirsute, cephalic setae maximum length 30 μ m, inserted above cephalic arch, posterior rim of cephalic capsule crenelated (indistinct)	<i>E. galeatum</i>
-	Larger species (2.2–2.9 mm long), male head hirsute, cephalic setae maximum length 50 μ m, longer than head diameter, inserted just below cephalic arch, posterior rim of cephalic capsule not crenelated	<i>E. exploratoris</i>
12	Male head hirsute with many subcephalic and cervical setae	<i>E. enoploidiforme</i>
-	Male head not hirsute.....	13
13	Mandibles very long and slender, mandibular columns about twice as long as distance between apical teeth	<i>E. gorgonocephalum</i>
-	Mandibles not long and slender, distance between mandibular teeth less, or only slightly longer (1.2x), than mandibular columns.....	<i>E. georgei</i>
14	Tail long, 4 or more anal diameters, spicules of equal length, may be annulated	15
-	Tail short, only 3 anal diameters, spicules always annulated, may be of unequal length.....	18
15	Spicules >200 μ m (3–3.5 anal diameters), always annulated.....	16
-	Spicules 130–175 μ m (3–3.5 anal diameters) long, not annulated.....	19
16	Larger species, males and females more than 4 mm long, α value 27–34, onchia nearly reaching cephalic arch, inner cephalic setae long, 40 μ m.....	17
-	Smaller species, 2.9–3.1 mm long, α value 117–19, onchia small, not reaching cephalic arch, inner cephalic setae very short, 28 μ m	<i>E. durapelle</i>
17	Tail setae numerous (>10 setae).....	<i>E. buetschlii</i>
-	Tail setae sparse(only two medial setae).....	<i>E. stekhoveni</i>
18	Spicules of unequal	<i>E. nadjae</i>
-	Spicules equal in length	<i>E. saveljevi</i>
19	Head blunt anteriorly, mandibular columns parallel, diverging strongly at apex, male supplement 90 μ m in front of anus	<i>E. brevispiculosum</i>
-	Head pointed anteriorly, mandibular columns parallel, male supplement 132–158 μ m in front of anus.....	<i>E. polysetosum</i>

Acknowledgements

We are grateful to the Brazilian Petroleum Company (PETROBRAS) for financial support that made it possible for a nematode taxonomic project to be included in the Brazilian deep-sea research program in Campos Basin. A special thanks to Dr. Veronica da Fonsêca-Genevois for the opportunity to study this genus and, specially, for her unconditional support to this study. We also thank Nicole Smol, Ghent University, Belgium, for her help and advice with *Epacanthion* new species. We thank Alessandra Botelho for the animal pictures and Luciana Davina Tosta Sobral for preparing the plates. Finally, our sincerely thanks to Tatiana F. Maria, Ghent University, for her relevant comments and Dr. Janet W. Reid, JWR Associates, for her critical revision of the English text.

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