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ALEXANDRE LACERDA DE LARRAZÁBAL FILHO

Estudo taxonômico da família Desmodoridae (Nematoda:Desmodorida) na Bacia Potiguar, Rio Grande do Norte, Brasil.

Recife

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Tese de doutorado apresentada ao programa de Pós-graduação em Biologia Animal da Universidade Federal de Pernambuco, como parte dos requisitos para obtenção do título de doutor em Biologia Animal.

Área de concentração: Taxonomia

Orientador: Dr. André Morgado Esteves

Coorientadora: Dra. Patrícia Fernandes Neres

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RESUMO

Nematódeos são extremamente diversos e abundantes, ocupando quase todos os possíveis habitats. Cerca de 27.000 espécies estão descritas, mas provavelmente isso seja apenas uma fração da real diversidade. Esse estudo tem como objetivo identificar espécies da família Desmodoridae, baseado em caracteres morfológicos. Os estudos desta família no Brasil começaram em 2011 e resultaram na descrição de 39 novas espécies. A Bacia Potiguar (35° 30'S e 35° 37°W) fica localizada entre os estados do Ceará e do Rio Grande do Norte. Na campanha emissários, realizada entre 2009 e 2014, estações estão localizadas em áreas rasas (6 à 60m) foram amostradas com corer (10 x 10 cm) através de mergulho. Nas estações mais profundas foram lançados equipamentos (Van Veen, Box-corer e Draga) para a coleta de sedimento. Os indivíduos coletados foram lavados e retidos em peneiras de malha de 0,5 mm e 0,045mm. Este trabalho contém a descrição de 16 novas espécies e um gênero novo pertencentes as subfamílias Desmodorinae e Spiriniinae na Bacia Potiguar, nordeste do Brasil. Foram descritas novas espécies de: *Stygodesmodora*, *Bolbonema*, *Spinonema* **gen. nov.**, *Desmodorella*, *Zalonema* e *Pseudodesmodora*. *Stygodesmodora amphidialis* **sp. n.** e *Stygodesmodora paramphidialis* **sp. n.** compartilham algumas características em comum como *fovea amphidialis* grande e suplementos em forma de tubo, no entanto diferem no formato do bulbo. *S. robusta* **sp. n.** possui cutícula fortemente anelada e um grande dente dorsal. *S. potiguensis* **sp. n.** possui diformismo sexual relacionado ao tamanho da *fovea*. *Bolbonema braziliensis* **sp. n.** possui um gubernáculo dobrado e orientado dorsalmente e duas cerdas pré-cloacais. *B. papillae* **sp. n.** possui uma grande *fovea amphidialis* e duas papilas cloacais. *B. zildae* **sp. n.** única espécie que possui *fovea amphidialis* multiespiral com 3 voltas. *Spinonema* **gen. nov.** possui uma ala lateral e algumas espécies possui um espinho dorsal. *Desmodorella spinata* **sp. n.**, *D. potiguensis* **sp. n.**, *D. allium* **sp. n.** e *D. amphidialis* **sp. n.** possuem características únicas que precisaram modificar a diagnose do gênero. *Zalonema laqueusis* **sp. n.** possui *fovea amphidialis* em forma de loop e diformismo sexual relacionado a essa mesma característica. *Pseudodesmodora ritae* **sp. n.** tem uma grande *fovea* criptospiral em cima de uma placa cuticularizada. Além de descrições, novas chaves foram construídas, listas de espécies atualizadas e distribuição geográfica do gênero *Bolbonema*.

Palavras-chave: Nova espécie. Desmodoridae. Meiofauna. novo gênero. taxonomia.

ABSTRACT

Nematodes are extremely diverse and abundant, they occupy almost every possible habitat. About 27,000 species are described, but this is probably only a fraction of the actual diversity. This study aims to identify species of the family Desmodoridae, based on morphological characters. Studies of this family in Brazil began in 2011 and resulted in the description of 39 new species. The Basin (35° 30'S and 35° 37°W) is located between the states of Ceará and Rio Grande do Norte. In the campaign conducted in 2009 until 2014, stations are located in shallow areas, were sampled with corer (10 x 10 cm) through diving. In the deepest stations were launched equipment (Van Veen, Box-corer and Dredge) to collect sediment. The collected individuals were washed and retained in 0.5 mm and 0.045 mm mesh sieves. This work describes 16 new species and a new genus belonging to the subfamilies Desmodorinae and Spiriniinae in the Potiguar Basin, northeastern Brazil. New species of *Stygodesmodora*, *Bolbonema*, *Spinonema* **gen. nov.**, *Desmodorella*, *Zalonema* and *Pseudodemodora*. *Stygodesmodora amphidialis* **sp. n.** and *Stygodesmodora paramphidialis* **sp. n.** They share some common features such as large *fovea amphidialis* and tube-shaped supplements, however they differ in bulb shape. *S. robusta* **sp. n.** it has cuticle strongly annulated except in final portion of tail and a large dorsal tooth. *S. potiguensis* **sp. n.** has sexual diformism related to the size of the *fovea*. *Bolbonema braziliensis* **sp. n.** it has a bent and dorsally oriented gubernaculum and two pre-cloacal setae. *B. papillae* **sp. n.** has one large *fovea amphidialis* and two cloacal papillae. *B. zildae* **sp. n.** only species that has *fovea amphidialis* multspiral with 3 turns. *Spinonema* **gen. nov.** it has a lateral alae and some species have a dorsal spine. *Desmodorella spinata* **sp. n.**, *D. potiguensis* **sp. n.**, *D. allium* **sp. n.** and *D. amphidialis* **sp. n.** have unique characteristics that needed to modify the diagnosis of genera. *Zalonema laqueusis* **sp. n.** it has *fovea amphidialis* in a loop-shape and sexual diformism related to this same characteristic. *Pseudodemodora ritae* **sp. n.** it has a large cryptospiral *fovea amphidialis* with a plate and central spot. In addition to descriptions, new keys were constructed, updated species lists and geographic distribution of the genus *Bolbonema*.

Keywords: New species. Desmodoridae. Meiofauna. New genus. taxonomy.

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INTRODUÇÃO GERAL

As plataformas continentais são áreas que se estendem desde o nível médio da baixa-mar até o talude continental (SUGUIO, 2003). No oceano Atlântico, esse compartimento representa 7,9% da área oceânica (TESSLER E MAHIQUES, 2009).

Devido à relativa proximidade da costa, as plataformas continentais estão sob influência da descarga de água doce (pluvial e fluvial), que transportam sedimento, nutrientes e poluentes provindos do continente (VALIELA, 1995). As correntes oceânicas transportam as massas de água, controlando a disposição delas na plataforma continental e consequentemente, mudando as condições de temperatura, salinidade e concentração de nutrientes locais (TESSLER & MAHIQUES, 2009).

Dentro desses ecossistemas de plataforma continental, a fauna bentônica desempenha papel vital tanto como receptora de energia proveniente do pelagial, quanto como fornecedora de energia para os organismos demersais (PROPP ET AL., 1979; POSTMA E ZIJLSTRA, 1988). A estrutura da comunidade do bentos marinho varia com os fatores ambientais. Diferenças entre latitude, hábito alimentar e sedimentos condicionam comunidades distintas, não só quanto à composição específica, mas também quanto à dominância de grandes grupos taxonômicos (LANA, 2002; GERLACH, 1965; NYBAKKEN E BERTNESS, 2004).

A fauna bentônica é dividida dimensionalmente em macro, meio e microfauna, estando seus componentes intimamente associados entre si. Agrupam-se entre outros fatores, pelo tamanho corporal: a comunidade de macrofauna variando, de poucos milímetros a vários centímetros, meiofauna de tamanho intermediário (normalmente 0,4 mm a 1 mm) e a microfauna (normalmente inferior a 0,4 mm) (ÓLAFSSON, 2003).

Os organismos de meiofauna, que habitam o ambiente intersticial, sofreram adaptações ao longo da evolução para que fossem aptos a sobreviver neste tipo de ambiente. Tais organismos são associados a algum tipo de substrato necessário para locomoção, alimentação e reprodução, além de serem responsáveis por diversos processos ecológicos para manutenção e boa qualidade do ambiente (GIERE, 1993; ARMONIES & REISE, 2000; RUPPERT ET AL., 2005).

A comunidade meiofaunística ocorre em ambientes de água doce e em habitats marinhos, desde ambientes de praia até o oceano profundo. Habitam qualquer tipo de sedimento seja ele fino, tal como silte e argila, até locais com sedimento arenoso e presença de cascalho. Podem ocorrer ainda em habitat acima do sedimento, normalmente associados a plantas e animais ou em camadas superficiais de gelo em regiões com temperaturas muito baixas (CAREY E MONTAGNA, 1982; SCHIZAS & SHIRLEY, 1996).

Assim como a meiofauna, os Nematoda são definidos pelo tamanho, menor do que aqueles encontrados na macrofauna (SHARMA ET AL., 2011). Os Nematoda são, usualmente, os metazoários dominantes da meiofauna, tanto em abundância como em biomassa (HEIP ET AL., 1982; MOENS E VINCX, 1997; DANOVARO ET AL., 2000; GALÉRON ET AL., 2001). Frequentemente, as maiores densidades da meiofauna refletem as densidades dos Nematoda (COULL, 1999). De acordo com Heip et al. (1985), de 80 a 95% dos indivíduos e de 50 a 90% da biomassa do meiobentos, usualmente consiste de nematódeos. Soetaert et al. (1995) cita que cada metro quadrado do fundo oceânico é habitado por 1-12 milhões de nematódeos.

Nematódeos são extremamente diversos e abundantes, eles ocuparam quase todos os possíveis habitats e são de extrema importância econômica e médica. Cerca de 27.000 espécies estão descritas, mas provavelmente isso seja apenas uma fração da real diversidade (SCHIMIDT-RHAESA, 2014).

A Taxonomia e Sistemática de Nematoda sofreu algumas modificações com as mudanças propostas por De Ley et al. (2006). De acordo com esta nova proposta outras ordens foram criadas e os Nematoda livres e parasitas foram redistribuídos. Vale ressaltar que a classificação de De Ley et al. (2006), além de fundamentada numa base molecular, apresenta-se em consonância com a classificação proposta por Lorenzen (1994).

Desvendar as espécies que habitam a terra continua sendo um encargo fundamental da Biologia, mesmo quando estamos entrando na “idade filogenômica” na história da Taxonomia (ZHANG, 2011), sendo uma ciência que vem enfrentando uma escassez de conhecimentos e de financiamento. Particularmente notável nos países em desenvolvimento onde a grande parte da biodiversidade é desconhecida (SMITH ET AL., 2011). Segundo o mesmo autor, na Nematologia estudos taxonômicos marinhos

estão em desvantagem em relação aos estudos de nematódeos parasitas ou de solo. Isto porque são de extrema importância na agricultura, no meio ambiente (papel de decompositor e biodegradador de compostos tóxicos) e na saúde humana (COBB, 1914; GIERE, 1995; PLATT, 1994; FERRIS, 1999).

A ordem Desmodorida De Coninck, 1965 foi por muito tempo parte integrante da Ordem Chromadorida Chitwood, 1933 quando ainda era somente Família Desmodoridae Filipjev, 1922 (DE LEY ET AL., 2006). Esta foi elevada a Ordem em 2002 por De Ley e Blaxter, tendo sua confirmação em 2004 pelos mesmos autores. Contudo, esta nova classificação só foi propagada em 2006 por De Ley et al. Desmodorida é caracterizada principalmente por apresentar indivíduos com cutícula com estrias transversais, em geral sem pontuação e ornamentação (DECRAEMER E SMOL, 2006). A ordem é composta por nematódeos quase que exclusivamente marinhos, exceto por *Prodesmodora* Micoletzky, 1923 e *Sibayinema* Swart e Heyns, 1991 como representantes de água doce (DECRAEMER E SMOL, 2006). Dentro dessa ordem encontramos sete famílias: Desmodoridae Filipjev, 1922; Draconematidae Filipjev, 1918, Epsilonematidae Steiner,1927; Microlaimidae Micoletzky,1922; Monoposthiidae Filipjev,1934; Aponchiidae Gerlach, 1963; Richtersiidae Kreis, 1929, tendo esta última família como um suplemento dentro da ordem (TCHESUNOV, 2014).

A família Desmodoridae é composta de 6 subfamílias, sendo: Desmodorinae Filipjev, 1922; Spiriniinae Gerlach e Murphy, 1965; Pseudonchinae Gerlach e Riemann, 1973; Stilbonematinae Cobb, 1936; Molgolaiminae Jensen, 1978 e Prodesmodorinae Lorenzen, 1981 (DECRAEMER & SMOL, 2006).

A família Desmodoridae Filipjev, 1922 inclui um grupo diverso e heterogêneo de nematóides de vida livre, principalmente marinhos, (DECRAEMER & SMOL 2006). Os desmodorídeos são muito abundantes em habitats tais como recifes de corais tropicais (TIETJEN 1991), praias arenosas (VERSCHELDE & VINCX 1996), tapetes de ervas marinhas (NDARO & ÓLAFSSON 1999), em águas profundas (VERSCHELDE ET AL. 1998; CAVALCANTI ET AL. 2009) e habitats de água doce (DECRAEMER & SMOL 2006). As espécies dentro da família provavelmente são um componente importante da diversidade funcional das cadeias alimentares bentônicas devido à sua variada morfologia e relações simbióticas com bactérias (OTT, 1996).

A família Desmodoridae pertence à superfamília Desmodoroidea Filipjev, 1922, juntamente com as famílias Draconematidae Filipjev, 1918 e Epsilonematidae Steiner, 1927. É composta por seis subfamílias, 35 gêneros e 318 espécies (HODDA, 2011), no entanto esses números podem variar de acordo com a fonte (ARMENTEROS ET AL., 2014a). Esta família descrita por Filipjev não possui nenhuma sinapomorfia. As Famílias Draconematidae Filipjev, 1918 e Epsilonematidae Steiner, 1927 apresentam como sinapomorfias: a forma distinta do corpo com região faríngea inchada e a presença de cerdas somáticas especializadas (LORENZEN 1994), sendo facilmente distinta da Família Desmodoridae. Evidências moleculares, baseadas em pequenas subunidades do DNA ribossômico (SSU rDNA), indicaram que a família Desmodoridae é altamente polifilética (VAN MEGEN ET AL. 2009). Ainda mais, a sistemática da família é mal compreendida, porque (1) os caracteres morfológicos são conflitantes para desvendar as relações entre taxa (KAMPFER ET AL. 1998) e (2) análises filogenéticas (ARMENTEROS ET AL. 2014b) sugeriram natureza monofilética das subfamílias Desmodorinae e Spiriniinae, enfatizando ainda mais a necessidade de se coletar mais dados de gêneros e espécies dessas subfamílias. Além disso, a taxonomia dos desmodorídeos sofre de táxons pobremente descritos (por exemplo, *Laxonema* Cobb, 1933; *Metadesmodora* Schuurmans Stekhoven, 1942), além da falta de chaves de identificação para alguns gêneros (por exemplo, *Desmodora* de Man, 1889) e a ausência de listas de espécies atualizadas (ARMENTEROS ET AL. 2014a).

A Família Desmodoridae é caracterizada por apresentar *fovea amphidialis* geralmente com um ou duas voltas, cauda cônica e gubernáculo sem apófise dorsal. Os estudos desta família no Brasil começaram em 2011 e resultaram na descrição de 39 novas espécies (LARRAZÁBAL-FILHO ET AL. 2018). Este trabalho contém a descrição de 16 novas espécies e um gênero novo pertencentes as subfamílias Desmodorinae e Spiriniinae na Bacia Potiguar, nordeste do Brasil. Com a descrição dessas novas espécies, o esforço de estudo taxonômico representa cerca de 35% do total de espécies descritas desde 2011 dentro da família Desmodoridae.

2. OBJETIVO GERAL

Estudar a Nematofauna da Bacia Potiguar, Rio Grande do Norte, Brasil, com ênfase na taxonomia e filogenia, com base em caracteres morfológicos da família Desmodoridae.

2.1 OBJETIVOS ESPECÍFICOS

● Identificar as espécies da família Desmodoridae provenientes de amostras coletadas ao longo da Bacia Potiguar.

● Descrever as novas espécies da família Desmodoridae da Bacia Potiguar.

3. MATERIAL E MÉTODOS

Para a concretização desse estudo foram utilizadas amostras do Projeto de caracterização ambiental da Bacia Potiguar de 2009 até 2014, usadas apenas as malhas amostrais de monitoramento ambiental dos emissários submarinos. Porém, este trabalho não tem como objetivo avaliar se há impactos na região, apenas o intuito de descrever os indivíduos da família Desmodoridae.

3.1 Área de Estudo

A Bacia Potiguar (35° 30'S e 35° 37°W) fica localizada entre os estados do Ceará e do Rio Grande do Norte (Brasil) (Figura 1). Abrange uma extensão total de 48.000 km^2 onde 21.500 km^2 são emersas e distribuídas entre os estados e 26.500 km^2 são submersas (COSTA ET AL., 2006). Tal plataforma continental é relativamente ampla, aproximadamente 20 a 30 km de largura, e de baixa profundidade (em geral inferior a 30m), alcançando o talude entre 40 e 100 m (CHAVES ET AL., 1979, KNOPPERS ET AL., 1999).

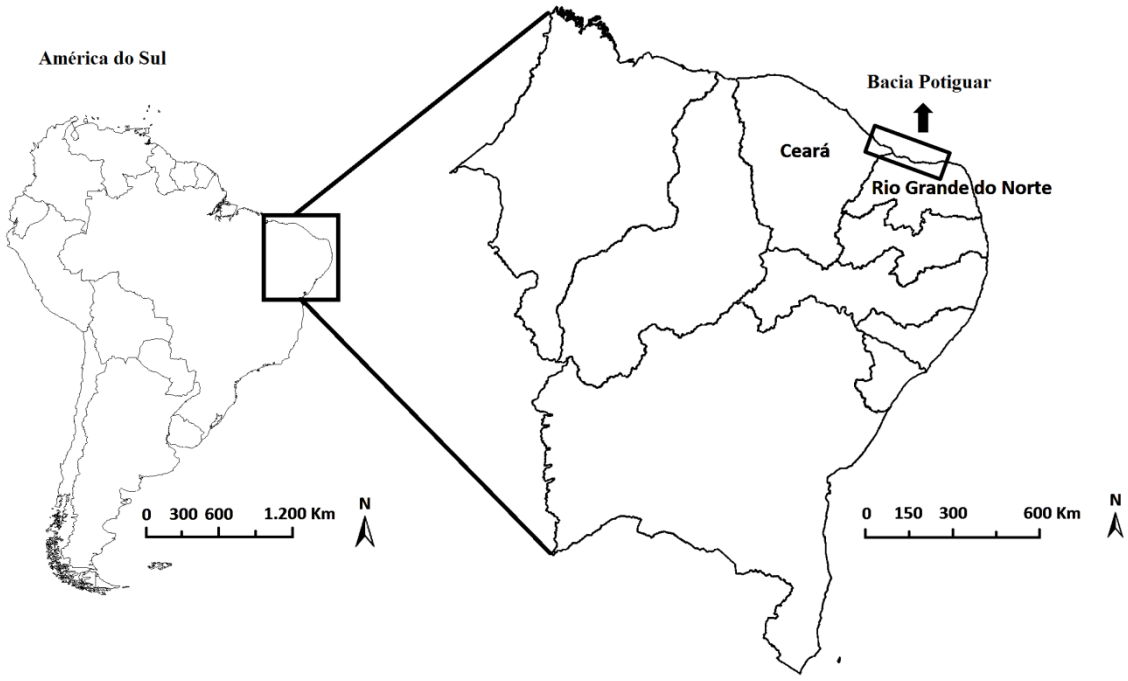

Figura 1 - Localização da Bacia Potiguar no continente sul americano e no nordeste do Brasil.

3.2 Malhas amostrais

O projeto é composto por cinco malhas amostrais. Sendo elas: caracterização ambiental/ monitoramento dos emissários, monitoramento dos emissários submarinos, malha regional, PMAE pré e pós-perfuração e PAI.

É importante ressaltar que todos os espécimes utilizados neste trabalho foram encontrados na malha amostral Emissários nos anos de 2009 até 2014.

Para o estabelecimento das estações de coleta, foram lançadas ao mapa duas grades sobrepostas (malha de 50 m e 500 m) para dimensionamento da espacialização da pluma de dispersão. Sobre estas grades foram delimitados círculos concêntricos ao ponto de lançamento do efluente, de forma a cobrir e representar o comportamento da pluma. Os raios definidos foram de 50 m, 200 m, 500 m, 1000 m e 2000 m de distância do difusor do emissário I, e 50 m, 200 m, 500 m, 1000 m para o emissário II. A geração de um mapa com estas informações mostrou-se uma estratégia eficiente na avaliação e posicionamento das estações de coleta.

Foram estabelecidas 36 estações de coleta, sendo dez de controle (Figura 2). As 26 estações de monitoramento foram plotadas concentradas nos raios mais próximos ao ponto de lançamento do efluente (área do difusor), com o objetivo de caracterizar o impacto da área mais crítica com relação à concentração do naftaleno. Desta forma, foram posicionadas ao todo 17 estações nas radiais de 50 m, 200 m e 500 m, considerada a área mais crítica, e o restante das estações foram distribuídas nas áreas de contorno e fora do alcance da pluma de dispersão formada pelos emissários, de forma a permitir a avaliação do decaimento de concentração dos efluentes lançados. Foram dispostas estações também a oeste da malha amostral cobrindo, assim, a área de maior probabilidade de observação dos efeitos da pluma de efluente conforme demonstrado nas quatro campanhas de caracterização e monitoramento realizadas anteriormente (2002 a 2004), em que as correntes presentes na área possuem direção preferencial para noroeste e sudoeste. As estações de controle foram posicionadas 20 km a leste dos emissários, em uma área com faciologia e batimetria semelhantes, e fora da influência da pluma de dispersão de efluentes, de sentido preferencial para oeste.

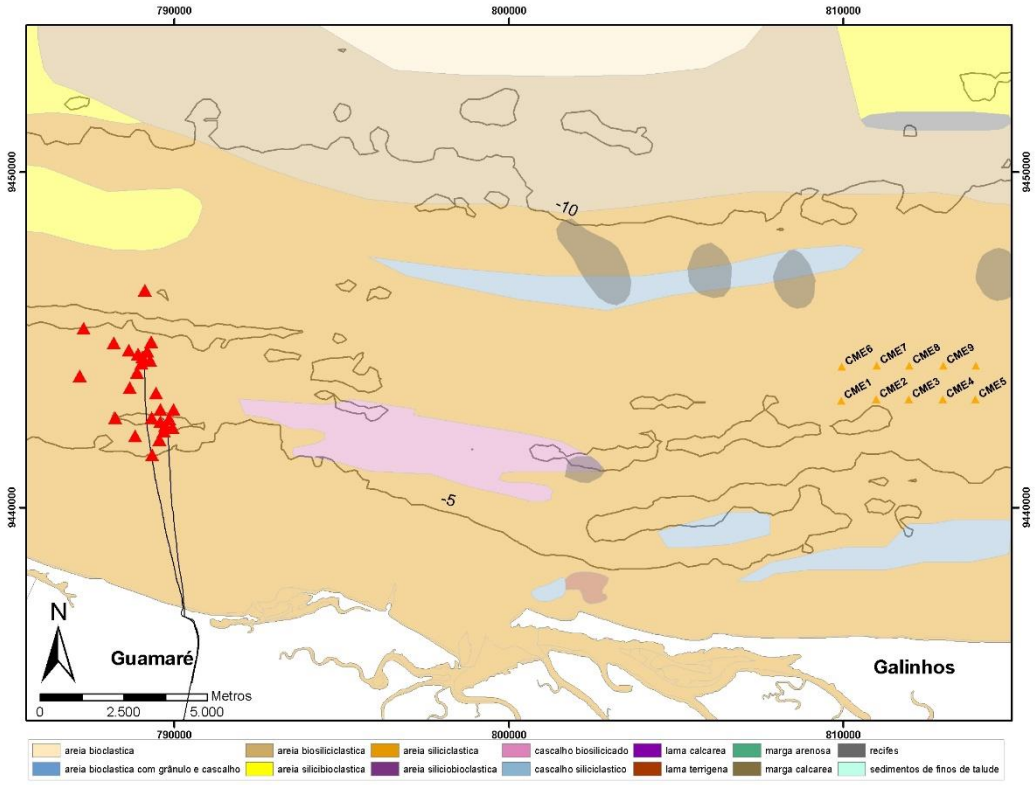

Figura 2 - Mapa das estações de coleta de bentos na área de Guamaré, realizada em novembro de 2008, mostrando a faciologia da região, os dois emissários submarinos e a localização das estações de monitoramento em torno dos difusores dos emissários (▲) e de controle (▲).

3.3 Procedimentos de Campo

Em todas as estações consideradas, a coleta sedimentológica foi efetuada em triplicada. Na campanha de 2009 até 2014, nas estações localizadas em áreas rasas as amostragens foram realizadas com corer (10 x 10 cm) através de mergulho. Nas estações mais profundas foram lançados equipamentos (Van Veen, Box-corer e Draga) para a coleta de sedimento. A escolha do equipamento utilizado em cada estação esteve fundamentada no conhecimento pretérito da região (granulometria do sedimento, profundidade local e características dos equipamentos). No caso da utilização do Van Veen ou Box-corer, o sedimento foi sub-amostrado com um corer de 10 cm de diâmetro (área de 78,8 cm^2) e 10 cm de profundidade/altura (ELEFTHERIOU E MOORE, 2005). O material retido no coletor foi acondicionado em potes plásticos, etiquetados, fixado com formaldeído (4% vol) e armazenado para transporte.

3.4 Procedimento de Laboratório

As amostras de sedimento foram lavadas através de peneiras de 0,5 mm e 0, 045 mm, sendo que o material, retido na peneira de menor abertura, passou pela técnica de flotação com uma solução de sulfato de magnésio, a fim de extrair os animais (GIERE, 2009). Em seguida a amostra foi colocada em placas de *Dolffus*, composta de 200 quadrados de 0,25 cm^2 cada um e levados ao estereomicroscópio para triagem dos indivíduos da nematofauna.

3.5 Diafanização e Preparação das lâminas

Foram retirados 130 Nematoda de cada amostra (no caso de número inferior, retirou-se o total de indivíduos presentes). Os animais passaram por um processo de diafanização para clareamento das estruturas internas (DE GRISSE, 1969). Essas soluções são classificadas como solução I, contendo formol (4%) e glicerina; solução II com etanol (96%) estando presente com 95 partes e glicerina com 5 partes e por último a solução III que contém os mesmos componentes da solução II anteriormente citada. No entanto esta terceira solução contém 50 partes de etanol e 50 partes de glicerina. O objetivo desse processo é a transferência total da glicerina para o

corpo do animal, sem resíduos de etanol. Isso possibilita melhor visualização das estruturas e uma maior durabilidade do espécime.

No final desse processo, os nematódeos foram depositados em lâminas permanentes, seguindo o método de Cobb (1917). Para a montagem, as lâminas foram previamente lavadas com álcool a 70%, para eliminação de impurezas presentes no vidro. Estas foram preparadas com um círculo de parafina, contendo uma gota de glicerina no centro, onde foi disposto um único animal e posteriormente recoberto por uma lamínula. Por aquecimento, a parafina foi derretida e a lamínula ficou aderida à lâmina. As lâminas foram levadas a microscópio óptico para a identificação dos Nematoda.

3.6 Identificação dos Nematoda

Nos estudos taxonômicos de Nematoda, características morfológicas os diferenciam, levando em consideração estruturas peculiares como: a cutícula, o arranjo de setas, glândulas caudais, esôfago, anfídeo, aparelhos reprodutores e a cavidade bucal de animais adultos (LORENZEN, 1994; GIERE, 2009). Contudo no presente estudo, foram incluídos indivíduos juvenis, pois alguns apresentavam características que diferiam dos adultos. Os Nematoda apresentam quatro estágios juvenis (J1, J2, J3, J4) até chegar à fase adulta (BIRD E BIRD, 1991).

Usando as características descritas acima, para o nível genérico utilizou-se a chave pictorial de Platt e Warwick (1983; 1988) e de Warwick et al., (1998). A classificação taxonômica foi baseada em De Ley et al., (2006) e Lorenzen (1994).

Além da morfologia corpórea, medidas são essenciais para a descrição e identificação de nematódeos (COBB, 1917). Para a identificação das espécies serão efetuadas medidas do corpo com o auxílio de microscópio binocular OLYMPUS CX 31 acoplado a um tubo de desenho. Para confirmação das espécies será utilizada Gerlach e Riemann (1973, 1974), além do site de consulta NeMys, da Universidade de Gent que possui um banco de dados sobre as espécies já descritas até o presente momento.

4. RESULTADOS

4.1 Sistemática

Classificação Taxonômica de acordo com Decraemer e Smol (2006)

Filo NEMATODA Potts, 1932

Classe CHROMADOREA Inglis, 1983

Subclasse CHROMODORIA Pearse, 1942

Ordem DESMODORIDA De Coninck, 1965

Subordem DESMODORINA De Coninck, 1965

Superfamília DESMODOROIDEA Filipjev, 1922

Família DESMODORIDAE Filipjev, 1922

Subfamília Desmodorinae Filipjev, 1922

Gênero *Acanthopharyngoides* Chitwood, 1936

Gênero *Acanthopharynx* Marion, 1870

Gênero *Bolbonema* Cobb, 1920*

Gênero *Croconema* Cobb, 1920

Gênero *Cornurella* da Silva, Silva, Esteves e Decraemer, 2018

Gênero *Desmodora* De Man, 1889

Gênero *Desmodorella* Cobb, 1933*

Gênero *Onepunema* Leduc e Verschelde, 2013

Gênero *Psammonema* Verschelde e Vincx, 1995

Gênero *Pseudochromadora* Daday, 1899

Gênero *Pseudodesmodora* Boucher, 1975*

Gênero *Sibayinema* Swart e Heyns, 1991

Gênero *Spinonema* Larrazábal-Filho, Neres, Silva e Esteves 2019*

Gênero *Zalonema* Cobb, 1920*

Subfamília Molgolaiminae Jensen, 1978

Gênero *Molgolaimus* Ditlevsen, 1921

Subfamília Prodesmodorinae Lorenzen, 1981

Subfamília Pseudonchinae Gerlach e Riemann, 1973

Subfamília Spiriniinae Chitwood, 1936

Gênero *Chromadoropsis* Filipjev, 1918;

Gênero *Chromaspirina* Filipjev, 1918

Gênero *Echinodesmodora* Blome, 1982

Gênero *Metachromadora* Filipjev, 1918

Gênero *Onyx* Cobb, 1891

Gênero *Papillonema* Verschelde, Muthumbi e Vincx, 1995

Gênero *Paradesmodora* Schuurmans Stekhoven, 1942

Gênero *Parallelocoilas* Boucher, 1975

Gênero *Perspiria* (Wieser e Hopper, 1967)

Gênero *Polysigma* Cobb, 1920

Gênero *Pseudometachromadora* Timm, 1952

Gênero *Spirinia* Gerlach, 1963

Gênero *Spirodesma* Cavalcanti *et al.*, 2009

Gênero *Stygodesmodora* Blome, 1982*

Subfamília Stilbonematinae Chitwood, 1936

Gênero *Catanema* Cobb, 1920

Gênero *Centonema* Leduc, 2013

Gênero *Eubostrichus* Certes, 1899

Gênero *Laxus* Cobb, 1894

Gênero *Leptonemella* Cobb, 1920

Gênero *Parabostrichus* Tchesunov, Ingels e Popova, 2012

Gênero *Robbea* Gerlach, 1956

Gênero *Stilbonema* Cobb, 1920

*gêneros estudados e descritos na tese.

4.2 Artigo 1 - Four new species and an identification key for *Stygodesmodora* Blome, 1982 (Nematoda: Spiriniinae) from the continental shelf off northeastern Brazil

(Publicado no periódico Zootaxa https://doi.org/10.11646/zootaxa.4294.1.2) 2017

SYSTEMATICS

Taxonomic classification, according to Decraemer & Smol (2006)

Class CHROMADOREA Inglis, 1983

Subclass CHROMODORIA Pearse, 1942

Order DESMODORIDA De Coninck, 1965

Suborder DESMODORINA De Coninck, 1965

Superfamily DESMODOROIDEA Filipjev, 1922

Family DESMODORIDAE Filipjev, 1922

Subfamily SPIRINIINAE Chitwood, 1936

Genus *Stygodesmodora* Blome, 1982

Diagnosis (emended from Leduc & Verschelde, 2015)

Cuticle with coarse annulations; numerous long somatic setae may be present; head region annulated (sometimes intraspecific variation present, with the head of some specimens only partially annulated in dorsal and ventral regions). Amphid unispiral to spiral, located on amphideal plate; buccal cavity small- to medium-sized, with dorsal tooth and (usually) smaller subventral teeth. Pharynx with rounded or pyriform posterior bulb, lumen may be bipartite. Precloacal supplements present or absent; spicules short, arcuate, with well-developed *capitulum*; gubernaculum present.

The diagnosis proposed by Leduc & Verschelde (2015) was expanded to include another feature, the bipartite lumen. This is a diagnostic feature at the species level. The

term "simple lumen" is used throughout the text, to distinguish from "bipartite lumen". A simple lumen has only one section in the esophagus, while a bipartite lumen has two sections.

***Stygodesmodora amphidialis* sp. n.**

(measurements in Table 1, Figs. 3, 4 and 5).

Type material: Holotype Male adult MNRJ 367. Station ME2C4 (05°02'10"S, 036°23'02"W).

Paratype female: Adult, MNRJ 368. Station CME3 (05°01'54"S, 036°11'15"W).

Other paratypes: 12 females (188 and 192 LMZOO-UFPE), 8 males (193–197 LMZOO-UFPE) and 8 J1 and 2 J3 (198 LMZOO-UFPE), data as for holotype.

Etymology. The species epithet is given for the size of the *fovea amphidialis*, the largest in the genus.

Description

Holotype (Figs. 3 and 5)

Body relatively short, cylindrical, yellowish brown, tapering slightly toward each end. Cuticle annulated except in final portion of tail, no lateral differentiation. Ventral ala absent. The somatic setae are arranged in eight longitudinal rows: two dorsal, four lateral and two ventral; in some specimens these are difficult to see. Head region with annulations completely surrounding *fovea amphidialis* (Fig. 3A). In some specimens, labial region folded inward. Anterior sensilla arrangement: six outer labial papillae (difficult to see), four cephalic setae, and below, 16 cervical setae near cephalic circle. Cervical setae arranged in four circles: four at level of cephalic setae, four at anterior edge of *fovea amphidialis*, four at mid-level of *fovea*, and four at level of posterior half of *fovea* (Fig. 3A). Cryptospiral *fovea amphidialis* longitudinally elongated, occupying 83% of diameter of head, located on cuticularized *amphideal* plate. Oral cavity with one dorsal tooth and one ventral tooth. Cylindrical pharynx with muscular, pyriform endbulb. Lumen simple (Figs. 3E and 4D). Nerve ring located 82 µm from anterior region. Ventral gland and excretory-secretory pore not observed. Cardia well developed, inserted in intestine. Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched. Sperm cells globular. Spicules tiny, with pointed ends. Broad *velum* present, gubernaculum well developed. Seven tubular precloacal supplements (Fig. 3C). All specimens with anterior group of four closely set

supplements, remaining supplements more widely separated from each other. Caudal papillae present. Tail conical, with three small caudal glands and spinneret.

Paratype female (Figs. 4 and 5)

Similar to male in body size, with minor differences: *fovea amphidialis* smaller than in male and a different cephalic arrangement (i.e. two sexual dimorphisms). Female with 12 cervical setae. Cervical setae arranged in two circles: four at mid-level of *fovea* and eight just below *fovea amphidialis*. In all specimens, nerve ring not visible. Reproductive system with paired ovaries, opposite and reflexed, situated to right of intestine. Vulva as transverse slit. *Vagina vera* short, *vagina uterina* with sphincter muscle. No egg found. Vulva comprising 60% of total body length (595 µm distant from anterior end). Tail conical.

Juveniles

Very similar to adults, except for lack of some characteristics such as supplements, the immature reproductive system, and the size of the *fovea amphidialis* (smaller than males). Juveniles in stage 1 lack cervical setae and have very few somatic setae along the body. Juveniles in stage 3 have four cervical setae and some somatic setae along the body. Ten juveniles were found, eight in stage 1 and two in stage 3.

Diagnosis

Stygodesmodora amphidialis **sp. n.** is characterized by the cephalic arrangement, with four cephalic setae and four distinct circles of cervical setae (for males). In females, the cervical setae are located in different circles (see Fig. 4A). *Fovea amphidialis* large (larger in males than in females, sexually dimorphic in size). 6–8 tubular supplements, group of anteriorly aggregated supplements, remaining supplements more widely separated from each other.

Differential diagnosis

Stygodesmodora amphidialis **sp. n.** is similar to *Stygodesmodora bacillicauda* (Gerlach, 1963) in the annulated cuticle, buccal cavity and size of the spicules. It differs from *S. bacillicauda* in the absence of supplements, caudal papillae and cervical setae. *Stygodesmodora bacillicauda* has numerous somatic setae in the tail region, which are absent in *S. amphidialis* **sp. n.**

Stygodesmodora amphidialis **sp. n.** is similar to *Stygodesmodora epixantha* Blome, 1982 in having a *velum*, cephalic setae, and the buccal cavity with one dorsal and one ventral tooth. It differs in the supplements (setiform in *S. epixantha*) and the size of the *fovea amphidialis* (larger in *S. amphidialis,* 83%, vs. 55% in *S. epixantha*). *Stygodesmodora amphidialis* **sp. n.** is comparable to *Stygodesmodora confusa* Leduc & Verschelde, 2015 in the presence of a well-developed *capitulum* and *velum*. It differs in the number of somatic setae (many somatic setae in *S. confusa*), cephalic arrangement (cervical setae absent in *S. confusa*) and shape of the supplements (tubular in *S. amphidialis* **sp. n.** and setiform in *S. confusa*).

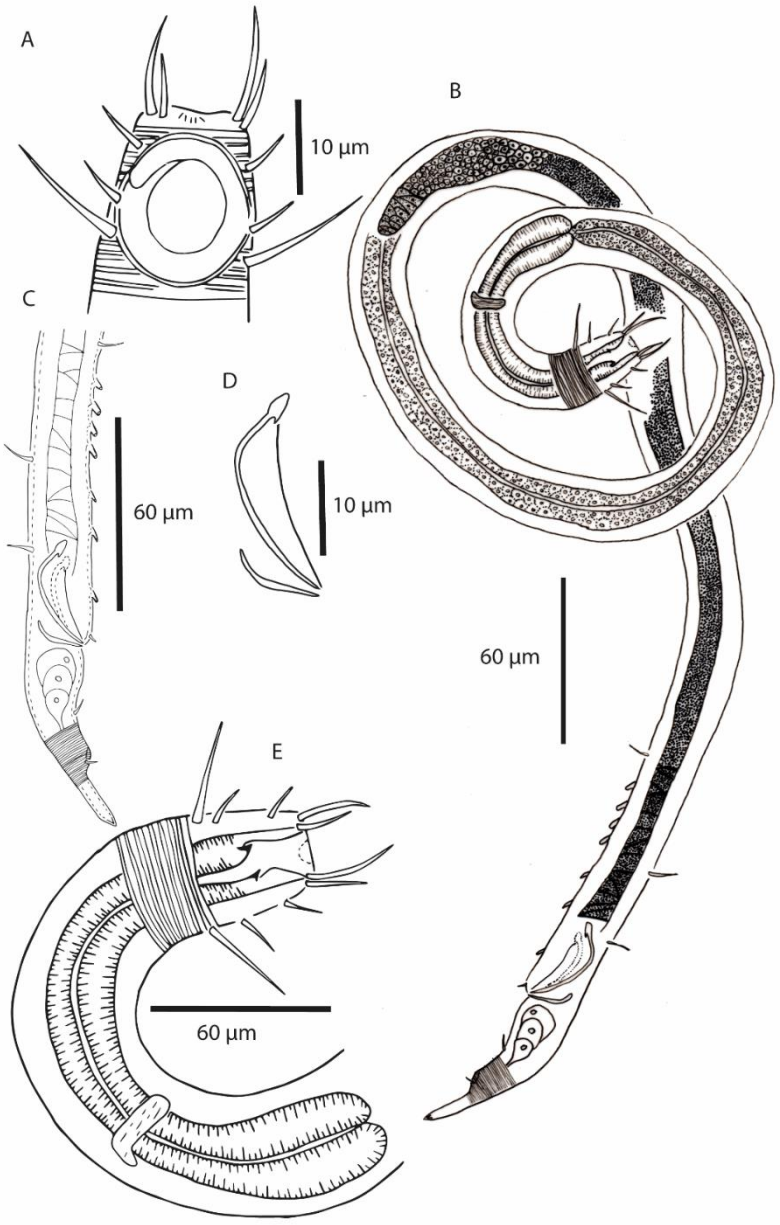

Figura 3 - *Stygodesmodora amphidialis* sp. n. Holotype male MNRJ 367. A: Head region; B: Overview; C: Tail region; D: Copulatory apparatus; E: Anterior region.

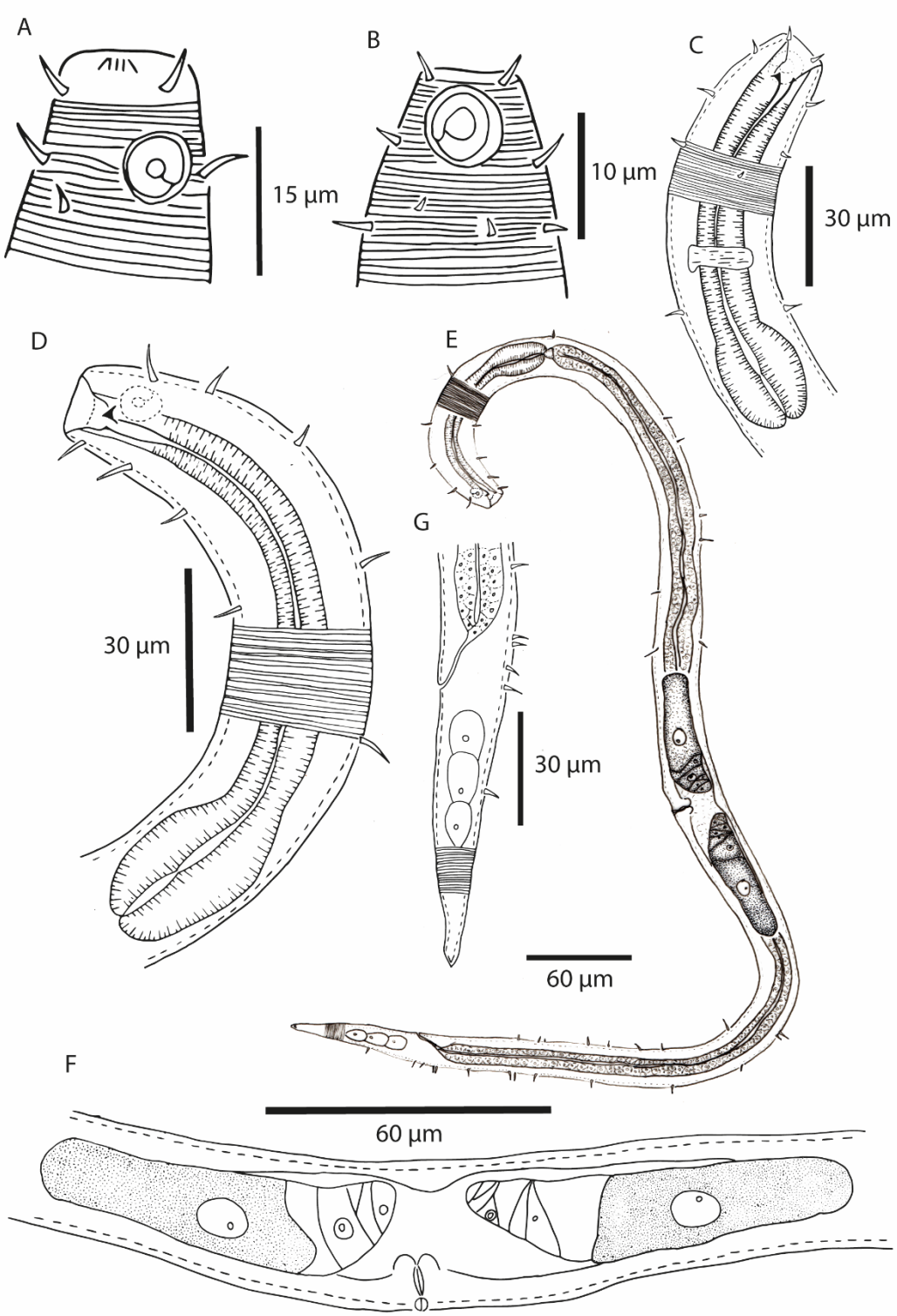

Figura 4 - *Stygodesmodora amphidialis* sp. n. A Head region of paratype female MNRJ 368; B: Head region of juvenile (J3); C: Anterior region of juvenile (J3); D: Anterior region of paratype female MNRJ 368; E: Overview of paratype female MNRJ

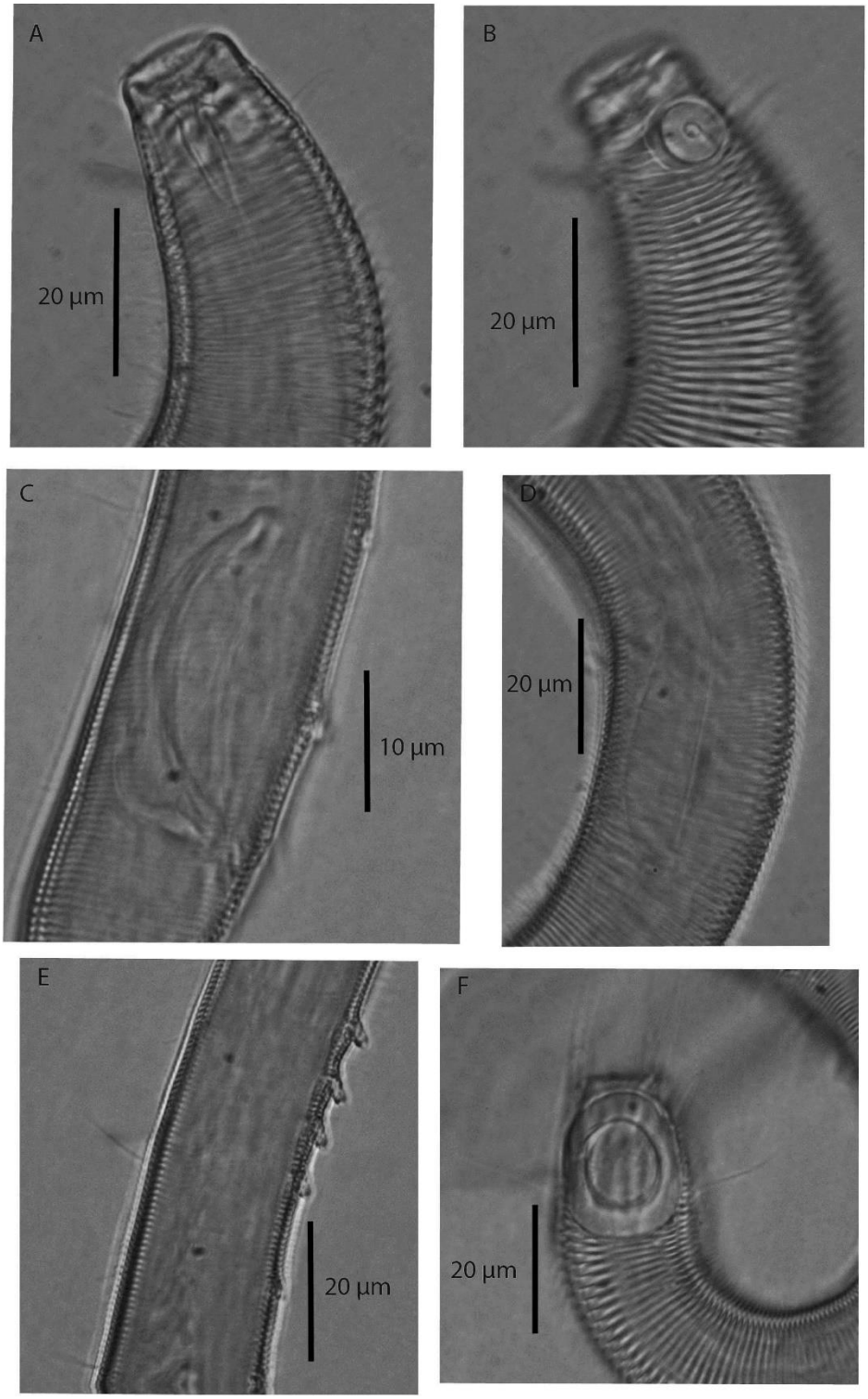

Figura 5 - Stygodesmodora amphidialis sp. n. A–B: Cephalic region of paratype female MNRJ 368. C–F: Holotype MNRJ 367; C: Spicules; D: Endbulb; E: Supplements; F: Anterior region and fovea amphidialis.

Tabela 1 - Measurements (µm) of *Stygodesmodora amphidialis* sp. n. from the Potiguar Basin, Brazil. "–" = not applied. The mean and standard deviation are followed by the range for paratype measurements

Species	*Stygodesmodora amphidialis* sp. nov.				
Sex	Male		Female		Juvenile
	Holotype	Paratype	Paratype	Paratype	Paratype
Number of specimens	–	8	–	12	10
Body length	1023	1064±150(949-1290)	998	1002±134(868-1228)	752±224(595-1215)
Pharynx length	138	134±5(129-138)	141	141±17(120-165)	113±31(94-172)
Maximum body diameter	36	34±3(31.5-37)	40.5	39±3(35-41)	32±6(27-44)
Anal body diameter	33	31±3(28.5-34.5)	29	32±15(22-30)	23±4(19-30)
Tail length	81	79±4(75-85)	91.5	84±23(78-97.5)	74±8(69-90)
Tail end length	16.5	16±2(13.5-18)	15	19±3(15-22.5)	18±2(16-23)
Head diameter	21	22±2(20-26)	17.5	22±4(17-26)	19±2(17-22)
Length of cephalic setae	9	11±3(9-16)	8	9±1(7-9.5)	7±1(6.5-8.5)
Length of subcephalic setae	9	9±3(6-14)	8	10±3(6.5-12)	7±1(6-8.5)
Nerve ring from anterior end	82	81±6(75-88)	*	*	68±3(64-75)
Percentage of bulb diameter	72	61±7(59-74)	75	73±4(66-76)	69±6(65-80)
*Fovea amphidialis*diameter (%cephalic capsule)	83	76±6(70-82)	37	43±8(31-50)	50±5(44-60)
Amphideal width	17.5	18±1(16-20)	6.5	9±2(6.5-10)	8±1(7-11)
Amphideal height	25	22±5(17-26)	7	10±2(7-11.5)	9±1(8-11)
Spicules length	50.5	46±6(38-51)	–	–	–
Gubernaculum length	19	21±2(19-24)	–	–	–
Velum length	34	29±4(24-34)	–	–	–
Number of supplements	7	7±1(6-8)	–	–	–
Anterior to vulva	–	–	403	489±79(397-651)	–
Position of vulva as percentage of body length from anterior end	–	–	40	49±2(42-53)	–
a	28	31±3(26-35)	25	25±3(22-29)	23±2(22-28)
b	7.5	8±1(7-9)	7	7±0.3(6-8)	7±0.3(6-7)
c	12.5	16±7(11-15)	11	11±1(11-13)	10±2(8.5-13)

***Stygodesmodora paramphidialis* sp. n.**

(measurements in Table 2, Figs. 6, 7 and 8).

Type material: Holotype Male adult MNRJ 384. Station ME1E3 (05°00'51"S, 036°24'30"W).

Paratype female: Adult, MNRJ 385. Station CME7 (05°01'20"S, 036°11'45"W).

Other paratypes: 9 females (199 and 203 LMZOO-UFPE), 9 males (204–208 LMZOO-UFPE), 9 J1 and 1 J4 (209 LMZOO-UFPE), same data as for holotype.

Etymology. The specific epithet "*paramphidialis*" is given because this species has many similarities to *Stygodesmodora amphidialis*.

Description

Holotype (Figs. 6 and 8)

Body cylindrical, yellowish brown, tapering slightly toward each end. Cuticle annulated except in final portion of tail, no lateral differentiation. Ventral ala absent. Based on pores and some setae along the body, the somatic setae are arranged in eight longitudinal rows: two dorsal, four lateral and two ventral. Head region with annulations completely surrounding *fovea amphidialis* (Fig. 6B). In some specimens, labial region folded inward. Anterior sensilla arrangement: six outer labial papillae (difficult to see), four cephalic setae and 12 cervical setae. Cervical setae are arranged in two circles: four at the anterior edge of the *fovea amphidialis* and six just below the *fovea amphidialis* (Fig. 6B). *Fovea amphidialis* cryptospiral, occupying 62% of diameter of head, located on cuticularized amphideal plate. Oral cavity with one dorsal tooth and one ventral tooth. Pharynx cylindrical, with muscular and slightly elongated endbulb. Lumen bipartite (Figs. 6E and 7C). Nerve ring located 77 µm from anterior region. Ventral gland and excretory-secretory pore not observed. Cardia well developed, inserted in intestine. Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched. Spicules arched, proximal region rounded. *Velum* present, gubernaculum well developed and slightly arched. Seven tubular precloacal supplements (Fig. 6A). Supplements irregularly distributed in precloacal region. Caudal papillae present. Tail conical, with three small caudal glands and spinneret.

Paratype female (Figs. 7 and 8)

Similar to male in body size, with minor differences: *fovea amphidialis* smaller than in male and with different cephalic arrangement (i.e. two sexual dimorphisms). Female

with eight cervical setae, in two circles: four between cephalic setae and *fovea amphidialis* and four at anterior edge of *fovea amphidialis*. Reproductive system with paired ovaries, opposite and reflexed, situated to right of intestine. Vulva as transverse slit. *Vagina vera* short, *vagina uterina* with sphincter muscle. Egg found in uterus (Fig. 6F). Globular spermatic cells visible in uterus within a spermatheca. Vulva comprising 62% of total body length (545 µm from anterior end). Tail conical.

Juveniles

Very similar to adults, except lacking some characteristics such as supplements, immature reproductive system, and size of *fovea amphidialis* (smaller than males). Juveniles in stage 1 lack cervical setae and have very few somatic setae along the body. Juveniles in stage 4 are very similar to adults. Ten juveniles were found, nine in stage 1 and one in stage 4.

Diagnosis

Stygodesmodora paramphidialis **sp. n.** is characterized by a cephalic arrangement with four cephalic setae and 12 cervical setae (for males). Sexually dimorphic in size of *fovea amphidialis* (larger in male than in female) and the number of cervical setae (12 in males and eight in females). Slightly elongated endbulb with bipartite lumen. With 6–8 tubular supplements, approximately equally spaced, without clustering.

Differential diagnosis

Stygodesmodora paramphidialis **sp. n.** is similar to *Stygodesmodora amphidialis* **sp. n.** Both species have four cephalic setae, one dorsal and one ventral tooth, arched spicules, developed *capitulum, velum,* tubular supplements and caudal papillae. The species can be distinguished by the size of the *fovea amphidialis* (larger in *S. amphidialis* **sp. n.**, occupying 83% of the head diameter, than in *S. paramphidialis* **sp. n.**, occupying 62% of the head diameter in males). *Stygodesmodora paramphidialis* **sp. n.** has a slightly elongated endbulb with a bipartite lumen; this feature is also observed in the female and juvenile, and is the main difference between the females in the two taxa, since *S. amphidialis* **sp. n.** has a pyriform endbulb and a simple lumen. Another difference is the cephalic arrangement: *S. amphidialis* **sp. n.** has four cephalic setae and 16 cervical setae; whereas *S. paramphidialis* **sp. n.** has four cephalic and 12 cervical setae. The last major difference is in the position of the supplements. *Stygodesmodora amphidialis* **sp.**

n. has a group of anteriorly aggregated supplements and the remaining supplements are more separated from each other, whereas in *S. paramphidialis* **sp. n.** all the supplements are irregularly distributed.

Stygodesmodora paramphidialis **sp. n.** can be distinguished from other species by means of the above comparisons with *S. amphidialis* **sp. n.**

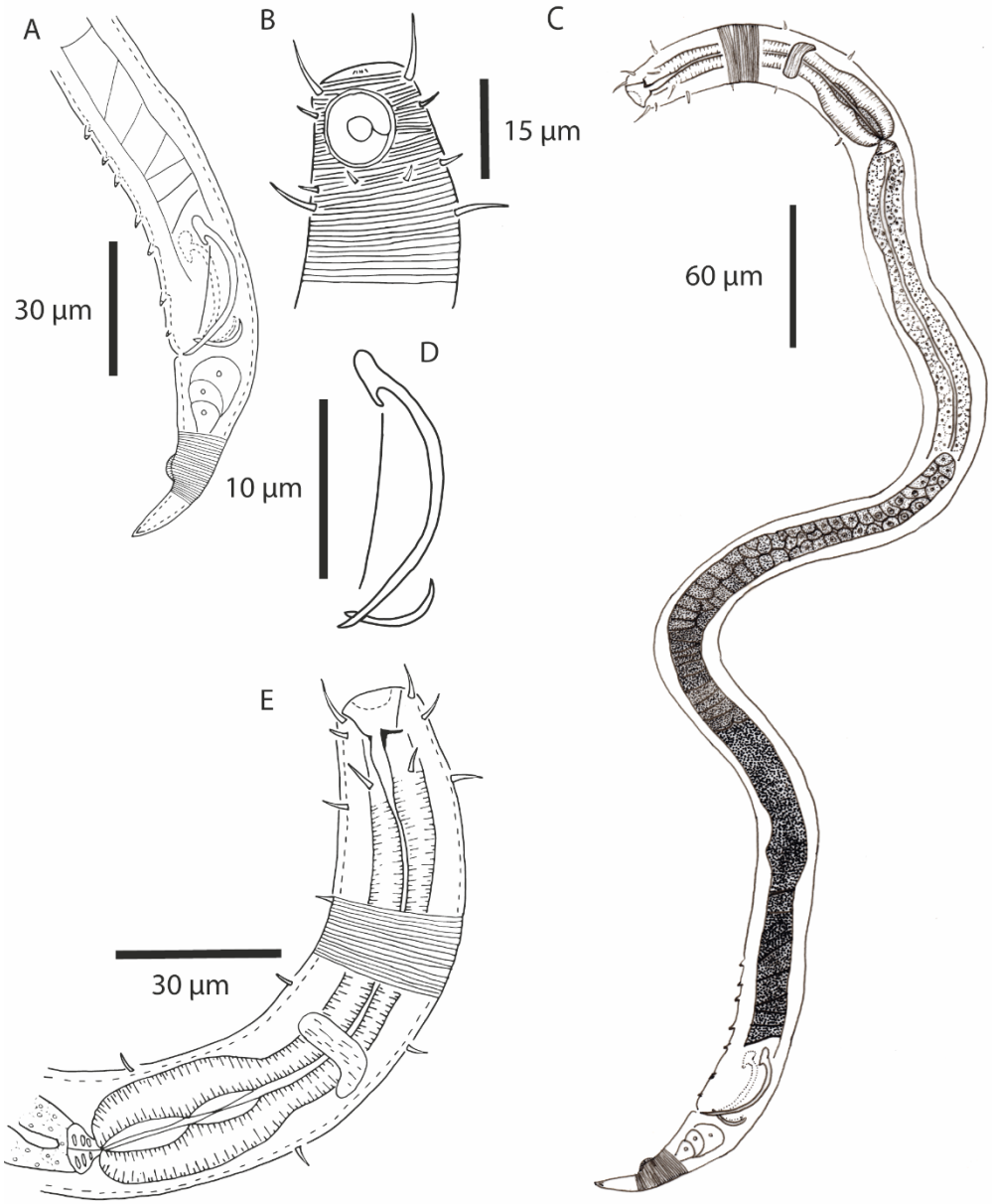

Figura 6 - *Stygodesmodora paramphidialis* sp. n. Holotype male MNRJ 384. A: Tail region; B: Head region; C: Overview; D: Copulatory apparatus; E: Anterior region.

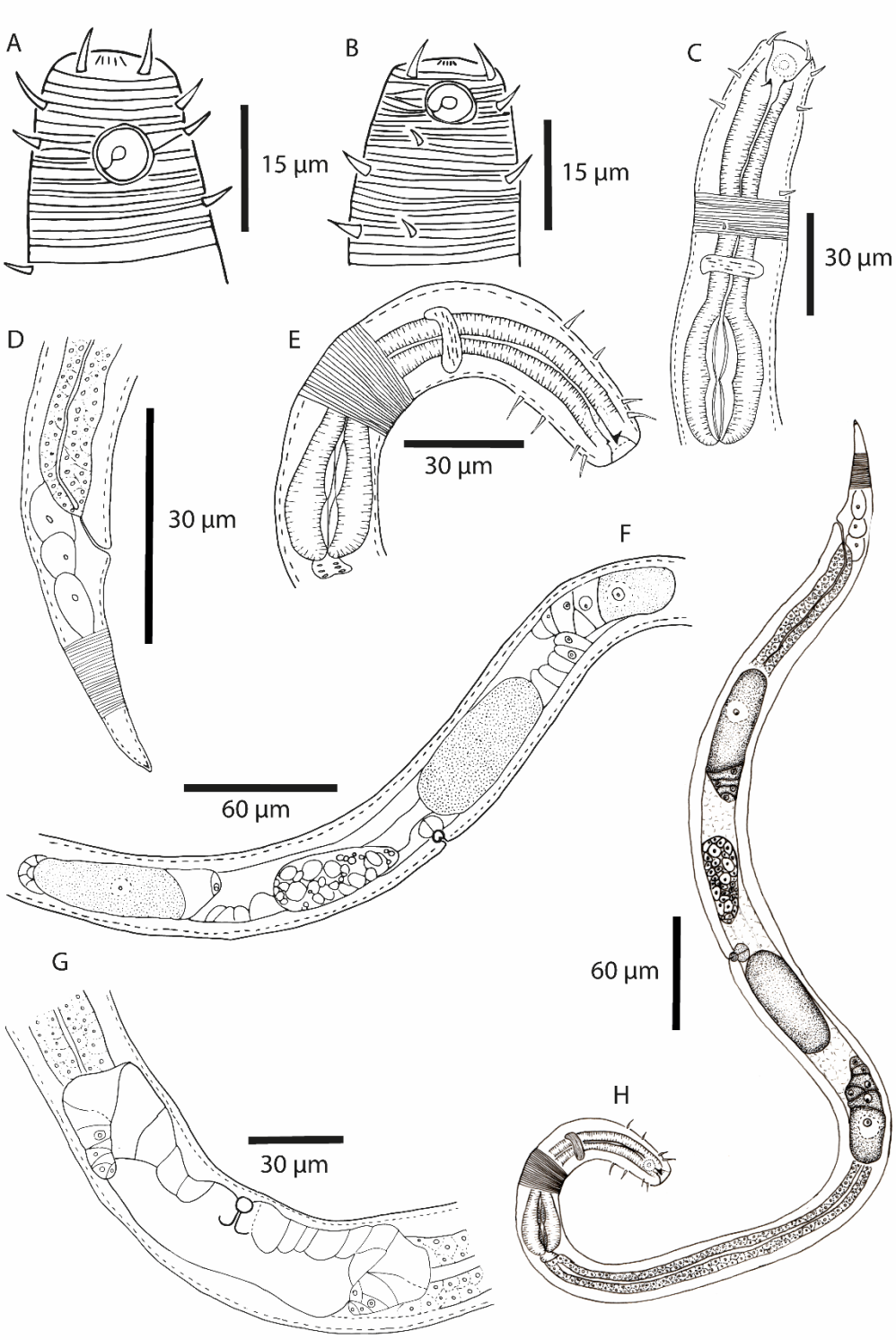

Figura 7 - *Stygodesmodora paramphidialis* sp. n. A: Head region of female MNRJ 385; B: Head region of juvenile (J4); C: Anterior region of juvenile (J4); D: Tail region of female MNRJ 385; E: Anterior region of paratype female MNRJ 385; F: Ovary and vulva opening of female MNRJ 385; G: Ovary of juvenile (J4); H: Overview of female MNRJ 385.

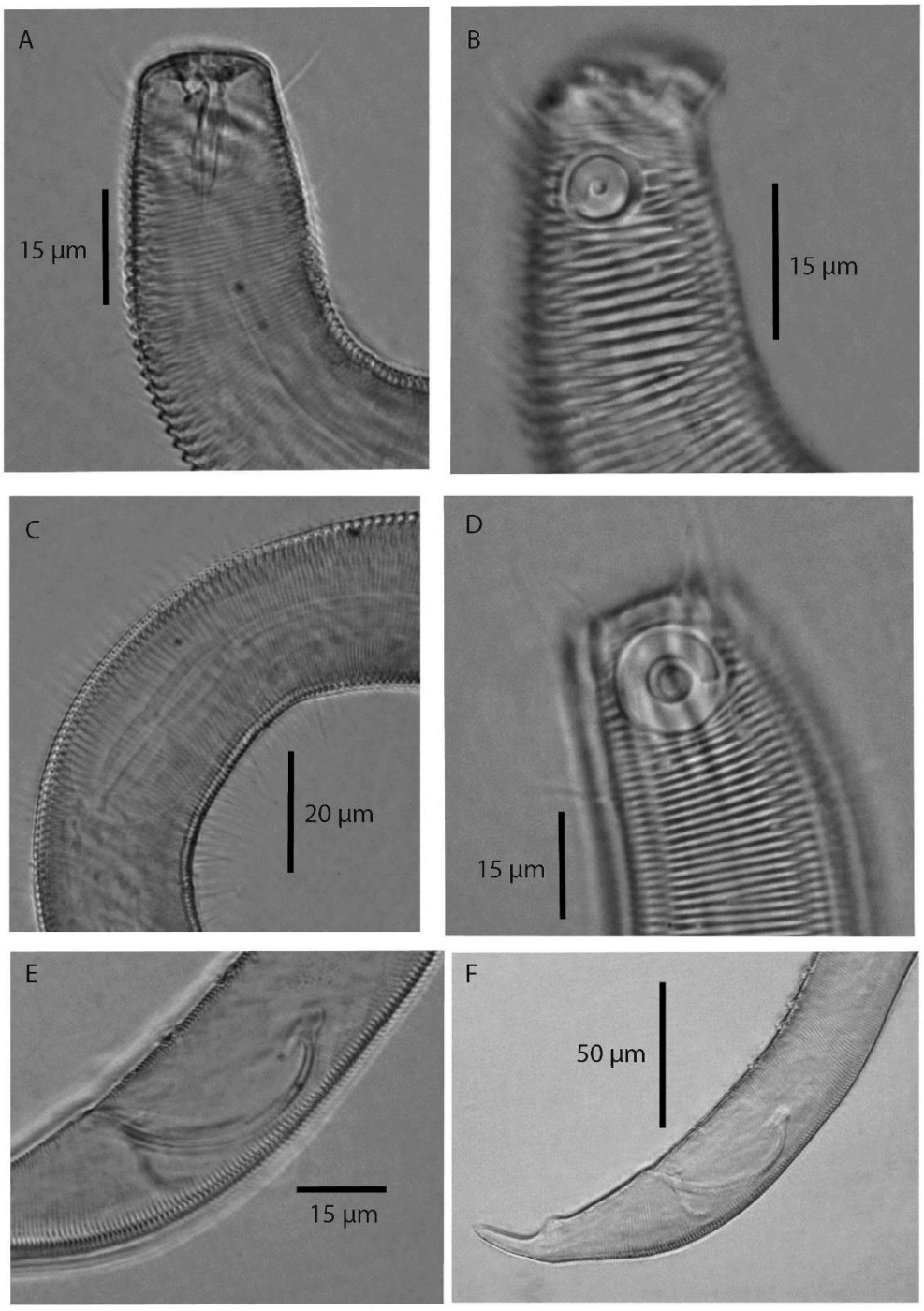

Figura 8 - *Stygodesmodora paramphidialis* sp. n. A–B: Cephalic region of paratype female MNRJ 385. C–F: Holotype male MNRJ 384; C: Endbulb; D: Head region; E: Copulatory apparatus; F: Tail region and supplements.

Tabela 2 - Measurements (µm) of *Stygodesmodora paramphidialis* sp. n. from the Potiguar Basin, Brazil. "–" = not applied. The mean and standard deviation are followed by the range for paratype measurements.

Species	*Stygodesmodora paramphidialis* sp. nov.				
Sex	Male		Female		Juvenile
	Holotype	Paratype	Paratype	Paratype	Paratype
Number of specimens	–	9	–	9	10
Body length	775	917±141(769-1128)	868	900±164(787.5-1184)	707±131(600-1041)
Pharynx length	127.5	123±8(111-132)	141	130±15(111-150)	107±6(102-121)
Maximum body diameter	37.5	36±5(27.5-39)	38	37±4(31-41)	28±2(26-31.5)
Anal body diameter	28.5	30±4(24-33)	25.5	26±2(22.5-28)	26±1(25.5-27)
Tail length	73.5	78±6(67-82)	73.5	75±5(67-81)	71±20(60-121)
Tail end length	21	20±3(15-22)	21	20±2(18-22)	14±1(13.5-15)
Head diameter	19.5	29±7(19-34)	22	21±2(18-23)	18±1(18-20)
Length of cephalic setae	13	12±2(8-13)	11	10±2(7-11)	9±1(8-10)
Length of subcephalic setae	7	9±2(6-10)	7	8±1(6-9.5)	8±2(6-12)
Nerve ring from anterior end	77	79±5(69-83)	61	72±12(58-85)	77±2(75-80)
Percentage of bulb diameter	62	69±8(59-77)	68	71±6(65-79)	63±3(61-70)
*Fovea amphidialis*diameter (%cephalic capsule)	62	64±5(57-69)	38	38±5(31-43)	33±3(30-39)
Amphideal width	11	14±2(13-16)	7	6±1(5.5-7)	7±1(6-8)
Amphideal height	12	15±2(12.5-17)	8	8±1(6.5-8)	6±1(5-7)
Spicules length	50.5	46±6(35-49)	–	–	–
Gubernaculum length	19	21±2(19-24)	–	–	–
Velum length	34	32±3(26-34)	–	–	–
Number of supplements	7	7±1(6-8)	–	–	–
Anterior to vulva	–	–	545	479±63(403-620)	–
Position of vulva as percentage of body length from anterior end	–	–	62	54±5(48-64)	–
a	21	26±4(21-33)	23	24±3(20-29)	25±3(22-33)
b	6	7±1(6-9)	6	7±1(6-9)	7±1(6-8.5)
c	10.5	12±1(10-13)	12	12±2(11-15)	10±1(10-11)

***Stygodesmodora robusta* sp. n.**

(measurements in Table 4, Figs. 9, 10 and 11).

Type material: Holotype Male adult MNRJ 386. Station ME1D1 (05°01'47"S, 036°23'44"W).

Paratype female: Adult, MNRJ 387. Station ME1C2 (05°01'11"S, 036°23'45"W).

Other paratypes: 6 females (210 and 214 LMZOO-UFPE), 11 males (215–219 LMZOO-UFPE), and 5 J1 and 5 J3 (220 LMZOO-UFPE), same data as for holotype.

Etymology. The species epithet is given for the strong body shape.

Description

Holotype (Figs. 9 and 11)

Body robust, long and cylindrical, yellowish brown. Cuticle strongly annulated except in final portion of tail, no lateral differentiation. Ventral ala absent. Somatic setae arranged in eight longitudinal rows: two dorsal, four lateral and two ventral. Head region with annulations completely surrounding amphid (Fig. 9B). In some specimens, labial region folded inward. Anterior sensilla arrangement: six outer labial papillae (difficult to see), four cephalic setae, and eight cervical setae. Cervical setae arranged in two circles: four at anterior edge of *fovea amphidialis* and four at posterior edge of *fovea* (Fig. 9B). *Fovea amphidialis* cryptospiral, occupying 57% of diameter of head, located on cuticularized amphideal plate. Oral cavity with one dorsal tooth and one ventral tooth. Pharynx cylindrical, with muscular and slightly elongated endbulb. Nerve ring, ventral gland and excretory-secretory pore obscured by thick cuticle, not observed. Cardia inserted in intestine (difficult to see). Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched. Spermatic cells globular. Spicules large and arched, proximal region rounded, well developed and with hook-shaped invagination. Laminar of gubernaculum positioned dorsally, without apophysis. *Velum* absent. One row of nine ventrally placed precloacal setae (Fig. 9C). Tail conical, with three small terminal setae, three caudal glands, and spinneret.

Paratype female (Figs. 10 and 11)

Similar to male, with minor differences: four cervical setae positioned at mid-level of *fovea amphidialis*. Reproductive system with paired ovaries, opposite and reflexed, situated to left of intestine. Vulva as transverse slit. *Vagina vera* short, *vagina uterina*

with sphincter muscle. No eggs. Globular spermatic cells visible in uterus. Vulva comprising 60% of total body length (886.5 µm from anterior end). Tail conical.

Juveniles

Very similar to adults, except lacking some characteristics such as supplements. Reproductive system immature. Juveniles in stage 1 lack cervical setae and have very few somatic setae along the body. Juveniles in stage 3 have four cervical setae and somatic setae along the body. Ten juveniles found, five in stage 1 and five in stage 3.

Diagnosis

Stygodesmodora robusta **sp. n.** is characterized by the long, robust body, strongly annulated cuticle, nine to 13 precloacal setae, and spicules large and arched, proximal region rounded, well developed and with hook-shaped invagination.

Differential diagnosis

Stygodesmodora robusta **sp. n.** can be compared with *S. confusa* in the presence of somatic setae along the body and the presence of setiform supplements. It differs in the cephalic setae arrangement (cervical setae absent in *S. confusa*), buccal cavity (ventral tooth absent in *S. confusa*) and number of supplements (*S. robusta* **sp. n.** with 9–13 setae vs. *S. confusa* with 4 setae).

Stygodesmodora robusta **sp. n.** is similar to *S. bacillicauda* in the annulated cuticle and buccal cavity. However, *S. bacillicauda* has more somatic setae than in *S. robusta* **sp. n.** Furthermore, *S. bacillicauda* lacks cervical setae and supplements (both features are present in *S. robusta* **sp. n.**).

Stygodesmodora robusta **sp. n.** is similar to *S. epixantha* in the strongly annulated cuticle, cephalic arrangement (four cephalic and eight cervical setae), buccal cavity (one dorsal and one ventral tooth). It differs in the shape and number of supplements (papilliform in *S. epixantha* vs. setiform in *S. robusta* **sp. n.**), absence of *velum* (present in *S. epixantha*), non-annulated tail end (shorter in *S. epixantha* than in *S. robusta* **sp. n.**), shape of capitulum (rounded in *S. epixantha* and hook-shaped in *S. robusta* **sp. n.**), and shape of gubernaculum (terminal region wing-shaped in *S. epixantha* and laminar in *S. robusta* **sp. n.**).

Stygodesmodora robusta **sp. n.** can be distinguished from *S. amphidialis* **sp. n.** and *S. paramphidialis* **sp. n.** by the strongly annulated cuticle (larger and thicker in *S.*

robusta **sp. n.** than in *S. amphidialis* **sp. n.** and *S. paramphidialis* **sp. n.**), shape of supplements (precloacal setae in *S. robusta* **sp. n.**), size of *fovea amphidialis* (larger in *S. amphidialis* **sp. n.** and *S. paramphidialis* **sp. n.** than in *S. robusta* **sp. n.**) and absence of a *velum* (in *S. robusta* **sp. n.**).

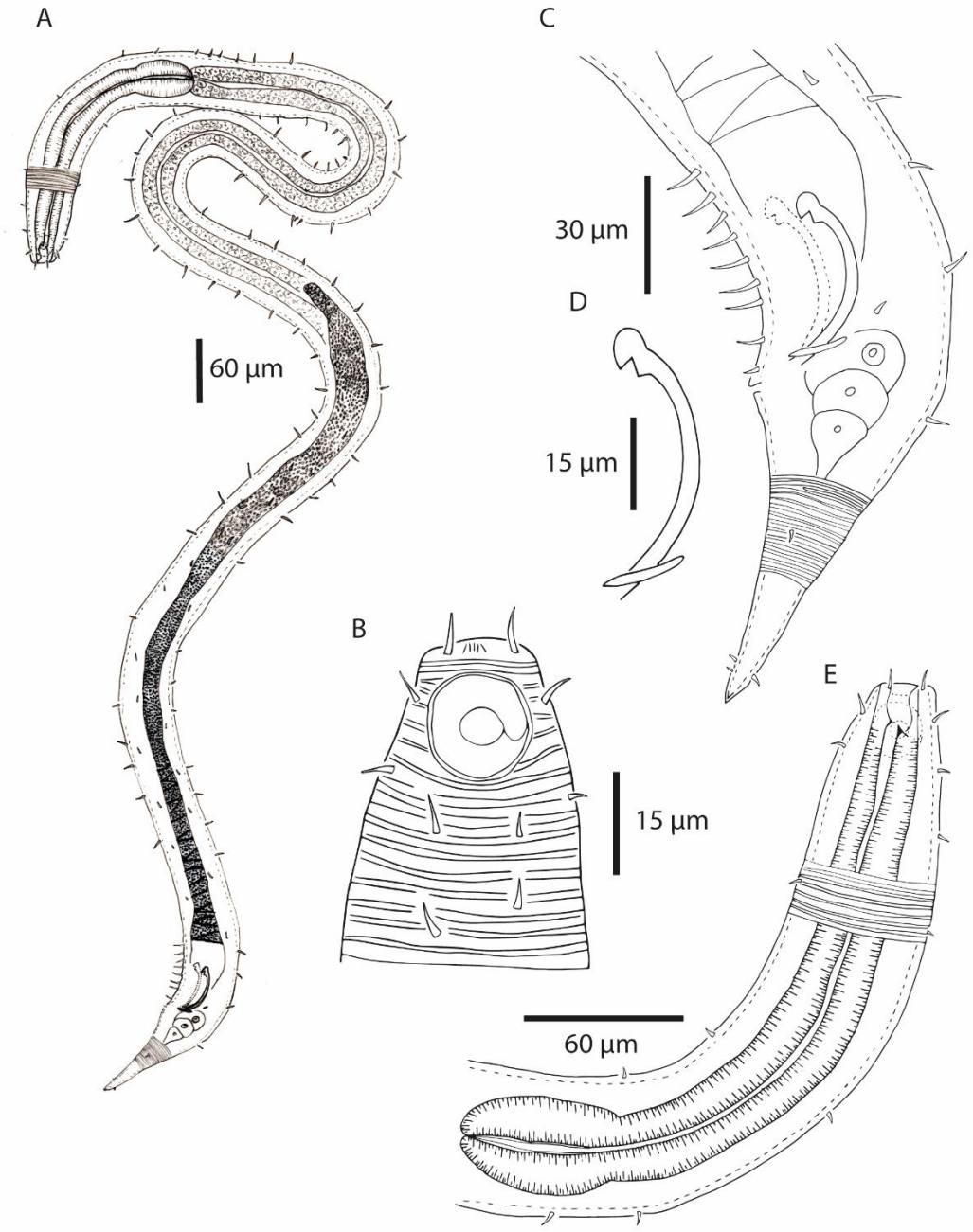

Figura 9 - *Stygodesmodora robusta* sp. n. Holotype male MNRJ 386. A: Overview; B: Head region; C: Tail region; D: Copulatory apparatus; E: Anterior region.

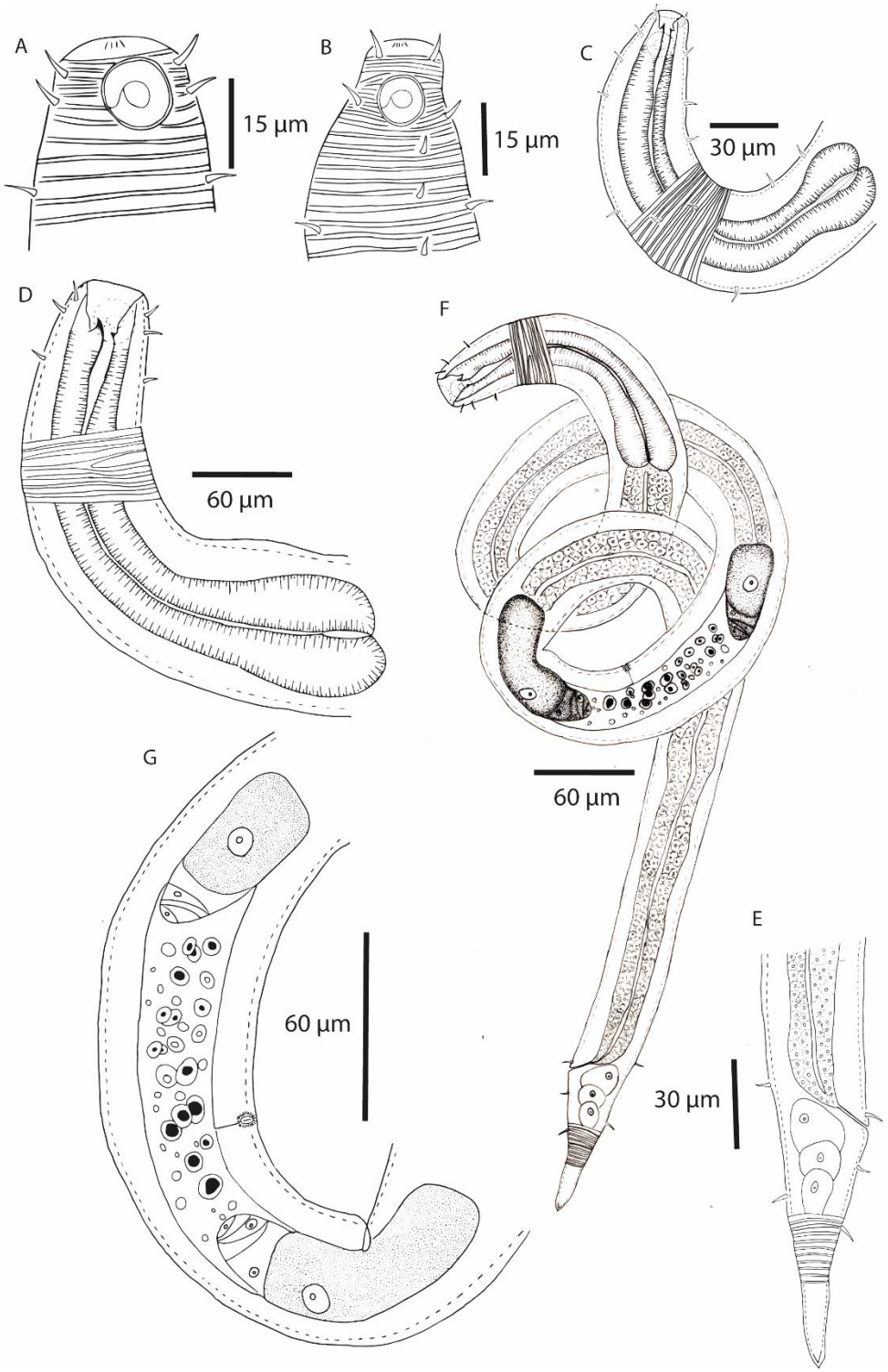

Figura 10 - *Stygodesmodora robusta* sp. n. A: Head region of paratype female MNRJ 387; B: Head region of juvenile (J3); C: Anterior region of juvenile (J3); D: Anterior region of paratype female MNRJ 387; E: Tail region of paratype female MNRJ 387; F: Overview of paratype female MNRJ 387; G: Ovary and vulva opening of paratype female MNRJ 387.

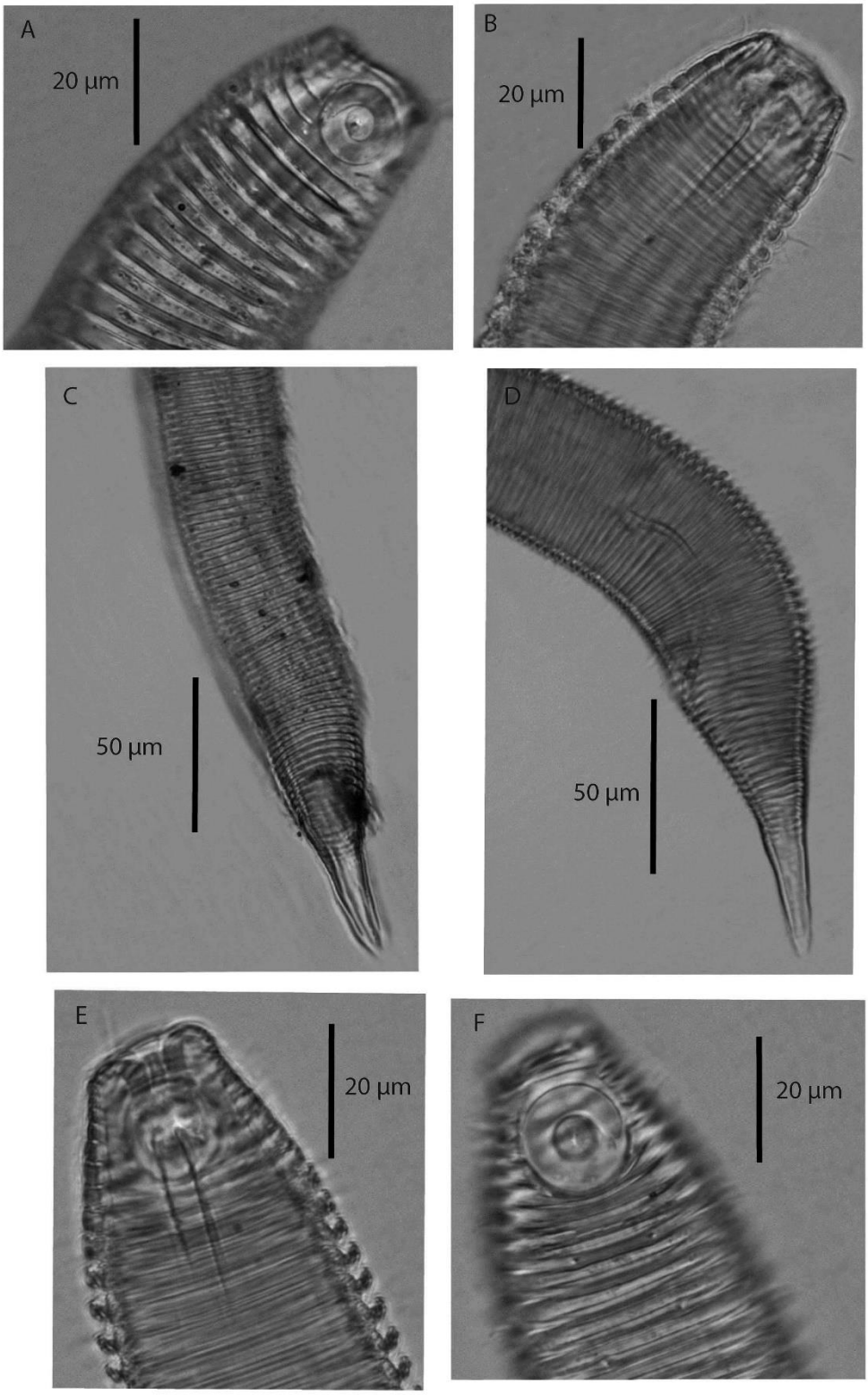

Figura 11 - *Stygodesmodora robusta* sp. n. A–C: Paratype female MNRJ 387; A–C: Cephalic region; C: Tail region. D–F: Holotype male MNRJ 386; D: Tail region; E–F: Cephalic region and fovea amphidialis.

Tabela 3 - Measurements (µm) of *Stygodesmodora robusta* sp. n. in the Potiguar Basin, Brazil. "–" = not applied. The mean and standard deviation are followed by the range for paratype measurements.

Species	*Stygodesmodora robusta* sp n				
Sex	Male		Female		Juvenile
	Holotype	Paratype	Paratype	Paratype	Paratype
Number of specimens	–	11	–	6	10
Body length	1620	1560±216(1215-1815)	1587	2043±546(1695-3000)	1036±392(600-1792)
Pharynx length	232.5	175±34(139.5-225)	181.5	198±28(183-253.5)	153±49(133-230)
Maximum body diameter	51	54±4(48-58.5)	66	66±3(64.5-69)	50±10(43-60)
Anal body diameter	48	49±8(39-58)	43.5	43±3(39-45)	47±4(42-52)
Tail length	94.5	95±9(84-108)	88.5	96±8(88-105)	75±18(87-99)
Tail end length	39	37±5(31.5-43.5)	36	61±21(36-82)	36±2(31.5-37.5)
Head diameter	29	30±2(27.5-33)	32	34±5(27-39)	28±5(20-30)
Length of cephalic setae	9	10±2(8-12)	6	10±2(6-11.5)	10±2(6-11)
Length of subcephalic setae	9	10±1(7-11)	8	9±1(7-10)	10±2(7-11)
Percentage of bulb diameter	68	65±7(56-72)	69	64±3(61-67)	68±3(65-72)
*Fovea amphidialis*diameter (%cephalic capsule)	57	56±7(45-63)	45	52±4(45-57)	57±4(51-62)
Amphideal width	17	17±1(15-18)	12.5	16±2(12-17)	15±2(11-18,5)
Amphideal height	17	16±1(15-18)	14	16±2(12.5-18)	14±3(9,5-18.5)
Spicules length	66	59±8(51-69)	–	–	–
Gubernaculum length	27	30±3(25-34)	–	–	–
Number of precloacal setae	9	11±2(9-13)	–	–	–
Length of precloacal setae	9	10±1(9-11.5)	–	–	–
Anterior to vulva	–	–	886.5	762±55(694.5-812)	–
Position of vulva as percentage of body length from anterior end	–	–	60	39±7(40-49)	–
a	32	24±2(25.5-32)	24	31±7(26-40)	20±4(18-29)
b	7	9±1(5.5-11)	9	10±2(9-13)	7±1(5-9)
c	17	16±1(11-18)	18	21±4(18-28)	14±3(11-18)

***Stygodesmodora potiguensis* sp. n.**

(measurements in Table 4, Figs. 12, 13 and 14).

Type material: Holotype Male adult MNRJ 388. Station ME1D1 (05°01'47"S, 036°23'44"W).

Paratype female: Adult, MNRJ 389. Station ME2C2 (05°02'18"S, 036°23'23"W).

Other paratypes: 1 J2 (221 LMZOO-UFPE), same data as for holotype.

Etymology. The specific epithet "***potiguensis***" is given for the location where the material was found, in the Potiguar Basin.

Description

Holotype (Figs. 12 and 14)

Body relatively long, cylindrical, yellowish brown, tapering slightly toward each end. Cuticle annulated except in final portion of tail, no lateral differentiation. Ventral ala absent. Many somatic setae, irregularly distributed along body. Head region with annulations completely surrounding *fovea amphidialis*. Anterior sensilla arrangement: six outer labial papillae (difficult to see), four cephalic setae, and four cervical setae. Cervical setae positioned at mid-level of *fovea amphidialis* (Fig. 12A). *Fovea amphidialis* large, cryptospiral, occupying 90% of diameter of head, located on cuticularized amphideal plate. Oral cavity with one dorsal tooth and one ventral tooth. Pharynx cylindrical with muscular and pyriform endbulb. Nerve ring, ventral gland and excretory-secretory pore not observed. Cuticle and somatic setae strongly cuticularized and obscuring internal structures. Cardia inserted in intestine. Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched. Spicules arched, proximal region rounded and hook-shaped (Fig. 12E). *Velum* absent; gubernaculum simple, well developed. Caudal and precloacal regions with few setae. Supplements absent. Tail conical-cylindrical, with three small caudal glands and spinneret.

Paratype female (Figs. 13 and 14)

Similar to male in body size, with minor differences: *fovea amphidialis* smaller than in male and cephalic arrangement different (i.e. two sexual dimorphisms). Cervical setae arranged in two circles: four at mid-level of *fovea amphidialis* and four just below *fovea*. Reproductive system with paired ovaries, opposite and reflexed, situated to right

of intestine. Vulva as transverse slit. *Vagina vera* short, *vagina uterina* with sphincter muscle. No egg found. Vulva comprising 37% of total body length (456 µm distant from anterior end). Tail conical.

Juveniles

Very similar to adults, except lacking some characteristics such as supplements, with an immature reproductive system, and the size of the *fovea amphidialis* (smaller than males). Juveniles in stage 2 have four cervical setae and some somatic setae along the body. One juvenile was found, in stage 2.

Diagnosis

Stygodesmodora potiguensis **sp. n.** is characterized by having the cuticle strongly annulated, many somatic setae along the body, sexual dimorphism in the size of the *fovea amphidialis*, and supplements absent.

Differential diagnosis

Stygodesmodora potiguensis **sp. n.** is similar to *S. bacillicauda* in the annulated cuticle, many somatic setae along the body, and the absence of supplements. However, *S. bacillicauda* lacks cervical setae, the shape of the *capitulum* is different (rounded in *S. bacillicauda* vs. rounded and hook-shaped in *S. potiguensis* **sp. n.**), the gubernaculum (in *S. bacillicauda* the distal portion of the gubernaculum is enlarged) and the tail (conical in *S. bacillicauda* vs. conical-cylindrical in *S. potiguensis* **sp. n.**).

Stygodesmodora potiguensis **sp. n.** is similar to *S. epixantha* in the cephalic arrangement (four cephalic setae) and buccal cavity (one dorsal and one ventral tooth). It differs in the size of the *fovea amphidialis* (larger in *S. potiguensis*, at 90%, than in *S. epixantha* at 55%), the number of somatic setae along the body (*S. potiguensis* **sp. n.** has many more setae), the lack of a *velum* (present in *S. epixantha*) and the shape of the *capitulum* (rounded in *S. epixantha*).

Stygodesmodora potiguensis **sp. n.** resembles *Stygodesmodora confusa* in the presence of somatic setae. It differs in the cephalic arrangement (cervical setae absent in *S. confusa*), shape of the *capitulum* (rounded in *S. confusa*), the presence of a *velum* (absent in *S. potiguensis* **sp. n.**), and the size of the *fovea amphidialis* (larger in *S. potiguensis* **sp. n.**).

Stygodesmodora potiguensis **sp. n.** can be distinguished from the other new species described here by the presence of many somatic setae along the body and the absence of supplements.

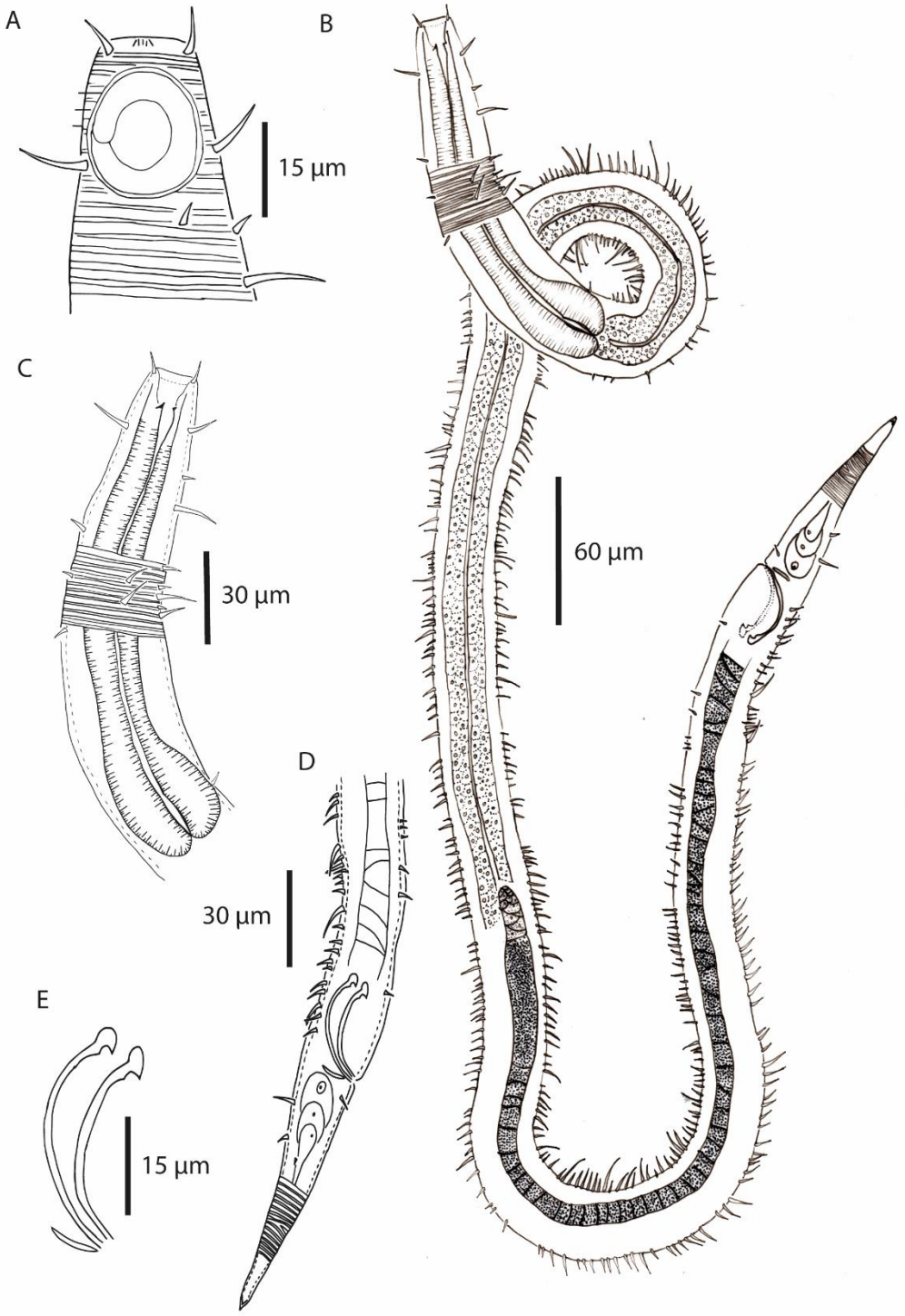

Figura 12 - *Stygodesmodora potiguensis* sp. n. Holotype MNRJ 388. A: Head region; B: Overview; C: Anterior region; D: Tail region; E: Copulatory apparatus.

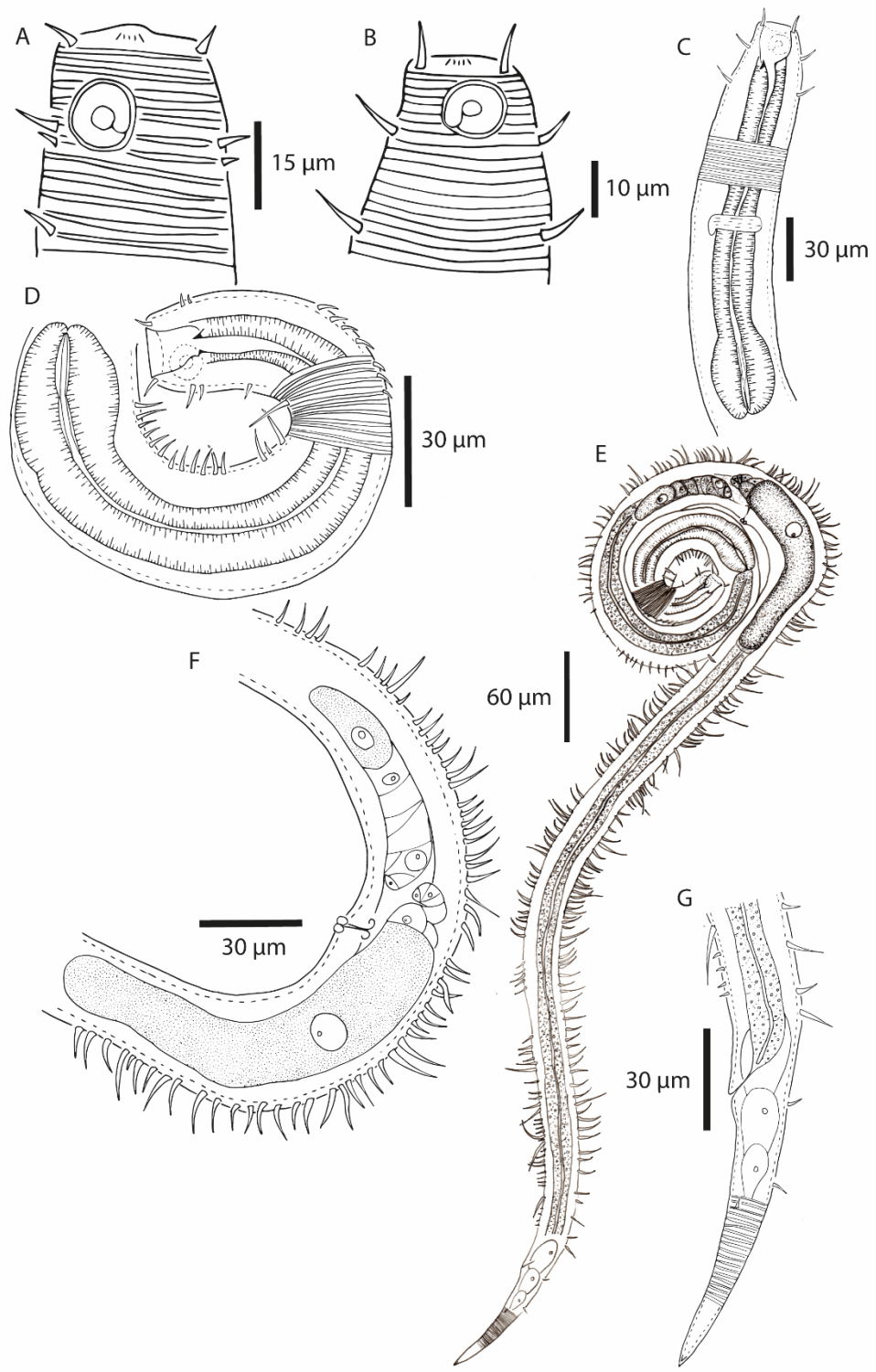

Figura 13 - *Stygodesmodora potiguensis* sp. n. A: Head region of paratype female MNRJ 389; B: Head region of juvenile (J2); C: Anterior region of juvenile (J2); D: Anterior region of paratype female MNRJ 389; E: Overview of paratype female MNRJ 389; F: Ovary and vulva opening of paratype female MNRJ 389; G: Tail region of paratype female MNRJ 389.

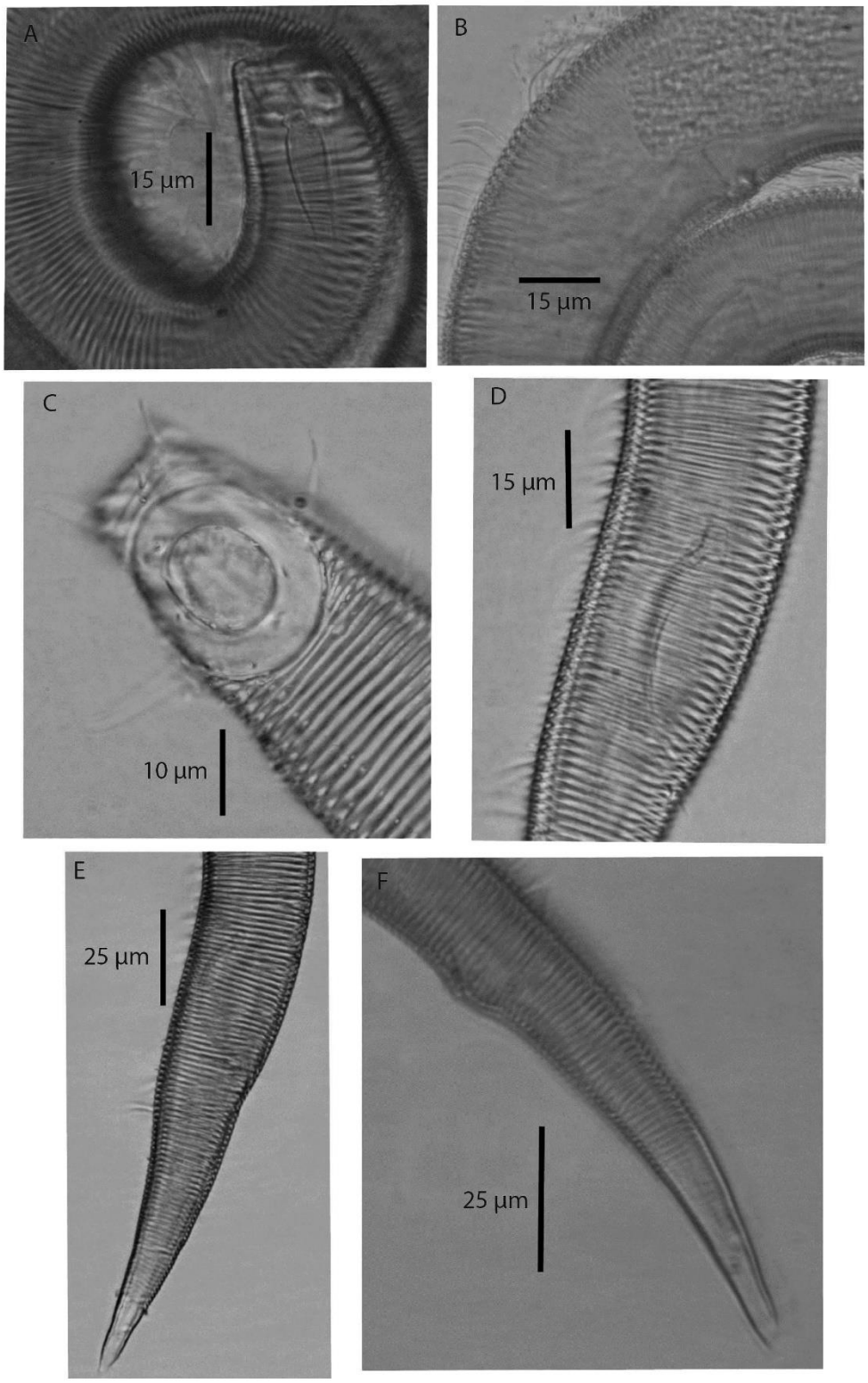

Figura 14 - *Stygodesmodora potiguensis* sp. n.: A–B, F: Paratype female MNRJ 389; C–E: Holotype male MNRJ 388. A: Cephalic region; B: Vulva opening; C: cephalic region and fovea amphidialis; D: Spicules; E: Male tail region; F: Female tail region.

Tabela 4 - Measurements (µm) of *Stygodesmodora potiguensis* sp. n. from the Potiguar Basin, Brazil. "–" = not applied.

Species	*S. potiguensis* sp n		
Sex	Male	Female	Juvenile
	Holotype	Paratype	Paratype
Number of specimens	1	1	1
Body length	1184	1240	812
Pharynx length	172.5	180	132
Maximum body diameter	38	42	36
Anal body diameter	30	28.5	24
Tail length	99	99	81
Tail end length	24	24	22.5
Head diameter	23.5	20	17
Length of cephalic setae	9	9.5	8.5
Length of subcephalic setae	11	8.5	10
Percentage of bulb diameter	68	66	72
*Fovea amphidialis*diameter (%cephalic capsule)	90	42	44
Amphideal width	21.5	8.5	7
Amphideal height	24.5	8.5	6
Length of spicules	46	–	–
Gubernaculum length	14	–	–
Anterior to vulva	–	456	–
Position of vulva as percentage of body length from anterior end	–	37	–
a	31	29	22.5
b	7	7	6
c	12	12.5	10

Key to identify males of the genus *Stygodesmodora* Blome, 1982.

1 – Supplements absent..... 2
– Supplements present.....3
2(1) – Cervical setae absent; tail conical; gubernaculum with enlarged distal portion…… *S. bacillicauda*
– Cervical setae present; tail conical-cylindrical; gubernaculum simple.....*S. potiguensis* **sp. n.**
3(1) – Supplements setiform or papilliform……..4
– Supplements tubular……...…….... 6
4(3) – Supplements setiform; gubernaculum simple (laminar).……5
– Supplements papilliform; gubernaculum with apophysis.....*S. epixantha*
5(4) – Supplements consisting of 4 small setae; spicules with *velum*; cervical setae absent…… *S. confusa*
– Supplements consisting of 9–13 setae of different sizes; spicules without *velum*; cervical setae present…….*S. robusta* **sp. n.**
6(3) – Supplements tubular (6–8), group of anteriorly aggregated supplements, and remaining supplements more widely separated from each other; males with *fovea*

amphidialis occupying 75–88% of corresponding body diameter; endbulb with simple lumen……..*S. amphidialis* **sp. n.**

– Supplements tubular (6–8), approximately equally spaced, without clustering; males with *fovea amphidialis* occupying 57–69% of corresponding diameter; endbulb with bipartite lumen……..*S. paramphidialis* **sp. n.**

Discussion

One taxonomic attribute of these new species is their sexual dimorphism. Three of the species (*S. amphidialis* **sp. n.**, *S. paramphidialis* **sp. n.** and *S. potiguensis* **sp. n.**) show sexual dimorphism in the size of the *fovea amphidialis*. Larrazábal-Filho *et al*. (2015) and Moura *et al*. (2014) also observed and discussed the sexual dimorphism of the *fovea amphidialis*. Sexual dimorphism occurs in the subclass Chromadoria (Lorenzen, 1981, 1994). Lorenzen (1981, 1994) stated that when this occurs, the dimorphism is generally in the size of the *fovea*, which is larger in males than in females. In the Desmodoridae, this dimorphism has been recorded for members of *Croconema* Cobb, 1920; *Desmodora* de Man, 1889; *Desmodorella* Cobb, 1933; *Pseudochromadora* Daday, 1889; *Metachromadora* Daday, 1889; *Stygodesmodora* Blome, 1982; and *Zalonema* Cobb, 1920.

Desmodorid nematodes are abundant in shallow habitats such as tropical coral reefs (Tietjen, 1991), sandy beaches (Verscheld & Vincx, 1996), and seagrass beds (Ndaro & Ólafsson, 1999), but also occur in the deep sea (Verschelde *et al*., 1998; Leduc & Verschelde, 2015) and freshwater habitats (Decraemer & Smol, 2006). Members of *Stygodesmodora* occur in a wide range of depths: they are common in shallow waters (*S. epixantha*, *S. bacillicauda*, *S. amphidialis* **sp. n.**, *S. paramphidialis* **sp. n.**, *S. robusta* **sp. n.**, and *S. potiguensis* **sp. n.**) and also in the deep sea (*S. confusa* Leduc & Verschelde, 2015).

In the last three years, 10 new species of nematodes have been described from the Potiguar Basin (Neres *et al*., 2013; 2014; Larrazábal-Filho *et al.*, 2015). Among these, four new species and one new occurrence belong to the family Desmodoridae. The present study raises the number of desmodorid species reported from the Potiguar Basin to eight (Larrazábal-Filho *et al*., 2015), and more than doubles the number of species known in this genus. Samples from the basin are still being studied, and we expect additional descriptions of new desmodorid taxa.

4.3 Artigo 2 - The genus *Bolbonema* Cobb, 1920 (Nematoda: Desmodoridae): emended diagnosis, key to males, and description of three new species from the continental shelf off northeastern Brazil

(Publicado no periódico Zootaxa https://doi.org/10.11646/zootaxa.4420.4.6) 2018

SYSTEMATICS

Taxonomic classification, according to Decraemer & Smol (2006)

Class CHROMADOREA Inglis, 1983

Subclass CHROMODORIA Pearse, 1942

Order DESMODORIDA De Coninck, 1965

Suborder DESMODORINA De Coninck, 1965

Superfamily DESMODOROIDEA Filipjev, 1922

Family DESMODORIDAE Filipjev, 1922

Subfamily DESMODORINAE Filipjev, 1922

Genus *Bolbonema* Cobb, 1920

Diagnosis (emended from Verschelde *et al.*, 1998)

Desmodorinae. Head capsule globular. Cuticle undifferentiated, without ornamentation. Cephalic setae may be located at anterior, middle or posterior level of the *fovea amphidialis*. Buccal cavity minute but may have two or three teeth. One dorsal tooth and one or two subventral teeth. Cryptospiral, spiral or multispiral *fovea* with up to three turns; edge of posterior portion of *fovea amphidialis* may extend to cuticle striation. Long and shorter somatic setae. Supplements may be present.

Remarks: The diagnosis proposed by Verschelde *et al.* (1998) is expanded to include other features. The cephalic setae may be inserted at any level of the *fovea*. The buccal cavity may have three, two or indistinct teeth. The *fovea amphidialis* may be cryptospiral, spiral or multispiral, with up to three turns; the posterior edge of the *fovea* may be present in the striations. May exceed the limit of the cephalic capsule.

***Bolbonema braziliensis* sp. n.**

(measurements in Table 5, Figures 15, 16 and 17).

Type material: Holotype Male adult MNRJ 390. Station CME1 (05°01'55.3"S, 36°12'20.4"W).

Paratype female: Adult, MNRJ 391. Station CME1 (05°01'21.2"S, 36°12'18.7"W).

Other paratypes: 5 females (221 and 225 LMZOO-UFPE), 6 males (226–230 LMZOO-UFPE) and 2 J1, 1 J2 and 3 J3 (231 LMZOO-UFPE), data as for holotype.

Etymology. The specific epithet "***braziliensis***" is given for the location where the material was found, in Brazil.

Description

Holotype (Figures 15 and 17)

Body cylindrical, yellowish brown, tapering slightly toward each end. Cuticle annulated except in final portion of tail, no lateral differentiation. Eight longitudinal rows of somatic setae; two subdorsal, two subventral and four sublateral. They start from cervical region to level of cloaca, alternating in long setae with shorter setae. Head capsule well developed with thick cuticle without annulations. Anterior sensilla arrangement: six outer labial papillae (difficult to see) and four cephalic setae positioned at middle level of *fovea amphidialis*. *Fovea amphidialis* cryptospiral, relatively large, posterior border in contact with cuticle striations, occupying 64% of diameter of head. Buccal cavity small, with one dorsal tooth and one small ventral tooth, not always visible. Pharynx muscular with well-developed posterior bulb. Cardia and excretory-secretory system not observed. Nerve ring located 54 µm from anterior region. Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched. Sperm cells globular. Spicules arched, proximal region expanded. Gubernaculum a bent rod dorsally oriented. *Velum* absent. Two precloacal setae inserted on two small papillae (Fig 15E) in subventral position. Tail conical, with three small caudal glands and spinneret.

Paratype female (Figures 16 and 17)

Similar to the male in body size, with minor differences: in female, cephalic setae positioned at posterior level of *fovea* (Fig 16B). Female didelphic, ovaries antidromously reflexed and both genital branches to right of intestine. Vulva as simple

transverse slit-like aperture. Proximal portion of vagina slightly cuticularised (Fig 16C). Globular sperm cells visible. No egg found. Vulva located at 49% of total body length (689 µm distant from anterior end). Tail conical.

Juveniles (Figure 15)

Similar to adults, except not possessing some characteristics such as supplements; reproductive system immature. Juveniles in stage 1, without rows of somatic setae. Five juveniles were found, two in stage 1, one in stage 2 and two in stage 3.

Diagnosis

Bolbonema braziliensis **sp. n.** is characterized by the cryptospiral *fovea amphidialis*, arched spicules, gubernaculum a bent rod dorsally oriented, and two subventral precloacal setae just above the cloaca.

Differential diagnosis

Bolbonema braziliensis **sp. n.** is similar to *Bolbonema longisetosum* (Jensen, 1985) in the shape and size of the *fovea amphidialis*, cephalic setae at the middle level of the *fovea amphidialis*, spicules arched and the proximal region expanded, and papilliform supplements associated with setae. It differs from *B. longisetosum* in the number of papillae supplements (two in *B. braziliensis* **sp. n.** and 24 in *B. longisetosum*) and the absence of an apophysis.

Bolbonema braziliensis **sp. n.** is comparable to *Bolbonema brevicolle* Cobb, 1920 in the shape of the *fovea amphidialis*. It differs in the absence of subcephalic setae (present in *B. brevicolle*) and the shape of the spicules (expanded in *B. brevicolle*).

Bolbonema braziliensis **sp. n.** can be distinguished from *Bolbonema spiralis* Hourston & Warwick, 2010 by the shape of the *fovea amphidialis* (spiral in *B. spiralis*), the presence of precloacal supplements, and the shape of the spicules and gubernaculum (arched without a rounded capitulum; and a small simple gubernaculum in *B. spiralis*).

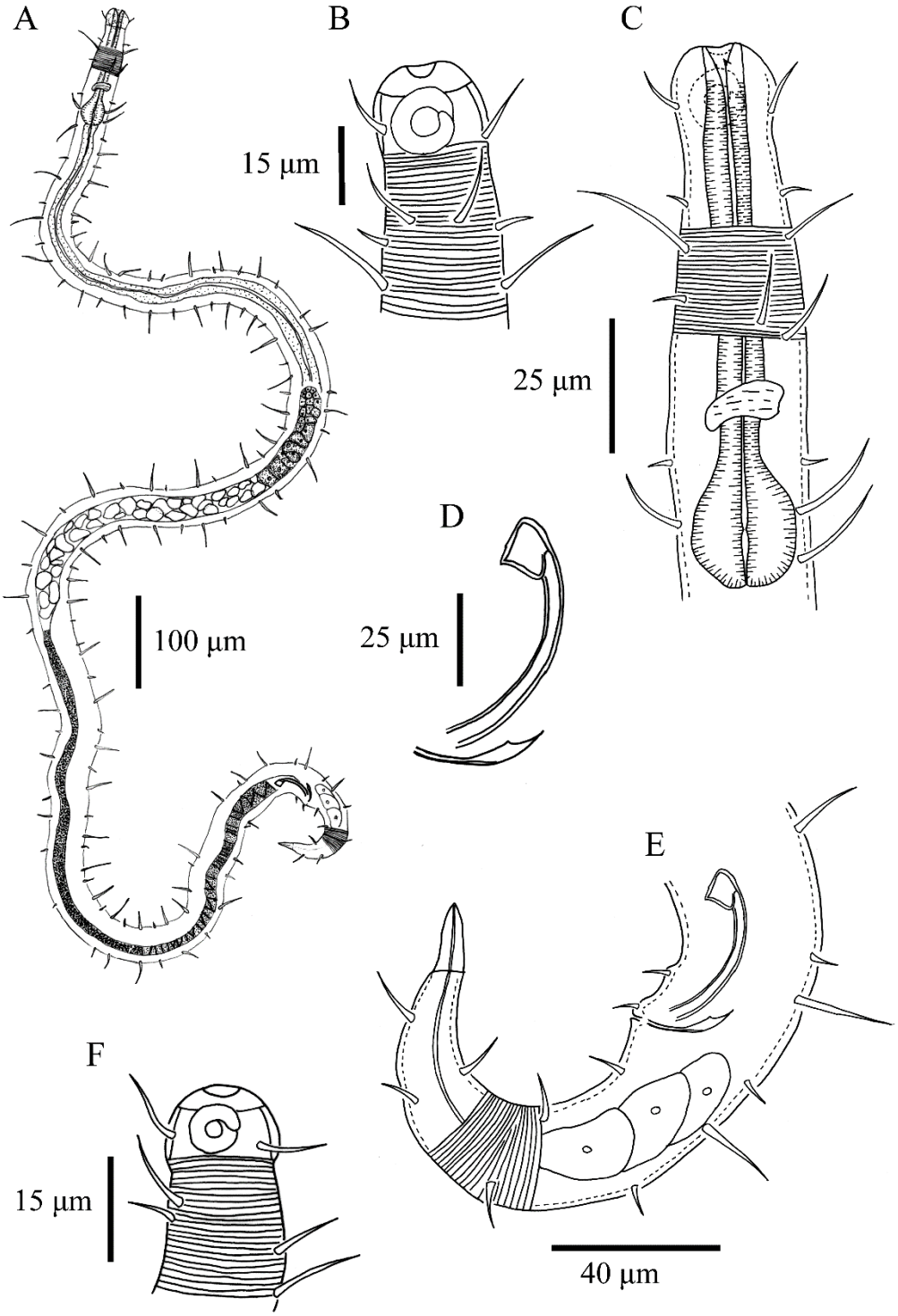

Figura 15 - *Bolbonema braziliensis* sp. n. Holotype MNRJ 390—A: overview. B and C: anterior region. D: copulatory apparatus. E: tail region; and F: cephalic region of juvenile 3.

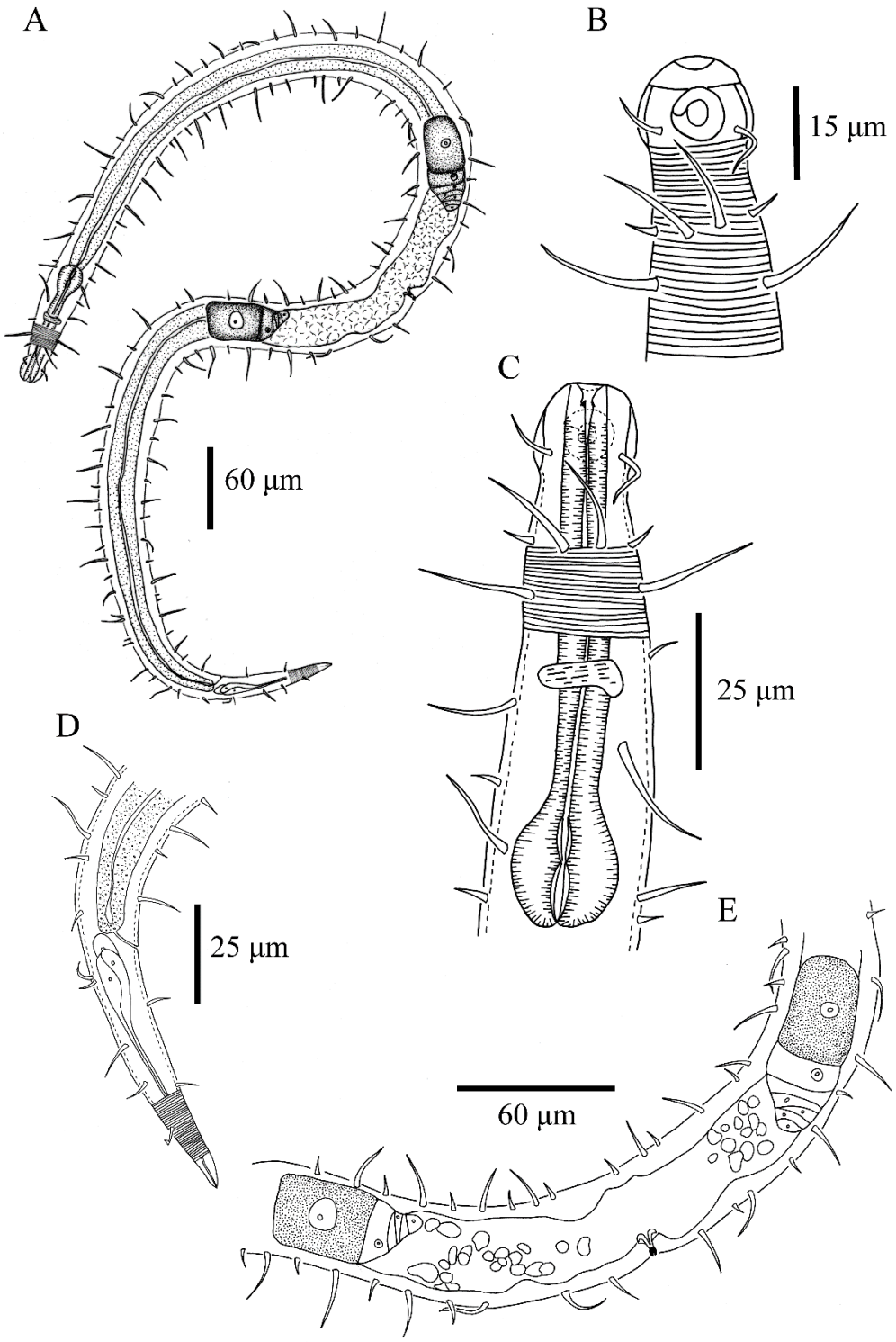

Figura 16 - *Bolbonema braziliensis* sp. n. Paratype female MNRJ 391—A: overview; B and C: anterior region; D: tail region; E: ovary and vulva opening.

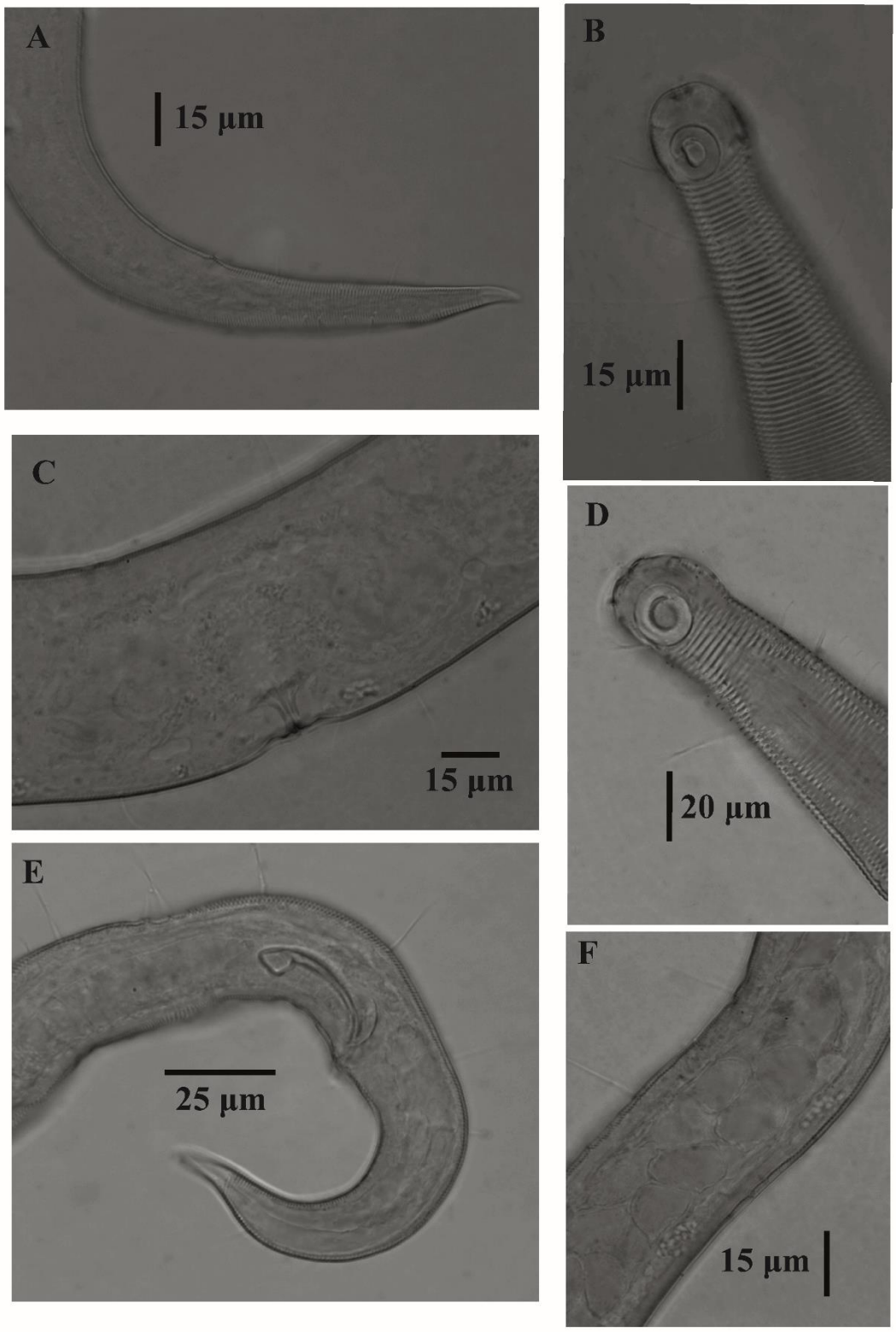

Figura 17 - *Bolbonema braziliensis* sp. n. A–C: paratype female MNRJ 391; A: tail region; B: cephalic region; C: vulva opening. D–F: holotype male MNRJ 390; D: cephalic region; E: tail and spicules; and F: globular sperm cells

Tabela 5 - Measurements (μm) of *Bolbonema braziliensis* sp. n. in the Potiguar Basin, Brazil "–" = not applicable. The mean and standard deviation are followed by range for paratype measurements.

Species	*Bolbonema braziliensis* sp. nov.				
Sex	Male		Female		Juvenile
	Holotype	Paratype	Paratype	Paratype	Paratype
Number of specimens	1	6	1	5	5
Body length	1530	1493±198(1235-1815)	1410	1335-1755(1502±186)	819-1345(1031±207)
Pharynx length	109.5	106±6(99-109.5)	100.5	100-117(108±6)	82.5-96(90±7)
Maximum body diameter	44	45±4(40-49.5)	49.5	45-55.5(50±3)	29-36(34±4)
Anal body diameter	30	34±2(33-36)	25.5	24-31.5(27±3)	21-27(24±2)
Tail length	117	108±18(87-108)	94.5	96-111(103±8)	73-96(86±8)
Tail end length	16	16±2(12.5-18)	13.5	12-21(15±3)	9-21(15±4)
Head diameter	20.5	21±2(19-22)	22	19-21.5(21±1)	15.5-20.5(18±2)
Length of cephalic setae	11.5	13±2(11-16)	13	14-18(14±2)	11.5-17(14±2)
Length of somatic setae long	24	21±2(17-23.5)	23	17-24(21±3)	17-20(18±1)
Length ofsomatic setae short	10	11±2(7-13.5)	9	6-8.5(8±1)	6.5-10(8±2)
Nerve ring from anterior end	54	58±7(45-69)	57	58.5-79.5(68±9)	51-82.5(65±12)
Percentage of bulb diameter	66	64±8(50-78)	62	56-72(67±7)	63-75(67±5)
*Fovea amphidialis*diameter (%cephalic capsule)	64	58±5(51-62)	53	43-66(51±9)	46-60(51±6)
Amphideal width	12	12±0(12-12.5)	12.5	8.5-11.5(11±2)	7-10(9±1)
Amphideal height	12.5	13±2(9-14)	11	9-15(11±2)	7-9.5(8±1)
Spicules length	52.5	49±3(45-51)	–	–	–
Gubernaculum length	22.5	27±3(24-30.5)	–	–	–
Precloacal setae	8	8±2(6.5-10)	–	–	–
Anterior to vulva	–	–	689	578-851(752±108)	–
Position of vulva as percentage of body length from anterior end	–	–	49	43-55(50±4)	–
a	35	34±4(29-37)	28	25-33(30±4)	28-34(30±3)
b	14	14±1(12-16)	14	13-15.5(14±1)	10-14(11±2)
c	13	14±1(12-16)	15	12.5-17(15±2)	10-14(12±1)

***Bolbonema papillae* sp. n.**

(measurements in Table 6, Figures 18, 19 and 20).

Type material: Holotype Male adult MNRJ 392. Station ME2A1 (05°02'24.2"S, 36°23'11.9"W).

Paratype female: Adult, MNRJ 393. Station ME1C2 (05°01'11"S, 36°23'45"W).

Etymology. The specific epithet is given for the presence of papilliform supplements.

Description

Holotype (Figures 18 and 20)

Body cylindrical, yellowish brown. Cuticle annulated except in final portion of tail, no lateral differentiation. Eight longitudinal rows of somatic setae; two subdorsal, two subventral and four sublateral. They start from cervical region to level of cloaca, alternating in long setae with shorter setae. Head capsule well developed with thick cuticle without annulations. Anterior sensilla arrangement: six outer labial papillae (difficult to see) and four cephalic setae positioned at anterior edge of *fovea amphidialis*. *Fovea amphidialis* multispiral with three turns. *Fovea amphidialis* large, posterior border exceed the limit of the cephalic capsule entering the striations of the cuticle. *Fovea* occupying 78% of diameter of head (Fig 18C). Buccal cavity small, with one dorsal tooth and one small ventral tooth, not always visible. Pharynx muscular with well-developed posterior bulb. Cardia and excretory-secretory system not observed. Nerve ring located 48 µm from anterior region. Reproductive system monorchic, with single anterior testis situated to right of intestine, outstretched. Many globular sperm cells. Spicules arched, proximal region appearing folded. Gubernaculum laminar, well developed and surrounding distal portion of spicules (Fig 18E). *Velum* absent. Two precloacal supplements present, consisting of thin, rounded cuticular extensions. (Fig 5D) in subventral position. Tail conical with three small caudal glands and spinneret.

Paratype female (Figures 19 and 20)

Similar to male in body size, with minor differences: in female, cephalic setae positioned at middle level of *fovea* (Fig 19B), *fovea amphidialis* multispiral with 2.5 turns and smaller than male (i.e. sexually dimorphic), and tail conical-cylindrical (Fig 19D). Female didelphic, ovaries antidromously reflexed and both genital branches to right of intestine. Vulva as simple transverse slit-like aperture. Proximal portion of

vagina slightly cuticularised (Fig 19D). Globular sperm cells visible. No egg found. Vulva located at 52% of total body length (630 µm distant from anterior end). Tail conical.

Juveniles

No juvenile was found.

Diagnosis

Bolbonema papillae **sp. n.** is characterized by the multispiral *fovea amphidialis* with three turns in the male and 2.5 in the female (sexual dimorphism) and two precloacal supplements present, consisting of thin, rounded cuticular extensions.

Differential diagnosis

Bolbonema papillae **sp. n.** is similar to *Bolbonema longisetosum* (Jensen, 1985) in the presence of supplements. It differs in the shape of the *fovea amphidialis* (multispiral in *B. papillae* **sp. n.** and cryptospiral in *B. longisetosum*) and the number and shape of supplements (two in *B. papillae* **sp. n.** and 24 papillae with associated setae in *B. longisetosum*).

Bolbonema papillae **sp. n.** can be distinguished from *Bolbonema spiralis* Hourston & Warwick, 2010 and *Bolbonema brevicolle* Cobb, 1920 by the shape of the *fovea amphidialis*; it is the only species in the genus that has a multispiral *fovea* with three turns. Moreover, *B. papillae* **sp. n.** has supplements, whereas *B. spiralis* and *B. brevicolle* do not.

Both *Bolbonema papillae* **sp. n.** and *B. braziliensis* **sp. n.** have two precloacal supplements, but they differ in shape. *B. papillae* **sp. n.** has two precloacal supplements present, consisting of thin, rounded cuticular extensions, while *B. braziliensis* **sp. n.** has small papilliform supplements with setae. Other differences between these species are the shape of the *fovea* (cryptospiral in *B. brasiliensis* **sp. n.**) and the gubernaculum (gubernaculum a bent rod dorsally oriented in *B. braziliensis* **sp. n.** and laminar with the distal portion surrounding the spicules in *B. papillae* **sp. n.**).

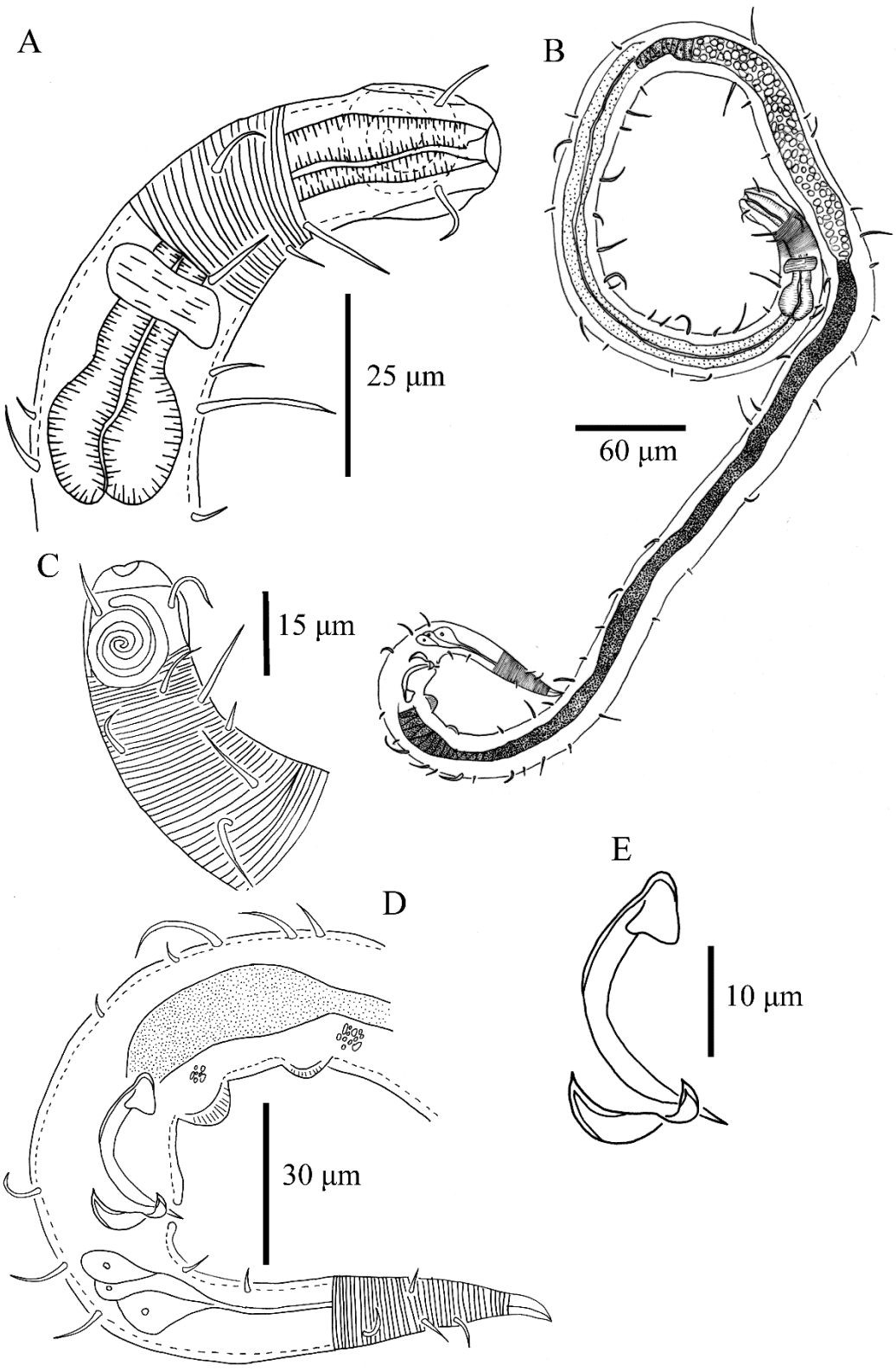

Figura 18 - *Bolbonema papillae* sp. n. Holotype MNRJ 392—A and C: anterior region; B: overview; D: tail region; and E: copulatory apparatus.

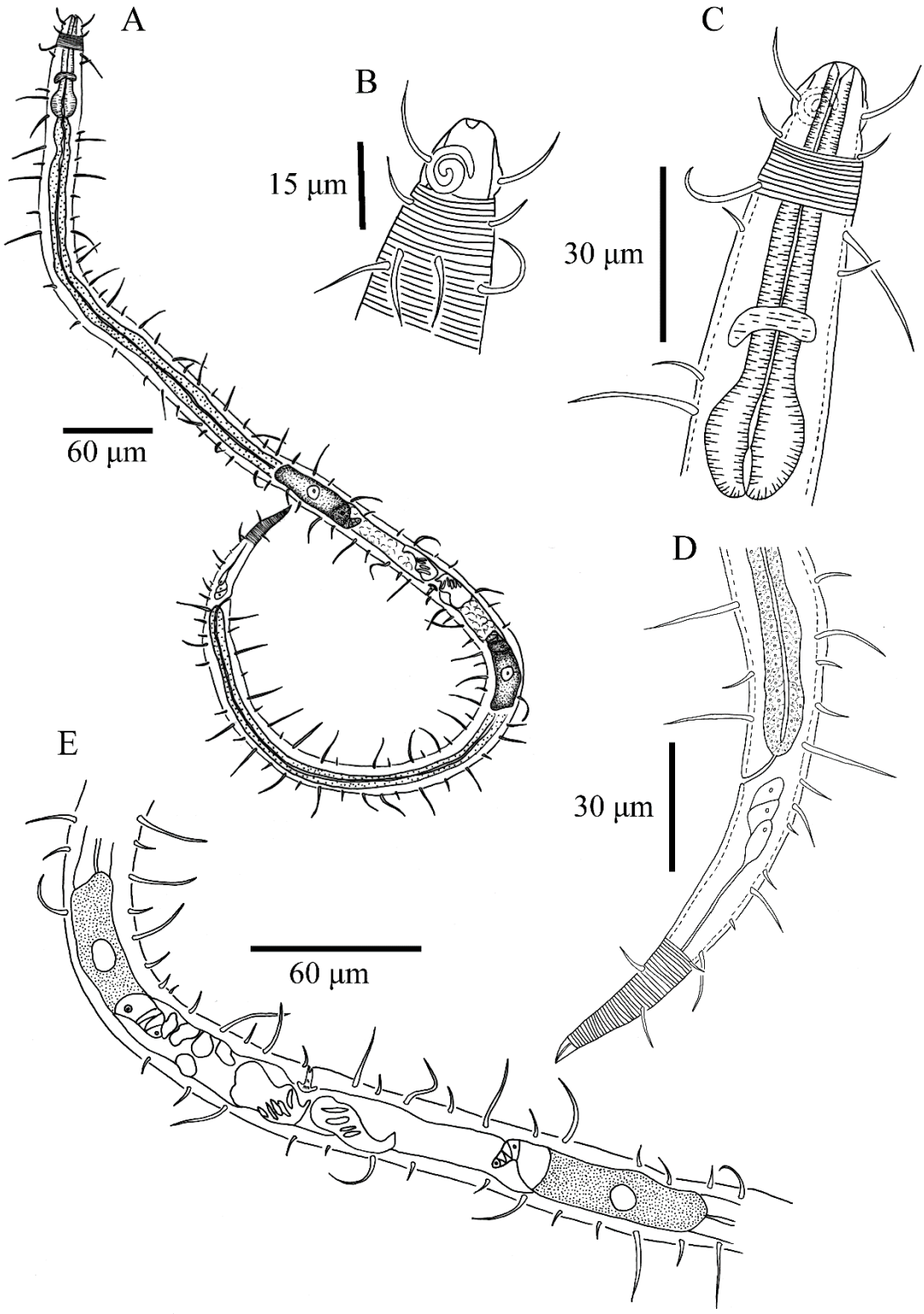

Figura 19 - *Bolbonema papillae* sp. n. Paratype female MNRJ 393—A: overview; B and C: anterior region; D: tail region; E: ovary and vulva opening.

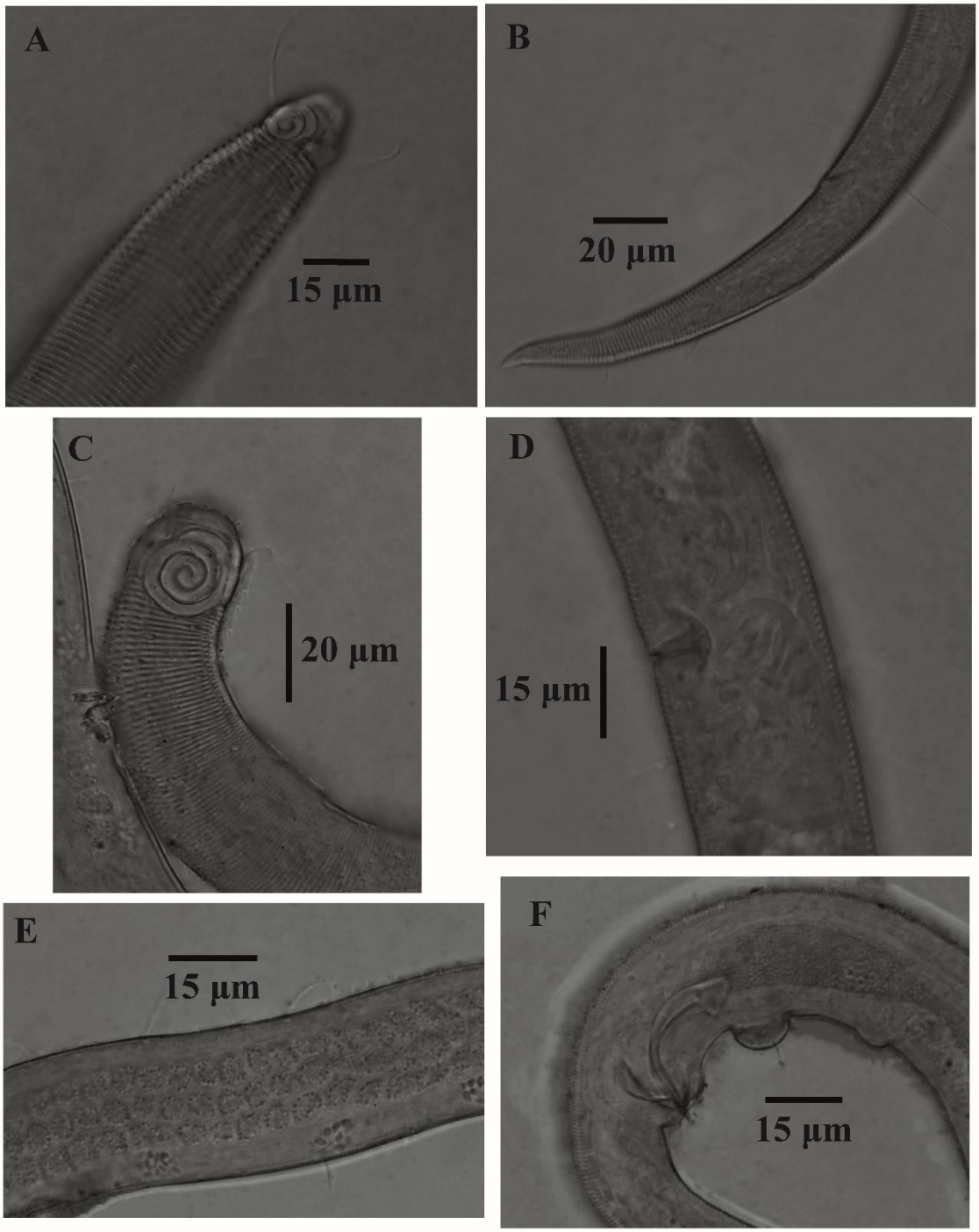

Figura 20 - *Bolbonema papillae* sp. n. A–B: cephalic and tail region of paratype female MNRJ 393. D: vulva opening; C, E and F: holotype male MNRJ 392. C: cephalic region; E: globular sperm cells; and F: spicules and papillae.

Tabela 6 - Measurements (µm) of *Bolbonema papillae* sp. n. in the Potiguar Basin, Brazil. "–" = not applicable.

Species	*Bolbonema papillae* sp. nov.		
Sex	Male		Female
	Holotype	Paratype	Paratype
Number of specimens	1	3	1
Body length	1384	1046-1150	1202
Pharynx length	88.5	88.5-96	82.5
Maximum body diameter	36	31.5-35	34.5
Anal body diameter	31	28.5-30	19.5
Tail length	115	91.5-102	109
Head diameter	21.5	19-21	14.5
Length of cephalic setae	14.5	12.5-24	21
Length of somatic setae long	19	16-22	20
Length of somatic setae short	8	6.5-10	9
Nerve ring from anterior end	48	54-65	52.5
Number of supplements	2	2	–
Supplement distal	28.5	22.5-25.5	–
Supplement proximal	54	42-45	–
Percentage of bulb diameter	67	61-72	60
*Fovea amphidialis*diameter (%cephalic capsule)	78	75-80	62
Turns of *fovea amphidialis*	2.5	2.5	1.5
Amphideal width	17	14	9.5
Amphideal height	19	16-18	9.5
Spicules length	37	33-40	–
Gubernaculum length	18	17-19	–
Anterior to vulva	–	–	630
Position of vulva as percentage of body length from anterior end	–	–	52
a	38	30-36.5	35
b	16	11-13	14.5
c	12	11	11

***Bolbonema zildae* sp. n.**

(measurements in Table 7, Figures 21,22 and 23).

Type material: Holotype Male adult MNRJ 394. Station CM6 (05°01'21.2"S, 36°12'18.7"W).

Paratype female: Adult, MNRJ 395. Station ME1A1 (05°01'17.9"S, 36°23'31.8"W).

Other paratypes: 9 females (232 and 236 LMZOO-UFPE), 8 males (237–241 LMZOO-UFPE) and 4 J1, 3 J2 and 3 J3 (242 LMZOO-UFPE), data as for holotype.

Etymology. The species name is a tribute to Zilda Lacerda, the first author's grandmother.

Description

Holotype (Figures 21 and 23)

Body cylindrical, yellowish brown. Cuticle annulated except in final portion of tail, no lateral differentiation. Eight longitudinal rows of somatic setae; two subdorsal, two subventral and four sublateral. They start from cervical region to level of cloaca, alternating in long setae with shorter setae. Head capsule well developed with thick cuticle without annulations. Anterior sensilla arrangement: six outer labial papillae (difficult to see) and four cephalic setae positioned at middle level of *fovea amphidialis*. *Fovea amphidialis* spiral with 1.25 turns. *Fovea amphidialis* occupying 46% of diameter of head (Fig 21B). Buccal cavity small, with one dorsal tooth and one small ventral tooth, not always visible. Pharynx muscular with well-developed posterior bulb. Cardia and excretory-secretory system not observed. Nerve ring located 58.5 µm from anterior region. Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched. Sperm cells large (Fig 21A). Spicules arched, proximal region bean-shaped. *Velum* present. Gubernaculum with dorsal apophysis and distal portion enfolding spicules (Fig 21E). *Velum* present. Supplements absent. Tail conical, with three small caudal glands and spinneret.

Paratype female (Figures 22 and 23)

Similar to male. Female didelphic, ovaries antidromously reflexed and both genital branches to right of intestine. Vulva as simple transverse slit-like aperture. Proximal portion of vagina heavily cuticularised, proximal portion of vagina surrounded by

constrictor muscle (Fig 22E). Globular sperm cells visible. Two eggs found. Vulva located at 43% of total body length (520 µm distant from anterior end). Tail conical.

Juveniles (Figure 22)

Similar to adults, except lacking some characteristics such as supplements; reproductive system immature. Juveniles in stage 1 without rows of somatic setae. Ten juveniles were found, four in stage 1, three in stage 2 and three in stage 3.

Diagnosis

Bolbonema zildae **sp. n.** is characterized by the *fovea amphidialis* spiral with 1.25 turns. Spicules arched, proximal region bean-shaped. *Velum* present. Gubernaculum well developed, hook-shaped, enfolding distal region of spicules.

Differential diagnosis

Bolbonema zildae **sp. n.** can be compared only with the species *Bolbonema spiralis* Hourston & Warwick, 2010, in the shape of the *fovea amphidialis* and the absence of supplements. It differs in the shape of the spicules: *B. zildae* **sp. n.** has arched spicules with the proximal region bean-shaped, the *velum* present, and the gubernaculum with a dorsal apophysis; while *B. spiralis* has the proximal region of the spicules simple, without cephalation, and a laminar gubernaculum.

Bolbonema zildae **sp. n.** differs from *B. papillae* **sp. n.** and *B. braziliensis* **sp. n.** in the absence of supplements and the spiral *fovea* with 1.25 turns. Two other species that differ are *B. brevicolle* Cobb, 1920 and *B. longisetosum* (Jensen, 1985), both of which have a cryptospiral *fovea amphidialis*. Moreover, *B. longisetosum* has 24 supplements (absent in *B. zildae* **sp. n.**). *B. brevicolle* has very different spicules, the proximal region without cephalation, and a laminar gubernaculum.

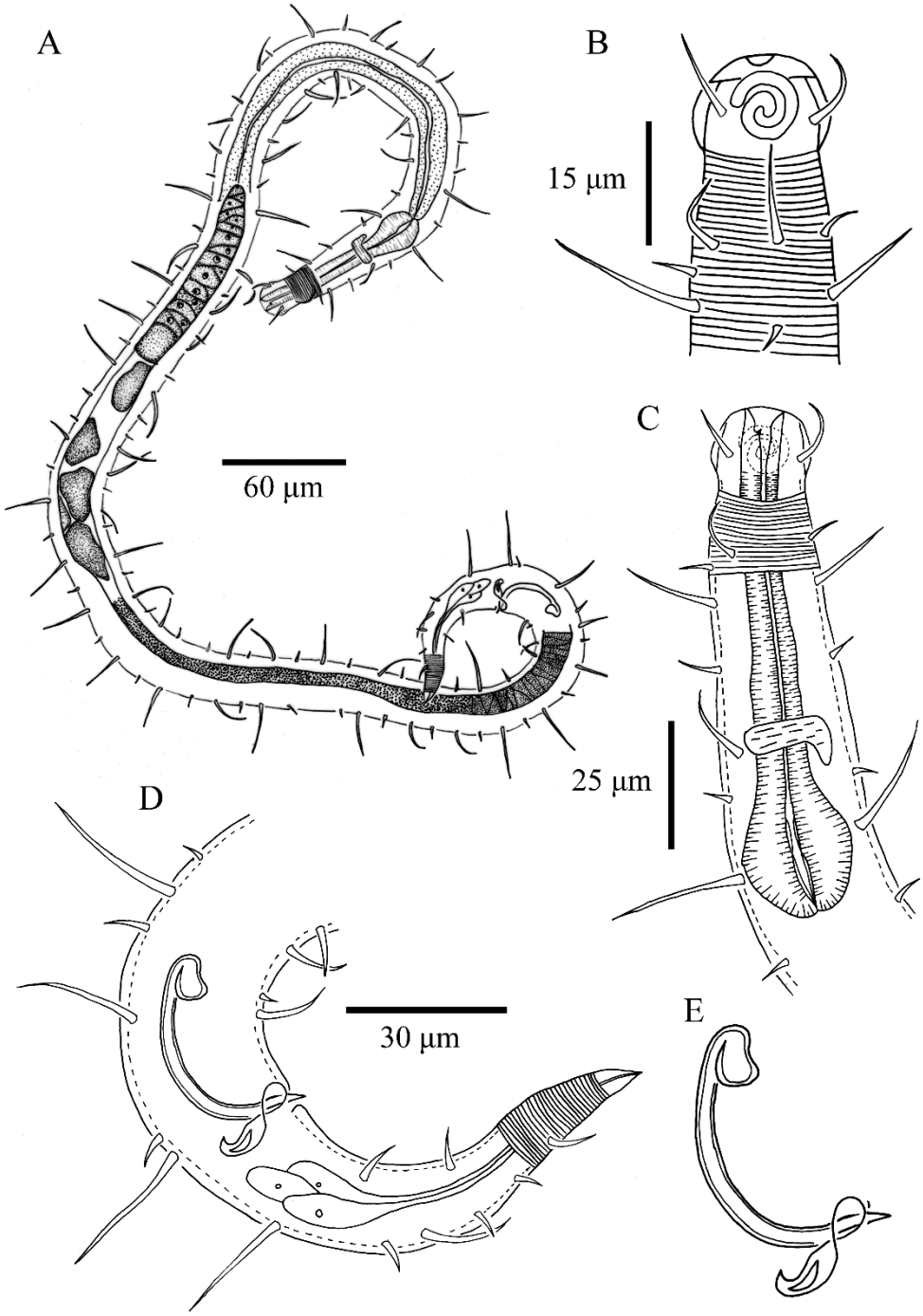

Figura 21 - *Bolbonema zildae* sp. n. Holotype MNRJ 394—A: overview; B and C: anterior region; D. tail region; and E: copulatory apparatus.

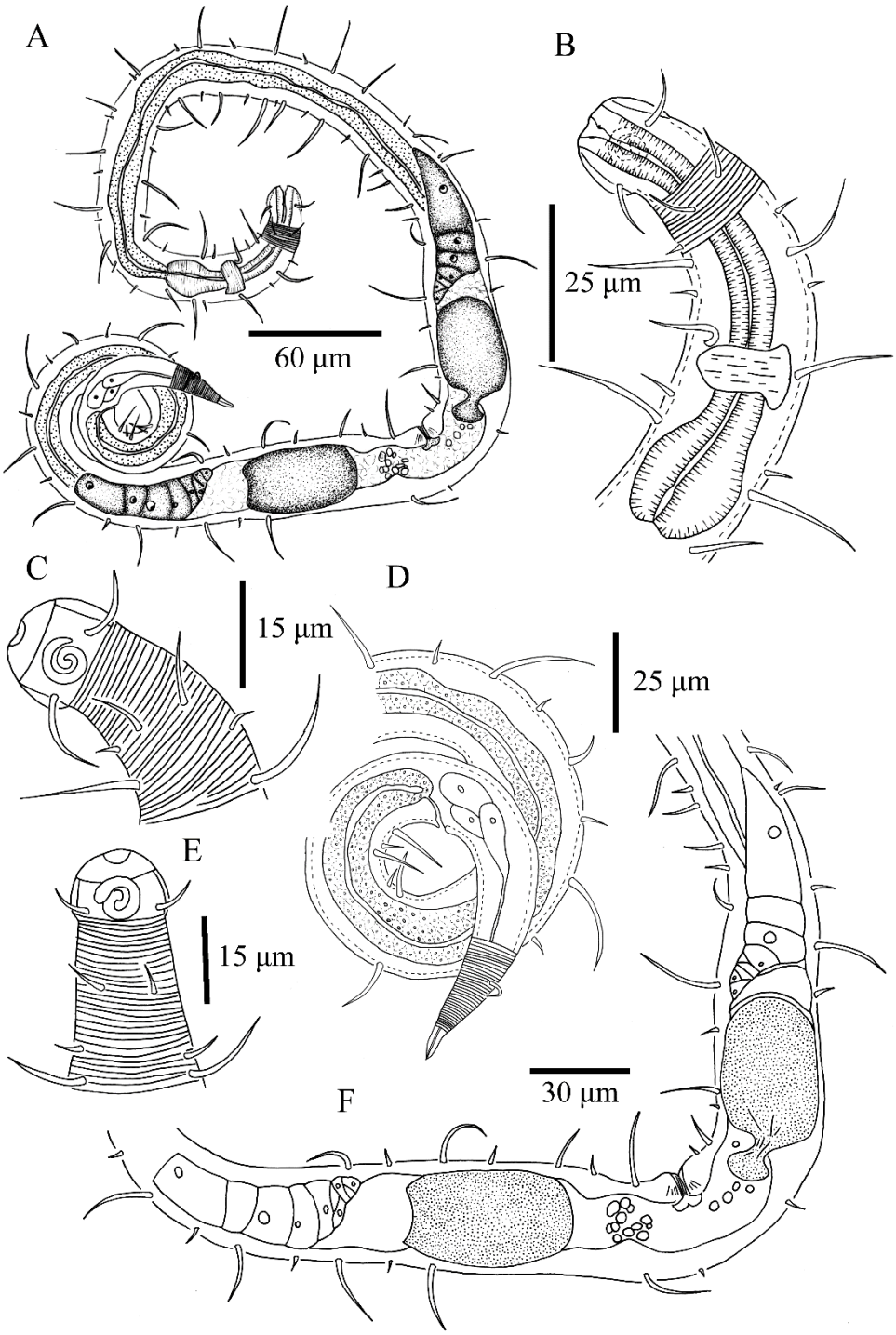

Figura 22 - *Bolbonema zildae* sp. n. Paratype female MNRJ 395—A: overview; B and C: anterior region; D: tail region; E: anterior region of juvenile 3; F: ovary and vulva opening.

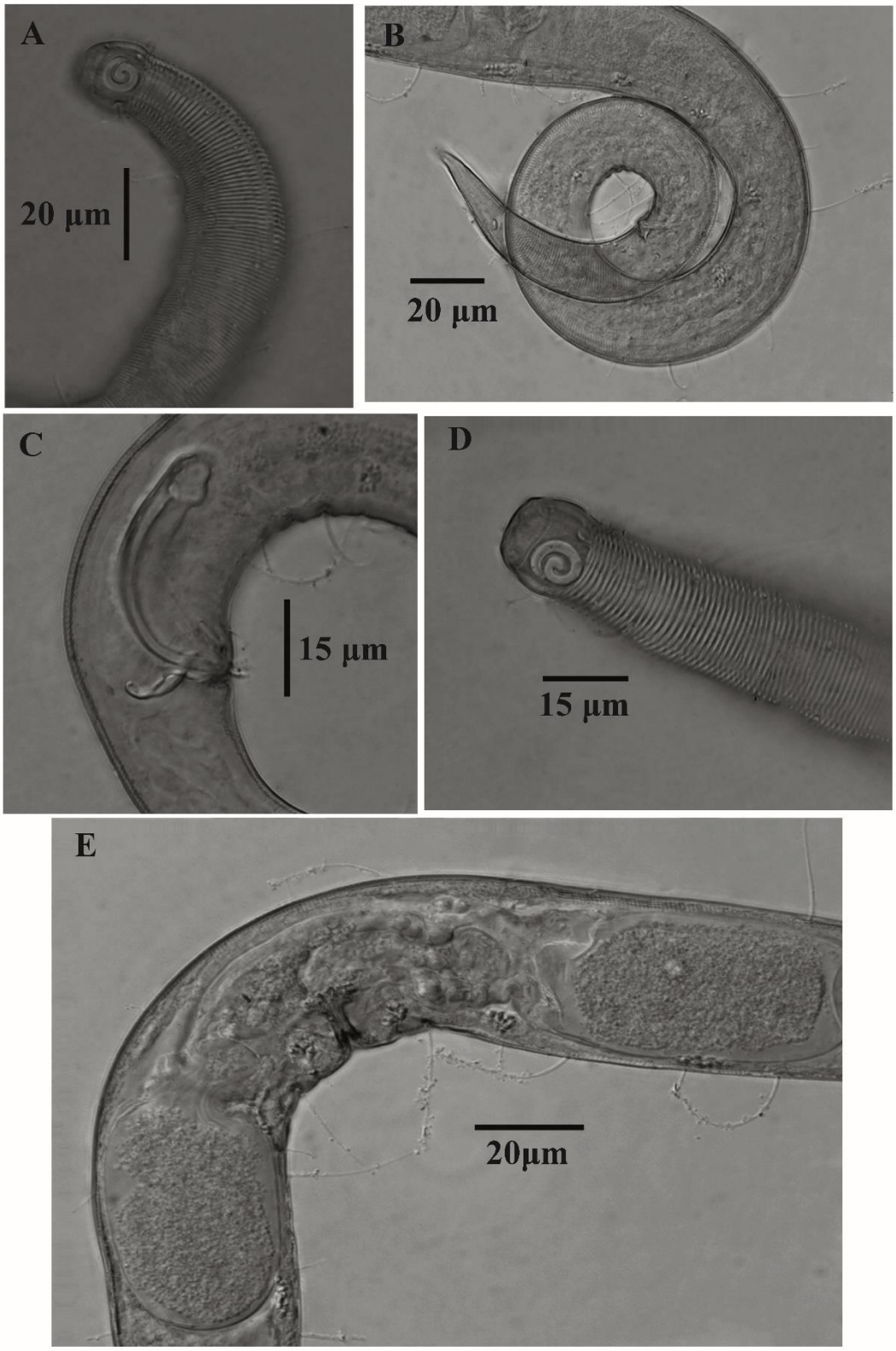

Figura 23 - *Bolbonema zildae* sp. n. A; B and E: Paratype female MNRJ 395; A: cephalic region; B: tail region; C–D: holotype male MNRJ 394; C: spicules; D: cephalic region and E: ovary and vulva opening

Tabela 7 - Measurements (µm) of *Bolbonema zildae* sp. n. from the Potiguar Basin, Brazil. "–" = not applicable. The mean and standard deviation are followed by range for paratype measurements.

Species	*Bolbonema zildae*sp. nov.				
Sex	Male		Female		Juvenile
	Holotype	Paratype	Paratype	Paratype	Paratype
Number of specimens	1	9	1	9	10
Body length	1137	1176±86(1079-1345)	1222	1145±144(1002-1241)	863±131(665-1059)
Pharynx length	99	99±5(90-105)	99	97±5(90-105.5)	85±6(78-94)
Maximum body diameter	36	39±5(33-42)	35	40±3(35-46.5)	31±4(24-35)
Anal body diameter	31.5	32±3(27-37.5)	27	24±1(22.5-24)	33±3(19.5-28)
Tail length	93	104±8(99-115)	96	95±8(85-99)	85±9(73.5-96)
Head diameter	20	104±8(16-21)	19	17±1(14.5-18)	15±1(13-17)
Length of cephalic setae	10	14±3(10-19)	15	15±2(14-17)	12±2(9-14)
Length of somatic setae long	15	17±1(15-19)	24	25±2(22-27)	16±2(14-19)
Length of somatic setae short	9	9±0(8-9)	13	11±1(9-12.5)	8±1(6-14)
Nerve ring from anterior end	58.5	63±4(58-67.5)	67.5	66±4(58.5-70.5)	59±5(50-64)
Percentage of bulb diameter	70	70±4(63-78)	65	66±7(55-75)	66±4(58-70)
*Fovea amphidialis*diameter (%cephalic capsule)	46	51±3(48-56)	47	55±5(48-65)	53±7(40-59)
Amphideal width	10	9±0(8.5-9)	9.5	9±0(8.5-9.5)	7±1(6-9.5)
Amphideal height	8	9±1(9-12.5)	9	9±1(7-9.5)	7±1(6.5-8)
Spicules length	52.5	51±5(39-57)	–	–	–
Gubernaculum length	24	23±2(18-24)	–	–	–
Anterior to vulva	–	–	520	568±47(495-611)	–
Position of vulva as percentage of body length from anterior end	–	–	42.5	50±4(46-58)	–
a	31.5	30±2(28-33)	35	29±4(23-35)	28±4(21-34)
b	11	12±1(10-13)	12	12±1(11-14)	10±1(9-12)
c	12	11±1(10-13)	13	12±2(10-15)	10±2(7-13)

Identification key to the males of the genus *Bolbonema* Cobb, 1920.

1. Supplements absent.....2
- Supplements present.....4
2. *Fovea amphidialis* spiral (less than 2 turns)…….....3
- *Fovea amphidialis* cryptospiral…..…….....*B. brevicolle*
3. Spicules arched, proximal region bean-shaped, *velum* present, gubernaculum with dorsal apophysis, and final portion enfolding distal region of spicules…….....*B. zildae* **sp. n.**
- Spicules arched, without cephalation, gubernaculum laminar, buccal cavity minute and unarmed……..…….....*B. spiralis*
4. Supplements papilliform with associated setae; *fovea amphidialis* cryptospiral……..…..…….....5
- Supplements papilliform without associated setae (two precloacal supplements present, consisting of thin, rounded cuticular extensions); *fovea amphidialis* multispiral (three turns)……..…….*B. papillae* **sp. n.**
5. Twenty-four precloacal supplements and three postcloacal supplements; gubernaculum with dorsal apophysis……...……..……...*B. longisetosum*
- Two precloacal setae inserted in small papillae; gubernaculum a bent rod dorsally oriented…….…….……*B. braziliensis* **sp. n.**

Geographical distribution of *Bolbonema* species

The genus *Bolbonema* has only six valid species, including those described here, yet it has an interesting geographic distribution. Members of the genus have been recorded in the North Atlantic, South Atlantic and Indian oceans. However, as seen in Figure 11, it seems that the genus is more diverse in the western Atlantic.

Bolbonema brevicolle described by Cobb (1920) and later redescribed by Gerlach (1963), Pastor de Ward (1988) and Armenteros *et al.* (2014) was also found in northeastern Brazil, together with the other species described here, extending its known distribution (Jamaica, Cuba, southern Argentina, northeastern Brazil and the Maldives). However, the species redescribed by Gerlach (1963) from the Maldives, based only on females, may not represent *B. brevicolle* but rather a similar genus and species. This suggests that the distribution of *B. brevicolle* is restricted to the Americas.

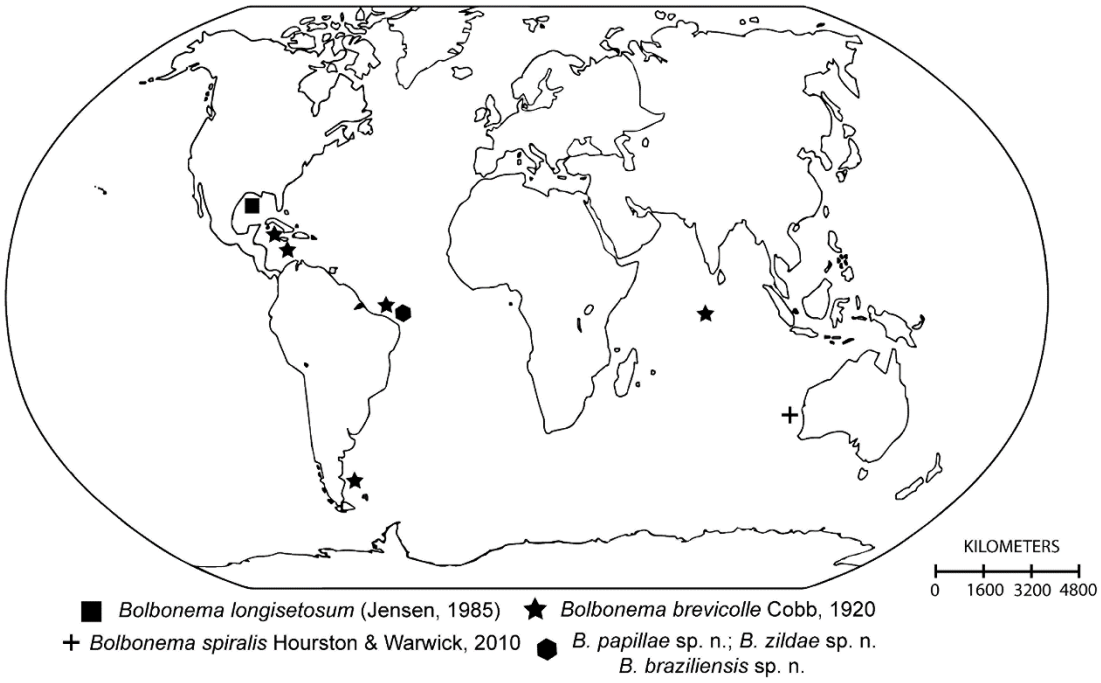

Figura 24 - Geographic distribution of the six species of the genus *Bolbonema* Cobb, 1920.

Discussion

Lorenzen (1981) considered the genus *Bolbonema* as a subgenus of *Desmodora* de Man, 1889. *Desmodora* had six subgenera (*Bolbonema*, *Croconema*, *Desmodora*, *Pseudochromdora*, *Xenodesmodora* and *Zalonema*), and regarded *Desmodorella* as a synonym of *Desmodora* (Lorenzen 1981). In 1998, Verschelde *et al.* elevated all subgenera to genus rank and synonymized the genus *Xenodesmodora* with *Croconema*. Some characteristics of the species described here may cause confusion with other genera of the subfamily Desmodorinae, for example *Zalonema*. This genus has a triangular cephalic capsule, a large multispiral *fovea amphidialis*, and subcephalic setae and lateral or ventral alae present. None of these features occur in the genus *Bolbonema*. Another genus with some similarities is *Desmodora* de Man, 1889. However, *Desmodora* differs in characters of the buccal cavity, i.e., a large dorsal tooth and smaller subventral teeth; in addition to the absence of long and short somatic setae along the body, a different cephalic capsule (globular in *Bolbonema*), and cuticle with stronger striation.

Recently the family Desmodoridae has been studied extensively; from 2011 to the present (including this contribution), 39 new species of this family have been

described (Larrazábal-Filho *et al.*, 2017). The family is extremely diverse and found in several different habitats (Verschelde & Vincx, 1996; Verschelde *et al.*, 1998; Ndaro & Ólafsson, 1999; Decraemer & Smol, 2006; Leduc & Verschelde, 2015). In addition, recent phylogenetic studies (Leduc & Zhao, 2016; Armenteros *et al.*, 2014 and Ott *et al.*, 2014) and reviews clarified, organized and compiled taxonomic information. As for example modifications to the classification of the subfamilies Desmodorinae and Spiriniinae proposed by Armenteros *et al.*, (2014), have facilitated understanding of the genera with complicated morphological definitions (e.g., *Laxonema* Cobb, 1933 and *Metadesmodora* Schuurmans Stekhoven, 1942), helping and encouraging more research of the diversity in this family.

In the last six years, 15 new species of nematodes have been described from the Potiguar Basin (Neres *et al.*, 2013; 2014; Larrazábal-Filho *et al.*, 2015; Manoel *et al.*, 2017; Larrazábal-Filho *et al.*, 2017). Of these, eight new species, two new occurrences and one redescription of *Desmodora nini* (Inglis, 1963) belong to the family Desmodoridae. Samples from the basin are still being studied, and we expect additional descriptions of new desmodorid taxa.

4.4 Artigo 3 – A new genus with three new species of free-living marine nematodes of the subfamily Desmodorinae (Nematoda: Desmodoridae), from the continental shelf off northeastern Brazil

(Publicado no periódico Zootaxa https://doi.org/10.11646/zootaxa.4615.2.5) 2019

SYSTEMATICS

Taxonomic classification, according to Decraemer & Smol (2006)

Class CHROMADOREA Inglis, 1983

Subclass CHROMODORIA Pearse, 1942

Order DESMODORIDA De Coninck, 1965

Suborder DESMODORINA De Coninck, 1965

Superfamily DESMODOROIDEA Filipjev, 1922

Family DESMODORIDAE Filipjev, 1922

Subfamily Desmodorinae Filipjev, 1922

Diagnosis (emended from Armenteros *et al.*, 2014)
Head capsule conspicuous, characterized by the thickened cuticle and mostly with an external demarcation between labial and cephalic regions, except in *Sibayinema* Swart & Heyns, 1991 (Verschelde *et al*. 2006). *Fovea amphidialis* not surrounded by cuticle striations; may be located on a cuticularized plate. Buccal cavity always with distinct teeth. Cuticle usually coarsely striated, in some cases with ornamentation.

Genus *Spinonema* gen. n.

Diagnosis. Desmodorinae. Cylindrical body with well-developed cephalic capsule and short conic tail. Thick, annulated cuticle with annuli extending from posterior edge of amphideal aperture to near tail tip, vacuoles inserted in cuticle. Ornamentation present on cuticle, consisting of lateral differentiation (see figure 25); dorsal spine present in some species. Anteriorly to this lateral differentiation, the direction of the cuticular ring reverses. Longitudinal rows of somatic setae are unclear or hardly distinguishable in the pharyngeal region, and totally absent from remainder of body. Cephalic capsule either smooth or partly to entirely ornamented with small vacuoles (inner cuticle). Four cephalic setae can be located posteriorly or anteriorly to *fovea amphidialis*; subcephalic setae absent. *Fovea amphidialis* cryptospiral, spiral or multispiral (may vary from 1.25 to 3 turns) in different species. Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched; short spicules, capitulum present, *velum* can be present. Precloacal setae can be present. Female reproductive system didelphic, amphidelphic with reflected ovaries, can be antidromous.

Etymology. The name refers to the spine present on the dorsal side (Latin *spina*) combined with *nema*, thread (Greek νῆμα); gender neuter.

Differential diagnosis

Spinonema **gen. n.** is assigned to the subfamily Desmodorinae based on the head capsule well-developed with thick cuticle, buccal cavity with teeth and cuticle with transverse annuli except in head region. *Spinonema* **gen. n.** has some features in common with *Desmodora* De Man, 1889, e.g. cephalic capsule well developed (in some

species with vacuoles), shape of *fovea amphidialis* (cryptospiral and spiral) and small arched spicules. *Spinonema* **gen. n.** and *Desmodora* differ in the body annuli (annulated cuticle in *Spinonema* **gen. n.)**, absence of subcephalic setae and ornamentation on the cuticle (lateral ridge and can have dorsal spine in *Spinonema* **gen. n.**). *Spinonema* **gen. n.** resembles *Desmodorella* Cobb, 1933 in the shape of the *fovea amphidialis* (multispiral) and ornamentation of the cuticule, but differs mainly in the type of ornamentation: absence of longitudinal rows of spines on the body cuticle and spicules smaller and arched; a velum can be present.

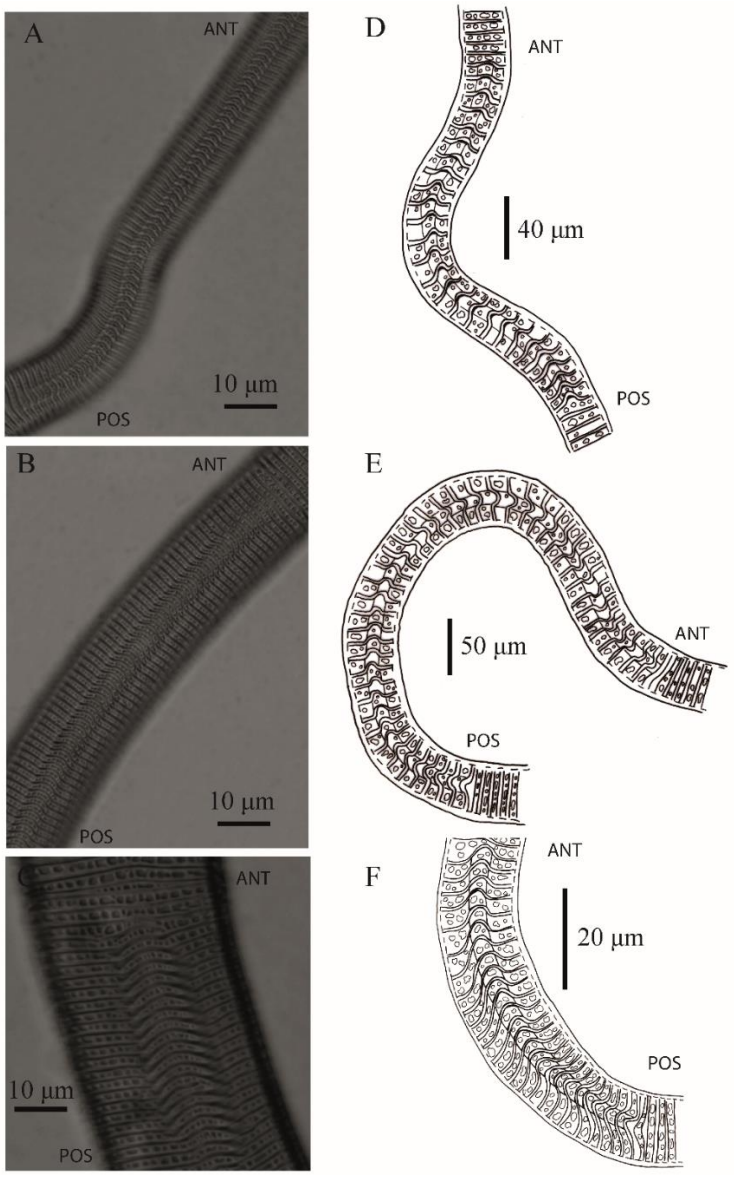

Figura 25 - Lateral alae of the species *S. cuticulatum* gen. et. sp. n . (A and D); *S. spirale* gen. et sp. n. (B and E) and *S. absente* gen. et sp. n. (C and F). Anterior part (ANT) and Posterior part (POS).

Remarks

The main characteristic of subfamily Desmodorinae is the well-developed cephalic capsule without annulations. So, some genera were transferred to Spiriniinae (e.g. *Stygodesmodora* Blome, 1982; *Echinodesmodora* Blome 1982; *Paradesmodora* Schuurmans Stekhoven, 1950 and *Parallelocoilas* Boucher 1975) (Armenteros *et al.*, 2014). Reinforcing the presence of this new genus in the Desmodorinae subfamily.

List of valid genera of Desmodorinae (13) (after Armenteros *et al.*, 2014)

Acanthopharyngoides Chitwood, 1936; *Acanthopharynx* Marion, 1870; *Bolbonema* Cobb, 1920; *Croconema* Cobb, 1920; *Desmodora* de Man, 1889; *Desmodorella* Cobb, 1933; *Onepunema* Leduc & Verschelde, 2013; *Psammonema* Verschelde & Vincx, 1995; *Pseudochromadora* Daday, 1899; *Pseudodesmodora* Boucher, 1975; *Sibayinema* Swart & Heyns, 1991; *Spinonema* **gen. n.**; *Zalonema* Cobb, 1920.

Type species *Spinonema cuticulata* **gen. et sp. n.**

Description of species

***Spinonema cuticulata* gen. et sp. n.**

(measurements in Table 8, Figures 26, 27 and 28)

Type material: Holotype, Male adult MNRJ 396 (03°00'00"S, 038°45'00"W) collected in June 2009 from the Potiguar Basin, between 45 and 100 m deep. Faciology: fine to coarse bioclastic sand. Gear: Van Veen grab.

Paratype female: Adult, MNRJ 397 (03°00'00"S, 038°45'00"W) collected in June 2009 from the Potiguar Basin, between 45 and 100 m deep. Faciology: fine to coarse bioclastic sand. Gear: Van Veen grab.

Other paratypes: 2 females (242-243 LMZOO-UFPE), 5 males (244-248 LMZOO-UFPE) and 5 juveniles. Two in second stage of development (J2) and three in first stage of development (J1) (249 LMZOO-UFPE) collected on same date as holotype.

Etymology. The species name refers to the ornate cuticle.

Description

Holotype (Figures 26 and 28)

Body cylindrical, yellowish brown. Cuticle annulated with vacuoles distributed irregularly, that start to appear from 9th cuticular ring. Annuli ornamented similarly to those in members of family Epsilonematidae. Annuli absent on cephalic capsule and final portion of tail. Cuticle with lateral ridge, thicker than rest of body (Figs 26E and 28E). Diameter of annulation 3 µm in anterior region, 2 µm at midline and 3 µm in posterior region. Longitudinal rows of somatic setae unclear or hardly distinguishable in pharyngeal region. Few somatic setae and papillae irregularly distributed along body. Dorsal spine strongly sclerotized, located on 18th cuticular ring. This spine is a projection of cuticle (Fig 26C and 28A). Inversion of direction of annuli occurring after 83rd cuticular ring. Head triangular. Cephalic capsule 10 µm long and well-developed with thick cuticle without annulations. Anterior sensilla arrangement: six inner labial papillae, six external setae and four cephalic setae positioned at midlevel of *fovea amphidialis*. *Fovea amphidialis* spiral (1.25 turns), occupying 65% of head diameter. Oral cavity with small dorsal tooth and one small ventral tooth. Pharynx cylindrical, with muscular pyriform endbulb. Ventral gland and secretory-excretory pore not observed. Cardia inserted in intestine. Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched. One precloacal seta present. Spicules short, arched and in proximal region are hook-shaped (Fig 26F). Broad *velum* present; gubernaculum simple, without apophysis. Three ejaculatory glands and three caudal glands (Fig 26D and 26G). Tail short, conical, with vacuoles and in terminal portion without annulation. Short spinneret.

Paratype female (Figures 27 and 28)

Similar to the male in body size, with minor differences: vacuoles present in cuticle appear on 15th ring. Inversion of direction of annuli occurring after 76th cuticular ring. Reproductive system with paired ovaries, opposite and reflected antidromous, and both genital branches to right of intestine. Vulva as simple transverse slit-like aperture. Proximal portion of vagina slightly cuticularised. Egg found in uterus (Fig 27D). Vulva comprising 40% of total body length (559 µm distant from anterior end). Tail conical.

Juveniles (Figure 27)

Very similar to adults, except not possessing lateral differentiation. Five juveniles were found, three in stage 1 and two in stage 2.

Diagnosis and relationships

Spinonema cuticulata **gen. et sp. n.** is characterized by the annulated cuticle with vacuoles along the body, spiral *fovea amphidialis* (1.25 turns), one dorsal spine, lateral differentiation, spicules arched with proximal region hook-shaped, *velum* present and three ejaculatory glands.

Spinonema cuticulata **gen. et sp. n.** is similar to *Desmodora* de Man, 1889 in the presence of a spiral *fovea amphidialis* (e.g. *Desmodora communis* (Bütschli, 1874); *Desmodora coniseta* (Schuurmans Stekhoven, 1950); *Desmodora ignava* Gagarin & Klerman, 2008), spicules arched, with a velum (*Desmodora granulata* Vincx & Gourbault, 1989; *Desmodora marci* Verschelde, Gourbault & Vincx, 1998; *Desmodora masira* Warwick, 1973) and the buccal cavity with one dorsal and one ventral tooth (seldom in *Desmodora*). It differs in the cuticle. *Spinonema cuticulata* **gen. et sp. n.** has an annulated cuticle with lateral differentiation and a dorsal spine. It can be compared with *Croconema* Cobb, 1920 in the cephalic capsule offset and strongly annulated, and in some species the presence of a *velum* (e.g. *Croconema otti* Gourbault & Vincx, 1990). It can be distinguished by the absence of somatic and subcephalic setae. Another similar genus is *Desmodorella* Cobb, 1933, in the spiral shape of the *fovea amphidialis* (e.g. *Desmodorella filispiculum* (Lorenzen, 1976); *Desmodorella papillostoma* (Murphy, 1962); *Desmodorella perforata* (Wieser, 1954) and ornamentation on the cuticle, but differs mainly in the type of ornamentation. In *Desmodorella* the ornamentation consists of longitudinal rows of spines on the cuticle; whereas in *Spinonema cuticulata* **gen. et sp. n.** the ornamentation consists of lateral differentiation in the form of a ridge. Thus, this species can be distinguished from any other species/genus by the combination of three characteristics: annulated cuticle, dorsal spine and lateral differentiation.

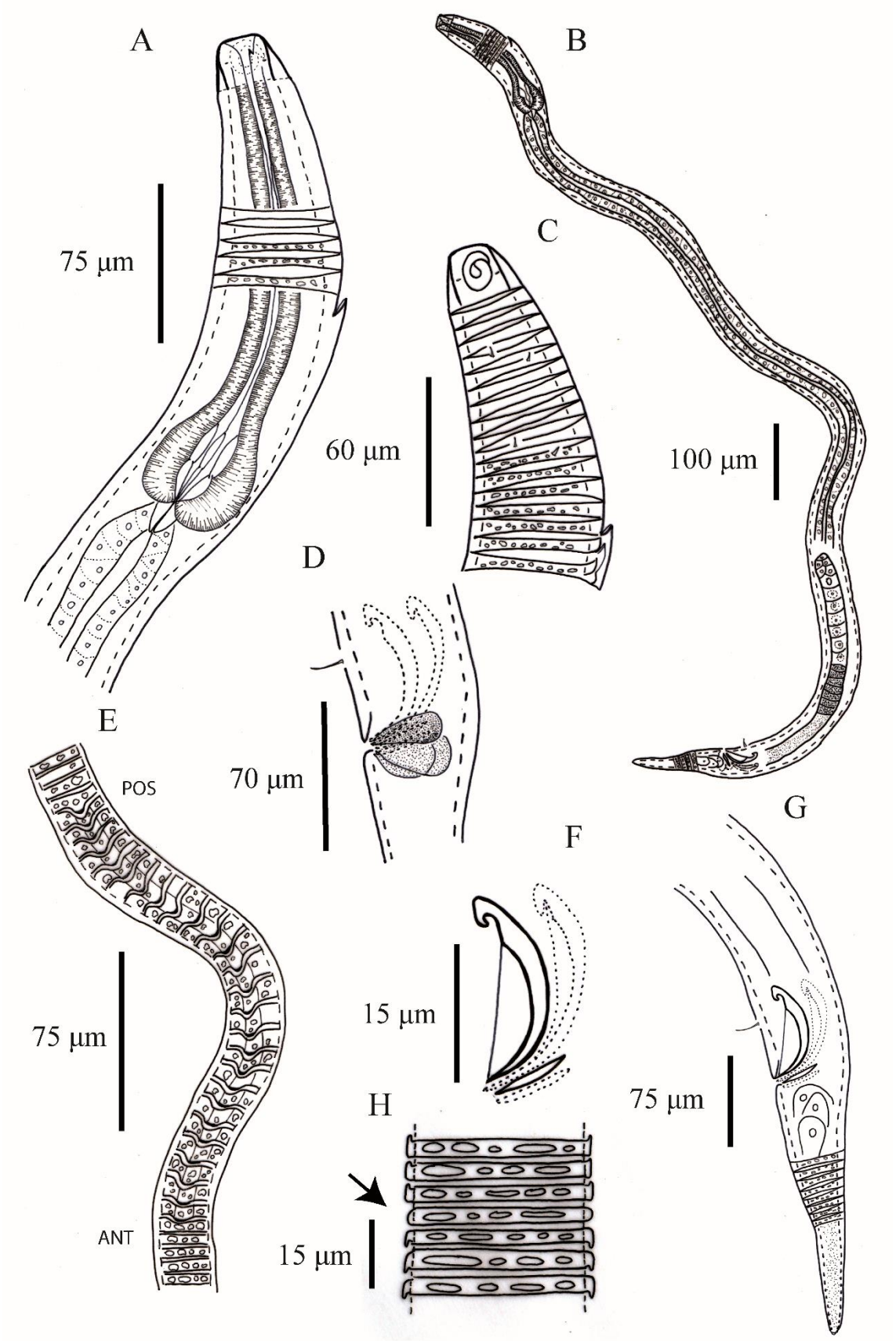

Figura 26 - *Spinonema cuticulatum* gen. et sp. n. Holotype MNRJ 396. A and C: anterior region; B: overview; e: lateral alae (ANT anterior part and POS posterior part); D and F: copulatory apparatus; g: tail region; H: Inversion of direction of annuli.

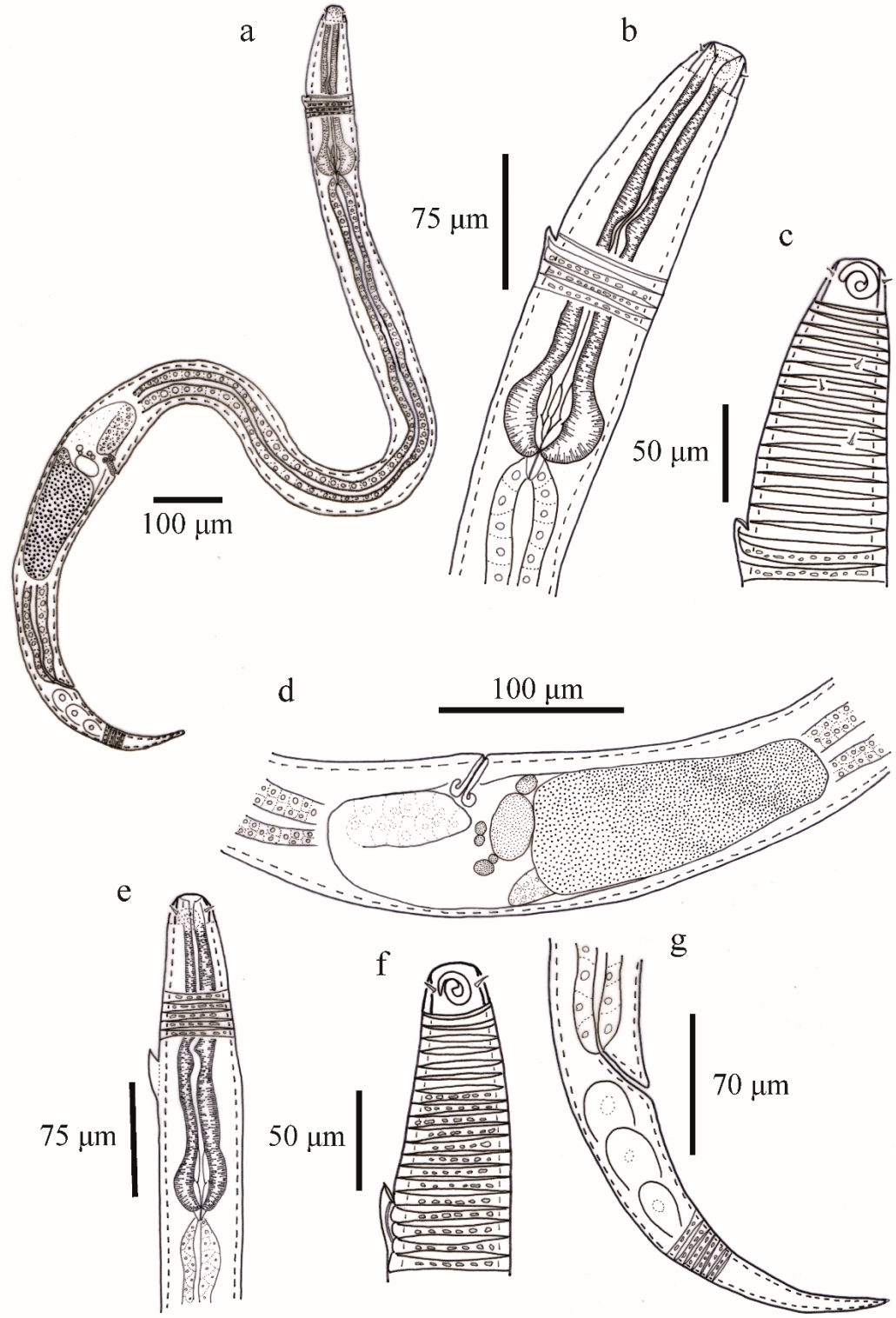

Figura 27 - *Spinonema cuticulatum* gen. et sp. n. Paratype female MNRJ 397. A: overview; B and C: anterior region; D: ovary and vulva opening; g: tail region. e and F: juvenile in stage 1, anterior region.

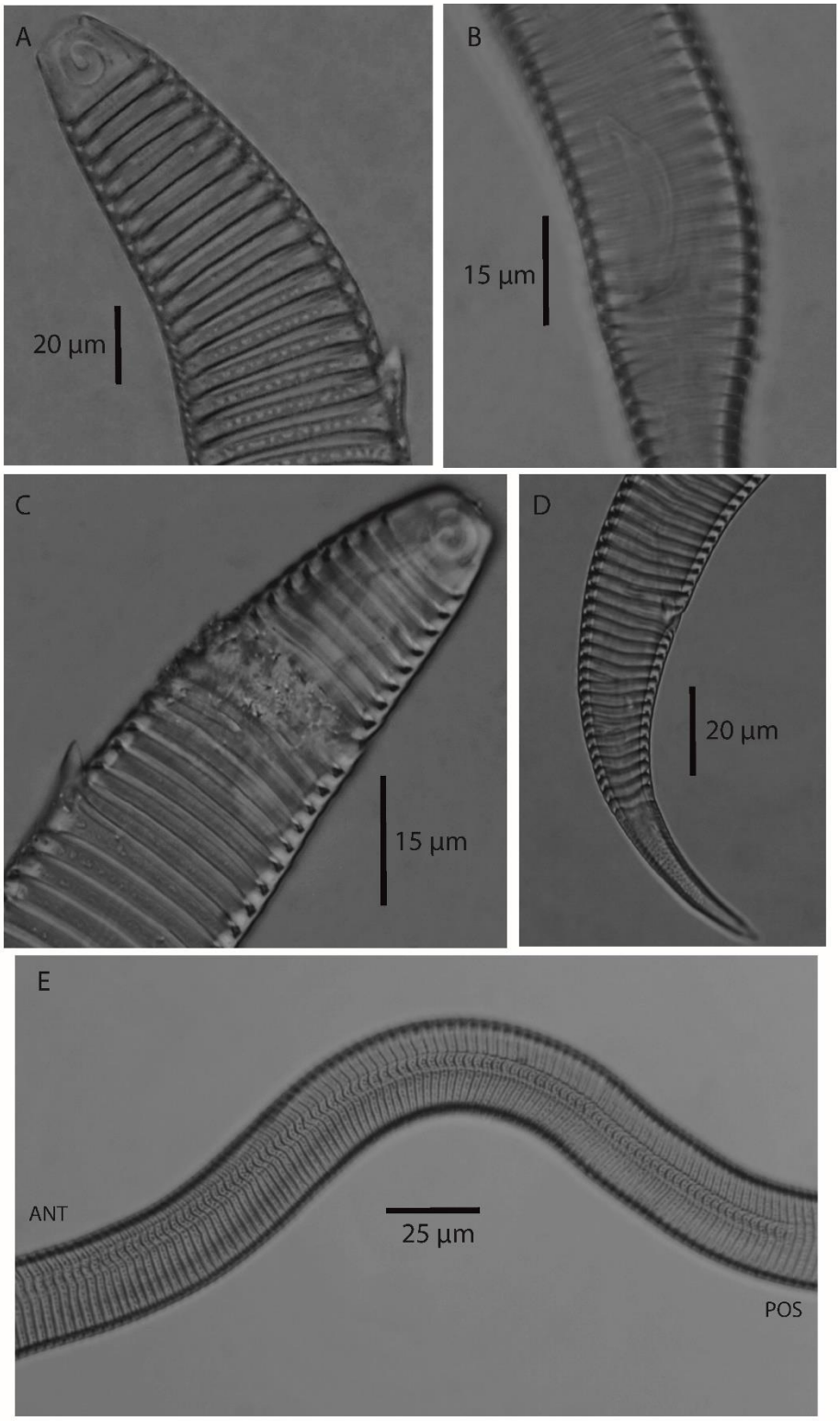

Figura 28 - *Spinonema cuticulatum* gen. et sp. n. A, B and e Holotype MNRJ 396; A: Cephalic region; B: Spicules; e: Lateral alae (ANT anterior part and POS posterior part). C and D Paratype female MNRJ 397; C: Cephalic region; D: Tail region.

Tabela 8 - Measurements (µm) of *Spinonema cuticulatum* gen. et sp. n. in the Potiguar Basin, Brazil. "-" = not applicable. The mean and standard deviation are followed by the range for paratype measurements.

Sex	Male Holotype	Paratypes	Female Paratypes	Juvenile Paratypes
Number of specimens		5	3	5
Body length	825.5	884±89(812.5–1066)	774(747.5–806)	612±73(530–720)
Pharynx length	99	105±14(87–133.5)	113(102–134.5)	94±10(82–106)
Maximum body diameter	28.5	38±30(23.5–34.5)	36(30-39)	26±4(21–30)
Anal body diameter	24	22±2(19.5–24)	25(24–25.5)	19±2(17–21)
Tail length	76.5	82±8(69–91.5)	81(76.5–84)	74±8(67–85)
Length of unstriated tail tip	19.5	23±2(20–26)	31(29-32)	37±3(32–41)
Spine length	13.5	14±2(13–18)	14(13.5–15)	12±2(9–15)
Head diameter	22.5	20±5(13.5–30)	18(16.5–19.5)	13±2(10–15)
Cephalic capsule length	22.5	21±3(15–22.5)	19(16.5–19.5)	10±2(8–12)
Spicule length	33	40±9(33–43.5)	-	-
Gubernaculum length	15	17±2(13–19.5)	-	-
Velum length	29	31±2(29–31.2)	-	-
Lateral alae length	268.5	286±36(214–310.5)	228(224–235.5)	-
Length of cephalic setae	3	4±0(3–4)	3(3–3.2)	4±1(3–5)
Percentage of bulb diameter (cbd)*	63	59±5(50–64)	68(60–75)	55±5(50–63)
Diameter of *fovea amphidialis* in % of cephalic capsule width	65	60±11(46–70)	44(41–46)	53±8(41–62)
Distance from anterior end to the vulva		-	557(552.5–559)	-
V%		-	40(39–40)	-
Striation of the cuticle	5	5±0(4.5–5)	4.5(4.5)	5±0(5)
Ring with the spine	18	18±0(18)	18(18)	18±1(17–19)
Ring with the inversion of direction of annulation	81	80±2(77–83)	76(74–79)	-
a	29	33±2(29–35.5)	22(19.5–25)	24±3(20.5–27)
b	8	8±0(8–10)	6(5.5–8)	7±0(6–7)
c	11	11±1(10–12)	9(9.5)	4±1(3.5–5)

***Spinonema spiralis* sp. n.**

(measurements in Table 9, Figures 29, 30 and 31).

Material type: Holotype, Male adult, MNRJ 398 (04°45'00"S, 036°45'00"W) collected in June 2009 in the Potiguar Basin, between 45 and 100 m deep. Faciology: coarse lithoclastic sand. Gear: Van Veen/corer.

Paratype Female: Adult, MNRJ 399 (04°45'00"S, 036°45'00"W) collected in June 2009 in the Potiguar Basin, between 45 and 100 m deep. Faciology: coarse lithoclastic sand. Gear: Van Veen/corer.

Other paratypes: 1 female (250 LMZOO-UFPE), 2 males (251-252 LMZOO-UFPE) and 4 juveniles. All juveniles in first stage of development (J1) (253 LMZOO-UFPE) collected on same date as holotype.

Etymology. Species name refers to the shape and turns of the *fovea amphidialis*.

Description

Holotype (Figures 29 and 31)

Body cylindrical, yellowish brown. Cuticle annulated, with vacuoles distributed irregularly, including the base cephalic capsule. Annulations absent on cephalic capsule and final portion of tail. Cuticle with lateral differentiation consisting of thickened ridge (Fig 29D). Diameter of annulation 4 µm in anterior region, 2 µm at midline and 2.5 µm in posterior region. Sparse somatic setae irregularly distributed along body. Longitudinal rows of somatic setae unclear or hardly distinguishable in pharyngeal region. Dorsal spine strongly sclerotized, located on 9th cuticular ring. This spine is like projection of cuticle, identical of the species described above (Figs 29C and 31A). Inversion of direction of cuticular annuli occurring after 63rd cuticular ring. Head square. Cephalic capsule 19.5 µm long and well-developed with thick cuticle without annulations. Anterior sensilla arrangement: six inner labial papillae, six external setae and four cephalic setae positioned at upper level of *fovea amphidialis*. Subcephalic setae absent. *Fovea amphidialis* multispiral (3.25 turns), occupying 72% of diameter of head (smaller in female: sexual dimorphism). Oral cavity with one dorsal and one small ventral tooth. Pharynx cylindrical, with muscular and pyriform endbulb. Nerve ring located 100 µm from anterior region (Fig 29F). Ventral gland and secretory-excretory pore not observed. Cardia inserted in intestine. Reproductive system monorchic, with

single anterior testis situated to left of intestine, outstretched. Sperm cells large, globular. Spicules short and arched, with proximal end rounded, and broad velum present. Gubernaculum simple; apophysis wing-shaped, embracing distal portion of spicules (Fig 29E). Three caudal glands. Short conical tail and in terminal portion without annulation and vacuoles. Spinneret visible.

Paratype female (Figures 6 and 7)

Similar to male in body size and with minor differences: cephalic capsule with many vacuoles. *Fovea amphidialis* proportionally smaller, occupying 53% of cephalic capsule, and differing in number of turns (2.5 turns; Figs 6C and 7A). Inversion of direction of annuli occurring after 58th cuticular ring. Nerve ring difficult to observe. Reproductive system with paired ovaries, opposite and reflected. Both genital branches to right of intestine. Vulva as simple transverse slit-like aperture. Proximal portion of vagina slightly cuticularised. No egg found in uterus. Vulva comprising 39% of total body length (598 µm distant from anterior end). Tail conical.

Juvenile (Figures 6 and 7)

Very similar to adults, except not possessing lateral differentiation. However, in the juvenile stage one characteristic is remarkable, the presence of setae or spines on the cuticle (Figs 6F and 7F). In the course of development, this feature is lost. Four juveniles were found, all in stage 1.

Diagnosis and relationships

Spinonema spiralis **gen. sp. n.** is characterized by having a cuticle with vacuoles in all parts of the body, multispiral *fovea amphidialis* (3.25 turns), one dorsal spine, lateral differentiation, and apophysis wing-shaped, embracing distal portion of the spicules.

Spinonema spiralis **gen. sp. n.** is similar to another species described above, *Spinonema cuticulata* **gen. et sp. n.** The similarities are mainly in the cuticle, which show strong annulations and vacuoles, a sclerotized dorsal spine and an inversion ring (structure that defines the inversion of the direction of the cuticular annuli). Differences also occur in the cuticle, i.e. in *Spinonema cuticulata* **gen. et sp. n.** the vacuoles are between the 9th and 11th cuticular ring, whereas *Spinonema spiralis* **gen. sp. n.** has vacuoles in all rings, including the cephalic capsule. The size, shape and number of turns of the *fovea amphidialis* differ between the two species: *Spinonema cuticulata* **gen. et sp. n.** has

1.25 turns whereas *Spinonema spiralis* **gen. sp. n.** has 3.25 turns. However, the major differences are in the male reproductive system. *Spinonema cuticulata* **gen. et sp. n.** has spicules in proximal region hook-shaped and the gubernaculum lacks an apophysis. *Spinonema spiralis* **gen. sp. n.** has spicules with the proximal end rounded, the gubernaculum embracing the distal portion, and a wing-shaped and strongly sclerotized dorsal apophysis.

All juveniles found have similar characteristics to adults. In this species, juveniles of the first stage have setae associated with cuticular annulations, which are lost during development. Juveniles possessing characteristics that will later be lost by adults has not been reported for any species of Desmodorinae. However, this difference may only be apparent, because the majority of the species are poorly described and juvenile descriptions are not included. The gain of characteristics in adulthood has been observed in *Desmodora* de Man, 1889, *Desmodorella* Cobb, 1933 and *Zalonema* Cobb, 1920.

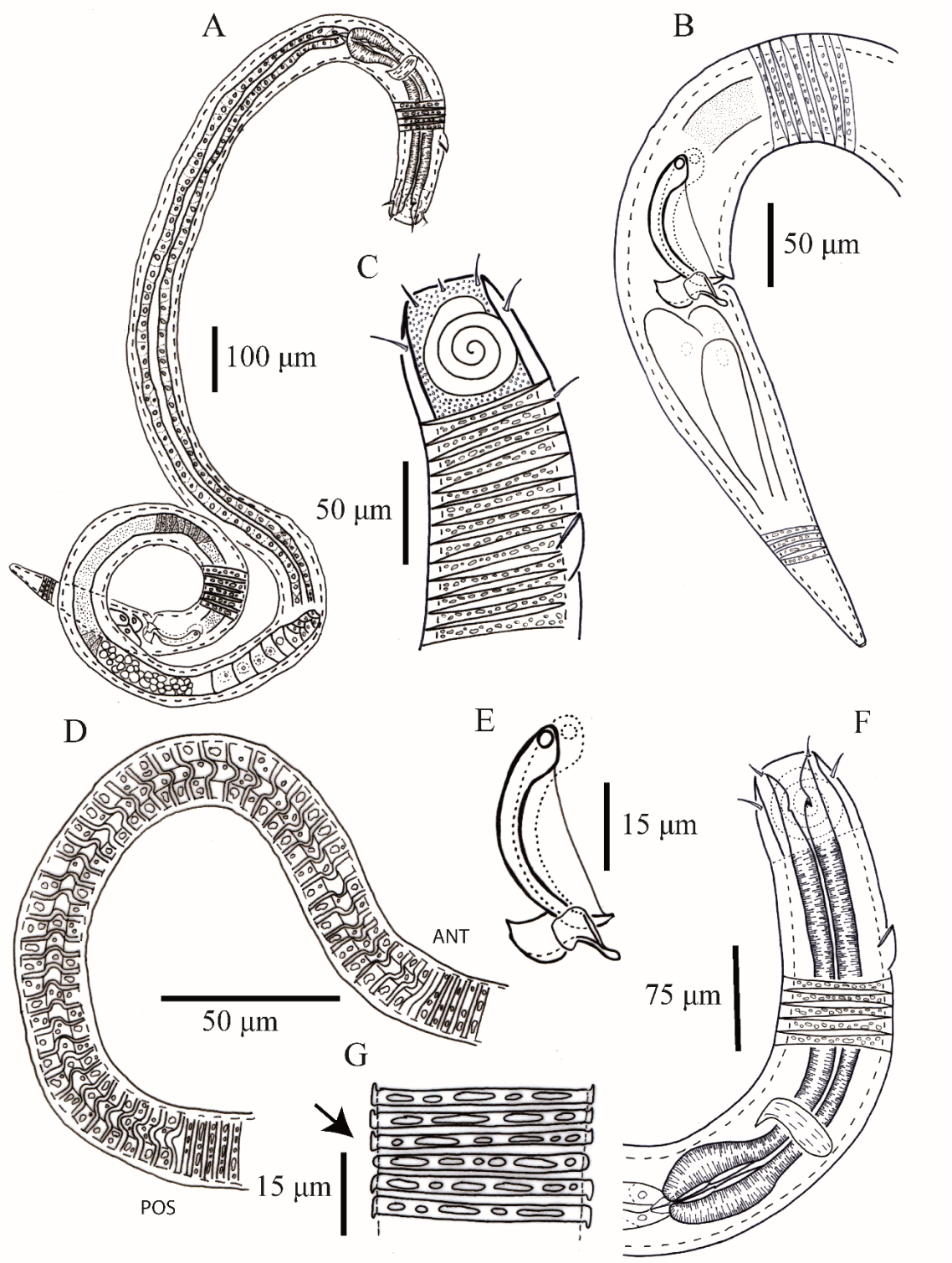

Figura 29 - *Spinonema spirale* gen. et sp. n. Holotype MNRJ 398. A: overview; B: tail region; C: anterior region; D: lateral alae (ANT anterior part and POS posterior part); e: spicules; F: anterior region; g: Inversion of direction of annuli.

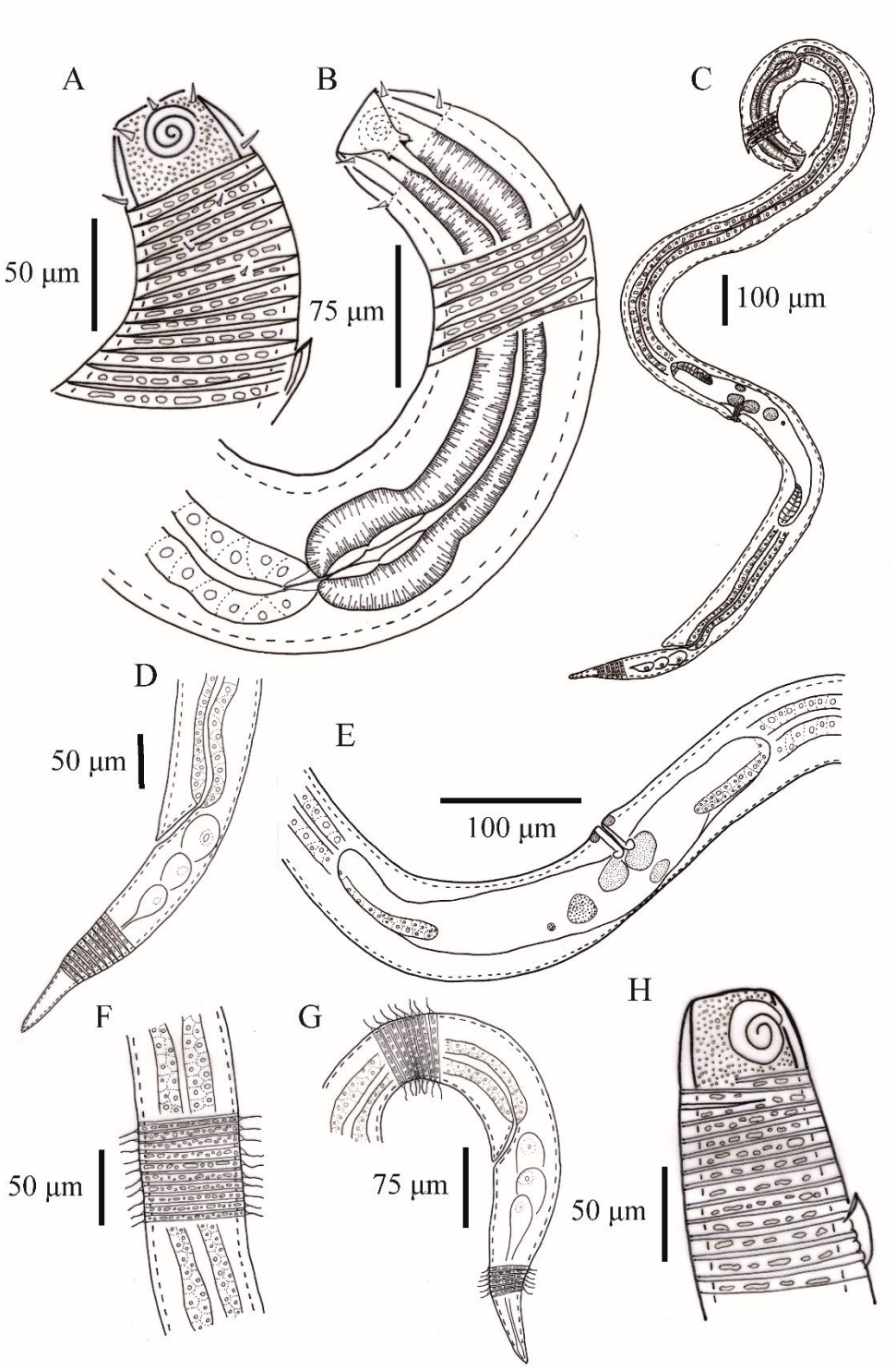

Figura 30 - *Spinonema spirale* gen. et sp. n. Paratype female MNRJ 399. A and B: anterior region; C: overview; D: tail region; e: ovary and vulva opening. Paratype juvenile in stage 1. F: spines on cuticle; g: tail region; H: anterior region.

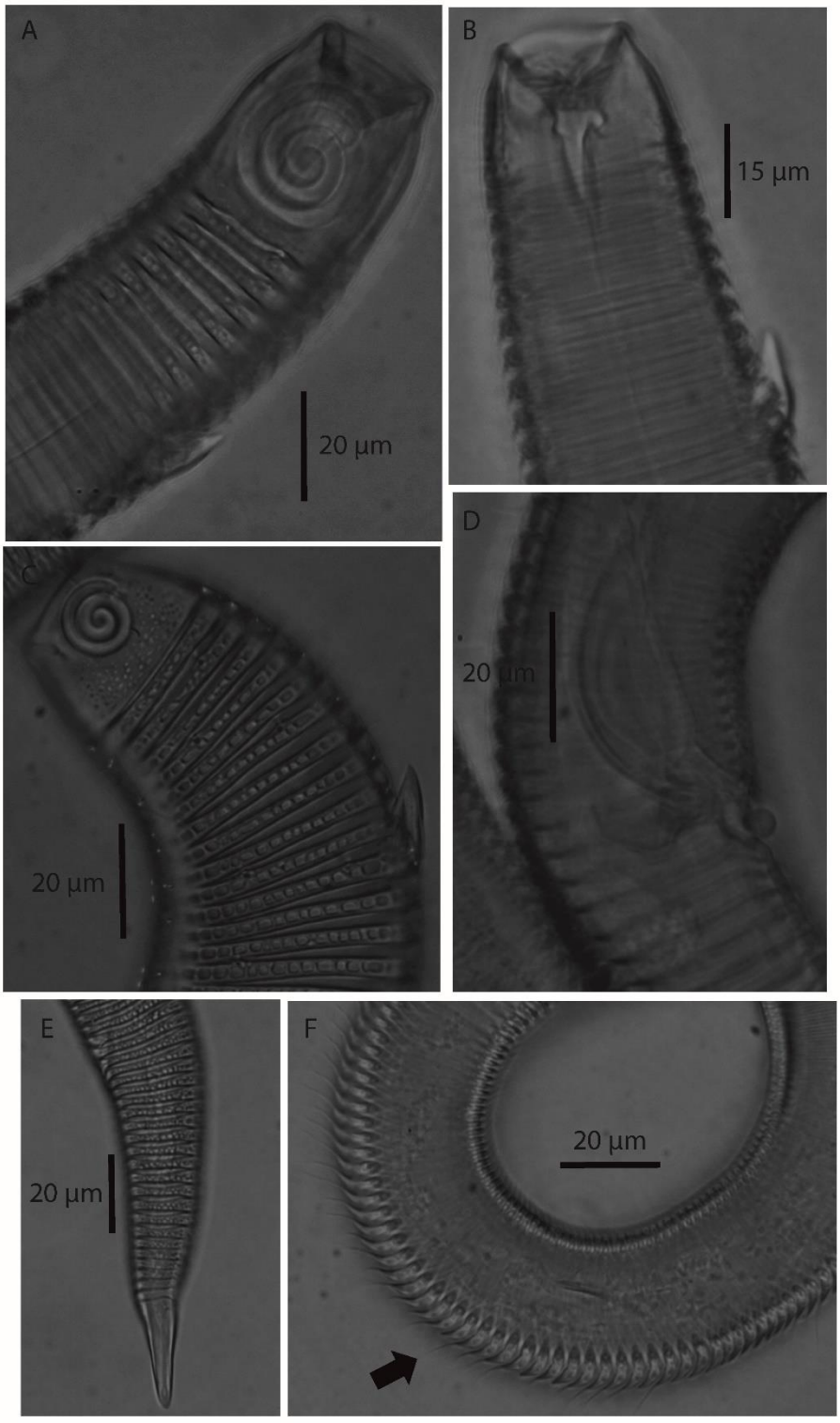

Figura 31 - *Spinonema spirale* gen. et sp. n. A and D, Holotype MNRJ 398; A: Cephalic region; D: Spicules. C and E, Paratype female MNRJ 399; C: Cephalic region; E: Tail region. B and F, Paratype juvenile in stage 1; B: Cephalic region; F: Spines on cuticle.

Tabela 9 - Measurements (µm) of *Spinonema spirale* gen. et sp. n. in the Potiguar Basin, Brazil. "-" = not applicable. The mean are followed by the ange for paratype measurements.

Sex	Male		Female	Juvenile
	Holotype	Paratypes	Paratype	Paratype
Number of specimens		2	2	4
Body length	1053	999(903–1014)	858(812.5-903.5)	677(541–818.5)
Pharynx length	126	123(118–126)	121(112.5-129)	120(105–135)
Maximum body diameter	40.5	38(31.5–41)	34(33-34.5)	37(27–42.5)
Anal body diameter	40	33(28.5–30)	24(24)	28(21–34)
Tail length	87	85(76.5–90)	89(82.5-94.5)	90(88.5–91.5)
Length of unstriated tail tip	22	22(20–25)	31(30-31)	29(27–31)
Spine length	15	16(12–19.5)	16(15-16.5)	13(10–15)
Head diameter	19.5	25(27.5–28.5)	23(22.5-24)	22(18–27)
Cephalic capsule length	20	25(27–28)	23(22.5-24)	18(15–20)
Spicule length	43.5	39(33.40.5)	-	-
Gubernaculum length	21	18(15–18)	-	-
Apophyses length	20	20(18–19.2)	-	-
Velum length	32	29(23–31)	-	-
Lateral alae length	361.5	424(416–494)	488(436.5-539.5)	-
Length of cephalic setae	6	6(5–6)	6(6-6.5)	6(4–7)
Length of external sensilla	6.5	7(6–7)	6(6)	6(5–6)
Percentage of bulb diameter (cbd)*	68	65(60–68)	59(56-62)	68(64–74)
Diameter of *fovea amphidialis* in % of cephalic capsule width	72	64(53–66)	51.5(50-53)	51(41–57)
Turns of *fovea amphidialis*	3.15	3(3–3.15)	2.5(2.5)	3(3)
Striation of the cuticle	5	5(5–5.5)	5(4.8-5)	4(4)
Distance from anterior end to the vulva	-	-	605(598-611)	-
V%	-	-	39(38-39)	-
Ring with the spine	10	8(8)	11(11)	10(9–12)
Ring with the inversion of direction of annulation	63	63(63)	63(58-67)	-
a	26	25(23–32)	25(23.5-27.5)	22(18–25)
b	8.5	8(7.5–8.5)	7(6-8)	6(5–7)
c	12	12(11–12)	10(9.5-10)	7(6–9)

***Spinonema absentis* gen. sp. n.**

(measurements in Table 10, Figures 32, 33 and 34).

Material type: Holotype, Male adult MNRJ 400 (04°45'00"S, 036°45'00"W) collected on June 2009 in the Potiguar Basin, between 30 and 35 m deep. Faciology: coarse bioclastic sand. Gear: Van Veen/corer.

Paratype female: Adult, MNRJ 401 (03°30'00"S, 038°15'00"W) from the Potiguar Basin, between 30 and 35 m deep. Faciology: coarse lithoclastic sand. Gear: Van Veen/corer.

Other paratypes: 4 females (251-254 LMZOO-UFPE), 5 males (255-259 LMZOO-UFPE) and 5 juveniles. Four in first stage of development (J1) and one in fourth stage of development (J4) (260 LMZOO-UFPE), collected on same date as holotype.

Etymology. This species lacks a dorsal spine. L. *absentia*, absence.

Description

Holotype (Figures 32 and 34)

Body cylindrical, yellowish brown. Cuticle annulated, with irregularly distributed vacuoles that start to appear from 6th cuticular ring. Cephalic capsule and final portion of tail without annulations. Cuticle with lateral differentiation, thicker than rest of body, reaching only 19 rings of total body. Diameter of annulation in anterior region 4.5 µm, at midline 4 µm, and in posterior region 3.5 µm. Sparse somatic setae irregularly distributed along body. Longitudinal rows of somatic setae unclear or hardly distinguishable in pharyngeal region. Inversion of direction of cuticular annuli occurring after 80th cuticular ring. Cephalic capsule long and well-developed with thick cuticle without annulations. Anterior sensilla arrangement: six inner labial papillae, difficult to see; and four cephalic setae. Cryptospiral *fovea amphidialis*, occupying 58% of diameter of head. Oral cavity with one dorsal tooth and one (or two, difficult to see) ventral tooth. Cylindrical pharynx with muscular and pyriform endbulb. Ventral gland and secretory-excretory pore not observed. Cardia inserted in intestine. Reproductive system monorchic, with single anterior testis situated to left of intestine, outstretched. Globular sperm cells. Spicules arched, sclerotized and capitulum is rounded. *Velum*

absent; gubernaculum laminar without apophysis (Fig 32C). Three caudal glands. Tail conical with numerous vacuoles, terminal portion without annulation. Three precloacal setae (Fig 34C). Spinneret conical.

Paratype female (Figures 33 and 34)

Similar to male in body size and with minor differences: inversion occurs after 76th cuticular ring, measures 61 µm and reaches 17 annuli. Reproductive system with paired ovaries, opposite and reflected antidromous and both genital branches to right of intestine. Vulva as simple transverse slit-like aperture. Proximal portion of vagina slightly cuticularised. No egg found. Vulva comprising 70% of total body length (578.5 µm distant from anterior end). Tail conical.

Juveniles (Figure 33)

Similar to adults, except lacking some characteristics including supplements and lateral differentiation; reproductive system immature. Juveniles in stage 1 lack somatic setae arranged in rows. Five juveniles were found, four in stage 1 and one in stage 4.

Diagnosis and relationships

Spinonema absentis **gen. sp. n.** is characterized by having a cuticle with irregularly distributed vacuoles that start to appear from the 6th cuticular ring, cryptospiral *fovea amphidialis*, absence of dorsal spine, presence of lateral ridge, and three precloacal setae.

Spinonema absentis **gen. sp. n.**, *Spinonema spiralis* **gen. sp. n.** and *Spinonema cuticulata* **gen. et sp. n.** are similar in the presence of vacuoles, the inversion ring and the lateral ridge, although varying in length (these three features are on the cuticle). *S. absentis* **gen. sp. n.** differs from the others in the absence of the dorsal spine, shape of the *fovea amphidialis* (*Spinonema cuticulata* **gen. et sp. n.** spiral and *Spinonema spiralis* **gen. sp. n.** multispiral) capitulum is rounded (*Spinonema cuticulata* **gen. et sp. n.** hook-shaped), spicules without apophysis (*Spinonema spiralis* **gen. sp. n.** apophysis wing-shaped) and presence of three precloacal setae (absent in *Spinonema spiralis* **gen. sp. n.** and *Spinonema cuticulata* **gen. et sp. n.**).

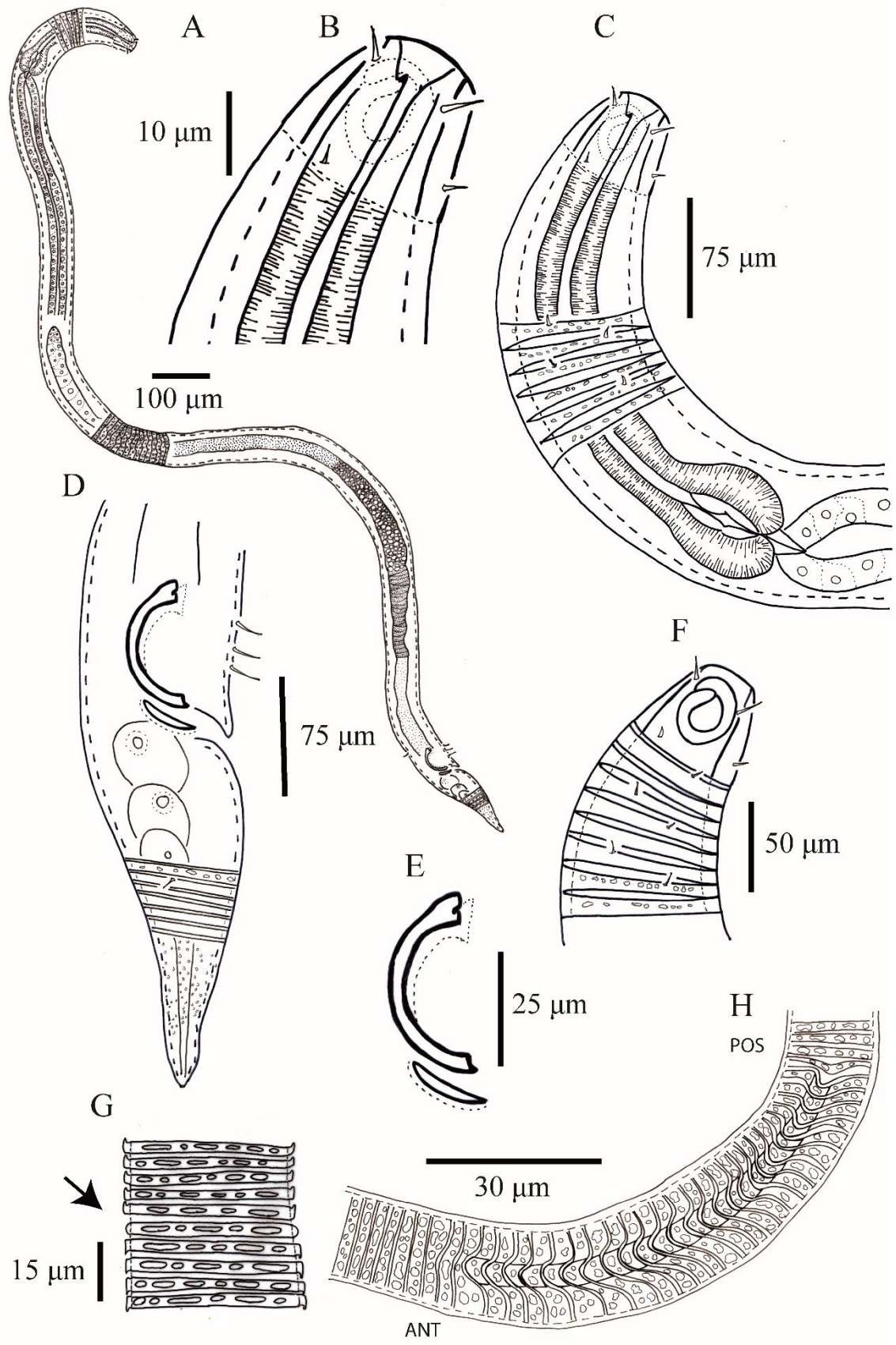

Figura 32 - *Spinonema absente* gen. et sp. n. Holotype MNRJ 400. A: overview; B, C and F: anterior region; D: tail region; e: spicules; H: lateral alae (ANT anterior part and POS posterior part); G: Inversion of direction of annuli.

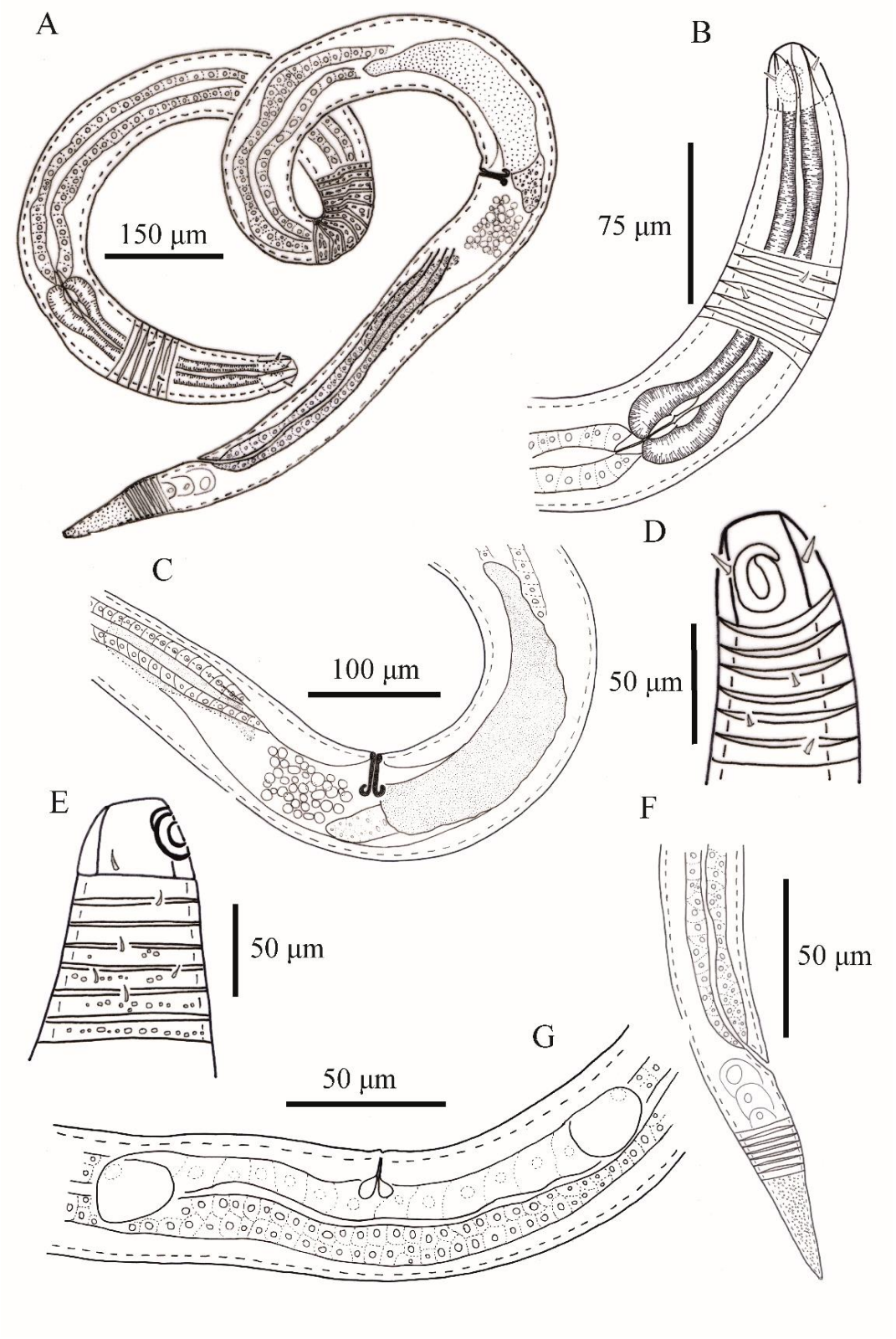

Figura 33 - *Spinonema absente* gen. et sp. n. Paratype female MNRJ 401. A: overview; C: Ovary and vulva opening; B and D: Anterior region. Paratype juvenile in stage 4. e: Anterior region; F: Tail region; g: Ovary of juvenile.

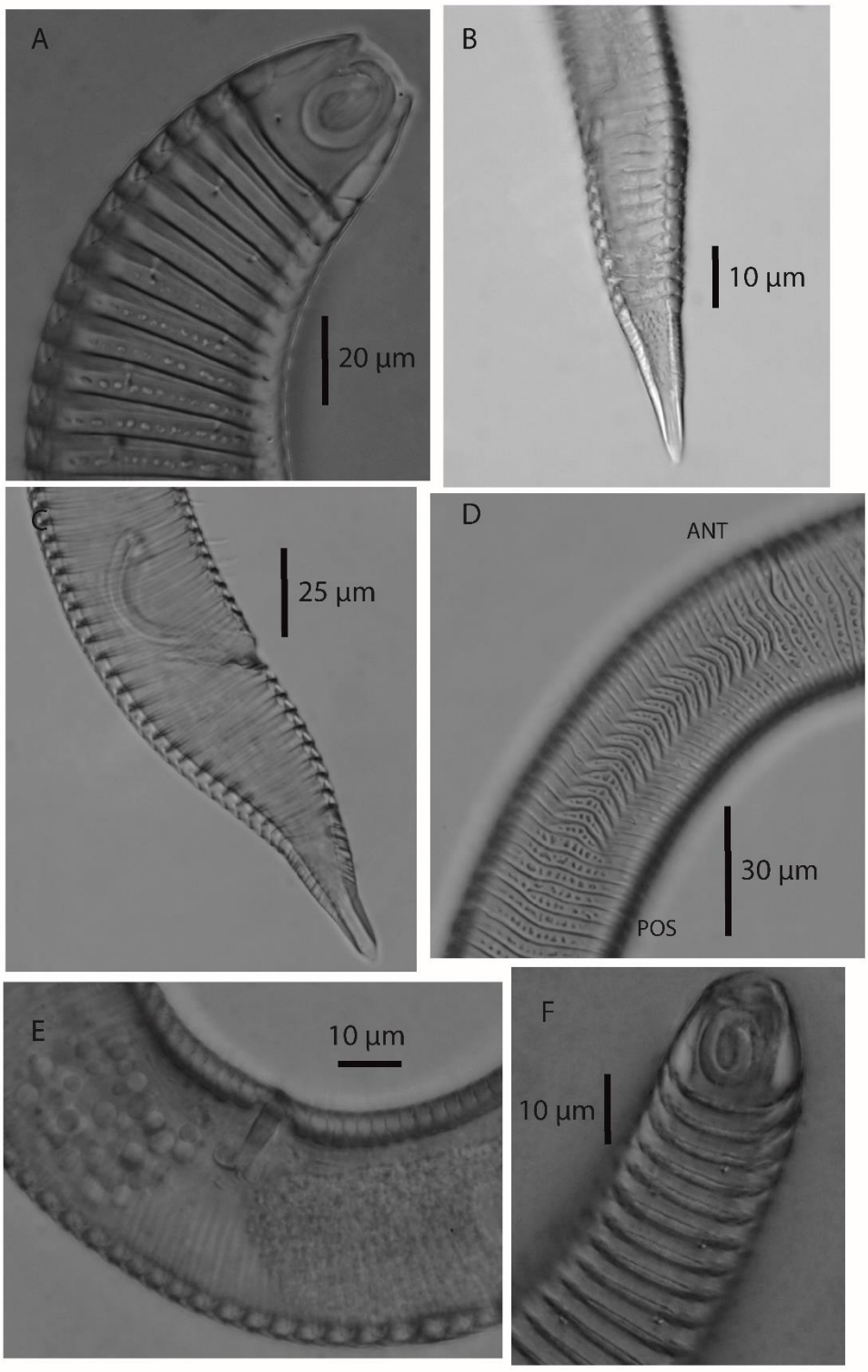

Figura 34 - *Spinonema absente* gen. et sp. n. A and C, Holotype male MNRJ 400; A: Cephalic region; C: Tail region. B, D, e and F, Paratype female MNRJ 401; B: Tail region; D: Lateral alae (ANT anterior part and POS posterior part); e: Vulva opening; F: Anterior region.

Tabela 10 - Measurements (µm) of *Spinonema absente* gen. et sp. n. in the Potiguar Basin, Brazil. "-" = not applicable. The mean and standard deviation are followed by the range for paratype measurements.

Sex	Male		Female	Juvenile
	Holotype	Paratypes	Paratype	Paratype
Number of specimens		5	5	5
Body length	1020	1014±102(806–1163.5)	1069±132(825–1196)	939±110(871–1135)
Pharynx length	127.5	127±9(103.5–141)	127±8(129–141)	119±13(102–130)
Maximum body diameter	34.5	35±3(27–40.5)	36±3(31–40.5)	39±5(32–45)
Anal body diameter	34	32±5(21–40)	23±2(21–31.5)	27±3(23–30)
Tail length	81	74±4(70.5–79.5)	77±5(76–87)	81±10(68–91)
Length of unstriated tail tip	36	35±5(29–39)	39±2(35–41)	35±2(33–38)
Head diameter	21.5	24±3(19.5–30)	24±3(19–27)	19±2(17–21)
Cephalic capsule length	21.5	23±2(19.5–27)	24±3(19–27)	16±2(12–18)
Spicule length	51	43±5(33–52.5)		
Gubernaculum length	24	20±3(15–22.5)		
Velum length	32	31±3(25–37.5)		
Lateral alae length	67.5	63±5(55–72)	68±6(52–62)	
Length of cephalic setae	7	7±2(5.5–9)	5±1(5–6)	5±1(3.4–5.5)
Percentage of bulb diameter (cbd)*	65	60±5(57–67)	60±4(55–66)	65±6(55–70)
Diameter of *fovea amphidialis* in % of cephalic capsule width	58	56±6(50–62)	52±7(44–60)	49±5(40–53)
Striation of the cuticle	5.5	5±1(4.5–6)	6±0(5.5)	5±0(4.5–5)
Distance from anterior end to the vulva			709±113(600–832)	710±63(620–779)
V%			43±2(40–56)	66±4(60–71)
Ring with the inversion of direction of annulation	80	85±4(80–89)	77±2(75–89)	
a	29.5	29±3(25–32)	30±4(24–31)	26±2(25–30)
b	8	8±0(7.5–9)	8±1(6.5–10)	8±1(7.5–9)
c	12.5	14±1(11.5–16)	3±0(10–16)	12±1(11–14)

Discussion

According to Lorenzen (1981) there is no synapomorphy for the family Desmodoridae. This author commented that the family is notable mainly for lacking the typical characteristics of the families Epsilonematidae and Draconematidae, although they share some of them. This is the case for the three species described here, *Spinonema cuticulata* **gen. et sp. n.**, *Spinonema spiralis* **gen. sp. n.** and *Spinonema absentis* **gen. sp. n.**, which have the cuticle with strong annulations, vacuoles, and the reversal in the direction of annulations. Vacuoles are commonly found in the family Epsilonematidae Steiner, 1927. Decraemer *et al.* (2001) suggested that the presence of vacuoles in the cuticle or other ornamentation may depend on the habitat. Another characteristic shared with Epsilonematidae is the inversion in the direction of the annulations. In the present study, this reversal of annulations varies according to the species. Clasing (1980), in his study of the families Desmodoridae, Epsilonematidae and Draconematidae, noted that observations of the cuticle of individuals in post-embryonic development may help to indicate the phylogenetic relationships of these families.

One of the main morphological characteristics that define *Spinonema spiralis* **gen. sp. n.** and *Spinonema cuticulata* **gen. et sp. n.** is the presence of the spiniform cuticular projections, reported here for the first time in the family Desmodoridae. A similar structure and location (anterior region and dorsal position) can be observed in members of Epsilonematidae, specifically in *Glochinema agile* Lorenzen, 1974; *Metaglochinema globicephalum* and *Keratonema singulare*, both described by Gourbault and Decraemer, 1986. This feature is present in other orders of Nematoda, for example Araeolaimida De Coninck & Schuurmans Stekhoven, 1933 (genus *Paracomesoma* Hope & Murphy, 1972).

Some previous reports suggest that spiniform cuticular projections may have a copulatory action. This is the case for the family Epsilonematidae and the genus *Paranticoma* Micoletzky & Kreis 1930 (order Enoplida). In both cases, a gland associated with a cuticular projection can be observed.

4.5 Artigo 4 – Six new species of free-living marine nematodes of Desmodorinae (Nematoda: Desmodoridae) from the continental shelf off northeastern Brazil, with updated key to the subfamily

(A ser submetido)

Introduction

The family Desmodoridae is composed of six subfamilies: Desmodorinae Micoletzky, 1924; Molgolaiminae (Jensen, 1978); Prodesmodorinae Lorenzen, 1981; Pseudonchinae Gerlach & Riemann, 1973; Spiriniinae Gerlach & Murphy, 1965; and Stilbonematinae Chitwood, 1936. The subfamily Desmodorinae has 14 valid genera and is characterized by a conspicuous head capsule; a thickened cuticle with, in most species, an external demarcation between the labial and cephalic regions; the *fovea amphidialis* not surrounded by cuticle striations; and the buccal cavity always with distinct teeth (Armenteros *et al*. 2014).

Continuing the taxonomic effort to increase the knowledge of the biodiversity of Desmodoridae in Brazil (Castro *et al*. 2006; Cavalcanti *et al*. 2009; Larrazábal-Filho *et al*. 2015, 2017, 2018, 2019; Maria *et al*. 2009, 2014; Moura *et al*. 2014; Silva *et al*. 2009, 2017), we describe six new species of the subfamily Desmodorinae: *Desmodorella spinata* **sp. n.**, *Desmodorella alium* **sp. n.**, *Desmodorella amphidialis* **sp. n.**, *Desmodorella braziliensis* **sp. n.**, *Zalonema laqueusis* **sp. n.**, and *Pseudodesmodora ritae* **sp. n.** from the Potiguar Basin off northeastern Brazil, and provide an identification key for the subfamily Desmodorinae.

SYSTEMATICS

Taxonomic classification, according to Decraemer and Smol (2006)

Class CHROMADOREA Inglis, 1983

Subclass CHROMODORIA Pearse, 1942

Order DESMODORIDA De Coninck, 1965

Suborder DESMODORINA De Coninck, 1965

Superfamily DESMODOROIDEA Filipjev, 1922

Family DESMODORIDAE Filipjev, 1922

Subfamily Desmodorinae Filipjev, 1922

Diagnosis (Larrazábal-Filho *et al*. 2019)

Head capsule conspicuous, characterized by thickened cuticle and, in most species, with external demarcation between labial and cephalic regions, except in *Sibayinema* Swart and Heyns, 1991 (Verschelde et al. 2006). *Fovea amphidialis* not surrounded by cuticle striations; may be located on cuticularized plate. Buccal cavity always with distinct teeth. Cuticle usually coarsely striated, in some cases with ornamentation.

List of valid genera of Desmodorinae (14) (Larrazábal-Filho *et al*. 2019)

Acanthopharyngoides Chitwood, 1936; *Acanthopharynx* Marion, 1870; *Bolbonema* Cobb, 1920; *Cornurella* da Silva, Silva, Esteves & Decraemer, 2018; *Croconema* Cobb, 1920; *Desmodora* de Man, 1889; *Desmodorella* Cobb, 1933; *Onepunema* Leduc & Verschelde, 2013; *Psammonema* Verschelde & Vincx, 1995; *Pseudochromadora* Daday, 1899; *Pseudodesmodora* Boucher, 1975; *Sibayinema* Swart & Heyns, 1991; *Spinonema* Larrazábal-Filho *et al.*, 2019; and *Zalonema* Cobb, 1920.

***Remarks.** We provide a generic key for the subfamily Desmodorinae. The genus *Zalonema* Cobb, 1920 appears in the key twice, because the characteristic ventral or lateral alae are commonly but not always present in the genus. Of the nine valid species, five have this characteristic (*Z. vicentei* and *Z. mariae* Larrazábal-Filho, Silva & Esteves, 2015; *Z. myrianae* Verschelde & Vincx, 1996; *Z. ditlevseni* (Micoletzky, 1922); and *Z. laqueusis* **sp. n.**). The key serves both for species of the genus *Zalonema* that have lateral alae and for species that lack this characteristic, facilitating the determination of the genus. The triangular cephalic capsule has always been a diagnosic character of the genus *Zalonema*, although this shape is highly subjective. For each description of species of *Zalonema*, modified diagnoses are provided. Modified characters include, for example, the presence or absence of subcephalic setae, presence or absence of lateral alae, and shape of the *fovea amphidialis* (multispiral or loop). Provision of a set of characteristics permits a more secure identification.

Key to genera of Desmodorinae Filipjev, 1922

1 – Cephalic capsule smooth; monorchic with one testis …….....2
– Cephalic capsule striated; diorchic with two testes.....*Onepunema*

$2_{(1)}$ – Pharynx with long *postcorpus* (prolonged terminal bulb) …….3
– Pharynx with rounded or only slightly prolonged terminal bulb……...……4

3(2) – Head capsule smooth with numerous subcephalic setae present……....*Acanthopharynx*
– Head capsule formed of a number of cuticular plates (*suturae* between plates visible with light microscope); no subcephalic setae present ……. *Acanthopharyngoides*

4(2) – Cephalic capsule with ornamentation (horns or amphideal plate)…….……..……....5
– Cephalic capsule without ornamentation ……...…….……...6

5(4) – Two horns (cornus) at the base of the cephalic capsule……..…...*Cornurella*
,– Head capsule ornamentaded with amphids located on an amphidial plate; may have ventral ala…….....…….……*Pseudodesmodora*

6(4) – Presence of ornamentation in the cuticle……7
– Absence of ornamentation in the cuticle…….……...8

7(6) – Ornamentation consisting of lateral or ventral ala……..……9
–Ornamentation consisting of spines or ridges in longitudinal rows.....…..10

8(6) – A large number of subcephalic setae arranged in three (or more) circles on the head capsule; amphids anterior on the thickly cuticularized head capsule; coarse body annuli, non-annulated tail-end perforated; short but broad somatic setae……...……*Croconema*
– Single circle of subcephalic setae (or absent)…….....…….……..…11

9(7) – Lateral alae short, in the mid-region or in the caudal region…….……...12
– Lateral alae long, occupying a large part of the body….……..13

10(7) – Body ornamented with longitudinal rows of ridges or spines; spicules may be short and arched or long and filiform……...….……...……*Desmodorella*
– Amphids located centrally on main part of head capsule; body cuticle of adults ornamented with eight rows of clustered brushlike spines or ornaments; freshwater habitats…...…….…….*Sibayinema*

11(8) – No longitudinal rows of ridge or spines (no special ornamentation or appendages); no or few subcephalic setae; short and arched spicules……..*Desmodora*
– No special ornamentation or appendages; globular cephalic capsule; cephalic setae always well visible; cuticle finely striated; minute buccal cavity; long and shorter somatic setae alternating along body……..……...*Bolbonema*
– Triangular or rounded-triangular head capsule; multispiral amphids of two turns or more; finer body annuli throughout; slender pharynx with pyriform (onion-shaped) terminal bulb..…..... *Zalonema**

12(9) – Lateral alae located in caudal region of body (this characteristic is present in most but not all species of the genus); cephalic capsule triangular; *fovea amphidialis* multispiral or, less often, loop-shaped; cuticle finely striated; spicules short.....*Zalonema**

– Lateral alae located in mid-region of body; dorsal spine may be present in pharyngeal region; cephalic capsule well developed. with vacuoles; cuticle strongly annulated; spicules short and arched ……..…….....*Spinonema*

13(9) – Anterior edge of amphids located anterior on the main part of the head capsule; buccal cavity with denticles; lateral *alae* starting behind head capsule, in the pharyngeal region; conical tail…….……*Psamonema*
– Amphids located centrally or more posterior on the main part of the head capsule; buccal cavity without denticles; lateral *alae* starting at or posterior to level of the cardia; conical cylindrical tail……*Pseudochromadora*

Genus *Desmodorella* Cobb, 1933

Diagnosis (after Leduc & Zhao 2016)

Cuticle annulated, with longitudinal rows of ridges or spines. Lateral alae absent. Head capsule truncated or rounded. Large multispiral to loop-shaped *fovea amphidialis* located in head capsule. Cephalic setae anterior to or at level of anterior edge of *fovea amphidialis*. Pharynx with rounded or oval posterior bulb.

17 valid species (after Leduc & Zhao 2016)

Desmodorella abyssorum (Allgén, 1929); *Desmodorella alium* **sp. n.**; *Desmodorella amphidialis* **sp. n.**; *Desmodorella aquaedulcis* (Gagarin & Thanh, 2003); *Desmodorella balteata* Verschelde et al., 1998; *Desmodorella braziliensis* **sp. n.**; *Desmodorella curvispiculum* (Jensen, 1985); *Desmodorella filispiculum* (Lorenzen, 1976); *Desmodorella hirsuta* (Chitwood, 1936); *Desmodorella papillostoma* (Murphy, 1962); *Desmodorella perforata* (Wieser, 1954); *Desmodorella sanguinea* (Southern, 1914); *Desmodorella schulzi* (Gerlach, 1950); *Desmodorella sinuata* (Lorenzen, 1976); *Desmodorella spinata* **sp. n.**; *Desmodorella spineacaudata* Verschelde et al., 1998; *Desmodorella tenuispiculum* (Allgén, 1928).

Description of species

***Desmodorella spinata* sp. n.**

(measurements in Table 11, Figures 35 and 36)

Type material: Holotype, Male adult MNRJ 402 (04°58'19"S, 036°09'86"W) collected in June 2014 from the Potiguar Basin. Depth: 12 m. Faciology: coarse sand with gravel. Gear: Van Veen grab.

Paratype female: Adult, MNRJ 403 (05°02'16.6"S, 036°23'58.8"W) collected in June 2014 from the Potiguar Basin. Depth: 7.1 m. Faciology: sandy sediments. Gear: Van Veen grab.

Other paratypes: 4 females (261–265 LMZOO-UFPE), 4 males (266–269 LMZOO-UFPE) and 4 juveniles. Two in second stage of development (J2) and two in first stage of development (J1) (270 LMZOO-UFPE) collected on same date as holotype. Juvenile stages were identified through the reproductive system, based on Bird & Bird (1991).

Etymology. The specific epithet "*spinata*" is given for the spines along the body. L. *spinae.*

Description. Male Holotype (Figure 35). Body cylindrical, orange-brown, narrowest in region between pharynx and anterior end of testis and widest at mid-level of testis. Cuticle coarsely annulated; annules in anterior pharyngeal region more widely spaced than elsewhere. Vacuoles in cuticle, in cephalic capsule and along body. Along body are two lateral rows of cuticular expansions, in the shape of a fine thorn. Two more rows of ridges located approximately 117 µm (98–138 µm for paratypes) after cardia. Each ridge is 455 µm (409–543 µm for paratypes) in length. At end of longitudinal ridge (approximately in testis region), eight rows of cuticular expansions form and extend to cloaca; two subdorsal, two subventral and four sublateral. Head capsule long and well developed, with separate, retractable lip region (Figure 35E). Anterior sensilla arrangement: six inner labial papilliform sensilla, six outer labial papilliform sensilla, and four cephalic setiform sensilla situated slightly posterior to lip region and at level of anterior edge of amphids. Four subcephalic setae in middle of cephalic capsule. *Fovea amphidialis* multispiral, with 2 (2–2.5 for paratypes) turns. Buccal cavity with large cuticularized dorsal tooth and one smaller ventral tooth. Pharynx cylindrical, slightly swollen around buccal cavity and with small oval to pyriform posterior bulb. Cardia small. Secretory-excretory system and nerve ring not observed. Reproductive system monorchic, with outstretched testis located to left of intestine. Mature sperm globular. Spicules long and thin, with slightly swollen proximal end and pointed distal end. Gubernaculum small and laminar; gubernacular apophyses absent. Precloacal supplements or setae not observed. Tail long, conical, with non-annulated posterior end. Three caudal glands, difficult to see.

Females (Figure 36)

Very similar to male in body size. Didelphic, ovaries outstretched, and both genital branches to right of intestine. Vulva as simple transverse slit-like aperture. Vagina vera slightly cuticularized (Figure 36E). Vagina uterina surrounded by constrictor muscle. No egg found. "V" located at 53–68% of total body length (663–916 μm distant from anterior end). Tail conical.

Juveniles

Similar to adults, except lacking some characteristics such as supplements; reproductive system immature. Four juveniles were found, two in stage 1 and two in stage 2.

Diagnosis. *Desmodorella spinata* **sp. n.** is characterized by the coarsely annulated cuticle with vacuoles. Anterior sensilla arrangement: 6+4+4. Multispiral *fovea amphidialis* (2 turns). Spicules long and thin, with slightly swollen proximal end and pointed distal end. Gubernaculum small and laminar.

Relationships

Desmodorella spinata **sp. n.** is similar to *Desmodorella abyssorum* (Allgén, 1929) in the shape of the spicules and gubernaculum; turns and shape of the *fovea amphidialis*; vacuoles in the cephalic capsule; and the long conical tail. It differs from *D. abyssorum* in the presence of subcephalic setae, ornamented cuticle, and absence of precloacal setae.

Desmodorella spinata **sp. n.** is comparable to *Desmodorella balteata* Verschelde et al., 1998 in the shape of the spicules and gubernaculum; ornamented cuticle; vacuoles in the cephalic capsule; and shape of the *fovea amphidialis.* It differs in the presence of subcephalic setae (absent in *D. balteata*) and the absence of precloacal setae (present in *D. balteata*).

Both *Desmodorella spinata* **sp. n.** and *Desmodorella tenuispiculum* (Allgén, 1928) have multispiral *fovea amphidialis*, spicules filiform with a simple gubernaculum, and vacuoles in the cuticle. They differ in the absence of subcephalic setae in *D. tenuispiculum* (present in *D. spinata* **sp. n.**) and the presence of precloacal setae in *D. tenuispiculum* (absent in *D. spinata* **sp. n.**).

D. spinata **sp. n.** can be distinguished from *D. curvispiculum* (Jensen, 1985) by the presence of vacuoles along the body, coarsely annulated cuticle, and ornamentation.

D. spinata **sp. n.** can be distinguished from *D. papillostoma* (Murphy, 1962) by the presence of spines along the body, presence of four subcephalic setae (absent in *D. papillostoma*), and spicules shorter than in *D. papillostoma* (64 µm vs. 153 µm respectively).

D. spinata **sp. n.** can be compared with *D. sinuata* (Lorenzen, 1976) by the presence of spines along the body, the shape of the *fovea amphidialis* (multispiral), presence of a longitudinal ridge, and vacuoles in the cephalic capsule. It differs in the cephalic arrangement (four cephalic and eight subcephalic setae in *D. sinuata* and four cephalic and four subcephalic setae in *D. spinata* **sp. n.**) and the size of the spicules, which are longer in *D. sinuata* than in *D. spinata* **sp. n.** (250 µm vs. 64 µm respectively).

All the females described here can be distinguished from *D. spinata* **sp. n.** by having ovaries reflexed, whereas in *D. spinata* **sp. n.** the ovaries are outstretched.

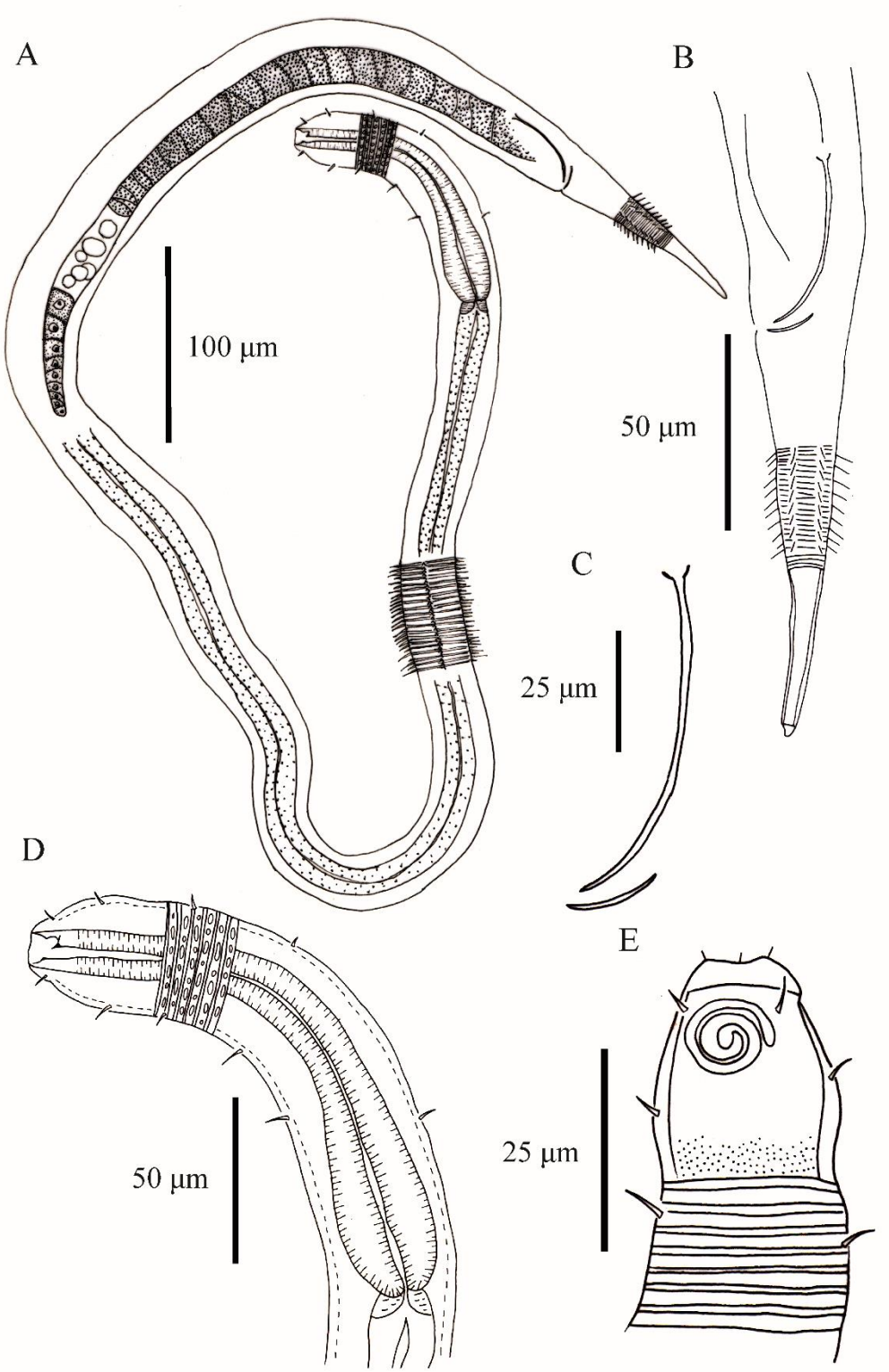

Figura 35 - *Desmodorella spinata* sp. n. Holotype MNRJ 402 - A: overview. B: tail region. C: copulatory apparatus. D and E: anterior region.

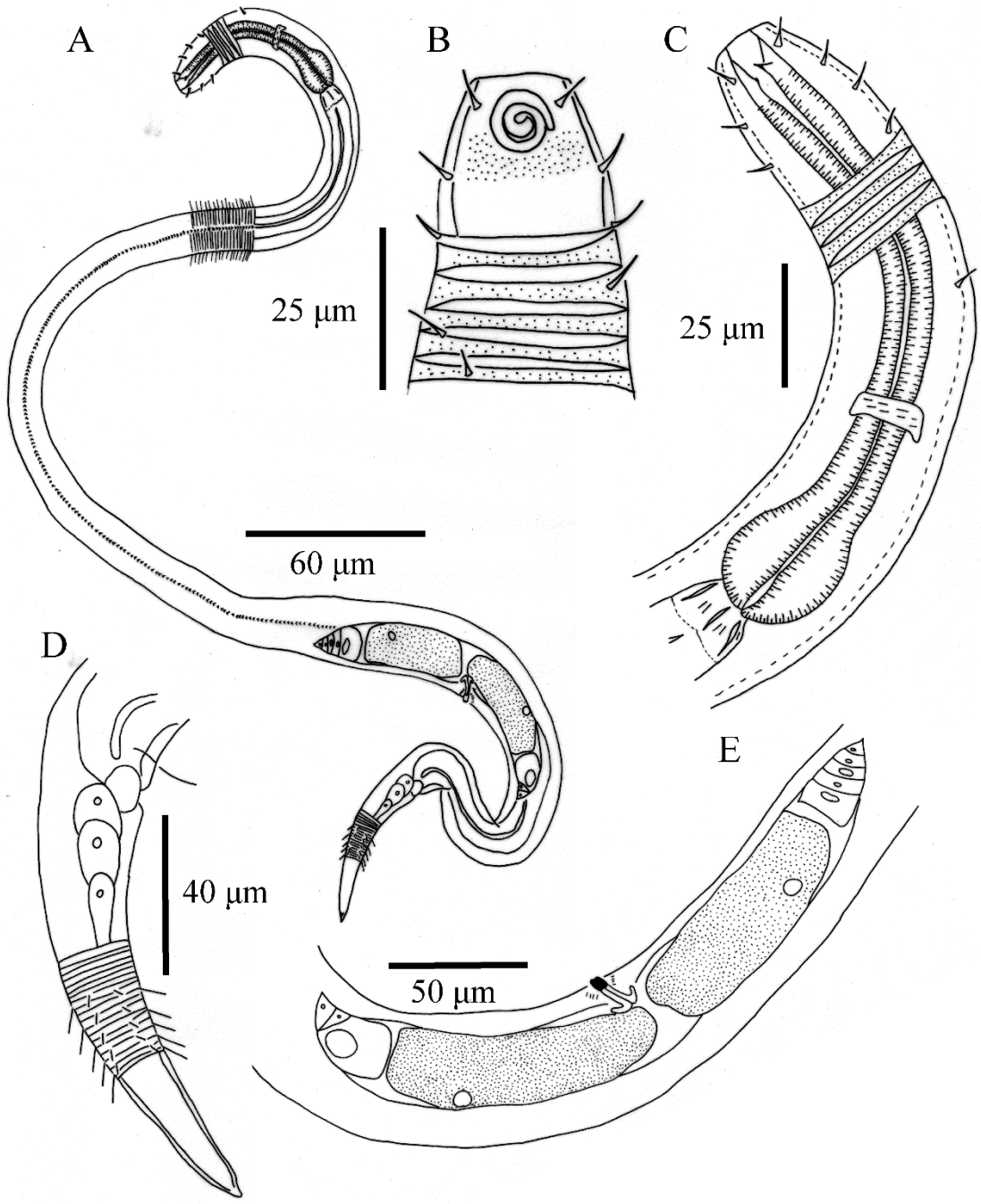

Figura 36 - *Desmodorella spinata* sp. n. Paratype female MNRJ 403 – A: overview. B and C: anterior region. D: tail region. E: ovary and vulva opening.

Tabela 11 - Measurements (µm) of *Desmodorella spinata* sp. n. in the Potiguar Basin, Brazil. "–" = not applicable or not observed. The mean and standard deviation are followed by the range for paratype measurements.

Sex	Male		Female	Juvenile
	Holotype	Paratype	Paratype	Paratype
Number of specimens	1	4	5	4
Body length	1378	1424 (1154–1716)	1323 ± 261 (1514–1034)	985 (630–1287)
Pharynx length	164	169 (111–169)	152 ± 2 (151–154)	113 (99–132)
Nerve ring	–	–	89 ± 14 (69–105)	–
Maximum body diameter	50	52 (49.5–54)	58 ± 11 (51–78)	39 (31.5–54)
Anal body diameter	31	39 (34.5–43.5)	34 ± 2 (31.5–36)	30 (22–34.5)
Tail length	111	115 (95–147)	105 ± 47 (99–124.5)	102 (102–110)
Head diameter	24	30 (27–34)	24 ± 1 (23–25)	22 (18–25)
Length of cephalic setae	5	6 (6–6.5)	6 ± 0 (6–7)	7 (5–9)
Length of subcephalic setae	6.5	6 (4–8)	6 ± 1 (4–7)	6 (4–8)
Length of ridge	455	487 (409–543)	470 ± 70 (387–538)	275 (105–389)
Percentage of bulb diameter (cbd)*	60	60 (58–61)	65 ± 4 (60–68)	63 (54–69)
Diameter of *fovea amphidialis* as % of cephalic capsule width	48	45 (43–52)	49 ± 6 (42–57)	51 (45–63)
Turns of *fovea amphidialis*	2	2 (2–2.5)	2 ± 0 (2–2.5)	2 (2)
Spicule length	64	47 (40–52)	–	–
Gubernaculum length	19	17 (13–17)	–	–
Distance from anterior end to vulva	–	–	811 ± 114 (663–916)	–
V%	–	–	62 ± 6 (53–68)	–
a	28	27 (20–30)	23 ± 4 (19–28)	25 (19–32)
b	8	10 (7–12)	9 ± 4 (7–10)	9 (8–10)
c	12	13 (9–16)	12 ± 6 (10–15)	10 (7–12)

***Desmodorella alium* sp. n.**

(measurements in Table 12, Figures 37 and 38)

Type material: Holotype, Male adult MNRJ 404 (05°01'52.6"S, 036°23'19.6"W) collected in June 2009 from the Potiguar Basin. Depth: 6.6 m. Faciology: sandy sediments. Gear: Van Veen grab.

Paratype female: Adult, MNRJ 405 (05°01'54.6"S, 036°11'14.7"W) collected in June 2014 from the Potiguar Basin. Depth: 8.2 m. Faciology: sandy sediments. Gear: Van Veen grab.

Other paratypes: 2 females (271–272 LMZOO-UFPE), 5 males (273–277 LMZOO-UFPE) and 5 juveniles. Two in second stage of development (J2) and three in first stage of development (J1) (278 LMZOO-UFPE) collected on same date as holotype. Juvenile stages were identified from the reproductive system, based on Bird & Bird (1991).

Etymology. Named for the highly distinctive characteristics within the genus. L. *alium* Strange, different, unique.

Description. Male Holotype (Figure 36). Body cylindrical, orange-brown, narrowest in region between pharynx and anterior end of testis and widest at mid-level of testis. Cuticle strongly striated. Ten longitudinal rows (hook-shaped) of the cuticle expansion, along the body; two subdorsal, two subventral and four sublateral (Figure 4A). Somatic setae randomly distributed throughout the body. Head capsule short and well developed, with separate retractable lip region. In some specimens large epizoic Suctoria are attached to the body: the base of the suctorine specimens "roots" into the cuticle. Anterior sensilla arrangement: six inner labial papilliform sensilla and six outer labial papilliform sensilla (difficult to see). Four cephalic setiform sensilla positioned at middle of *fovea amphidialis*. Eight subcephalic setae just below *fovea amphidialis*. *Fovea amphidialis* cryptospiral. Buccal cavity with one large cuticularized dorsal tooth and one smaller ventral tooth. Pharynx cylindrical, slightly swollen around buccal cavity and with small oval to pyriform posterior bulb. Cardia small. Secretory-excretory system not observed. Nerve ring located 136 μm (145 μm in paratype) from anterior region. Reproductive system monorchic with outstretched testis located to left of intestine. Sperm cells globular. Spicules arched, proximal region expanded (Figure 36D). Gubernaculum a bent, dorsally oriented rod; gubernacular apophyses absent.

Precloacal supplements or setae not observed. Tail short, conical, with non-annulated posterior end. Three caudal glands, difficult to see.

Females (Figure 38)

Similar to male in body size, with minor differences: subcephalic setae positioned at base of cephalic capsule (Figure 38A). Didelphic, ovaries antidromously reflexed and both genital branches to left of intestine. Vulva as simple transverse slit-like aperture. Vagina vera slightly cuticularized. Vagina uterina surrounded by constrictor muscle. Globular sperm cells visible. No egg found. "V" located at 65% of total body length (1605 μm distant from anterior end). Tail conical.

Juveniles (Figure 38)

Similar to adults, except lacking some characteristics such as supplements; reproductive system immature. Five juveniles were found, three in stage 1, one in stage 2 and one in stage 3.

Diagnosis. *Desmodorella alium* **sp. n.** is characterized by strongly striated cuticle. Ten longitudinal rows (hook-shaped) of the cuticle expansion, hook-shaped. Anterior sensilla arrangement: six outer labial papillae (difficult to see), four cephalic setae and eight subcephalic setae. *Fovea amphidialis* cryptospiral. Spicules arched, proximal region expanded. Gubernaculum a bent, dorsally oriented rod; gubernacular apophyses absent.

Relationships

Desmodorella alium **sp. n.** is comparable to *Desmodorella filispiculum* (Lorenzen, 1976) in the cryptospiral shape of the *fovea amphidialis*. It differs in the cephalic arrangement (four cephalic and eight subcephalic setae in *D. alium* **sp. n.** vs. four cephalic and ten subcephalic setae in *D. filispiculum*) and the shape of the spicules (short and arched in *D. alium* **sp. n.** vs. long and filiform in *D. filispiculum*).

Desmodorella alium **sp. n.** and *Desmodorella perforata* Wieser, 1954 share some charectistics in common, including the cryptospiral *fovea amphidialis* and the short arched spicules. They differ in the somatic setae and ornamentation in cuticle with ten longitudinal rows (hook-shaped) of the cuticle expansion (present in *D. alium* **sp. n.** and absent in *D. perforata*).

Desmodorella alium **sp. n.** resembles *Desmodorella schulzi* Gerlach, 1950 in the cryptospiral shape of the *fovea amphidialis*, the short spicules, and eight subcephalic setae. They differ in the shape of the spicules (short and arched in *D. alium* **sp. n.** vs. filiform in *D. schulzi*).

Desmodorella alium **sp. n.** can be distinguished from *Desmodorella aquaedulcis* Gagarin & Thanh, 2003 by the shape of the spicules (arched in *D. alium* and filiform in *D. aquaedulcis*), precloacal setae (absent in *D. alium* **sp. n.**) and cuticular ornamentation (unornamented in *D. aquaedulcis*).

Desmodorella alium **sp. n.** differs from *Desmodorella spinata* **sp. n.** in the shape of the *fovea amphidialis* (cryptospiral in the former, multispiral in the latter), cephalic arrangement (four cephalic and eight subcephalic setae in *D. alium* **sp. n**. vs. four cephalic and four subcephalic setae in *D. spinata* **sp. n.**) and the shape of the spicules (short and arched in *D. alium* **sp. n.** vs. long and filiform in *D. spinata* **sp. n.**).

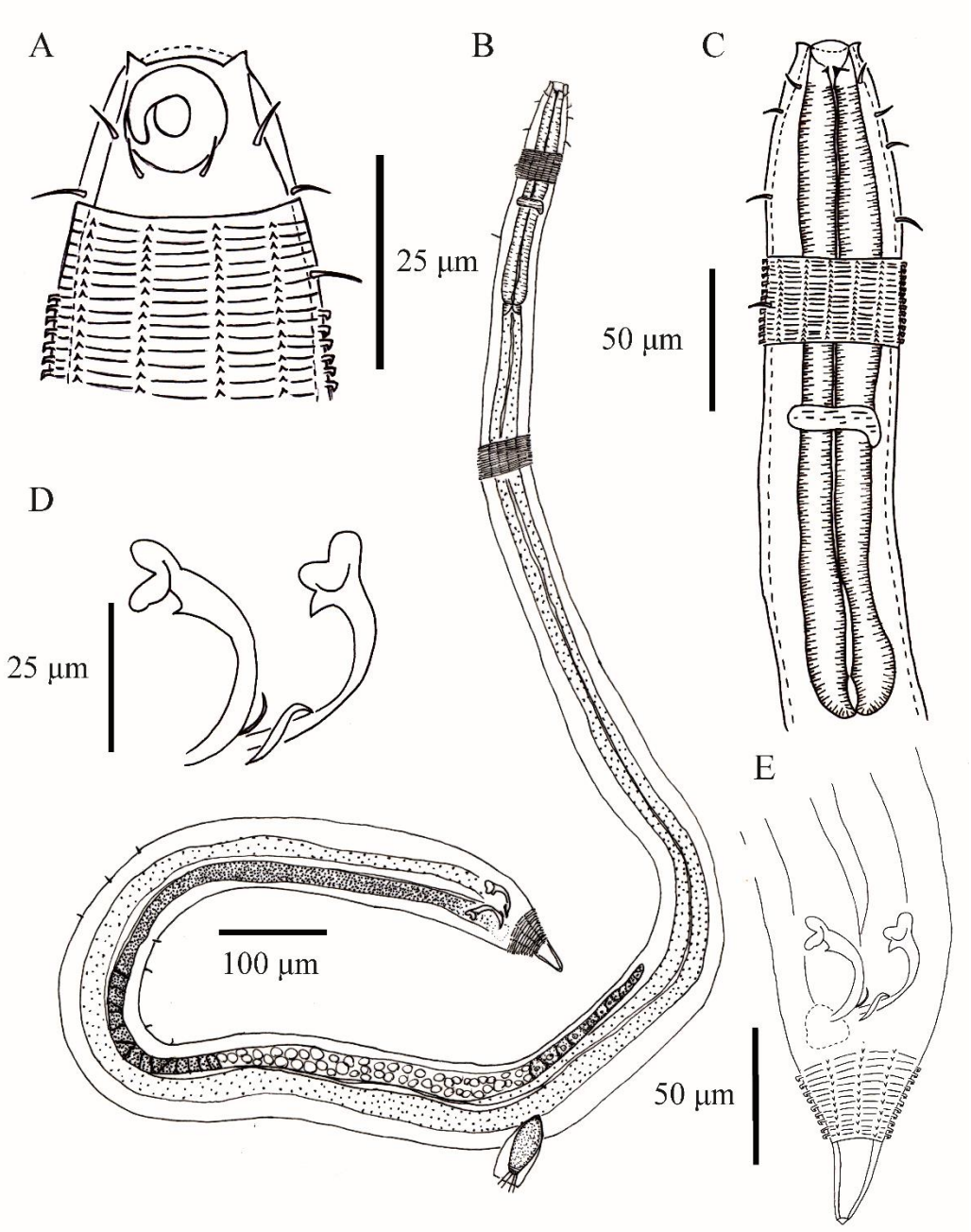

Figura 37 - *Desmodorella alium* sp. n. Holotype MNRJ 404 – A and C: anterior region. B: overview. E: tail region. D: copulatory apparatus.

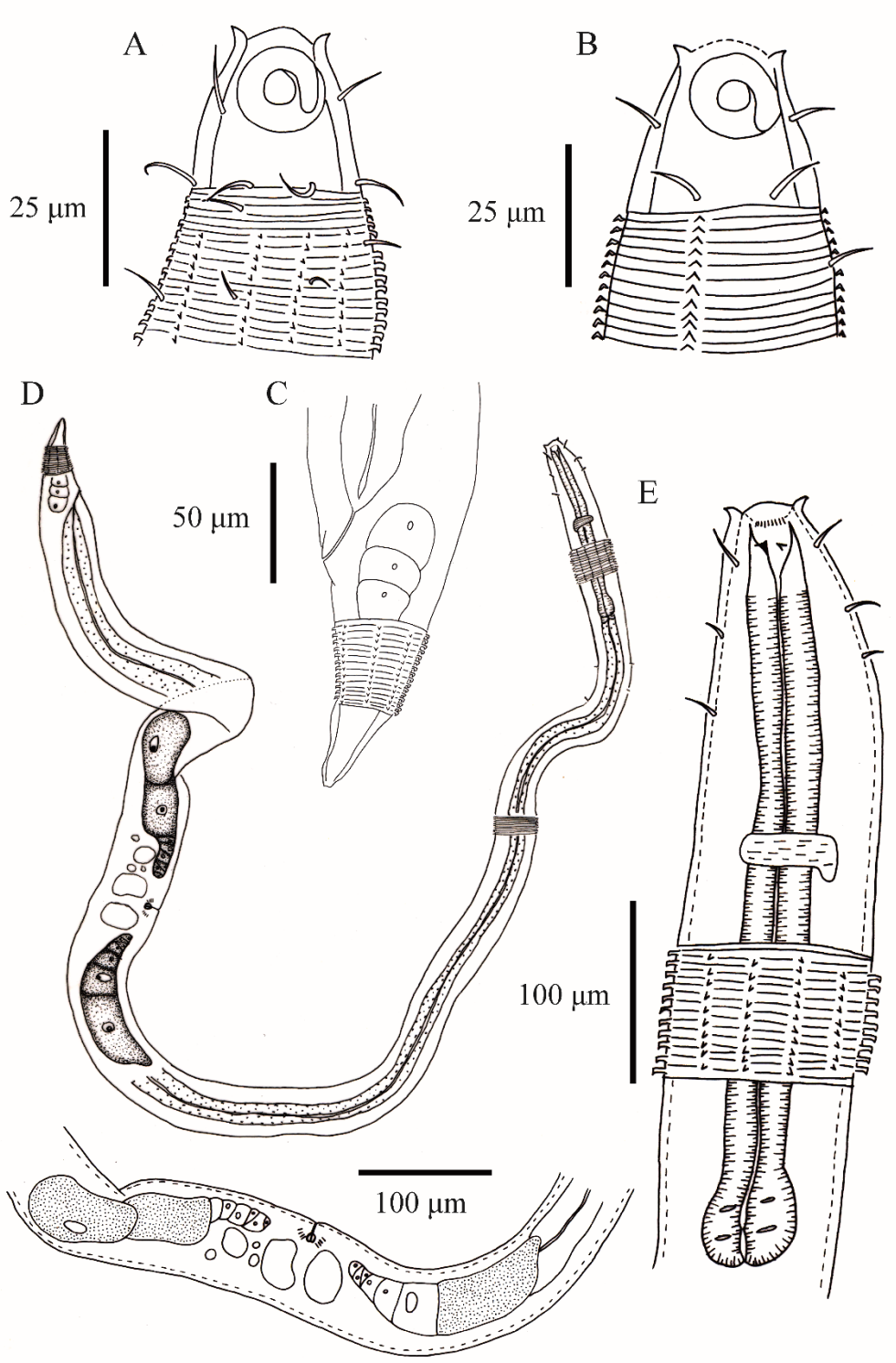

Figura 38 - *Desmodorella alium* sp. n. Paratype female MNRJ 405 – D: overview. A, B and E: anterior region. C: tail region. F: ovary and vulva opening.

Tabela 12 - Measurements (µm) of *Desmodorella alium* sp. n. in the Potiguar Basin, Brazil. "–" = not applicable or not observed. The mean and standard deviation are followed by the range for paratype measurements**.**

Sex	Male		Female	Juvenile
	Holotype	Paratype	Paratype	Paratype
Number of specimens	1	1	1	5
Body length	2070	2190	2475	1002 ± 282 (735–1365)
Pharynx length	161	159	155	121 ± 39 (75–164)
Nerve ring	136	145	100	69 ± 31 (55–119)
Maximum body diameter	72	77	90	47 ± 12 (35–65)
Anal body diameter	62	71	63	35 ± 11 (26–47)
Tail length	74	105	102	77 ± 29 (44–114)
Head diameter	30	29	31	25 ± 7 (19–35)
Length of cephalic setae	8.5	15	11	8 ± 2 (5.5–10)
Length of subcephalic setae	9	12	11	9 ± 1 (6.5–9)
Percentage of bulb diameter (cbd)*	68	65	59	67 ± 4 (66–72)
Diameter of *fovea amphidialis* as % of cephalic capsule width	58	58	63	47 ± 6 (42–55)
Spicule length	48	60	–	–
Gubernaculum length	18	22	–	–
Distance from anterior end to vulva	–	–	1605	–
V%	–	–	65	–
a	29	29	27	22 ± 3 (18–27)
b	13	14	16	9 ± 1 (6–10)
c	28	21	24	14 ± 3 (10–17)

***Desmodorella amphidialis* sp. n.**

(measurements in Table 13, Figure 39)

Type material: Holotype, Male adult MNRJ 406 (05°01'04.9"S, 036°23'58.6"W) collected in June 2009 from the Potiguar Basin. Depth: 7.6 m. Faciology: sandy sediments. Gear: Van Veen grab.

Other paratypes: 5 males (279–283 LMZOO-UFPE) collected on same date as holotype.

Etymology. Species with a large *fovea amphidialis.*

Description. Male Holotype (Figure 39). Body cylindrical, orange-brown. Cuticle coarsely annulated. Vacuoles in cuticle. Somatic setae randomly distributed throughout body. Anterior region with two lateral rows of cuticular expansions, shaped as fine spines. Approximately 135 µm (120–178 µm for paratypes) after cardia, two rows of longitudinal ridges present, these ridges 546 µm (533–602 µm for paratypes) in length (Figure 39G). At end of longitudinal ridge, eight rows of cuticular expansion form and extend to cloaca: two subdorsal, two subventral and four sublateral. Head capsule well developed, with thick cuticle without annulations. Anterior sensilla arrangement: six inner labial papilliform sensilla and six outer labial papilliform sensilla (difficult to see). Four cephalic setiform sensilla located just above *fovea amphidialis*. Four subcephalic setae located in middle of *fovea amphidialis*. *Fovea amphidialis* multispiral with 3.5 turns, relatively large, posterior border in contact with cuticle striations, occupying 84% (68–88%) of diameter of head. Buccal cavity small, with one dorsal tooth and one small ventral tooth, not always visible. Pharynx cylindrical, slightly swollen around buccal cavity and with small oval to pyriform posterior bulb. Cardia small. Secretory-excretory system not observed. Nerve ring located 99 µm (95–110 µm for paratypes) from anterior region. Reproductive system monorchic with outstretched testis located to left of intestine. Sperm cells globular. Spicules extremely long and thin with slightly swollen proximal end and pointed distal end. Small laminar gubernaculum, oar-shaped (Figure 39F); gubernacular apophyses absent. Five precloacal setae were observed (Figure 39E). Tail long, conical, with non-annulated posterior end. Three caudal glands.

No females or juveniles were found

Diagnosis. Cuticle coarsely annulated. Vacuoles in cuticle. In the anterior region there are two lateral rows of cuticular expansions, in the shape of a fine thorn. *Fovea amphidialis* mutispiral with 3.5 turns. Spicules extremely long and thin with slightly swollen proximal end and pointed distal end. Small laminar gubernaculum in oar-shaped and five precloacal setae.

Relationships

Desmodorella amphidialis **sp. n.** can be compared with *Desmodorella abyssorum* (Allgén, 1929) in the shape of the *fovea amphidialis* (multispiral), the vacuoles in the cuticle, the precloacal setae, the shape of the spicules (filiform), and the shape and size of the tail (long and conical). It differs in the size of the spicules (134 µm in *D. amphidialis* **sp. n.** and 60 µm in *D. abyssorum*), size and turns of the *fovea amphidialis* (3.5 turns and 84% diameter in cephalic head in *D. amphidialis* **sp. n.**, 2–2.5 turns and 46% in *D. abyssorum*) and presence of spines on cuticle (absent in *D. abyssorum*).

Another similar species to *D. amphidialis* **sp. n.** is *D. balteata* Verschelde, Goubarult & Vincx, 1998. They are comparable in the shape of the *fovea amphidialis* (multispiral), precloacal setae, filiform spicules, and size and shape of the tail (long and conical). They are distinguishable by the cuticle (annulated in *D. amphidialis* **sp. n.** and striated in *D. balteata*), size of the spicules (smaller in *D. balteata* than in *D. amphidialis* **sp. n.**, 60 µm vs 134 µm respectively), and the absence of subcephalic setae in *D. balteata* (present in *D. amphidialis* **sp. n.**).

D. amphidialis **sp. n.** can be distinguished from *D. curvispiculum* (Jensen, 1985) by the turns of the *fovea amphidialis* (3.5 vs 2.5 turns respectively), size of the spicules (134 µm in *D. amphidialis* **sp. n.** and 76 µm in *D. curvispiculum*), and the absence of subcephalic setae in *D. curvispiculum* (present in *D. amphidialis* **sp. n.**).

D. amphidialis **sp. n.** differs from *D. tenuspiculum* (Allgen, 1928) by the size of the *fovea amphidialis* (84% × 60% respectively), size of the spicules (134 µm × 85 µm), absence of subcephalic setae in *D. tenuspiculum* (present in *D. amphidialis* **sp. n.**), and cuticle striated in *D. tenuspiculum* (annulated in *D. amphidialis* **sp. n.**).

D. amphidialis **sp. n.** is very similar to *D. sinuata* (Lorenzen, 1976) in the cuticle annulated and with thorns, shape of the *fovea amphidialis* (multispiral), and shape of the spicules (filiform). It differs in the arrangement of the cephalic setae: *D. amphidialis* **sp.**

n. has four cephalic and four subcephalic setae, while *D. sinuata* has four cephalic and eight subcephalic setae. Moreover, *D. sinuata* has longer setae than *D. amphidialis* **sp. n.** (250 µm vs. 134 µm respectively).

D. amphidialis **sp. n.** can be distinguished from the other species described here (*D. spinata* **sp. n.** and *D. alium* **sp. n.**). *D. amphidialis* **sp. n.** has a multispiral *fovea amphidialis* (cryptospiral in *D. alium* **sp. n.**). *D. spinata* **sp. n.** has a multispiral *fovea amphidialis*, but with only two turns (three turns in *D. amphidialis* **sp. n.**). The shape of the spicules also differs: filiform in *D. amphidialis* **sp. n.** vs. short and arched in *D. alium* **sp. n.** *D. spinata* **sp. n.** has filiform spicules, but they are shorter than in *D. amphidialis* **sp. n.** (64 µm vs. 134 µm).

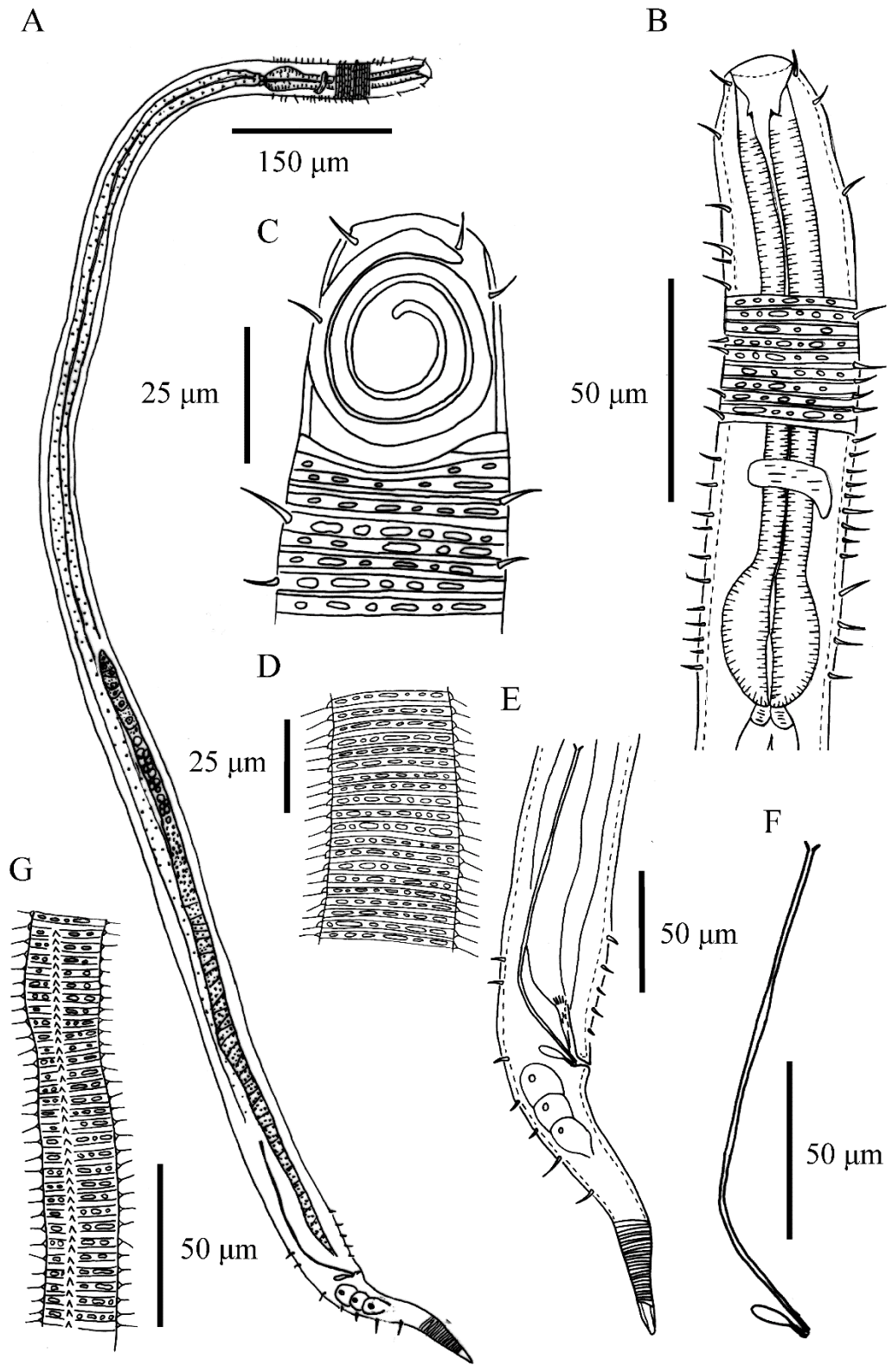

Figura 39 - *Desmodorella amphidialis* sp. n. Holotype MNRJ 406 – A: overview. B and C: anterior region. D and G: cuticle. E. tail region. F: copulatory apparatus.

Tabela 13 - Measurements (µm) of *Desmodorella amphidialis* sp. n. in the Potiguar Basin, Brazil. The mean is followed by the range for paratype measurements.

Sex	Male	
	Holotype	Paratype
Number of specimens	1	4
Body length	1335	1524 (1425–1543)
Pharynx length	150	153 (140–162)
Nerve ring	99	103 (95–110)
Maximum body diameter	45	51 (44–59)
Anal body diameter	33	42 (36–50)
Tail length	107	133 (126–138)
Head diameter	28	30 (26–33)
Length of cephalic setae	7	8 (6–9)
Length of subcephalic setae	6	7 (6–8)
Length of ridge	546	560 (533–602)
Percentage of bulb diameter (cbd)*	56	65 (60–70)
Diameter of *fovea amphidialis* as % of cephalic capsule width	84	79 (68–88)
Turns of *fovea amphidialis*	3.5	4 (3.5)
Spicule length	134	120 (113–143)
Gubernaculum length	24	26 (23–29)
a	30	30 (26–32)
b	9	10 (9–12)
c	12	11 (10–12)

***Desmodorella braziliensis* sp. n.**

(measurements in Table 14, Figures 40 and 41)

Type material: Holotype, Male adult MNRJ 407 (04°42'31"S, 036°35'27"W) collected in June 2014 from the Potiguar Basin. Depth: 52 m. Faciology: sandy with carbonate particles. Gear: Van Veen grab.

Paratype female: Adult, MNRJ 408 (04°51'58"S, 036°39'30"W), collected in June 2014 from the Potiguar Basin. Depth: 22 m. Faciology: sandy sediments. Gear: Van Veen grab.

Other paratypes: 1 female (284 LMZOO-UFPE) and 2 males (285 and 286 LMZOO-UFPE). No juveniles were found.

Etymology. After the name of the site where it was found.

Description. Male Holotype (Figure 40). Body cylindrical, orange-brown, narrowest in region between pharynx and anterior end of testis, and widest at mid-level of testis. Cuticle coarsely annulated; annules in anterior pharyngeal region more widely spaced than elsewhere. Vacuoles in the cuticle, in the cephalic capsule and along the body. Approximately 138 µm (121–129 µm) after the cardia, two ridges are observed. These rigde are 166.5 µm (144–147 µm for paratypes) in length (Figure 40B). Long, well-developed head capsule (Figure 40A). Anterior sensilla arrangement: six inner labial papilliform sensilla, six outer labial papilliform sensilla. Four cephalic setiform sensilla situated on anterior edge of amphids. Four subcephalic setae at base of cephalic capsule. *Fovea amphidialis* multispiral with 2.25 (2.25–2.5 for paratypes) turns. Buccal cavity with large cuticularized dorsal tooth and one smaller ventral tooth. Pharynx cylindrical, slightly swollen around buccal cavity and with small oval to pyriform posterior bulb. Cardia small. Nerve ring located 79 µm (94–96 µm) from anterior region. Secretory–excretory system not observed. Reproductive system monorchic with outstretched testis located to left of intestine. Mature sperm globular. Spicules long and thin, with slightly swollen proximal end and pointed distal end. Gubernaculum small, laminar; gubernacular apophyses absent. Seven precloacal setae observed. Tail long and conical, with non-annulated posterior end. Three caudal glands.

Females (Figure 41)

Very similar to male in body size. Didelphic, ovaries antidromously reflexed and both genital branches to right of intestine. Vulva as simple transverse slit-like aperture. Vagina vera slightly cuticularized (Figure 41D). Vagina uterina surrounded by constrictor muscle. Globular sperm cells visible. No egg found. “V” located at 58–80% of total body length (552–715 µm distant from anterior end). Tail conical.

No juveniles were found.

Diagnosis. *Desmodorella braziliensis* **sp. n.** is characterized by the cuticle coarsely annulated, with vacuoles. *Fovea amphidialis* multispiral (2.25 turns). Spicules thin and extremely long, with slightly swollen proximal end and pointed distal end. Gubernaculum small, laminar. Seven precloacal setae.

Relationships

Desmodorella braziliensis **sp. n.** can be compared with *D. abyssorum* by the shape and turns of *fovea amphidialis* (multispiral with 2.25 turns), presence of vacuoles in the cephalic capsule and cuticle, and the presence of precloacal setae. The species can be distinguished by the shape and size of the spicules (thinner and longer than in *D. abyssorum*) and the cephalic arrangement (subcephalic setae absent in *D. abyssorum*).

D. braziliensis **sp. n.** resembles *D. balteata* in the shape of the *fovea amphidialis*, presence of precloacal setae, and shape of the spicules (filiform). It can be distinguished by the number of precloacal setae (7 in *D. braziliensis* **sp. n.** and two latero-ventral rows in *D. balteata*) and the arrangement of cephalic setae (subcephalic setae absent in *D. balteata*).

Another very similar species is *D. spinata* **sp. n.** It differs in the presence of spines along the body (present in *D. spinata* **sp. n.**), absence of precloacal setae (present in *D. braziliensis* **sp. n.**) and the position of the subcephalic setae (in the middle in *D. spinata* **sp. n.** and at the base of the cephalic capsule in *D. braziliensis* **sp. n.**).

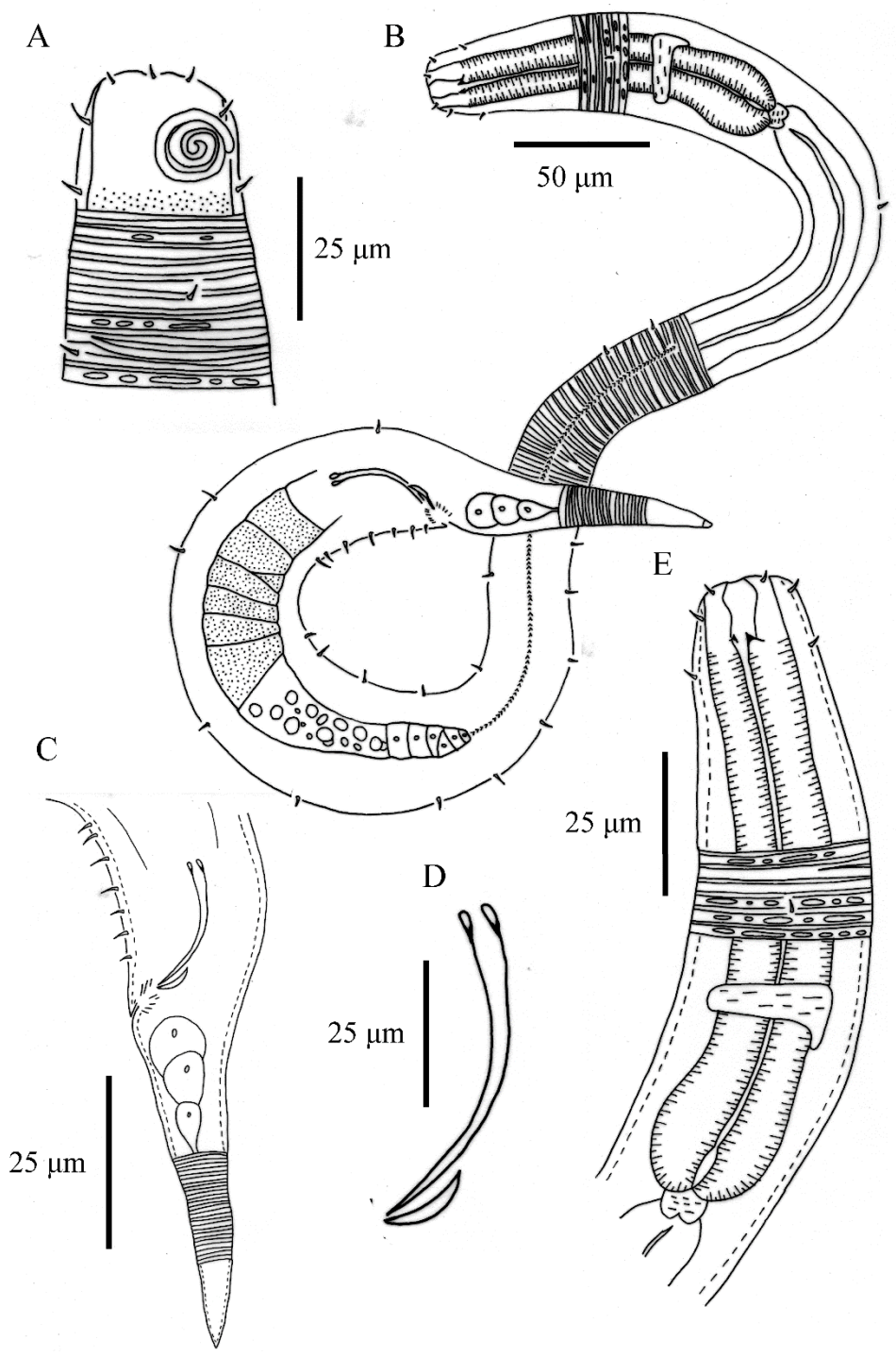

Figura 40 - *Desmodorella braziliensis* **sp. n.** Holotype MNRJ 407 – A and E: anterior region. B: overview. C: tail region. D: copulatory apparatus.

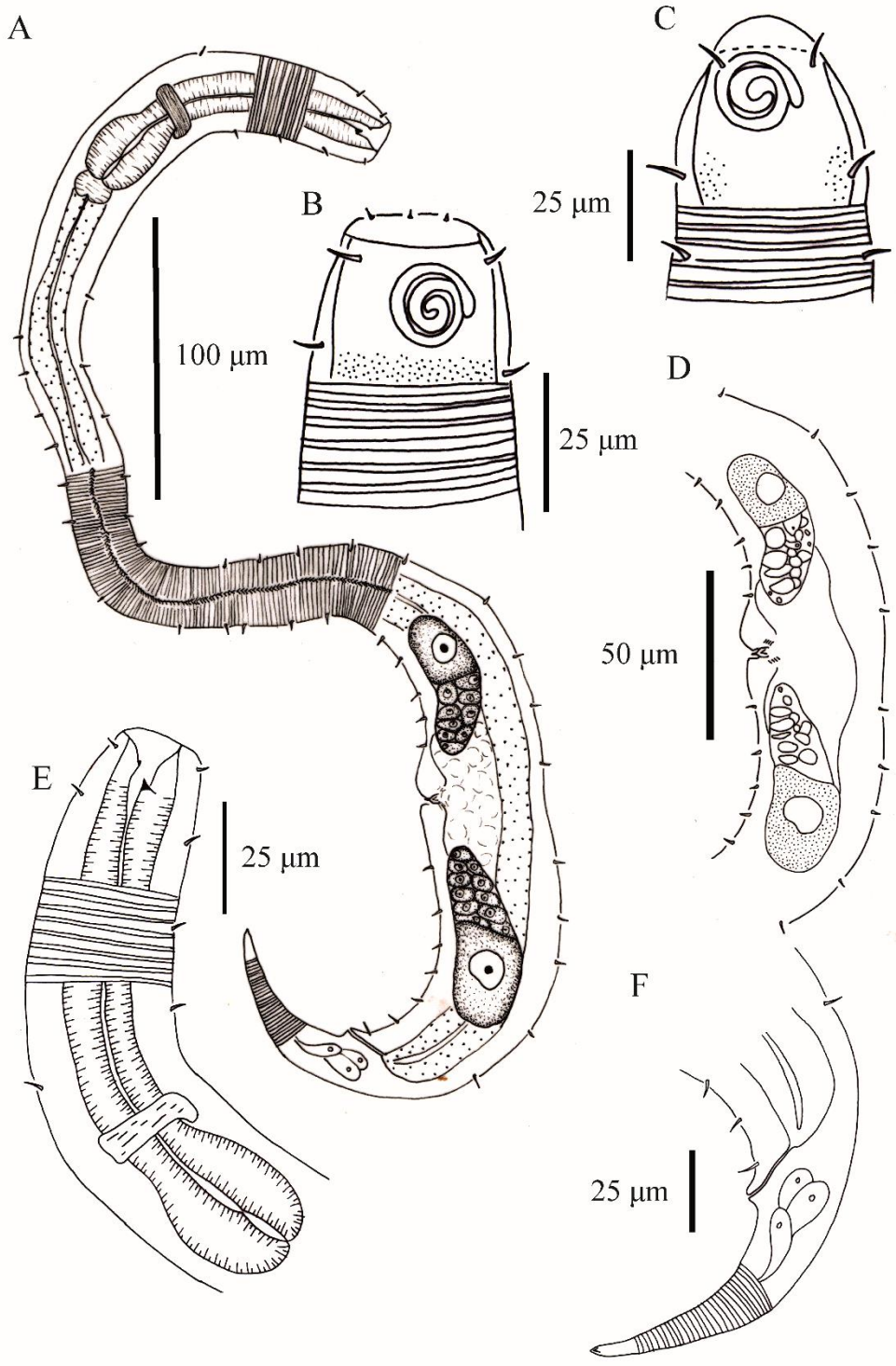

Figura 41 - *Desmodorella braziliensis* sp. n. Paratype female MNRJ 408 – A: overview. B, C and E: anterior region. F: tail region. D: ovary and vulva opening.

Tabela 14 - Measurements (µm) of *Desmodorella braziliensis* sp. n. in the Potiguar Basin, Brazil. "–" = not applicable.

Sex	Male		Female
	Holotype	Paratype	Paratype
Number of specimens	1	2	2
Body length	903	(670–878)	(672–1228)
Pharynx length	124	(135–148)	(115–150)
Nerve ring	79	(94–96)	(94–109)
Maximum body diameter	54	(52.5–67.5)	(61.5–75)
Anal body diameter	39	(32.5–42.5)	(34–38)
Tail length	109	(109–132)	(88.5–100)
Head diameter	26	(25–30)	(25–30)
Length of cephalic setae	5.5	(5–6.5)	(6.5)
Length of subcephalic setae	5	(5–6)	(5)
Length of ridge	166.5	(144–147)	(151–292)
Percentage of bulb diameter (cbd)*	57	(65–72)	(64–71)
Diameter of *fovea amphidialis* as % of cephalic capsule width	53	(51–63)	(50–62)
Turns of *fovea amphidialis*	2.25	(2.2–2.5)	(2.5)
Spicule length	54	(44–57)	–
Gubernaculum length	25.5	(18–30)	–
Distance from anterior end to vulva	–	–	(552–715)
V%	–	–	(58–80)
a	17	(10–16)	(11–16)
b	7	(4.5–6.5)	(7–8)
c	8	(5–8)	(8–12)

Genus *Zalonema* Cobb, 1920

Diagnosis (after Verschelde *et al.* 1998): The genus *Zalonema* Cobb, 1920 differs from the other genera of this subfamily in having a finely annulated cuticle, not marked by any longitudinal structures or lateral differentiation; a well-developed rounded triangular cephalic capsule; and a large, multispiral or looped *fovea amphidialis*.

Remarks

Subcephalic setae may be present or absent, i.e., this character is not required for the genus diagnosis. Another character is included, the loop-shaped *fovea amphidialis*.

9 valid species (after Fadeeva *et al.* 2016)

Zalonema myrianae Verschelde & Vincx, 1996; *Zalonema ditlevseni* (Micoletzky, 1922); *Zalonema megalosoma* (Steiner, 1918); *Zalonema mariae* Larrazábal-Filho, Silva & Esteves, 2015; *Zalonema vicentei* Larrazábal-Filho, Silva & Esteves, 2015; *Zalonema laqueusis* **sp. n.**; *Zalonema maldivensis* (Gerlach, 1963); *Zalonema kamchatkaensis* Fadeeva, Mordukhovich & Zograf, 2016; and *Zalonema kamchatkaensis* Fadeeva, Mordukhovich & Zograf, 2016.

***Zalonema laqueusis* sp. n.**

(measurements in Table 15, Figures 42 and 43)

Type material: Holotype, Male adult MNRJ 409 (05°00'12.8"S, 036°23'27.9"W), collected in June 2014 from the Potiguar Basin. Depth: 7.7 m. Faciology: sandy sediments. Gear: Van Veen grab.

Paratype female: Adult, MNRJ 410 (05°02'16.6"S, 036°23'58.8"W), collected in June 2009 from the Potiguar Basin. Depth: 7.1 m. Faciology: sandy sediments. Gear: Van Veen grab.

Other paratypes: 1 male (287 LMZOO-UFPE), collected on same date as holotype.

Etymology. Species name refers to the loop-shaped *fovea amphidialis*, from L. *laqueus*, loop, snare.

Description. Male Holotype (Figure 42). Body long and cylindrical, yellowish brown, with stout cephalic capsule. Cuticle with distinct fine striations, not marked by longitudinal structures or lateral differentiation. Cuticle striated except on cephalic

capsule and final portion of tail. Somatic setae short, arranged in six longitudinal rows; two dorsal, two lateral and two ventral. Head triangular with long cephalic capsule. *Fovea amphidialis* loop-shaped (Figure 42B). Buccal cavity relatively long, with three teeth (two dorsal and one ventral). Anterior sensilla arrangement: six inner labial papilliform sensilla, six outer labial setiform sensilla. Four cephalic setiform sensilla positioned above *fovea amphidialis*. Subcephalic setae absent. Pharynx with rounded endbulb with cuticularized lumen divided into four distinct regions. Nerve ring surrounding pharynx, position variable, at mid pharynx-length or in region closest to head. Ventral gland and secretory-excretory pore not observed. Cardia inserted in intestine. Reproductive system monorchic with outstretched testis located to left of intestine. Spicules strongly cuticularized, elongated, with rounded capitulum, pointed distally. Gubernaculum well developed, plate parallel to distal parts of spicules, lacking apophysis. Lateral ala present on each side of body in posterior region (Figure 42E). Three caudal glands. Tail conical with elongated non-annulated tail end, and spinneret.

Female (Figures 43)

Similar to male but lacking lateral alae and *fovea amphidialis* differently shaped (two sexual dimorphisms). *Fovea amphidialis* mutispiral with 2.5 turns. Four precloacal setae. Female didelphic, ovaries antidromously reflexed and both genital branches to left of intestine. Vulva as transverse slit. Vagina vera short, vagina uterina with sphincter muscle. Two eggs found. “V” located at 49% of total body length (1470 μm from anterior end). Tail conical.

No juveniles were found.

Diagnosis. Head triangular with long cephalic capsule. *Fovea amphidialis* loop-shaped in males and spiral in females. Buccal cavity relatively long, with three teeth (two dorsal and one ventral). Subcephalic setae absent. Spicules strongly cuticularized, elongated, with rounded capitulum. Lateral ala present on each side of body absence in females.

Relationships

This species is assigned to the genus *Zalonema* because it has a triangular cephalic capsule, striated cuticle, presence of lateral alae, and short arched spicules with the gubernaculum well developed, plate parallel to distal parts of spicules, and lacks an apophysis. *Zalonema laqueusis* **sp. n.** can be distinguished from its congeners by some

unique characteristics the loop-shaped *fovea amphidialis* and the absence of subcephalic setae. These characteristics have not been observed in other members of *Zalonema*, and therefore the diagnosis of the genus must be modified.

The female is very similar to the other females in the genus. Distinguishing characteristics include the absence of subcephalic setae (all other females have subcephalic setae) and the presence of four precloacal setae.

Another taxonomic character is the sexual dimorphism in this species. Sexual dimorphism is a common feature in the subfamily Desmodorinae (*Croconema*, *Desmodora*, *Desmodorella*, *Pseudochromadora* and *Metachromadora*) (Larrazábal-Filho et al. 2015), most prominently in *Zalonema*. Of nine valid species, five species have sexual dimorphism (*Z. vicentei*, *Z. mariae*, *Z. megalosoma*, *Z. kamchtkaensis* and *Z. laqueusis* **sp. n.**). In other words, more than half of the *Zalonema* species have sexual dimorphism, all related to the *fovea amphidialis*, whether by size, shape or number of turns.

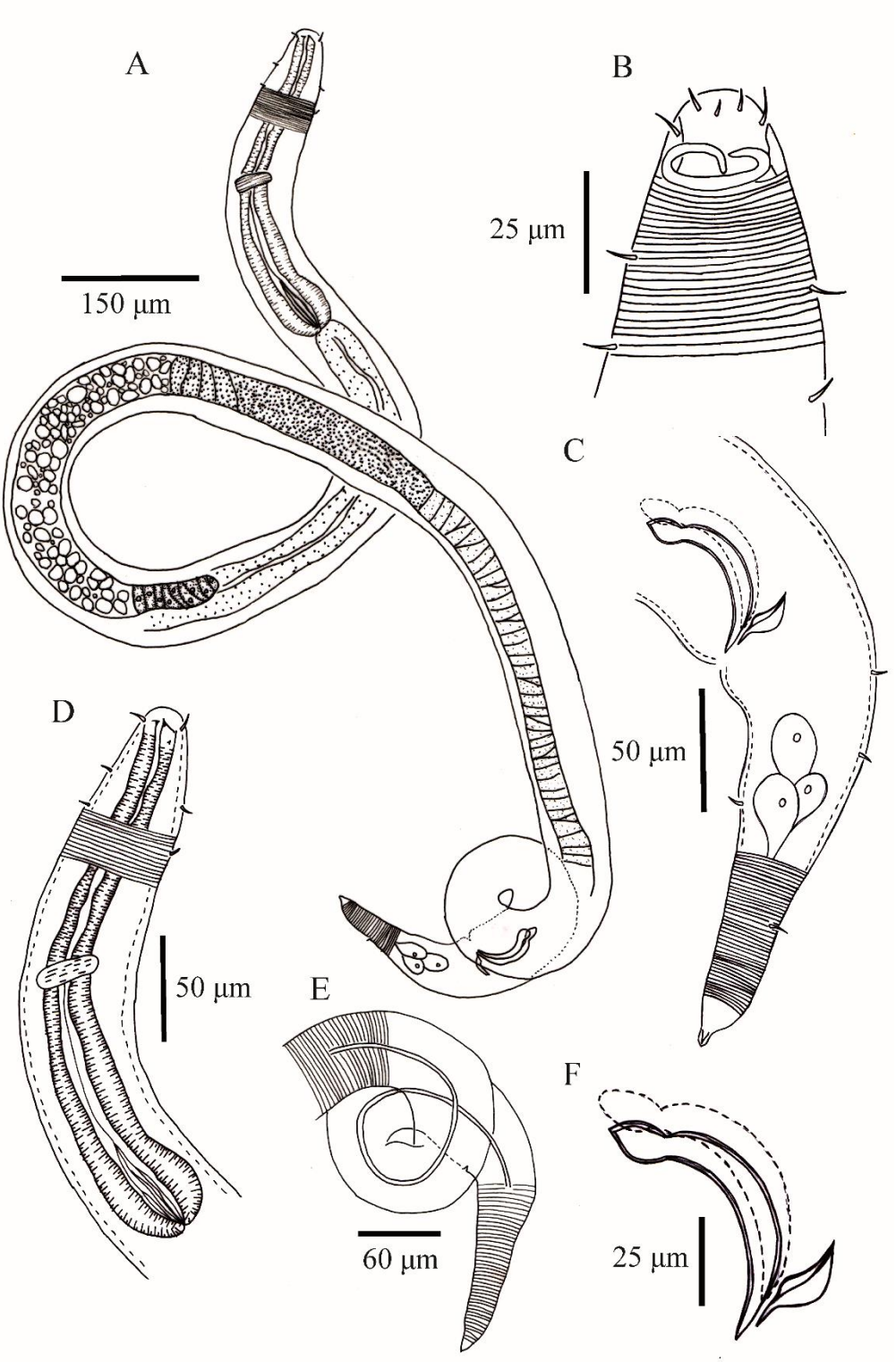

Figura 42 - *Zalonema laqueusis* sp. n. Holotype MNRJ 409 – A: overview. B and D: anterior region. C: tail region. E: lateral alae. F: copulatory apparatus.

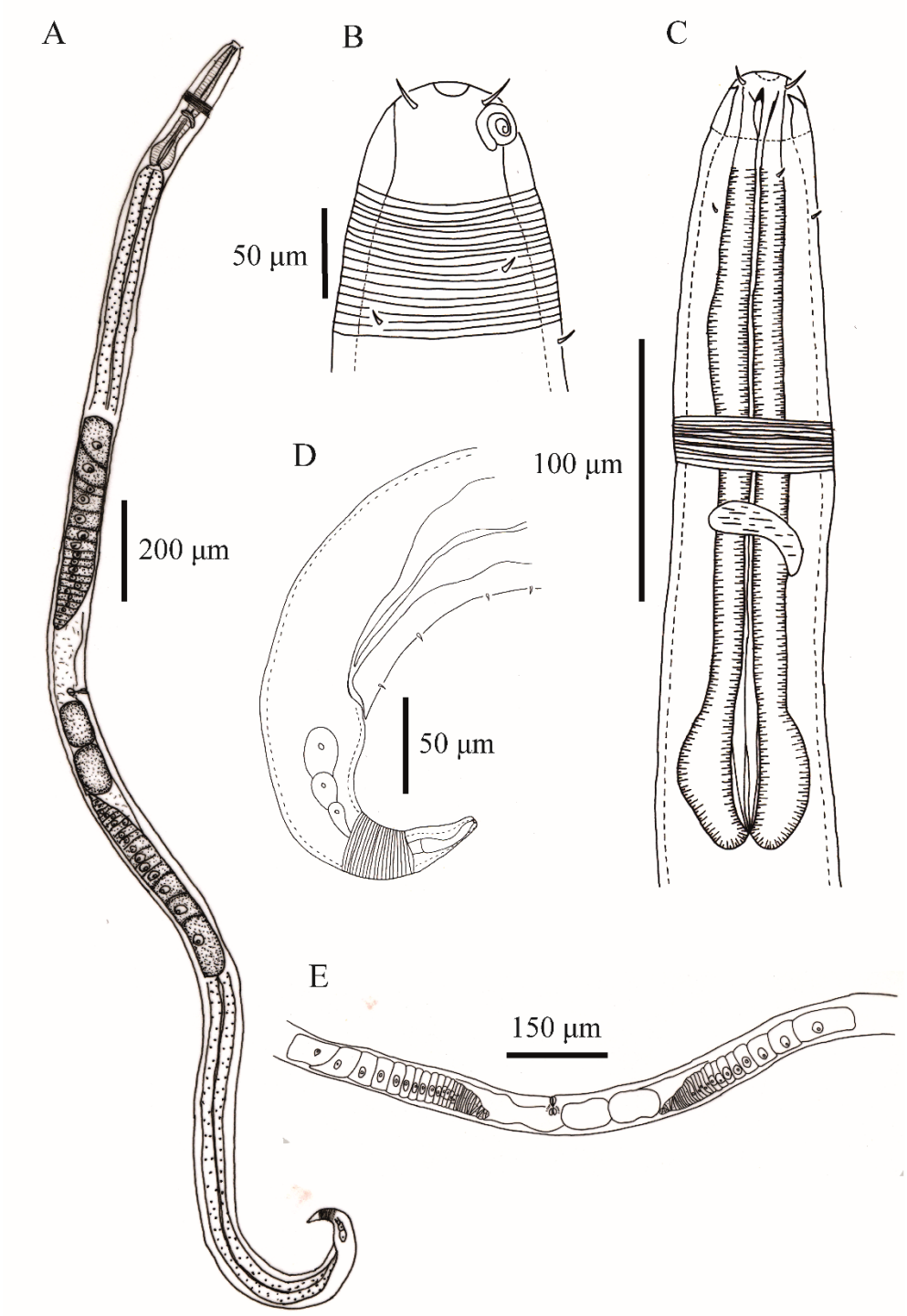

Figura 43 - *Zalonema laqueusis* sp. n. Paratype female MNRJ 410 – A: overview. B and C: anterior region. D: tail region. E: ovary and vulva opening**.**

Tabela 15 - Measurements (µm) of *Zalonema laqueusis* **sp. n.** in the Potiguar Basin, Brazil. "–" = not applicable.

Sex	Male		Female
	Holotype	Paratype	Paratype
Number of specimens	1	1	1
Body length	1852	1885	3000
Pharynx length	233	258	250
Nerve ring	122	125	175
Maximum body diameter	58	48	84
Anal body diameter	57	45	48
Tail length	141	137	117
Head diameter	27	27	31
Length of cephalic setae	8.5	6.5	9.5
Percentage of bulb diameter (cbd)*	64	65	76
Diameter of *fovea amphidialis* as % of cephalic capsule width	59	62	35
Turns of *fovea amphidialis*	–	–	2.5
Lateral alae	249	279	–
Spicule length	69	65	–
Gubernaculum length	40	39	–
Distance from anterior end to vulva	–	–	1470
V%	–	–	49
a	32	39	36
b	8	7	12
c	13	14	27

***Pseudodesmodora* Boucher, 1975**

Diagnosis (after Tchesunov 2014): Desmodorinae. Cephalic helmet present. *Fovea amphidialis* spiral in 1.25 turns or cryptospiral, located on a large cuticularized plate extending to or into anterior-most annules of body cuticle. Subcephalic setae present at base of helmet. Buccal cavity with large dorsal tooth and single ventrosublateral tooth. May have ventral ala.

5 valid species (after Leduc & Wharton 2010)

Pseudodesmodora amphidiscata Boucher, 1975; *Pseudodesmodora bipapillata* (Gerlach, 1967); *Pseudodesmodora bulbosa* (Jensen, 1985); *Pseudodesmodora lacrima* Leduc & Wharton, 2010; and *Pseudodesmodora ritae* **sp. n.**

***Pseudodesmodora ritae* sp. n.**

(measurements in Table 16, Figure 44).

Type material: Holotype, Male adult MNRJ 411 (04°51'58"S, 036°39'30"W), collected in June 2009, in the Potiguar Basin. Depth: 22 m. Faciology: sandy sediment. Gear: Van Veen/corer.

Other paratypes: 3 males (288–291 LMZOO-UFPE), collected on same date as holotype.

Etymology. The species name is a tribute to Rita Chiaverini, the first author's sister.

Description. Male Holotype (Figure 44). Body cylindrical, yellowish brown. Cuticle strongly annulated except on cephalic capsule and final portion of tail. Six rows of somatic setae paired along entire body, alternating in long setae with shorter setae. Head triangular. Cephalic capsule long. *Fovea amphidialis* large, cryptospiral, with plate and central spot, occupying 67% (45–47% for paratypes) of diameter of head. Amphidial plate small, only slightly larger than amphid. Buccal cavity with one large dorsal and one subventral tooth, and six lips with 12 folds. Anterior sensilla arrangement: six inner labial papilliform sensilla, six outer labial setiform sensilla. Four cephalic setiform sensilla located laterally to *fovea amphidialis*, and base of cephalic capsule with four subcephalic setae. Pharynx cylindrical with muscular rounded endbulb; lumen very wide. Nerve ring located 106.5 μm (105–106.5 μm) from anterior region. Ventral gland and secretory-excretory pore not observed. Cardia well developed, inserted in intestine. Reproductive system with outstretched testis. Sperm cells globular. Spicules arched and sclerotized with developed *velum* and small rounded capitulum. Gubernaculum laminar, strongly sclerotized, without apophysis (Figure 44E). Ventral ala present in posterior region (Figure 44B and 44E), along one-quarter of total body length. Fifteen pore-like supplements (12–15 for paratypes), difficult to see in some specimens. One precloacal seta. Three caudal glands. Tail conical, elongated terminal portion without annulation, and conical spinneret.

No females or juveniles were found

Diagnosis. *Pseudodesmodora ritae* **sp. n.** is characterized by the six rows of somatic setae paired along the body, a crypto-spiral *fovea amphidialis* with a plate, the ventral ala and pore-like precloacal supplements.

Relationships

This genus has only four valid species: *Pseudodesmodora amphidiscata* Boucher, 1975; *P. bipapillata* (Gerlach, 1967); *P. bulbosa* (Jensen, 1985) and *P. lacrima* Leduc & Wharton, 2010. Tchesunov (2014) stated in the genus diagnosis that no males had been described; however, only *P. amphidiscata* and *P. bipapillata* were described only from females and juveniles.

Pseudodesmodora ritae **sp. n.** has some features in common with the four congeners. It resembles *P. amphidiscata* in the shape of the *fovea amphidialis* and the buccal cavity with one dorsal and one ventral tooth, but differs in the cephalic arrangement (4 subcephalic setae *versus* 6 subcephalic setae in *P. amphidiscata*). *P. bipapillata* has pore-like precloacal supplements, very similar to *P. ritae* **sp. n.**, but differing in number: *P. bipapillata* has 2 supplements while *P. ritae* **sp. n.** has 15. *P. bulbosa* as described by Jensen (1985) has six longitudinal rows of somatic setae along the body and 15 precloacal supplements. All these features are found in *P. ritae* **sp. n.,** but *P. bulbosa* has several differences, for example the absence of subcephalic setae, the buccal cavity with one dorsal tooth and two subventral teeth, spicules without a velum, and lack of a ventral ala. Last, *P. lacrima* resembles *P. ritae* **sp. n.** in the shape of the *fovea amphidialis*, spicules with a small capitulum, precloacal setae, tail conical with a clear spinneret, and ventral ala. They differ in the subcephalic setae (absent in *P. lacrima*), buccal cavity (*P. lacrima* has one dorsal and two subventral teeth), endbulb (in *P. lacrima* the endbuld is tripartite, whereas in *P ritae* **sp. n.** it is rounded), and the precloacal supplements (absent in *P. lacrima*).

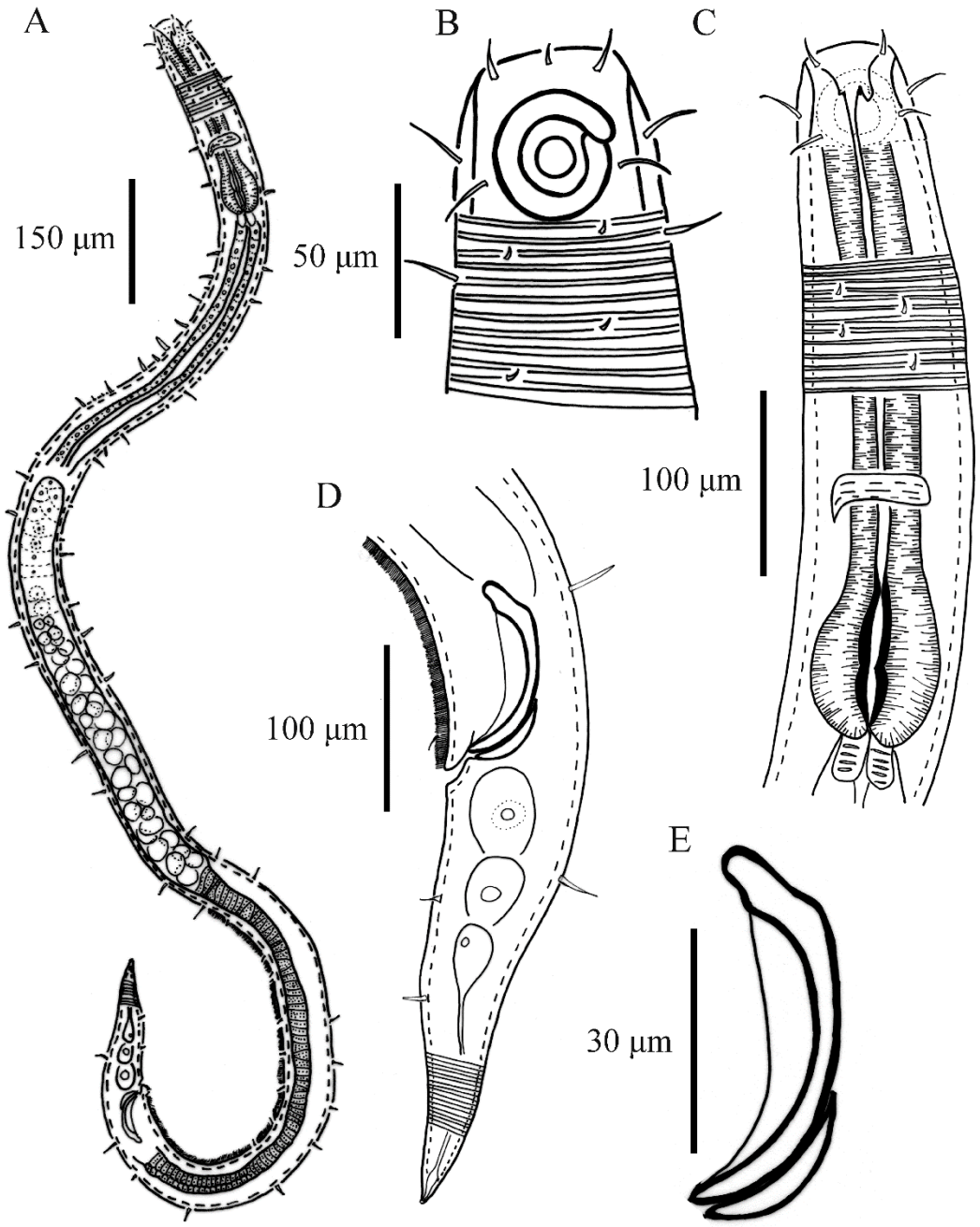

Figura 44 - *Pseudodesmodora ritae* sp. n. Holotype MNRJ 411 – A: overview. B and C: anterior region. D: tail region. E: copulatory apparatus.

Tabela 16 - Measurements (µm) of *Pseudodesmodora ritae* sp. n. in the Potiguar Basin, Brazil. The mean is followed by the range for paratype measurements.

Sex	Male	
	Holotype	Paratypes
Number of specimens	1	3
Body length	1185	1264 (937–1410)
Pharynx length	156	167 (162–171)
Nerve ring	106.5	105 (105–106.5)
Maximum body diameter	42	53 (46.5–58)
Anal body diameter	40.5	49 (45–51)
Tail length	97.5	91 (84–96)
Tail end length	17.5	20 (18.5–21)
Head diameter	27.5	35 (33.5–38.5)
Cephalic capsule	26	31 (30–32)
Spicule length	60	59 (54–63)
Gubernaculum length	30	35 (31.5–37.5)
Length of ventral ala	324	241 (142.5–394.5)
Velum	35.5	38 (36–39)
Length of external setae	8.5	7 (5.5–8)
Length of cephalic setae	9.5	8 (6–9)
Length of subcephalic setae	12	9 (7–11)
Length of long somatic setae	12	12 (9–15)
Length of short somatic setae	3.5	5 (3.5–6)
Length of precloacal setae	7	7 (6–7)
Spinneret	6.5	6 (5–6)
Striation of cuticle	4	4 (4–4.5)
Percentage of bulb diameter (cbd)*	69	72 (67–74)
Diameter of *fovea amphidialis* as % of cephalic capsule width	67	46 (45–47)
a	31.5	27 (25–30)
b	8.5	8 (5.5–9)
c	12	13 (11–15)

5. CONSIDERAÇÕES FINAIS

A família Desmodoridae é composta por seis subfamílias, 35 gêneros e 318 espécies. Os estudos desta família no Brasil começaram em 2011 e resultaram na descrição de 42 novas espécies, mesmo quando estamos entrando na idade filogenômica na história da taxonomia. Este trabalho mostra uma grande quantidade de espécies descritas numa única região da costa brasileira. A família vem sofrendo constantemente modificações nas diagnoses de subfamílias, gêneros e principalmente diagnoses específicas. Além disso, espécies estão sendo reclassificadas para outros gêneros (taxa com nova classificação) e diversos novos gêneros estão sendo descritos. Portanto, para trabalhos com taxonomia integrativa dentro da Familía Desmodoridae, fica evidente a necessidade de um esforço taxonômico maior. Assim, é necessário estudos mais aprofundados dentro dessa família diversa, rica e pouco estudada no mundo e principalmente no Brasil.

REFERÊNCIAS

ALLGÉN, C.A. Freilebende marine Nematoden von den Campbell-und Staten-Inseln. **Nyt Magazin for Naturvidenskaberne**, *Christiana*, 66, 249–309, (1928).

ALLGÉN, C.A. Neue freilebende marine Nematoden von der Westküste Schwedens. **Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere**, 57 (5), 431–496, (1929).

ARMENTEROS M., RUIZ-ABIERNO A. & DECRAEMER W. Revision of Desmodorinae and Spiriniinae (Nematoda: Desmodoridae) with redescription of eight known species. **European Journal of Taxonomy**, 96, 1–32, (2014)a.

ARMENTEROS, M., RUIZ-ABIERNO, A. & DECRAEMER, W. Taxonomy of Stilbonematinae (Nematoda: Desmodoridae): description of two new and three known species and phylogenetic relationships within the family. **Zoological Journal of the Linnean Society**, 171, 1–21, (2014)b.

ARMONIES W. & REISE K. Faunal diversity across a sandy shore**. Marine Ecology-Progress Series** 196, 49-57, (2000).

BIRD A. & BIRD J. **The Structure of Nematodes.** 2nd Edition. Academic Press, San Diego, California, 317 pp, (1991).

BLOME D. Systematik der Nematoda eines Sandstrandes der Nordseeinsel Sylt. **Mikrofauna des Meeresbodens**, 86, 1–194, (1982).

BOUCHER G. Nématodes des sables fins infralittoraux de la Pierre Noire (Manche occidentale). I. Desmodorida. **Bulletin du Muséum National d' Histoire Naturelle (Zoologie)**, 3(285), 101-128, (1975).

CAREY A. G. Jr. & MONTAGNA P. A. Artic Sea Ice Faunal Assemblage: Firt Approach to Description and Source of the Underice Meiofauna. **Marine Ecology Progress Series** 8, 1-8, (1982).

CASTRO, F.J.V., BEZERRA, T.N.C., SILVA, M.C. DA & FONSECA-GENEVOIS, V.G. *Spirinia elongata* sp. nov. (Nematoda, Desmodoridae) from Pina Basin, Pernambuco, Brazil. **Zootaxa**, 1121, 53–68, (2006).

CAVALCANTI, M. F., DA SILVA, M.C. & DA FONSECA-GENEVOIS, V. *Spirodesma magdae* nov. gen. nov. sp. (Nematoda: Desmodoridae) from the Brazilian deep sea (Campos Basin, Rio de Janeiro, Brazil). **Zootaxa**, 2096, 109–118, (2009).

CHAVES, H.A.F., ZEMBRUSCKI, S.G. & FRANÇA, A.M.C. Introduçao. *In*: Chaves, H.A.F. (Ed.), **Geomorfologia da Margem Continental Brasileira e das Áreas Oceânicas Adjacentes**. Projeto REMAC, PETROBRAS, Rio de Janeiro, 7, 11–23, (1979).

CHITWOOD B.G. Some marine nematodes from North Carolina. **Proceedings of the Helminthological Society of Washington**, 3(1), 1–16, (1936).

CLASING E. Post embryonic development in species of desmodoridae epsilonematidae and draconematidae. **Zoologischer Anzeiger**. v 6., p 337-344 (1980)

COBB, N.A. North American free-living fresh-water nematodes. Reprinted from Trans. Am. Micr. Soc. 33 in Cobb, N.A. **Contributions to a Science of Nematology** (1914).

COBB, N. A. Notes on nemas. **Contributions to a Science of Nematology**. 5, p 117-128. (1917)

COBB N.A. One hundred new nemas (type species of 100 new genera). **Contributions to a Science of Nematology** (Cobb), 9, 217–343, (1920).

COBB N.A. New nemic genera and species, with taxonomic notes. **Journal of Parasitology** ,10, 81–94, (1933).

COOMANS, A. A proposal for a more precise terminology of the body regions in the nematode. **Annales de la Société Royale Zoologique de Belgique**, 108, 155–177, (1979).

COOMANS, A. Nematode systematic: past, present and future. **Nematology** v 2(1), 3-7, (2000).

COOMANS, A. Present status and future of nematode systematic. **Nematology** v 4, p 573-582, (2002).

COSTA, F.H.S, PETTA, R.A., LIMA, R.F.S. & MEDEIROS, C.N. Determinação da vulnerabilidade ambiental na Bacia Potiguar, região de Macau (RN), utilizando sistemas

de informações geográficas. **Revista Brasileira de Cartográfica**, 58 (2), 119–127, (2006).

COULL, B. C., e BELL, S. S. **Perspectives of marine meiofaunal ecology**. *In*: ecological processes in coastal and marine systems, edited by R. J. Livingston. New York: Plenum Press, p 189-216, (1979)

COULL, B.C. Role of meiofauna in estuarine soft-bottom habitats. **Australian Journal of Ecology**, v. 24, p 327–343, (1999).

DADAY E.V. Uj-guineai szabadon élö nematodok. **Mathematikai és természettudo-mányi Értesitö**, 17, 557–572, (1899).

DANOVARO, R., A. TSELEPIDES, A. OTEGUI e DELLA CROCE N. Dynamics of meiofaunal assemblages on the continental shelf and deep-sea sediments of the Cretan Sea (NE Mediterranean): relationships with seasonal changes in food supply. **Progress in Oceanography** v. 46, p 367-400 (2000).

DE CONINCK L.A. Classe des Nématodes: Systematique des nématodes et sous-classe des Adenophorea. *In*: Grassé, P.P. (Eds) **Traité de Zoologie**, 4, pp. 586–681, (1965).

DE GRISSE A.T. Redescription ou modification de quelques techniques utilisés dans l'étude des nématodes phytoparasitaires. **Mededelingen van de Rijksfakulteit Landbouwwetenschappen te Gent.** 34, 251–369, (1969).

DE LEY, P.; BLAXTER, M. L. Systematic Position and Phylogeny. *In*: Lee, D.L. (Eds) **The Biology of Nematodes** - London & New York, Taylor & Francis. pp. 1-30 (2002).

De MAN, J.G.. Die Eingheimischen, frei in der reinen erde und im süssen wasser lebends Nematoden. **Tijdschr. Ned. Dierk.** Ver. 5: p 1-104 (1880)

De MAN J.G. Troisième note sur les Nématodes libres de la Mer du Nord et de la Manche. **Mémoires de la Société Zoologique de France**, 2, 182–216, (1889).

De LEY, P. e BLAXTER, M. L.. Systematic position and phylogeny. In: D.L. Lee (Eds.) **The Biology of Nematodes**. London, Taylor and Francis, p 1-30 (2002).

De LEY, P., DECRAEMER, W. e EYUALEM-ABEBE. Introduction: Summary of Present Knowledge and Research Addressing the Ecology and Taxonomy of Freshwater

Nematodes. In: Eyualem-Abebe, Traunspurger, W. e Andrássy, I. (Eds) **Freshwater Nematodes: Ecology and Taxonomy**. CABI Publishing, UK. p 3-30 (2006)

DEPREZ, T. *et al* (2005). NeMys. World Wide Web electronic publication. www.nemys.ugent.be, version (10/2013). Acesso em: 10/10/2013

DECRAEMER, W., COOMANS, A., BALDWIN, J. Morphology of Nematode *In*: Andreas Schmidt-Rhaesa (Eds.) **Gastrotricha, Cycloneuralia and Gnathifera Volume 2: Nematoda**. Berlin, Germany: De Gruyter, Dezembro de 2013. p 399-434, (2014)

DECRAEMER W., GOURBAULT, N. & HELLÉOUET M.N. Cosmopolitanism among nematodes: examples from Epsilonematidae. **Vie et Milieu**, 51(1–2), 1–19, (2001).

DECRAEMER W., KARANASTASI E., BROWN D. & BACKELJAU T. Review of the Ultrastructure of the Nematode Body Cuticle and Its Phylogenetic Interpretation. **Biological Reviews of the Cambridge Philosophical Society**, 78(3), 465–510, (2003).

DECRAEMER W. & SMOL N. Orders Chromadorida, Desmodorida and Desmoscolecida. *In*: Eyualem A., Traunspurger W. and Andrassy I. (Eds.), **Freshwater Nematodes: Ecology and Taxonomy**. CABI Publishing, Wallingford, UK, pp. 497–573, (2006).

ELEFTHERIOUS E., MOORE D.C. Macrofauna techniques. *In*: Eleftherious E, McIntyre A, (Eds). **Methods for the Study of Marine Benthos**, 3rd ed. Oxford, UK: Blackwell Publishing. p 160–22 (2005).

FADEEVA, N., MORDUKHOVICH, V. & ZOGRAF, J. Free-living marine nematodes of *Desmodorella* and *Zalonema* (Nematoda: Desmodoridae) with description of two new species from the deep sea of the North Western Pacific**. Zootaxa** 4175 (6), 501–520, (2016).

FERRIS, H. (1999). NEMAPLEX. World Wide Web electronic publication. http://plpnemweb.ucdavis.edu/nemaplex/index.htm, version (03/12/14). Acesso em: 21/03/2014.

FILIPJEV, I.N. Free-living marine nematodes of the Sevastopol area**. Transactions of the Zoological Laboratory and the Sevastopol Biological Station of the Russian Academy of Sciences**. Series II No. 4 (Issues I & II) (Translated from Russian), (1918).

FILIPJEV I.N. New data about free-living nematodes of the Black Sea. **Transactions of Stavropol Agricultural Institute**, 1, 83–184, (1922).

FONSÊCA-GENEVOIS, V. G. e LUCENA, A. Enfoques demográficos e ecológicos dos Turbellaria meiofaunísticos na plataforma continental do N/NE do Brasil. **Biológica Brasílica**, 2(1): p 39-60 (1990).

FONSÊCA-GENEVOIS, V. G. Les Annelides Oligochaetes Meio- Mixofaunistiques de L'Estuaire de La Loire, France, I - Les Naidadae. **Biologica Brasílica**, Recife, v. 3, n.2, p 201-237 (1991).

GALÉRON, J., SIBUET, M., VANREUSEL, A., MACKENZIE, K., GOODAY, A.J., DINET, A., WOLFF, G.A.. Temporal patterns among meiofauna and macrofauna taxa related to changes in sediment geochemistry at an abyssal NE Atlantic site. **Progress in Oceanography** v. 50, p 303–324 (2001).

GAGARIN V.G. & KLERMAN A.K. Two new species of free-living nematodes (Nematoda) from the Mediterranean Sea. **Invertebrate Zoology**, 5(1), 1–7, (2008).

GAGARIN, V.G. & NGUYEN, V.T. Two new species of free-living nematodes from the Cau River (Vietnam). **Zoologichesky Zhurnal**, 82, 1418–1425, (2003).

GAGARIN, V.G. & NGUYEN, V.T. Three new species of free-living marine nematodes of the order Desmodorida (Nematoda) from Vietnam. **Zoologichesky Zhurnal**, 89, 398–406, (2010).

GARCIA-JUNIOR J., MENDES L.F., SAMPAIO C.L.S., NÓBREGA M.F. & OLIVEIRA J.E.L. **Biodiversidade marinha da Bacia Potiguar/RN: Peixes da Plataforma Continental**. Museu Nacional – Rio de Janeiro, 217 pp, (2015).

GERLACH, S.A. Über einige Nematoden aus der Familie der Desmodoriden. **Zoologischer Anzeiger** 145, 178–198, (1950).

GERLACH, S.A. Freilebende Meeresnematoden von den Malediven II**.** ***Kieler Meeresforschungen***, 19, 67–103, (1963).

GERLACH, S.A. & MURPHY, D.G. Die Familiengruppen-Namen der freilebenden Nematoda-Adenophora (Aphasmidia). **Zoologischer Anzeiger** 175, 211–216, (1965). GERLACH, S. A. Bemerkungen zur Phylogenie der Nematoden, **Mitt. Boil. BundAnst. Ld u. Forstw**. 118: p 25 – 39 (1966).

GERLACH, S.A. Freilebende Meeres-Nematoden von den Sarso-Inseln (Rotes Meer). **Meteor-Forschungsergebnisse** *(D)*, 2, 19–43, (1967).

GERLACH, S. A. & RIEMANN, F. The Bremerhaven Checklist of Aquatic Nematodes. **Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven**, 4, 1-404, (1973).

GERLACH, S. A.; RIEMANN, F. The Bremerhaven Checklist of Aquatic Nematodes. **Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven**. 4, 404-735, (1974).

GIERE, O. Meiobenthology: the microscopic fauna in the aquatic sediments. **Berlin, Springer Verlag**. 328 pp, (1993).

GIERE, O. The bacterial endosymbiosis of the gutless nematode, Astomonema southwardorum - structural aspects. **Journal of Marine Biology Association of the UK** 75: p 153-164 (1995).

GIERE O. **Meiobenthology: the microscopic motile fauna in aquatic sediments**. Second Edition. Berlin: Springer-Verlag. p 527 (2009).

GOURBAULT N. & DECRAEMER W. Nématodes marins de Guadeloupe III. Epsilonematidae des genres nouveaux *Metaglochinema* n.g. (Glochinematinae) et *Keratonema* n.g. (Keratonematinae n. subfam.). **Bulletin du Muséum national d´Histoire naturelle**, Paris 8, sect. A, 171–183, (1986).

GOURBAULT N. & VINCX M. Two New Species of Brood Protecting Desmodoridae (Nematoda) From Guadeloupe. **Nematologica**, 36(1), 131–143, (1990).

INGLIS W.G. An outline classification of the Phylum Nematoda. **Australian Journal of Zoology**, 31, 243–255, (1983).

HEIP, C., VINCX, M., SMOL, N., VRANKEN, G. The systematics and ecology of freeliving marine nematodes. **Helminthological Abstracts Series B, Plant Nematology** v.51, n.1, p 1-31 (1982).

HEIP C., VINCX, M. e VRANKEN, G.. The ecology of marine nematodes. **Oceanography and Marine Biology – An Annual Review** v. 23, p 399–489 (1985).

HODDA, M. Phylum Nematoda Cobb 1932. *In*: Zhang, Z.-Q. (Ed.), *Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness*. **Zootaxa** 3148, 63–95, (2011).

HOPE, W.D. & MURPHY, D.G. A taxonomic hierarchy and checklist of the genera and higher taxa of marine Nematodes. **Smithsonian Contributions to Zoology**, 137, 1–101, (1972).

HOURSTON, M. & WARWICK, R.M. New species of free-living aquatic nematodes from south-western Australia (Nematoda: Axonolaimidae and Desmodoridae). **Records of the Western Australian Museum**, 26, 24–69, (2010).

HUANG, Y. & WANG, H. Review of *Onyx* Cobb (Nematoda: Desmodoridae) with description of two new species from the Yellow Sea, China. **Journal of the Marine Biological Association of the United Kingdom**, 95 (6), 1127–1132, (2015).

INGELS, J., VANHOVE, S., DE MESEL, I. & VANREUSEL, A. The biodiversity and biogeography of the free-living nematode genera *Desmodora* and *Desmodorella* (family Desmodoridae) at both sides of the Scotia Arc. **Polar Biology**, 29, 936–949, (2006).

INGELS, J., HAUQUIER, F., RAES, M. & VANREUSEL, A. **Biogeographic Atlas of the Southern Ocean. Scientific Committee on Antarctic Research**. Cambridge XII, 498 pp, (2014).

INGLIS, W.G. New marine nematodes from off the coast of South Africa. **Bulletin of the British Museum (Natural History), Zoology**, 10, 529–552, (1963).

JENSEN, P. Revision of Microlaimidae, Erection of Molgolaimidae fam.n., and Remarks on the Systematic Position of *Paramicrolaimus* (Nematoda, Desmodorida). **Zoologica Scripta**, 7, 159-173, (1978).

JENSEN, P. The nematode fauna in the sulphide-rich brine seep and adjacent bottoms of the East Flower Garden, NW Gulf of Mexico. 1. Chromadorida. **Zooogica Scripta**, 14, 247–263, (1985).

KAMPFER, S., STURMBAUER, C. & OTT, J. Phylogenetic analysis of rDNA sequences from Adenophorean nematodes and implications for the Adenophorea-Secernentea controversy. **Invertebrate Biology**, 117 (1), 29-36, (1998).

KNOPPERS, B., EKAU, W., FIGUEIREDO, A.G. The coast and shelft of east and northeast Brazil and material transport. **Geo-Marine Letters**, v. 19, p 171-178 (1999).

LANA, P.C. **Bentos de sedimento não consolidado**. *In*: Pereira, R.C.; Soares-Gomes, A. Biologia Marinha. Rio de Janeiro, p 328 (2002)

LARRAZÁBAL-FILHO A.L., SILVA M.C. & ESTEVES A.M. Four new species of free-living marine nematodes of the family Desmodoridae (Nematoda: Desmodorida) and a redescription of *Desmodora nini* (Inglis, 1963) from the continental shelf off northeastern Brazil. **Zootaxa**, 4021(1), 63–92, (2015).

LARRAZÁBAL-FILHO, A.L., NERES, P.F. & ESTEVES, A.M. Four new species and an identification key for *Stygodesmodora* Blome, 1982 (Nematoda: Spiriniinae) from the continental shelf off northeastern Brazil. **Zootaxa**, 4294 (1), 46–70, (2017).

LARRAZÁBAL-FILHO, A.L., NERES, P.F. & ESTEVES, A.M. The genus *Bolbonema* Cobb, 1920 (Nematoda: Desmodoridae): emended diagnosis, key to males, and description of three new species from the continental shelf off northeastern Brazil. **Zootaxa**, 4420 (4), 551–570, (2018).

LARRAZÁBAL-FILHO, A.L., NERES, P.F., SILVA, M.C. & ESTEVES, A.M. A new genus with three new species of free-living marine nematodes of the subfamily Desmodorinae (Nematoda: Desmodoridae), from the continental shelf off northeastern Brazil. **Zootaxa**, 4615(2), 321–342, (2019).

LEDUC, D. One new genus and two new deep-sea nematode species (Desmodoridae, Stilbonematinae) from phosphorite nodule deposits on Chatham Rise, Southwest Pacific Ocean. **Marine Biodiversity**, 43, 421–428, (2013).

LEDUC D. & VERSCHELDE D. One new genus and two new free-living nematode species (Desmodorida, Desmodoridae) from the continental margin of New Zealand, Southwest Pacific Ocean. **Zootaxa**, 3609(3), 274–290, (2013).

LEDUC, D. & VERSCHELDE, D. New *Spirinia* and *Stygodesmodora* species (Nematoda, Spiriniinae) from the Southwest Pacific, and a revision of the related genera

Spirinia, *Chromaspirina* and *Perspiria*. **European Journal of Taxonomy**, 118, 1–25, (2015).

LEDUC, W. & WHARTON, D.A. New free-living marine nematode species (Nematoda: Desmodoridae) from the coast of New Zealand. **Zootaxa**, 2611, 45–57, (2010).

LEDUC, D. & ZHANG, Z. Phylogenetic relationships within the superfamily Desmodoroidea (Nematoda: Desmodorida), with descriptions of two new and one known species. **Zoological Journal of the Linnean Society**, 176 (3), 511–536, (2016)a.

LEDUC, D. & ZHANG, Z. Morphological and molecular characterisation of new *Acanthopharynx* and *Desmodora* species (Nematoda: Desmodorinae) from intertidal sediments of New Zealand. **Nematology**, 18, 905–924, (2016)b.

LEDUC, D. & ZHAO, Z. Phylogenetic relationships within the superfamily Desmodoroidea (Nematoda: Desmodorida), with descriptions of two new and one known species. **Zoological Journal of the Linnean Society**. 176(3): 511-536 (2016).

LORENZEN S. *Glochinema* nov. gen. (Nematodes, Epsilonematidae) aus Südchile. **Mikrofauna des Meeresbodens**, 47, 393–412, (1974).

LORENZEN S. Desmodoridae (Nematoden) mit extrem lange Spicula aus Südamerika. **Mitteilungen aus dem Instituto Colombo-Alemán de Investigaciones Científicas**, 8, 63–78, (1976).

LORENZEN S. Entwurf eines phylogenetischen Systems der freilebenden Nematoden. **Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven**, suppl. 7, 1–472, (1981).

LORENZEN, S. **The Phylogenetic Systematics of Freeliving Nematodes**. The Ray Society, London, 167 pp, (1994).

MANOEL, A., SILVA, M.C. & ESTEVES, A.M. First record of spiral *fovea amphidialis* in *Acantholaimus* (Chromadoridae: Nematoda), with a description of a new species from shallow sediments of the South Atlantic and an emended diagnosis of the genus. **Zootaxa,** 4258, 257–270, (2017).

MARIA, T.F., ESTEVES, A.M., SMOL, N., VANREUSEL, A. & DECRAEMER, W. *Chromaspirina guanabarensis* sp.n. (Nematoda: Desmodoridae) and a new illustrated dichotomous key to *Chromaspirina* species. **Zootaxa**, 2092, 21–36, (2009).

MARIA, T.F., SMOL, N. & ESTEVES, A.M. Two new species of *Metachromadora* (Nematoda: Desmodoridae) from Guanabara Bay, Rio de Janeiro, Brazil, and a revised dichotomous key to the genus. **Journal of the Marine Biological Association of the United Kingdom**, 94, 105–114, (2014).

MARION A.F. Additions aux recherches sur des Nématoïdes libres du Golfe de Marseille. *Annales des Sciences naturelles***, Zoologie**, 14(1), 1–16, (1870).

MICOLETZKY, H. Die freilebenden Erd-Nematoden mit besonderer Berücksichtigung der Steiermark und der Bukowina, zugleich mit einer Revision sämtlicher nicht mariner, freilebender Nematoden in Form von Genus-Beschreibungen und Bestimmungsschlüsseln. **Archiv für Naturgeschichte Berlin**, 87 (Abt. A), 1–320, (1922).

MICOLETZKY, H. Weitere Beiträge zur Kenntnis freilebender Nematoden aus Suez. **Sitzungsberichte der Akademie der Wissenschaften in Wien, Mathematischen-Naturwissenschaftliche Klasse**, 1 (132), 225–262, (1924).

MOENS, T., BRAECKMAN U., DERYCKE S., FONSECA G., GALLUCCI F., GINGOLD R., GUILINI K., INGELS J., LEDUC D., VANAVERBEKE J., VAN COLEN C., VANREUSEL A. & VINCX M. **Ecology of free-living marine nematodes**. *In*: Schmidt-Rhaesa, A. (Eds.), *Gastrotricha, Cycloneuralia and Gnathifera. Vol. 2. Nematoda.* De Gruyter, Berlin, pp. 399–434, (2014).

MOENS, T. e VINCX, M. Observations on the feeding ecology of estuarine nematodes. **Journal of Marine Biology Association** UK v.77, p 211–227 (1997)

MORDUKHOVICH, V., FADEEVA, N., SEMENCHENKO, A. & ZOGRAF, J. New species of *Pseudochromadora* Daday, 1899 (Nematoda: Desmodoridae) from Russky Island (the Sea of Japan). **Russian Journal of Nematology**, 23, 125–135, (2015).

MOURA, J.R., SILVA, M.C. & ESTEVES, A.M. Four new species of *Desmodora* (Nematoda) from the deep south-east Atlantic, and a case of intersexuality in Desmodoridae. **Journal of the Marine Biological Association of the United Kingdom**, 94, 85–104, (2014).

MURPHY D.G. Three undescribed nematodes from the coast of Oregon. **Limnology and Oceanography**, 7(3), 386-389, (1962).

NDARO, S.G.M. & ÓLAFSSON, E. Soft-bottom fauna with emphasis on nematode assemblage structure in a tropical intertidal lagoon in Zanzibar, eastern Africa: Spatial variability. **Hydrobiologia**, 405, 133–148, (1999).

NERES, P.F., FONSÊCA-GENEVOIS, V.G. & ESTEVES, A.M. New records and species of Enchelidiidae (Nematoda): *Symplocostoma brasiliensis* sp. nov. and a first description of the female of *Calyptronema pigmentatum* Gerlach, 1957. **Marine Biology Research**, 9, 990–1004, (2013).

NERES, P.F., SILVA, M.C., MIRANDA-JÚNIOR, G.V., FONSÊCA-GENEVOIS, V.G. & ESTEVES, A.M. Five new species of *Oncholaimellus* (Oncholaimidae: Nematoda) from north-east Brazil, with an emended diagnosis and an updated key to the genus. **Journal of the Marine Biological Association of the United Kingdom**, 94, 703–727, (2014).

NYBAKKEN J. W. e BERTNESS M. D. **Marine Biology: An Ecological Approach** – 6th. Benjamin Cummings, San Francisco, California, p 342 (2004)

ÓLAFSSON, E. Do Macrofauna Structure Meiofauna Assemblages? *In*: Marine Soft-Bottoms? **Vie Milieu**, 53(4), p 249-265 (2003)

OTT, J.A., Sulphide Ectosymbioses in Shallow Marine Habitats In: Deep-Sea and Extreme Shallow-Water Habitats: Affinities and Adaptations. **Biosystematics and Ecology Series**, 11, 369-382, (1996)

OTT, J.A., GRUBER-VODICKA, H.R., LEISCH, N. & ZIMMERMANN, J. Phylogenetic confirmation of the genus *Robbea* (Nematoda: Desmodoridae, Stilbonematinae) with the description of three new species. **Systematics and Biodiversity**, 12, 434–455, (2014).

OTT, J.A., LEISCH, N. & GRUBER-VODICKA, H.R. *Eubostrichus fertilis* sp n., a new marine nematode (Desmodoridae: Stilbonematinae) with an extraordinary reproductive potential from Belize, Central America. **Nematology**, 16, 777–787, (2014).

PASTOR DE WARD, C.T. Nematodos marinos de la Ría Deseado (Desmodoroidea: Desmodoridae, Draconematidae), Santa Cruz, Argentina. VII. **Physis**, 46 (111), 61–72, (1988).

PLATT, H. M.; WARWICK, R. M. **Free-living Marine Nematodes** – Part I British Enoplids. Synopses of the British Fauna (New Series) Eds: Doris M. Kermack e R.S.K. Barnes. 28, p 307 (1983).

PLATT, H. M.; WARWICK, R. M. **Free-living Marine Nematodes** – Part II Chromadorids. Synopses of the British Fauna (New Series). (Eds.), Doris m. Kermarck and R. S. K. Barnes. 38, p 502 (1988).

PLATT, H. M. Foreword. *In*: The Phylogenetic Systematics of Free-living Nematodes, S. Lorenzen, (Eds.), pp.i-ii, **The Ray Society**, London. p 383 (1994).

PEARSE A.S. **An Introduction to Parasitology**. Charles C. Thomas, Springfield, Illinois, 375 pp, (1942).

POSTMA, H. e ZIJLSTRA, J.J. Continental Shelves. Ecosystems of the World. **Elsevier Sci.** Publi., Amsterdam. p 421 (1988).

PROOP, M V., TARASOFF, V.G., CHEERBADGI, I. I. e LOOTZIK, N. V. Benthic-pelagic oxugen and nutrient exchange in a coastal region of the dynamics. South Carolina, Belle W. Brauch Institute for **Marine Biology and Coastal Research.** p 265-284 (1979).

RUPPERT E. E.; FOX R. S. & BARNES R. D. Zoologia dos Invertebrados. **Uma abordagem funcional-evolutiva** 7ª Edição. Ed Roca Ltda. São Paulo, pp. 1168, (2005).

SCHMIDT-RHAESA A. **Gastrotricha, Cycloneuralia and Gnathifera Volume 2: Nematoda**. Berlin, Germany: De Gruyter, Dezembro de 2013. p 775 (2014)

SCHIZAS N. V & SHIRLEY T. C. Seasonal changes in structure of na Alaskan intertidal meiofaunal assemblage. **Marine Ecology Progress Series** 133, 115-124, (1996).

SCHUURMANS STEKHOVEN, J. H. Jr. The free living nematodes of the Mediterranean. III. The Balearic Islands. **Zoölogische Mededeelingen**, 3 (4), 229-262, (1942).

SCHUURMANS STEKHOVEN J.H. Jr The freeliving marine nemas of the Mediterranean. I. The bay of Villefranche. **Mémoires de l'Institut Royal des Sciences Naturelles de Belgique**, 37, 1–220, (1950).

SILVA, M.C., CASTRO, F.V., CAVALCANTI, M.F. & FONSECA-GENEVOIS, V. *Spirinia lara* sp.n. and *Spirinia sophia* sp.n. (Nematoda, Desmodoridae) from the Brazilian continental margin (Campos Basin, Rio de Janeiro). **Zootaxa**, 2081, 31–45, (2009).

SHARMA, J., BAGULEY, J., BLUHM, B. A., ROWE, B. G. Do Meio- and Macrobenthic Nematodes Differ in Community Composition and Body Weight Trends with Depth? **Plos ONE** v. 6(1), p 14491 (2011)

SILVA, M.C., SILVA, N.R.R., ESTEVES, A.M. & DECRAEMER, W. A new genus *Cornurella* gen.n. (Nematoda, Desmodoridae Filipjev, 1922) from Campos Basin, Rio de Janeiro, Brazil. **Marine Biodiversity**, 47, 1–14, (2017).

SMITH R.K., RASSMANN H.D. & KING N. Why Taxonomy Matters. (Eds.) BioNET-INTERNATIONAL, Egham, UK. Available from http://www.bionet-intl.org/why (accessed 10 march 2014), (2011).

SMOL, N., COOMANS, A. Order Enoplida. *In:* Eyualem-Abebe, Transpurger W, Andrássy I. (Eds.) **Freshwater Nematodes: Ecology and Taxonomy.** CABI Publishing UK, p. 225-292 (2006)

SOETAERT, K.; VINCX, M.; HEIP, C. H. R. Nematode community structure along a Mediterranean shelf-slope gradient. **Marine Ecology (Berlim),** 16(3), 189-206 (1995)

SOETAERT, K. E., HEIP, C. Nematodes assemblages of deep sea and shelf break sites in the North Atlantic and Mediterranean Sea. **Marine Ecology Progress Series**, 125, p 171–183 (1995)

SOMERFIELD P.J., WARWICK R.M. & MOENS T. Meiofauna techniques. *In*: Eleftheriou, A. and McIntyre, A. (Eds.), **Methods for the Study of Marine Benthos**. 3rd Edition. Blackwell Science Ltd, Oxford, pp. 229–272, (2005).

SOUTHERN, R. Nemathelmaia, Kinorhyncha, and Chaetognatha (Clare Island Survey, Part 54). **Proceedings of the the Royal Irish Academy**, 31, 1–80, (1914),

STEINER, G. Neue und wenig bekannte Nematoden von der Westküste Africa. **Zoologischer Anzeiger**, 50, 4–18, (1918).

STEINER G. Epsilonematidae, a new nemic family. **Journal of Parasitology** 14, 65–66, (1927).

SUGUIO, K. **Geologia Sedimentar**. São Paulo: editora Edgard Blücher Ltda, pp. 400, (2003).

SWART A. & HEYNS J. *Desmodora (Sibayinema) natalensis* subg. nov., spec. nov. from Lake Sibayi, South Africa (Nematoda: Desmodorida), **Phytophylactica** 23, 273–278, (1991).

TCHESUNOV, A.V. Order Desmodorida De Coninck, 1965. *In*: Schmidt-Rhaesa, A. (Ed.), **Gastrotricha, Cycloneuralia and Gnathifera**. *Vol. 2. Nematoda.* De Gruyter, Berlin, pp. 399–434, (2014).

TESSLER M.G. & MAHIQUES M.M. **Processos oceânicos e produtos sedimentares**. In: Decifrando a Terra. 2 ed. São Paulo: Companhia Editora Nacional, pp. 376-399, (2009).

TIETJEN, J.H. Ecology of free-living marine nematodes form the continental shelf of the Central Great Barrier Reef Province. **Estuarine, Coastal and Shelf Science**, 32, 421–438, (1991).

VAN MEGEN H., VAN DEN ELSEN S., HOLTERMAN M., KARSSEN G., MOOYMAN P., BONGERS T., HOLOVACHOV O., BAKKER J.& HELDER J. A phylogenetic tree of nematodes based on about 1200 full-length small subunit ribosomal DNA sequences. **Nematology** ,11 (6), 927–950, (2009)

VALIELA I. **Marine Ecological Processes**. 2. Ed. New York: Springer, pp 686, (1995).

VENEKEY V. Updates on information about free-living marine nematodes in Brazil: new records and comments on problems in taxonomic studies. **Zootaxa**, 4337(1), 38, (2017).

Verschelde D. & Vincx M. (1995) *Psammonema* gen. n. and *Pseudochromadora* Daday, 1889 (Nematoda, Desmodoridae) from sandy sediments of Gazi, Kenya.

Bulletin van het koninklijk Belgisch Instituut voor Natuurwetenschappen. Biologie 65, 11–39.

VERSCHELDE, D. & VINCX, M. Four new species of the family Desmodoridae (Nematoda, Desmodoroidea) from Kenya. **Zoologica Scripta**, 25, 1–20, (1996).

VERSCHELDE D., GOURBAULT N. & VINCX M. Revision of *Desmodora* with descriptions of new desmodorids (Nematoda) from hydrothermal vents of the Pacific. **Journal of the Marine Biological Association of the United Kingdom** 78, 75–112, (1998).

VERSCHELDE D., NICHOLAS W. & VINCX M. A review of the genera *Croconema* Cobb, 1920 and *Pseudochromadora* Daday, 1899 (Nematoda, Desmodoroidea): new species from the coasts of Kenya and Australia. **Hydrobiologia** 571, 17– 40, (2006).

VINCX M. & GOURBAULT. N. Desmodoridae from the Bay of Morlaix (Brittany) and the Southern Bight of the North Sea. **Cahiers de Biologie Marine, Station Biologique de Roscoff** 30(1), 103–11, (1989).

WARWICK R.M. Free-living marine nematodes from the Indian Ocean. *Bulletin of the British Museum of Natural History (Zoology)* 25, 87–117, (1973).

WARWICK, R.M., PLATT, H.M., & SOMMERFIELD, P. **Free-living Marine Nematodes Part III** – *Monhysterids*. *In:* Kermack, D.M. & Barnes, R.S.K. (Eds.), Synopses of the British Fauna (New Series), pp. 1–296, (1998).

WIESER, W. Untersuchungen über die algenbewohnende Mikrofauna mariner Hartböden. I. Zur Ökologie und Systematik der Nematodenfauna von Plymouth. **Österreichische Zoologische Zeitschrift**, 3, 425–480, (1951).

WIESER W. Free-living marine nematodes. II. Chromadoroidea. *Acta Universitatis Lundensis, Sectio 2, Medica,* **Mathematica, Scientiae Rerum Naturalium** *N.F.* 2, 50, 1–148, (1954).

ZHANG Z.Q. Animal Biodiversity: An outline of higher-level classification and survey of taxonomic richness. **Zootaxa** 314, 1–237, (2011).