Western Indian Ocean
JOURNAL OF
Marine Science

Volume 15 | Issue 2 | Jul – Dec 2016 | ISSN: 0856-860X

Chief Editor José Paula

Western Indian Ocean
JOURNAL OF
Marine Science

Chief Editor **José Paula** | Faculty of Sciences of University of Lisbon, Portugal

Copy Editor **Timothy Andrew**

Editorial Board

Serge ANDREFOUËT
France

Ranjeet BHAGOOLI
Mauritius

Salomão BANDEIRA
Mozambique

Betsy Anne BEYMER-FARRIS
USA/Norway

Jared BOSIRE
Kenya

Atanásio BRITO
Mozambique

Louis CELLIERS
South Africa

Lena GIPPERTH
Sweden

Johan GROENEVELD
South Africa

Issufo HALO
South Africa/Mozambique

Christina HICKS
Australia/UK

Johnson KITHEKA
Kenya

Kassim KULINDWA
Tanzania

Thierry LAVITRA
Madagascar

Blandina LUGENDO
Tanzania

Aviti MMOCHI
Tanzania

Nyawira MUTHIGA
Kenya

Brent NEWMAN
South Africa

Jan ROBINSON
Seycheles

Sérgio ROSENDO
Portugal

Melita SAMOILYS
Kenya

Max TROELL
Sweden

Published biannually

Aims and scope: The *Western Indian Ocean Journal of Marine Science* provides an avenue for the wide dissemination of high quality research generated in the Western Indian Ocean (WIO) region, in particular on the sustainable use of coastal and marine resources. This is central to the goal of supporting and promoting sustainable coastal development in the region, as well as contributing to the global base of marine science. The journal publishes original research articles dealing with all aspects of marine science and coastal management. Topics include, but are not limited to: theoretical studies, oceanography, marine biology and ecology, fisheries, recovery and restoration processes, legal and institutional frameworks, and interactions/relationships between humans and the coastal and marine environment. In addition, *Western Indian Ocean Journal of Marine Science* features state-of-the-art review articles and short communications. The journal will, from time to time, consist of special issues on major events or important thematic issues. Submitted articles are subjected to standard peer-review prior to publication.

Manuscript submissions should be preferably made via the African Journals Online (AJOL) submission platform (http://www.ajol.info/index.php/wiojms/about/submissions). Any queries and further editorial correspondence should be sent by e-mail to the Chief Editor, wiojms@fc.ul.pt. Details concerning the preparation and submission of articles can be found in each issue and at http://www.wiomsa.org/wio-journal-of-marine-science/ and AJOL site.

Disclaimer: Statements in the Journal reflect the views of the authors, and not necessarily those of WIOMSA, the editors or publisher.

Copyright © 2016 —Western Indian Ocean Marine Science Association (WIOMSA)
No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means without permission in writing from the copyright holder.
ISSN 0856-860X

Cover image: A seagrass meadow (*Thalassia hemprichii*) at Inhaca Island, Mozambique (© José Paula, 2017)

Psammonema waweri sp. n. (Nematoda: Desmodoridae), a brood protecting free-living marine nematode from the Continental Shelf and slope sediments along the Kenyan Coast

Agnes Muthumbi[1]*, Magda Vincx[2]

[1] School of Biological Sciences, University of Nairobi, P.O. Box 30197-00100, Nairobi, Kenya

[2] Marine Biological Section, Ghent University, Sterre Campus, Block S-8, B-9000, Ghent, Belgium

* Corresponding author: amuthumbi@uonbi.ac.ke

Abstract

Psammonema waweri is the third species in the recently described genus *Psammonema*, (Verschelde & Vincx, 1995) after the type species *P. ovisetosum* and *P. kuriani* (Jacob *et al.*, 2015). It is characterized by large loop-shaped amphids that overlap both the anterior and posterior part of the cephalic capsule, a lateral alae that begins posterior of the pharyngeal region, and two types of body setae (long thin setae that are extra long at the mid body in females, and short ones). *Psammonema. waweri* differs from *P. ovisetosum* in the lateral alae that begins at the pharyngeal in the latter, and posterior of the pharyngeal region, in the former species, in the male amphids which are a closed loop in *P. waweri* and an open-loop in *P. ovisetosum*. The female of the species protects the developing eggs by attaching them to the ventral mid body anterior and posterior of the vulval region, while in *P. ovisetosum* eggs are attached only at the anterior region of the vulva Thus, theavulva tends to be more anterior (still > 50 % of body length) in *P. waweri* than in *P. ovisetosum*. Amended diagnosis of the genus *Psammonema* is also provided in this paper.

Keywords: *Psammonema waweri*, Nematodes, Western Indian Ocean.

Introduction

Psammonema waweri is the third species in the genus after *P. kuriani* (Jacob *et al*., 2015) and *P. ovisetosum* (Verschelde and Vincx, 1995), the type species. The genus *Psammonema* was first described by Verschelde and Vincx (1995) with a single species *Psammonema ovisetosum* from estuarine mangrove sediments in Gazi Bay, Kenya. Although only a single species was discovered then, and although this species closely resembles *Pseudochromadora* and *Croconema*, Verschelde and Vincx (1995) placed the species in a new genus because of unique morphological characters which differentiated it from the known genera. Differences with *Pseudochromadora* were: shape and number of somatic setae in the pharyngeal region, position and shape of the lateral alae and the anterior position of the amphids in the head region, and ithe reproduction behaviour of brood protection in *Psammonema*. Differences with *Croconema* were the absence of sub-cephalic setae and the presence of lateral alae. *Psammonema waweri* from the continental shelf and upper continental slope sediments is the second species of the genus from Kenya and the third species of the genus, all from the Indian Ocean (*P. kuriani* is from the continental shelf of the Arabian Sea). *P. waweri* is a brood protector like the type species, *P. ovisetosum*. Brood protection has been observed in a few other free-living marine nematodes species such as *Croconema oti* and *Pseudochromadora incubans* (Gourbaut and Vincx, 1990) and *Croconema ovigerum* (Ott, 1976) of the family Desmodoridae.

Materials and Methods

Sediment samples were collected from the Western Indian Ocean off the Kenyan Coast during the

Southeast monsoon period as part of the Kenya-Netherlands Indian Ocean expedition in 1992. The specimens were found among other nematode species in samples collected at station 128 (02°03.16' S and 41°18.48' E) at 55m depth, and station 117 (03°08.21' S; 40°41.80' E) at 500m depth (See Muthumbi *et al*. (2004) for the site map). Sampling was carried out using a box core from which two sub-samples were taken up to a depth of 5cm using a plastic hand core of 2.6cm diameter.

The sediment samples were centrifuged in ludox, nematodes picked out, and transferred slowly through alcohol to glycerin. Drawings were made with the use of a camera lucida on a Leitz Dialux 20 EB microscope. Type specimens are deposited in the collection of the Koninlijk Belgisch Instituut voor Natuurwetenchappen (KBIN) in Brussels as slide numbers RIT 769 to RIT 773.

The abbreviations used in the text and tables are: a: body length divided by maximum body diameter; b: body length divided by pharyngeal length; c: body length divided by tail length; c': tail length divided by anal body diameter; abd: anal body diameter; V%: position of the vulva from the anterior; M: maximum body diameter; spic: spicule length.

Formula: distance from the anterior to:

Head	end of pharynx	M (vulva)	anus
	cbd		

All measurements for curved structures were measured along the arc.

Results

Psammonema waweri **sp. n.** (Fig. 1 A-J)

Type Specimens: Six males and six females on slide numbers: Holotype male and paratype males on slide RIT769; Allotype female, RIT770; other females on slide numbers RIT 771 (2 females), RIT772 (2 females), and RIT773 (1 female).

Etymology:

Species named after Waweru Muthumbi

Type Locality:

All material was collected from two sites along the Kenyan Coast during the Kenya- Netherlands Indian Ocean expedition in 1992. Samples were from station 128 (02°03.16' S and 41°18.48' E and 55m depth) in sediments that were 60% silt.

Measurement:

Male 1	–	126	M	742	849 µm
	21	30	31	25	
	a: 27.4;	b: 6.7;	c: 7.9		spic: 43 µm
Female 1	–	136	572	760	886µm
	22	32	85	18	
	a: 10.5;	b: 6.5;	c: 7.0;		V: 65%

Males 2- 6 L: 786-921µ; a: 22.3-28.6; b: 6.1-6.9; c: 7.8-9.0; spic: 42-55 µm

Females 2-6 L: 718-854 µ; a: 7.6-11.4; b: 5.1-6.8; c: 7.0-9.4; V: 64-69 %

Description

Males: The body is cylindrical with a broad and blunt anterior end (Fig. 1J), and a conico-cylindrical tail end (Fig. 1I).

The cuticle is annulated with annules beginning at the end of the cephalic capsule until the tail, leaving a small non-annulated end (Fig. 1B & I). There are six rows of somatic setae, possibly eight at the anterior pharyngeal region (Fig. 1E). These setae are of two types: the first type is long and thin, varying in length from 7-9 µm at the pharyngeal region, to 9-14 µm on the rest of the body, and 4-6 µm at the tail region; the second type of setae are short 'normal somatic setae' measuring 2-3 µm long along the whole body, alternating with the long ones. At the cloacal and tail region the ventral row of setae are thorn-like while the dorsal and ventral sub-lateral rows are shorter (4-6 µm) and stout (Fig. 1I). The lateral alae is fine and simple, extending from the level of the base of the pharyngeal bulb, or posterior to it, until 138-196 µm before the cloacal region.

The head capsule is well developed and made up of two parts (Fig. 1F). The anterior part has six inner and six outer tiny labial sensilla, while the posterior part

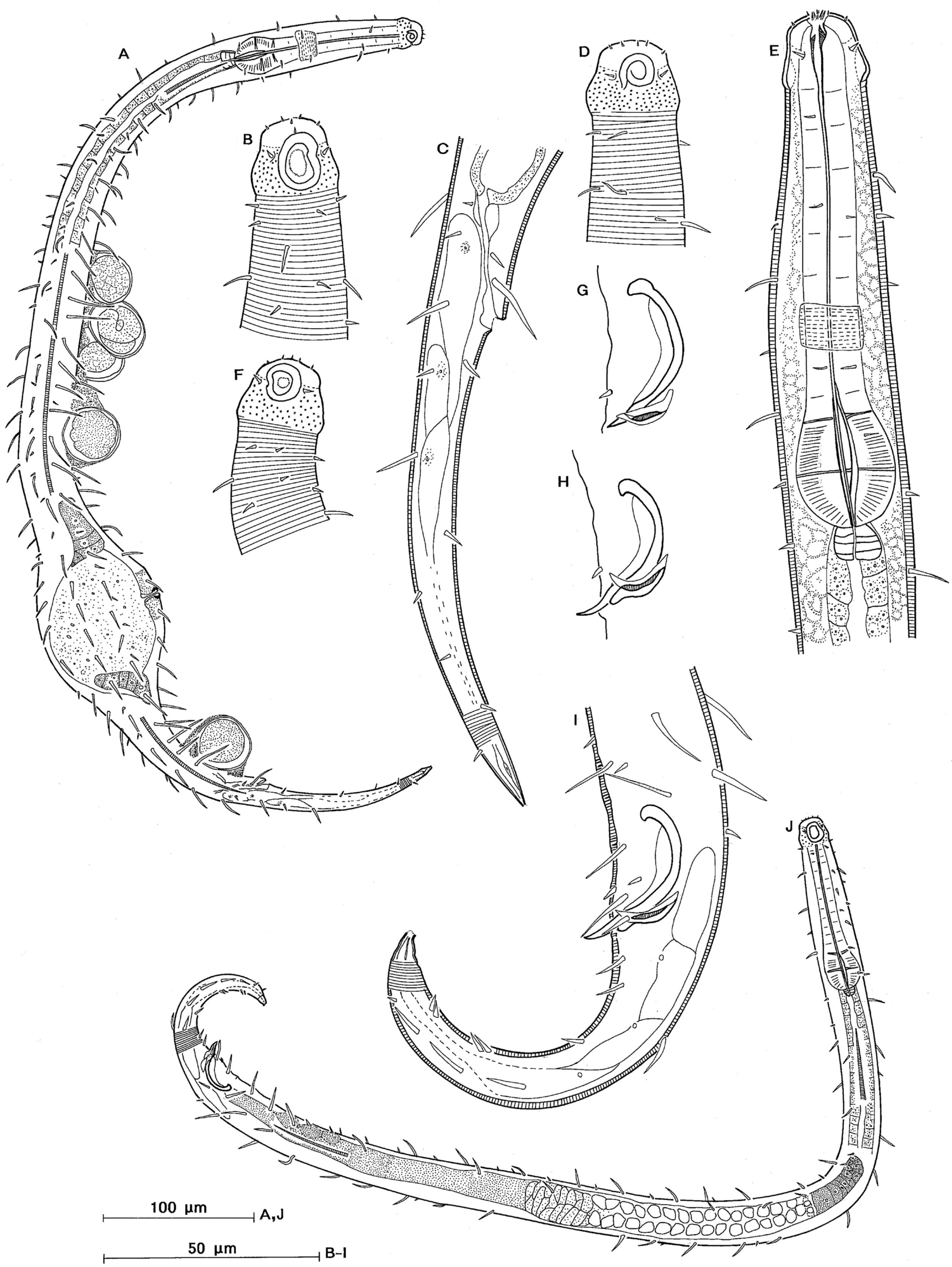

Figure 1. *Psammonema waweri*: A: Female body, B: Male anterior, C: Female tail; D: Female anterior; E: Male pharyngeal region, F: Female anterior, G & H: Male spicules, I: Male tail, J: Entire Male body

bears setiform (3 µm long) cephalic sensilla (Fig. 1B). The amphids are loop-shaped, 53-68 % of the corresponding body diameter, and situated at the level of the cephalic sensilla. The amphids overlap part of the anterior and the posterior head capsule (Fig. 1D). The stoma is large with one large dorsal and two sub-ventral teeth (Fig. 1E) and is surrounded by the pharyngeal tissue.

The pharynx is cylindrical, 124-136 µm long, with a well developed terminal bulb which has sclerotized valves (Fig. 1E). The ventral gland and the gland opening were not seen. Cardia is small but prominent.

The reproductive system is monorchic, with outstretched testis situated to the left of the intestine; spermatozoa are arranged in two rows in the testis (Fig. 1J). The spicules are arcuate, with well developed beak-shaped capitulum and narrow posterior shaft, and a thin velum (Fig. G, H & I). The gubernaculum is complex with lateral pieces. There is a ventral row of 10 to 11 pre-cloacal thorn-like supplements that extend from 113 µm in front of the cloaca and that appear to serve as outlets for the ventral row of glands located at this level.

The tail is conico-cylindrical, (c'= 3.1-5.1) with a short non-annulated tail end. At the tip the cuticle is more sclerotised on the ventral side than on the dorsal side (Fig. I) giving the tail a unique appearance. The caudal glands are located at the level of the cloaca or just posterior to it, and open through the terminal end.

Females: Similar to males in the head capsule, position of the cephalic setae and the cuticle. The amphids (Fig. 1D & F) are smaller, crypto-spiral or loop-shaped, and located at the level of the cephalic setae, overlapping both anterior and posterior parts of the head region without extending to the posterior end of the head capsule (as is the case with the males). The somatic setae are similar to those in the males in the pharyngeal region and anterior half of the body. At the level where eggs are glued onto the body (anterior and posterior of the vulva) the setae are much longer (20-25 µm), and specialized for holding eggs as described in *P. ovisetosum* (Verschelde and Vincx, 1995). At the level of the uterus there are 8 rows of setae.

The reproductive system is amphidelphic with reflexed ovaries, anterior to the left and posterior to the right of the intestine. The ovaries are short and no mature ova were seen. The uterus was swollen although no eggs could be discerned. The vulva is posteriorly positioned (V= 64-69 %), pore-like, and the vagina is muscular. The females are brood protectors where mature eggs are held onto the body with the aid of setae and/ or a sticky substance. Up to six eggs could be seen on the female body glued to the anterior and posterior region of the vulva.

The tail is elongate conical (c'= 4.9-7.0), 84 to 126µm long, with a short (14-17µm) non-annulated tip. The tail lacks the thick setae and the ventral sclerotization of the tip that is present in the males.

Differential diagnosis

Psammonema waweri sp. n. is characterized by a well developed head capsule with two parts, a smooth anterior part, and a punctated posterior part; an annulated cuticle with a fine lateral alae that begins at the level of the base of the terminal bulb or posterior to it; two types of somatic setae (short and long thin ones); six inner and six outer labial sensilla on the anterior part of the cephalic capsule; amphids located mid-way on the head capsule overlapping anterior and posterior parts of the head capsule. The amphids differ in males and females in size, being small crypto-spiral, or loop-shaped in females, and a wide loop in males that may overlap the whole posterior part of the head capsule. Spicules are curved and beak-shaped. Females hold the eggs both anteriorly and posteriorly of the vulva. Sexual dimorphism is apparent in the shape and relative size (c'= 3.1-5.1 in males, and 4.9-7.0 in females) of the tail.

Psammonema waweri sp. n. resembles *P. ovisetosum* (Verschelde and Vincx, 1995) and *P. kuriani* (Jacob *et al*., 2015) in having two types of somatic setae, a set of long and short setae, having loop shaped amphids, and a simple alae. *P waweri* sp. n. resembles *P. kuriani* in having closed looped amphids while *P. ovisetosum* has an open loop in males and a closed one in females. However, species dimorphism was observed in the size of the amphids in *P. waweri*, where the male amphids overlies the whole posterior part of the head capsule. The position of the lateral alae which begin at the level posterior of the cardia is similar in *P waweri* and *P. kuriani*. *P waweri* and *P. kuriani* both differ from P. *ovisetosum* in the extent of the lateral alae which begins at the pharyngeal region in *P. ovisetosum*, and posterior of the cardia in the other two species. In *P. kuriani* no females were described and so it is not possible to compare the female characters.

The females of *P. waweri* and *P. ovisetosum* are similar in that they are both brood protectors (carry the eggs attached to their body until they hatch) but differ in that the vulva in *P. waweri* is more anterior (V= 64-69%), and eggs are held both at the anterior and posterior of the vulva, while in *P. ovisetosum* the vulva is more posterior (V= 75-83%), and eggs are held only at the anterior region of the vulva.

Remarks

In the genus diagnosis of *Psammonema*, Verschelde and Vincx, (1995) used the extent of the lateral alae as a genus character. However, in this species the alae begins at the level of the base of the terminal bulb or posterior to it, which is consistent with the location in *P. kuriani*. It is preferable therefore, to keep the position of the alae in *P. ovisetosum* as a character for *Psammonema ovisetosum*, and not a genus character. The additional setae present on the head capsule in *P. ovisetosum* are not present in this new species or in *P. kuriani*. This places doubt as to the wide occurrence of the setae in other species of the genus.

The prolonged tripartite end bulb in *P. ovisetosum* and *P. kuriani* is used as a genus character for *Psammonema*. However, in the new species, *P. waweri*, the bulb is bipartite. Thus, the shape of the bulb is best retained as a species character rather than a genus character. Following the remarks above, we propose to amend the diagnosis of the genus *Psammonema*.

Amended diagnosis for the genus *Psammonema*

Cylindrical body with a head capsule divided in two parts and conico-cylindrical tail end. Cuticle annulated with fine annules and fine lateral alae that begins within the pharyngeal region or posterior of it. Somatic setae that occur in two forms; long slender and short ones. Eight rows of setae at the pharyngeal region and 6 on the rest of the body, except in the tail region. Six inner and six outer labial sensilla on the anterior part of the head capsule, and four cephalic sensilla on the posterior part of the head capsule. Additional sub-cephalic setae (Vershelde and Vincx, 1995) may occur on the head capsule. Sexual dimorphism in the shape and size of the amphids which are located mid-way on the head capsule, and may overlap both anterior and posterior parts of the head (in the males, the amphids are larger and the loop may extend until the end of the posterior part of the head capsule). Buccal cavity with one large dorsal tooth and two sub-ventral teeth.

Discussion

Psammonema (Vershelde and Vincx, 1995) closely resembles *Pseudochromadora* (Daday, 1899) and *Croconema* (Cobb, 1920) in general body shape and appearance.

Psammonema differs from *Pseudochromadora* in the shape (males have a large open or closed loop-shaped amphids, while females have a closed loop or crypto-spiral amphids), and size (at least 50% head diameter in width) of the amphids. Unlike *Pseudochromadora*, which has only one type of setae, *Psammonema* has two types of setae; long thin and short ones.

Psammonema can be differentiated from *Croconema* through the presence of a lateral alae and lack of true sub-cephalic setae.

Acknowledgement

The authors would like to thank the following organisations who made it possible for this work to be completed: Algemeen Bestuur voor de Ontwikkelingssamenwerking (ABOS, Belgium), and the Netherlands Indian Ocean Programme, 1990–1995. Sincere gratitude to Hendrik Gheerardyn for his assistance with the drawings.

References

Cobb NA (1920) Contributions to a Science of Nematology. IX. One hundred new Nemas. Williams & Wilkins Co, Baltimore. Pp 217-243

Daday J (1899) Uj-guineai szabadon elö nematodok. Mathematikai És Természettudományi Értesitö 17: 557-572

Gourbault N, Vincx M (1990) 2 New Species of Brood Protecting Desmodoridae (Nematoda) From Guadeloupe. Nematologica 36: 131-143

Jacob J, Anilkumar PR, Philip R, Rayaroth D (2016) *Psammonema kuriani* (Nematoda: Desmodoroidea), a novel species from the margin of the north-eastern Arabian Sea. Journal of the Marine Biological Association of the United Kingdom 96: 1469–1473

Muthumbi AW, Vanreusel A, Duineveld G, Soetaert K, Vincx M (2004) Nematode Community Structure along the Continental Slope off the Kenyan Coast, Western Indian Ocean. International Review of Hydrobiologia 89: 188-205

Ott JA (1976) Brood protection in a marine free living nematode - with description of *Desmodora* (Croconema) *ovigera* n sp. Zoologischer Anzeiger 196: 175-1811

Vershelde D, Vincx M (1995) *Psammonema* gen n. and *Pseudochromadora* Daddy, 1889 (Nematoda: Desmodoridae) from sandy sediments of Gazi Bay, Kenya. Bulletin van het Koninklijk Belgisch Instituut voor Natuurwetenschappen, Biologie 65: 11- 39