Oceanography & Fisheries
Open access Journal
ISSN: 2476-0536

Juniper PUBLISHERS key to the Researchers

Research Article
Volume 15 Issue 5 - February 2023
DOI: 10.19080/OFOAJ.2023.15.555922

Oceanogr Fish Open Access J

Preliminary Study of the Marine Ribbon Worm Species (*Nemertea*) along the Levantine Mediterranean Shore of Israel

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Submission: January 23, 2023; **Published**: February 07, 2023

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Abstract

A recent algal survey in the intertidal zone along the Levantine Mediterranean shore of Israel revealed four species of ribbon worms, *Baseodiscus delineatus*, *Evelineus mcintoshii*, *Lineus sanguineus*, and *Zygonemertes algensis*. Citizen scientists' (Fellow scientists) sighting information contributed the fifth species, namely, *Notospermus annulatus*, from the littoral subtidal zone in this sea area. This is the first study focused on the phylum Nemertea and their ecology in the southeastern Levantine region. Species collected were found associated with the local marine flora. The fact that four species from the intertidal are all found nearby Israel's biggest marine port might indicate recent introduction. Ecological aspects are also discussed.

Keywords: Nemertea; Levantine; Mediterranean; Israel; Lineus; *Evelineus; Zygonemertes*; *Baseodiscus; Notospermus*

Abbreviations: LMSI: Levantine Mediterranean shore of Israel; NIS: Non-Indigenous Species

Introduction

Nemerteans, or ribbon worms, are unsegmented lophotrochozoans that occur in oceans, freshwater, and terrestrial environments [1-8]. This phylum currently comprises about 1300 described extant and fossil species [9,10]. Of these, ca. 99% are marine species [11,12]. Over 15% (about 200 species) of them are distributed in the Mediterranean Sea [11,13].

The paucity of study concerning ribbon worms and their ecology from the Levantine Mediterranean shore of Israel (LMSI) is particularly notable, with only two species having so far been recorded from this area: *Evelineus mcintoshii* (Langerhans, 1880) [14] and "*Notospermatus geniculatus*" [sic] [15]. The latter would be meant to be *Notospermus geniculatus* (Delle Chiaje, 1822), the species concept of which has recently been narrowed down, with at least part of previous members being now known as *Notospermus annulatus* (Grube, 1840) [16]. Determining the species identity in the genus Notospermus Huschke, 1830 for the material reported in Ramos Esplá & Valle Pérez [15] requires additional data.

A recent faunal survey by the first author along the LMSI yielded another three species of nemerteans other than *E. mcintoshii* and *Notospermus sp*. In addition, underwater photographs taken by divers provide a new insight as to the species identity of *Notospermus* distributed in this region. The aim of this paper is to update the list of nemertean species in the LMSI based on the faunal survey and citizen science. Aspects of the ecology of the species found, especially *Zygonemertes algensis* (Bürger, 1895), are also in the spotlight.

Materials and Methods

A year-round survey was conducted along the LMSI between the summers of 2020 and 2021. Seaweeds were intensively and randomly collected from the intertidal and the shallow subtidal zones at eight sites distributed along ca. 195km of the shoreline between Gaza Strip in the south and the border with Lebanon, the northernmost site (Figure 1). Nemerteans, as well as polychaetes and crustaceans, associated with the seaweeds were sampled during 39 surveys. Morphological features and dimensions such as length and width of the specimens collected were also noted. Ecological data such as the host algal species, environmental factors, and habitat details were recorded both in the field and laboratory.

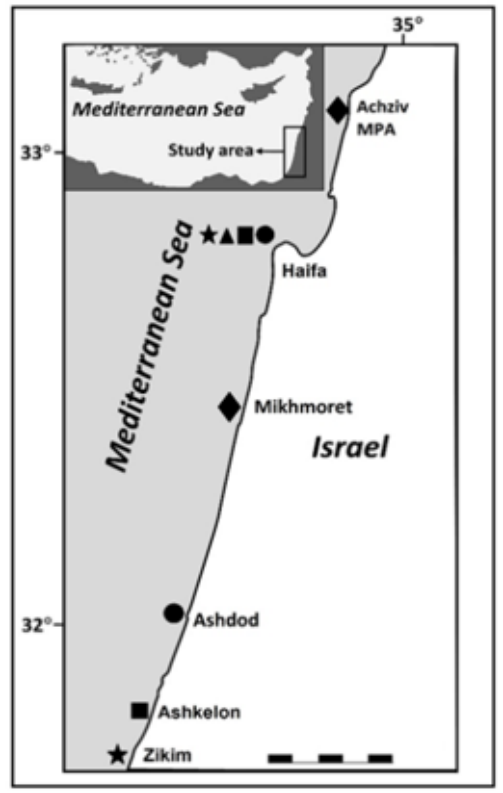

Figure 1: Map showing localities where nemerteans were confirmed along the Levantine Mediterranean shore of Israel: square, Baseodiscus delineatus; star, *Evelineus mcintoshii*; triangle, *Lineus sanguineus*; diamond, *Notopermus annulatus*; circle, *Zygonemertes algensis*. The two localities (Ma'agan Michael and Habonim) where *E. mcintoshii* was previously confirmed [14] as well as the locality (Nahli'eli) where "*Notospermatus geniculatus*" was observed [15] are not indicated on this map. Scale bar: 25km.

Specimens collected were preserved in 70% ethanol and deposited in a zoological collection of the Steinhardt Museum of Natural History, Israel National Centre for Biodiversity Studies in Tel Aviv University, Tel Aviv, Israel. They were examined with an Olympus MVX10 Research Macro Zoom Microscope and a Zeiss Axioplan 2 imaging compound microscope by squeezing preparation [17]. Images were acquired with an Olympus DP71 microscope digital camera and an Olympus SP820UZ digital camera. Digital underwater photographs of subtidal ribbon worms were provided by two divers.

Results

A total of 49 specimens of ribbon worms were collected during the survey at four of eight sites (Figure 1 & Table 1). There was no evidence of any nemertean during 11 collecting sessions that took place at the remaining four sites. The following four species in four genera were found (number of specimens in parentheses): *Baseodiscus delineatus* (5); *Evelineus mcintoshii* (2); *Lineus sanguineus* (8); and *Zygonemertes algensis* (34) (Table 1).

Worms were found convoluting and hiding inside the red macroalgae *Jania adhaerens* J.V. Lamouroux, growing as an epiphyte on *Palisada* sp., *Dignea simplex* (Wulfen) C. Agardh, and *Acanthophora nayadiformis* (Delile) Papenfuss, at all of the four sites (Table 1). Analysis of the marine fauna associated with these seaweeds revealed several taxa of polychaetes and crustaceans that mainly hide inside *J. adhaerens*; these polychaetes and crustaceans are possible food sources for the ribbon worms studied. However, one specimen of *Zygonemertes algensis* was found inside the red seaweed, *Centroceras* sp., with no polychaete observed. Citizen scientists' underwater photographs, taken before the present surveys, confirmed distribution of *Notospermus annulatus* in the littoral subtidal zone in the LMSI.

Table 1: Study sites, coordinates, number of surveys at each site, and number of specimens collected. Records of *Notospermus annulatus* [5] in this paper consist only of sighting information (without voucher specimen) and thus are not included in this table.

Study Site	Coordinate	Surveys Per Site	*Baseodiscus Delineates*	*Evelineus Mcintoshii*	*Lineus Sanguineus*	*Zygonemertes Algensis*	Total
Zikim	31.606266°N, 34.499376°E	5	-	1	-	-	1
Ashkelon marina	31.680806°N, 34.554035°E	5	1	-	-	-	1
Ashdod	31.858900°N, 34.663160°E	2	-	-	-	1	1
Tel Aviv	32.120923°N, 34.780892°E	2	-	-	-	-	0
Habonim	32.647260°N, 34.922740°E	2	-	-	-	-	0
Neve Yam	32.680140°N, 34.926519°E	2	-	-	-	-	0
Haifa	32.831662°N, 34.968541°E	15	4	1	8	33	46
Rosh HaNikra (Achziv Marine Protected Area)	33.086675°N, 35.105680°E	6	-	-	-	-	0
Total		39	5	2	8	34	49

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Taxonomic Account

Phylum Nemertea

Class Pilidiophora

Subclass Heteronemertea

Family Valenciniidae Hubrecht, 1879

***Baseodiscus delineatus* (Delle Chiaje, 1822)** (Figure 2A)

Delle Chiage *Polia delineata*, 1822 in Delle Chiage [1], pl. XX-VIII [28, but correctly 29 in position], Delle Chiage, 1825 in Delle Chiage [1]: 427-428, 444 [Naples, Italy]; [5], pp. 101-1 57-58, [Naples and Palermo, Italy]; [18], p. 209 [Naples, Italy]; [19], pp. 101-1 510-511 [Banyuls-sur-Mer, France].

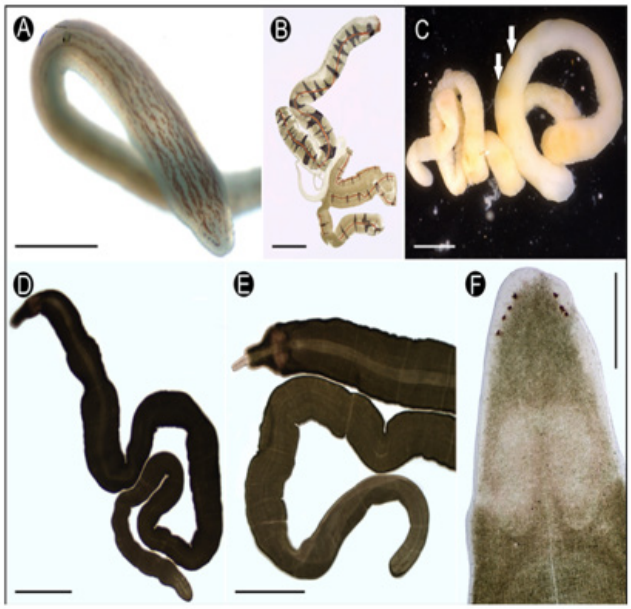

Figure 2: A, *Baseodiscus delineatus*, found in Haifa, November 2020. B–C, *Evelineus mcintoshii.* B, squeezed specimen, after Hoffman & Kajihara [14], collected in Habonim, October 2019; C, alcohol preserved specimen, collected in Zikim, December 2020 (arrows indicate places where black markings existed). These marking and Bands patterns almost faded away by the ethanol used to preserve the specimen. D–F, *Lineus sanguineus*, squeezing preparation: D, entire body, Haifa, June 2020; E, anterior and posterior ends, Haifa, August 2020 (proboscis slightly protruded); F, anterior end, showing ocelli, Haifa, August 2020. Scale bars: A, C, 1mm; B, D, E, 2mm; F, 500μm.

Nemertes delineatus: [20], p. 95 [Naples, Italy].

Eupolia delineata: [21], p. 230, pl. 8, (Figure 3) [Java, Indonesia]; [22], p. 825 [Torres Straits].

Eupolia delineata: [23], p. 151 [Naples, Italy]; [24], pp. 101-1 79-80, pl. I, Banyuls-sur-Mer, France; Citizen (1895), pp. 600–601, pl. 4, [Naples, Italy].

Taeniosoma delineatum: [25], p. 226 [Cove].

Baseodiscus curtus: [26], p. 102 [Curaçao].

Baseodiscus delineatus: [27], pp. 104-105 [Bogoni Island, Marshall Islands]; [28], pp. 442-443 [Brazil]; [29], pp. 101-1 139-146, [Low Isles, off Port Douglas, Great Barrier Reef, Australia].

Baseodiscus delineatus: [30], p. 3787, [Ischia, Italy; Rottnest Island, Australia]; [31], p. 62, [Carrie Bow Cay, Belize; Peanut Island, Florida, USA; Mouths of the Bull, Panama]; According to Gonzalez-Cueto et al. [32], p. 92, [Inca-Inca and Taganga, Colombia]; Mendes et al. [33], p. 149, [Caucasian, Brazil]; [34], p. 423, [Misaki, Japan]; [35], pp. 101-1 348-353, [Misaki, Japan]; [36] [Misaki, Japan].

Baseodiscus cf. delineatus: [37], p. 291, Table 1 [Australia].

Material examined

Five specimens: One from Ashkelon Marina, four from Haifa (Table 1). Description. Body 16–85mm long, 0.4-1.4mm wide (Table 2) dorsoventrally flattened; cephalic lobe broadly rounded. Grayish ground colour; dorsally with abundant short interrupted reddish brown longitudinal stripes, paler or completely absent on ventral surface (Figure 2A). Shallow, cerebral organ furrows post-cerebral, vertical and slightly oblique, with inconspicuous, orthogonally oriented secondary furrows. Ocelli 6-7 on each side, arranged irregularly along antero-lateral margin of head. Mouth ventral, posterior to cerebral organ furrows. Proboscis pore at anterior of head; proboscis short and thin.

Distribution

Warm waters worldwide: France [19,24], Italy (1,4,5,18,30), Israel (this study), Australia [30,37], Japan [34-36], Florida, USA (Schwartz 2009), Belize [31], Panama [31], Colombia [32], and Brazil [33]. Remarks. Our species identification for the present material must be regarded as preliminary because the characteristics found in our specimens - ventral stripes paler or absent - are also applicable to *Baseodiscus curtus* (Hubrecht, 1879). We identified the present Israeli specimens as *B. delineatus* because paler ventral stripes are known for smaller individuals [32]. In addition, the stripes are much denser in *B. curtus* than in *B. delineatus* [4] as in our material. Future studies with molecular barcode data should corroborate our species identification.

There was one extraordinary, long and thick specimen of *Baseodiscus delineates*, collected at early spring, and one short juvenile, collected during winter in Haifa (Table 1).

Ecology

Specimens observed in this study were found inside the red macroalgae Jania adhaerens growing epiphytically on other seaweeds in the intertidal zone throughout the year.

Family Lineidae [38]

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***Evelineus mcintoshii* (Langerhans, 1880)** (Figure 2B & C)

Cerebratulus mcintoshii [2], p. 138, pl. VI, [Madeira].

Lineus Mcdntoshii [sic]: [39], p. 187, [Misaki, Japan].

Evelineus tigrillus [40]: [Santos, Brazil; Itaipú, Brazil].

Lineus mcintoshii: [41], p. 1, [Kerala, India]; [34], p. 428, [Fukue, Japan].

Evelineus cf. mcintoshii: [42], p. 298, [Cu Lao Cham, Vietnam].

Evelineus mcintoshii: [43], p. 149, [Pernambuco, Brazil]; [44], p. 591, [Someshwara, India]; [14], p. 664, (Figure 2) [Haifa, Israel].

Material examined

Two specimens: One from Zikim, the other from Haifa (Table 1).

Description

Given in [14]; body dorsally pale yellowish and ventrally white; transverse reddish patch on dorsal surface near cephalic tip; single, narrow, reddish mid-dorsal stripe running throughout body; on either side of this line, numerous transverse black bands arranged rather regularly (Figure 2B). The characteristic dorsal markings have disappeared in specimens preserved in ethanol (Figure 2C).

Distribution

Warm waters worldwide: Israel [14], India [41,44], Vietnam [42], Japan [34,39], Brazil [40, 43], and Portugal (Madeira) [2].

Remarks

Evelineus mcintoshii is characterized by a conspicuous coloration. Because the shape of the reddish cephalic patch as well as the transverse black bands varies between reports from different localities, the supposed worldwide distribution must be tested with molecular data [42].

Evelineus mcintoshii turned out to be distributed along 140km of the LMSI; the assumption that it arrived recently to the central shore, with very minor distribution of a few km [14] does not hold true any longer.

Ecology

The two specimens were found in the intertidal zone.

***Lineus sanguineus* (Rathke, 1799)** (Figure 2D-F)

Planaria sanguinea [3], p. 83 [Copenhagen, Denmark].

Nemertes socialis [45], p. 143 [Rhode Island, USA].

Lineus nigricans [23], p. 159 [Naples, Italy]; [4], pp. 623-624, pl. 5, [Naples, Italy].

Lineus vegetus [46], pp. 55-59, [California, USA].

Lineus bonaerensis [47], pp. 5-11, [Buenos Aires, Argentina]; [48], pp. 129-134, [Buenos Aires, Argentina].

Myoisophagos sanguineus: [49], pp. 549-552, [Kaikoura, New Zealand; California, USA; between Massachusetts and Maine, USA].

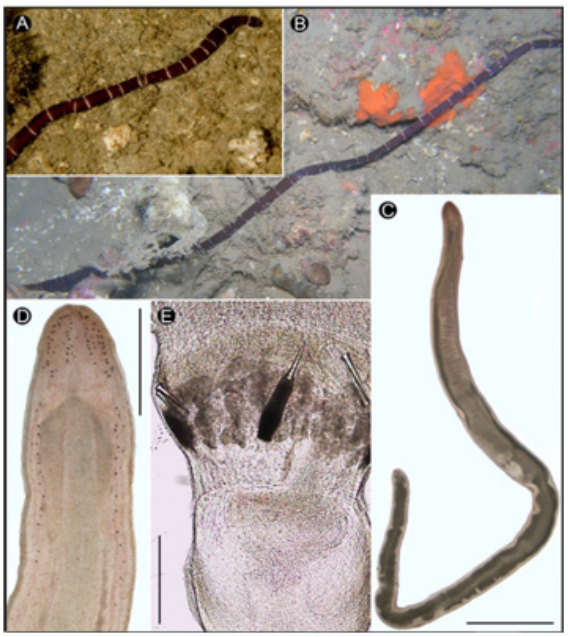

Figure 3: A–B, *Notospermus annulatus*: A, Achziv Marine Protected Area (image by Nimrod Shay); B, Michmoret (Mikhmoret), in 2007, 40-45m depth (image by Gal Eyal). C–E, *Zygonemertes algensis*, Haifa, June 2020: C, entire body; D, anterior end, showing post-cerebral eyes; E, stylet apparatus. Scale bars: C, 2 mm; D, 1mm; E, 200μm.

Ramphogordius sanguineus: [50], pp. 65-70, [Virginia, USA]; [51], pp. 579-587, (Table 1), [England, UK; Wales, UK; Asturias, Spain; Galicia, Spain; Cantabria, Spain; Catalonia, Spain; Liaoning, China; Shandog, China; Zhejiang, China; Fujian, China; Guangdong, China; British Columbia, Canada; Puerto Madryn, Argentina; Coquimbo, Chile; Totoralillo, Chile; Punta Tumbes, Chile].

Lineus sanguineus: [52], p. 3364; [36], p. 73, [Misaki, Japan].

Material examined

Eight specimens from Haifa (Table 1); two specimens by squeezing preparation.

Description

Body up to 4cm in length, 1mm in width (Table 2), uniformly dark brown in colour (Figure 2D); transverse rings (= less pigmented epidermal constrictions) arranged at regular intervals throughout body length (Figure 2E); proboscis white (Figure 2E); ocelli black, 3-4 in number on each side (Figure 2F).

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Table 2: Body size [length × diameter (mm)] of nemertean species studied in seasons. Average was calculated when more than one specimen was collected per season. Records of *Notospermus annulatus* in this paper consist only of sighting information (without voucher specimen) and thus are not included in this table.

Species	Season			
	Summer (June–September)	Autumn (October–November)	Winter (December–March)	Spring (April–May)
Baseodiscus delineatus	18.0 × 0.6 (n = 1)	28.0 × 0.8 (n=1)	16.0 × 0.4 (n=2)	85.0 × 1.4 (n=1)
Evelineus mcintoshii	—	3.0 × 1.0 (only head)	21.0 × 0.8 (n=1)	—
Lineus sanguineus	32.5 × 0.9 (n=5)	35.0 × 1.0 (n=1)	40.0 × 0.9 (n=1)	28.0 × 0.8 (n=1)
Zygonemertes algensis	29.7 × 0.8 (n=10)	11.2 × 0.4 (n=6)	5.6 × 0.3 (n=14)	24.5 × 0.8 (n=2)

Distribution

Worldwide: molecularly confirmed distribution includes the UK, Spain, China, Japan, Canada (Pacific coast), USA (both the Pacific and Atlantic coasts), Chile, and Argentina [51].

Remarks

The present material represents the first record of *Lineus sanguineus* from the LMSI. However, our species identification should be corroborated by molecular barcode data in future studies, because *L. sanguineus* is externally similar to *Lineus clandestinus* [53], *Lineus ruber* [54], and *Lineus viridis* [51,53,54]. *Lineus sanguineus* is capable of asexual regeneration by fragmentation followed by anterior and posterior regeneration [55]; this feature distinguishes *L. sanguineus* from *L. ruber* and *L. viridis* [56]. *Lineus sanguineus* is also distinguishable from *L. ruber* and *L. viridis* by the behavior upon stimulation: *L. sanguineus* tends to contract into a spiral coil, while *L. ruber* and *L. viridis* contract without coiling [6,49,56,57]. Neither the regenerative ability nor the contraction behavior was examined in our material, leaving room for misidentification.

Ecology

In the LMSI, *Lineus sanguineus* was found hiding inside the thallus of *J. adhaerens*, throughout the year in Haifa; no remarkable change in body size per seasons was observed (Table 2).

***Notospermus annulatus* (Grube, 1840)** (Figure 4A & B).

Meckelia annulata [5], p. 58, [Naples, Italy; Palermo, Italy].

Cerebratulus geniculatus: [24], p. 112, pl. II, [Banyuls-sur-Mer, France; Port-Vendres, France; Cerbère, France].

Lineus geniculatus: [4], pp. 616-619, pl. 5, [Naples, Italy].

Notospermatus [sic] geniculatus: [15], pp. IV-6, IV-13, annex II.2, annex III [Rosh HaNikra, Israel].

Notospermus geniculatus: [37] [Cabrela, Balearic Islands, Spain]; [13], p. 514, [Fuerteventura, Canary Islands, Spain; Alborán Sea, Almería, Spain; Strait of Gibraltar, Ceuta, Spain]; [58], pp. 1-6, [Sicily, Italy].

Notospermus annulatus: [36], pp. 71-72, [Cabrela, Balearic Islands, Spain].

Material examined

Digital in situ photographs of two specimens (no voucher specimen procured): (1) Achziv Marine Protected Area, date and depth unknown, by Nimrod Shay (Figure 4A); (2) Michmoret (Mikhmoret) in the year 2007 (month and day unknown) at a depth of 40-45m by Gal Eyal (Figure 4B).

Description

Body reddish brown: numerous transverse white rings arranged throughout body, dorsally discontinuous (Figure 3A & B); anterior-most ring on head mid-dorsally wedged forward (Figure 4A).

Distribution

So far known from the Mediterranean: Spain [36,37], France [25], Italy [4,5,58], and Israel (present study).

Remarks

Notospermus annulatus has been confused with *Notospermus geniculatus* until recently; they are distinguished by the white rings dorsally continuous (*N. geniculatus*) or discontinuous (*N. annulatus*). Both species occur in the Mediterranean, while *N. geniculatus* was also molecularly confirmed in Japan [36].

From the LMSI, Ramos Esplá & Valle Pérez [15] reported "*Notospermatus geniculatus*" [sic], convoluted on seaweed growing at a depth between 13-28m in the northernmost marine protected area near the border with Lebanon. Because no information is currently available whether the white rings were dorsally continuous in Ramos Esplá & Valle Pérez's [15] material, its identity remains uncertain; the photograph (number 1238) deposited in Unidad de Biología Marine, University of Alicante, Spain, would be helpful for this purpose.

Ecology

The species has been confirmed sub tidally in the LMSI.

Class: Hoplonemertea

Order: Monostilifera

Suborder: Eumonostilifera

Infraorder: Amphiporina

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***Zygonemertes algensis* (Bürger, 1895)** (Figures 3C-E)

Amphiporus algensis [4], p. 570, pl. 4, pl. 29, [Naples, Italy].

Amphiporus giardinae [59], p. 54, [Palermo, Italy].

Zygonemertes algensis: [60], pp. 11-18, [Naples, Italy].

Material examined

Thirty-four specimens; one in Ashdod, 33 in Haifa; one specimen from Haifa (collected in June 2020) was observed by squeezing preparation.

Description

Body up to about 3cm in length and 1mm in width (Table 2). In one specimen observed under microscope by squeezing preparation, body light brown and medially greenish (Figure 4C & D); eyes arranged in two rows pre-cerebrally; post-cerebral eyes extending posterior to stomach (Figure 4D); intestinal caecal diverticula not reaching to brain; central stylet 95µm long; basis 166µm long, posteriorly not lobulated (Figure 4E); stylet/basis ratio 0.57; two accessory stylet pouches present, each containing two and three accessory stylets (Figure 4E).

Distribution

So far known from the Mediterranean: Italy [4,60] and Israel (present study).

Remarks

This is the first record of *Zygonemertes algensis* outside Italy, although our species identification would need to be confirmed by future molecular data. We ventured to apply the species name *Z. algensis* to our material based on

a) the greenish body

b) the stylet/basis length ratio, which was 0.57 in our material, while Berg [60] reported 0.40-0.72 (mean 0.59) in the material from Naples

c) the basis posteriorly not lobulated (Figure 4E)

d) the intestinal caecal diverticulae not reaching to brain (Figure 4D)

e) the geographical closeness of the present cites (LMSI) from the type locality (Naples).

Ecology

In the LMSI, *Zygonemertes algensis* was found all year round. Individuals collected during late autumn and winter were remarkably smaller (Table 2) (Figures 4A & 4B). An outlier in autumn is represented by a long and thick specimen found in early October, when surficial seawater temperature was still 29°C in Haifa, whereas the other specimens, collected when temperatures dropped down at late fall, were very small, with the same dimensions as specimens collected during winter (Figures 3A & B).

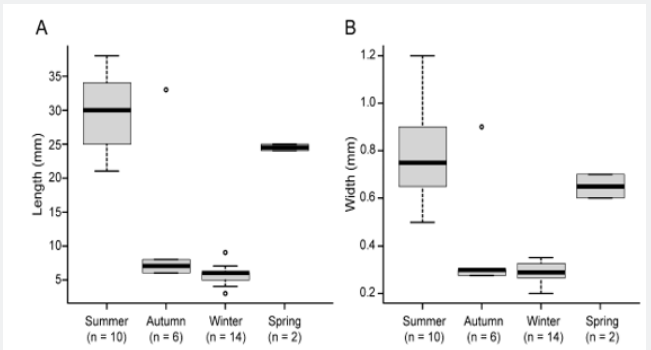

Figure 4: Box plots showing distribution of body lengths (A) and widths (B) among 32 specimens of *Zygonemertes algensis* in each season; small circles indicate outliers.

Discussion

The present survey, as well as citizen scientists' information and our previous report [14], indicate distribution of five species of ribbon worms in the LMSI: *Baseodiscus delineates, Evelineus mcintoshii, Lineus sanguineus, Notospermus annulatus*, and *Zygonemertes algensis*. This is a very small, almost negligible, value considering that only 2.5% of the nemertean species, reported from the Mediterranean Sea, are distributed along ca. 195km of the LMSI. This limited population might explain why no study of this group was published previously from Egypt, Israel, Lebanon and Syria, likely the eastern and southern Levantine Sea that stretched along ca. 1650km, although marine biology has been popular in Israel since its early years, with several zoologists having studied many aspects including taxonomy, diversity, and ecology of marine worms at the region [61]. Hence, we speculate that the eastern and southern Levantine Sea would be naturally poor in nemertean fauna until present days.

There is a chance that at least two of the newly found species reported here are actually recent migrants or even non-indigenous species (NIS) at the area. These two species are *E. mcintoshii* and *L. sanguineus*. The former, a very colourful and prominent species, was first recorded from the Mediterranean Sea in 2014 and is almost undoubtedly NIS with no other previous records from this sea [14]. Status of the latter is a bit more questionable because on one hand it was reported from the central and western basin of the Mediterranean Sea [23,51]. On the other hand, it is also distributed worldwide, with molecularly identified specimens so far confirmed in the UK, Spain, China, Japan, Canada (Pacific coast), USA (both the Pacific and Atlantic coasts), Chile, and Argentina [51]. However, one should consider that L. sanguineus might be a NIS in the Eastern Mediterranean because there was no previous report from this sea. Moreover, the eight specimens of L. sanguineus reported here were all collected at the same spot in Haifa, which works like a magnet, attracting alien species [62]. Distribution in the Atlantic Ocean and the North Sea indicates that this species is adapted to temperate and cold waters. However, the LMSI is no longer a temperate sea and due to global warming, it acquired tropical conditions with

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a warming trend of the surface seawater temperatures by 0.13°C per year in the past 40 years [63]. Considering that this trend would continue, the population of L. sanguineus might be under threat and this temperate-cold water species might end up episodic and cryptogenic.

We assume that some of the five species of nemerteans reported here are distributed all along the LMSI and maybe even in Egypt, Gaza Strip, Lebanon, and Syria. However, the concentration of these species, with 94% of specimens collected during this study, in Haifa, is particularly notable and suspicious because Haifa Bay hosts the biggest marine port of Israel and has become a hotspot for alien marine species from all over the world (Hoffman in prep.). It is to be noted that during the extensive survey of the marine flora and associated fauna, which took place on the intertidal along the LMSI, during the past 17 years and particularly in Haifa, there was no evidence of any ribbon worm at this habitat until 2014.

Our ecological observation indicates that ribbon worms would prefer living on red seaweeds and particularly on Jania adhaerens, which grows as an epiphyte on other local red macroalgae of the intertidal zone along the LMSI. However, the reason for this scenario is probably since bristle worms, their preferable food [14], find more secure sheltered habitat beneath the branches of this coralline rigid seaweed.

Our study revealed that *Evelineus mcintoshii* is now distributed along 140km of the LMSI, hence, the assumption that it would have arrived recently to the central shore, with very minor distribution of a few km [14], does not hold true anymore.

Conclusion

Preliminary study of the Nemertea fauna of the Levantine Mediterranean shore of Israel reveals only five species of this phylum in the region. This negligible number might indicate that the southern Levantine Sea is naturally poor in species of this unique group. The fact that nearly 95% of specimens collected, of the four Nemertean species studied during the survey, were found at a single site, which works like a magnet, attracting alien species, might indicate that not all of them are indigenous.

Acknowledgement

The authors are very grateful to Gal Eyal and Nimrod Shay for sharing precious underwater images; to Prof. Emeritus Ray Gibson for critically and professionally reviewing and editing this paper before its submission to the journal; and to the School of Plant Sciences and Food Security of Tel Aviv University for the use of their microscopes and cameras.

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How to cite this article: Razy Hoffman and Hiroshi Kajihara. Preliminary Study of the Marine Ribbon-Worm Species (Nemertea) along the Levantine Mediterranean Shore of Israel. Oceanogr Fish Open Access J. 2023; 15(5): 555922. DOI: 10.19080/OFOAJ.2023.15.555922

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DOI:10.19080/OFOAJ.2023.15.555922

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