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IS THE BRISTLEWORM *PYGOSPIO ELEGANS* CLAPAREDE (SPIONIDAE) REALY A DEPOSIT-FEEDER?

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Abstract

Gut contents of *Pygospio elegans* Claparede (Spionidae) individuals collected in the Polish coastal zone of the Baltic were analysed. Guts of almost all the *P. elegans* (89-100%) were found to contain sand grains and detritus. Microalgae (Bacillariophyta, Chlorophyta, Flagellata) occurred in the guts of 8-100% *P. elegans* individuals. Noteworthy was the finding, in the *P. elegans* gut contents, of oligochaeta remains, indicative of some predatory behaviour of the polychaete. The oligochaete contribution to the *P. elegans* food increased with polychaete size (from 33 to 100%). Therefore, *P. elegans* in the Baltic population should be regarded as omnivores rather than suspension feeders-deposit feeders they have been classified with so far.

Key words: Baltic coastal zone, *Pygospio elegans*, feeding

INTRODUCTION

Due to the low salinity (7-8 PSU), the Polish coastal zone of the Baltic Sea supports a species-poor polychaete fauna (Żmudziński 1982). *Pygospio elegans* Claparede (Spionidae) is a species that most often attains the highest abundance among the polychaetes, but – due to the small size – does not produce high biomass values, staying behind *Hediste diversicolor* and other polychaetes. *P. elegans* occurs in the Baltic within the depth range of 5-40 m (Warzocha 1994). Owing to high abundances of *P. elegans*, frequently averaging more than 1000 inds m^{-2} mainly within the depth range of 10-20 m (Żmudziński 1982), the species plays a certain ecological role in the coastal Baltic biocoenosis. Therefore, the author decided to investigate, to a more detail, the place of *P. elegans* in the food web of the coastal Baltic waters.

MATERIALS AND METHODS

Materials for the study were collected within 1998-2003 at 11 transects in the Polish coastal zone of the Baltic, of Kołobrzeg (May 2003), Darłowo (June 1999), Ustka (May 2000), Rowy (June 2001), Łeba (May 2000) and Władysławowo (May 1998). The sampling sites were designated to the shoreline in the distance of 0.25, 0.5, 1.0, 2.0 and 3.0 nautical miles from the shore (Fig. 1).
P. elegans was extracted from sediment samples collected with an 0.0625 m^2 Van Veen grab and washed through an 0.5 mm mesh size sieve, the sieving residue being preserved in 5% formalin. In the laboratory, *P. elegans* guts were dissected out under the stereomicroscope. The gut content was removed and examined under the microscope (magnification 720x); mineral and organic particles and organisms in the gut contents were identified and enumerated. Guts dissected out of 200 individuals measuring 5-16 mm were examined.

RESULTS

Guts of all the *P. elegans* examined showed the presence of detritus and sand (Tab. 1). In addition, microalgae represented by the Flagellata, Chlorophyta, and Bacillariophyta, as well as remains of oligochaetes were recorded. Among the microalgae,

Table 1

Frequency of detritus, sand and taxa organism of occurrence (%) in the diet of *Pygospio elegans* Claparede of different size classes

Size class Pygospio (mm)	Number of examined Pygospio (n)	Kind of material or of debris contained in alimentary line					
		Sand	Detritus	Oligochaeta	Flagellata	Chlorophyta	Bacillariophyta
5.0-5.9	18	100	100	33	83	8	8
6.0-6.9	23	100	100	43	69	37	12
7.0-7.9	19	92	100	47	77	23	38
8.0-8.9	32	100	100	62	84	40	8
9.0-9.9	35	100	100	71	68	29	18
10.0-10.9	15	100	100	60	75	0	12
11.0-11.9	19	89	100	80	78	11	11
12.0-12.9	14	100	100	85	100	57	57
13.0-13.9	10	100	100	100	75	25	25
14.0-14.9	11	100	100	45	50	25	25
15.0-15.9	8	100	100	100	33	33	37
∑	**204**						

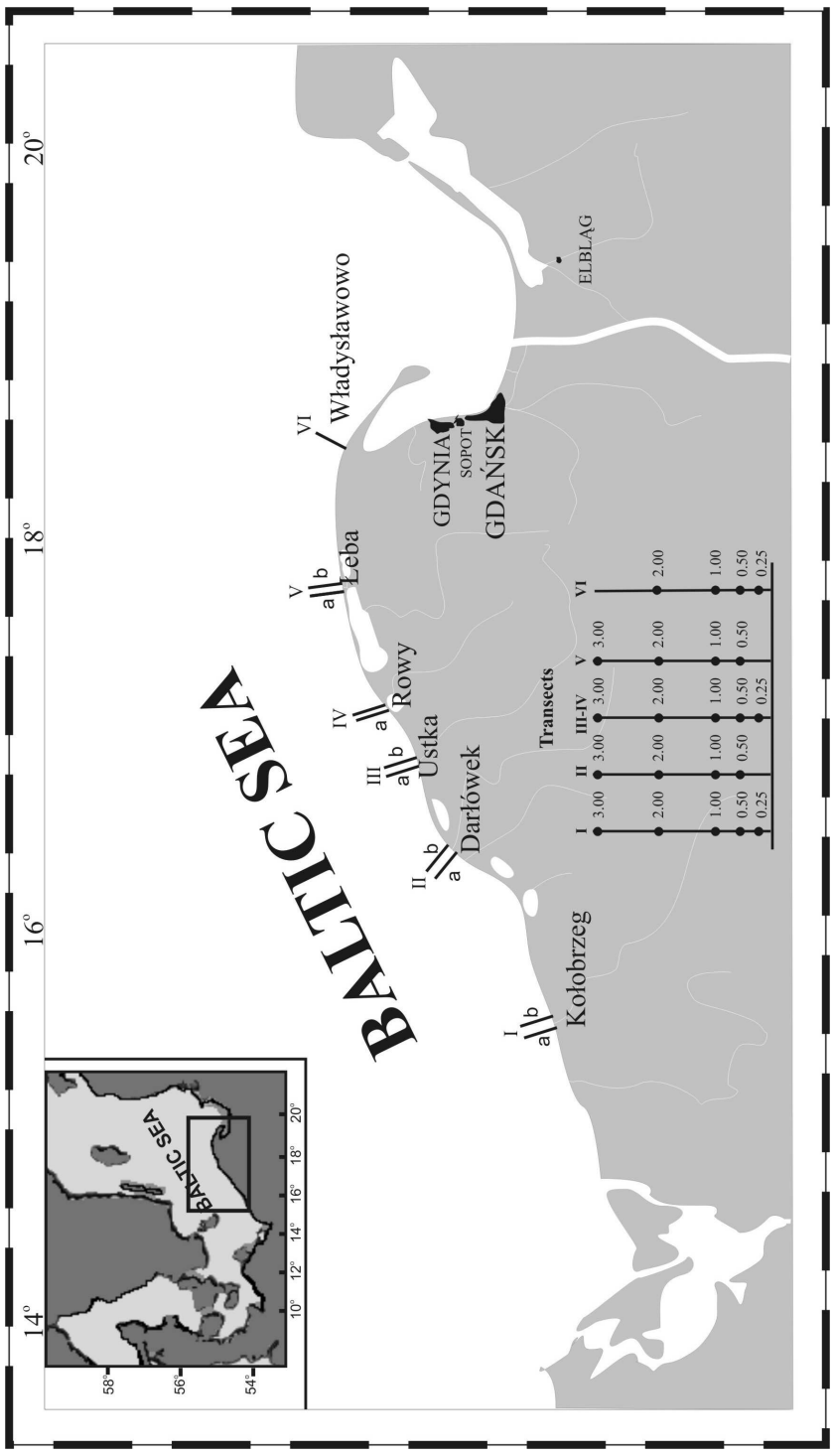

Fig. 1. Location of sampling stations

the highest mean frequency (72%) was typical of flagellates, commonly found in the guts of small (5-7.9 mm) (F = 76%), medium-sized (8-12 mm) (F = 76%), and large (longer than 12 mm) (F = 64%) *P. elegans*. The data show the lack of any correlation between the polychaete size and flagellate frequency, which was also the case with the remaining microalgal taxa, much less commonly observed in the gat content: chlorophytes occurred at a mean frequency of 26%, 22% being the mean frequency of bacillariophytes.
The mean frequency of oligochaete fragments and setae in *P. elegans* guts was 67%. The oligochaete frequency in guts was clearly correlated with *P. elegans* size (Tab. 1) and averaged 40, 69, and 84% in small, medium-sized, and large polychaetes, respectively.

DISCUSSION

In principle, tube-building polychaetes obtain food (bioseston) from the near-bottom water layer by a kind of filtration. Anterior appendages of those polychaetes (antennulae, palps, cirri) are most often transformed into a plume which, by means of cilia, intercepts bacteria, phyto-, and zooplankton and other food particles suspended in the water. *P. elegans* is most often classified as a suspension feeder – deposit feeder, similarly to, e.g., the bivalves. *Macoma balthica, Mya arenaria* and other benthic organisms.
The presence of oligochaete remains in the guts of more than a half (67%) of the *P. elegans* individuals examined, collected from the Polish coastal zone, may be taken as evidence that the species obtains its food primarily by predation. The two thin, mobile palps on the head can be suspected of serving to capture a prey (for instance, oligochaetes) rather than aiding in interception of suspended particles. According to some authors, *P. elegans* may feed on diatoms (Kube et al. 1996). The microalgae found in the guts of *P. elegans* could have originated from the microphytobenthos growing on sand grains, found in almost all *P. elegans* regardless of size. Most certainly, sand grains found in *P. elegans* guts were not filtered out of the water column. They were most probably swallowed to clean the tube and to make it permeable, which is important for respiration. Microalgae, similarly to detritus in the *P. elegans* guts, could have also originated in the intestines of oligochaetes. The Oligochaeta inhabiting the area of study are representatives of detritivorous species; *Tubifex costatus, Peloscolex benedeni, Phallodrilus monospermathecus,* the Enchytraeidae, and *Stylodrilus* sp. (Bartelik unpubl.). The oligochaete abundance in the area of study ranged from 0 to 2340 inds. m^{-2}. No direct correlation between the abundances of oligochaetes and *P. elegans* in the coastal zone of Central Pomerania was found (Piesik et al. unpubl.). This is indicative of the fact that oligochaetes are preyed upon by other zoobenthic species as well. As shown by Aarnio et al. (1996), oligochaetes are included in the diet of *Platichthys flesus* up to 50 mm long (F = 26-53%) in the Aland archipelago waters. According to the authors quoted, *P. elegans* is avoided by juvenile turbot *(Scophthalmus maximus), P. elegans* frequency in the guts of juvenile flounder (*Platichthys flesus*) was as low as up to 1%. Studies on the

food of juvenile *P. flesus* (21 mm and less) in the Polish coastal zone (Gulf of Gdańsk, Central Pomerania) failed to show oligochaetes in the diet, while polychaetes (without identifying *P. elegans)* accounted for up to 30% of the food (Krzykawski and Załachowski 1983, Malorny 1992).

The microalgae, and particularly diatoms, can be ingested by oligochaetes together with faecal pellets and agglutinates produced and excreted by suspension feeders (e.g., the bivalves *Mytilus, Macoma, Mya,* and *Cardium* or the crustaceans *Balanus, Corophium,* and *Bathyporeia*) during bio sedimentation. Due to light regime in the Polish coastal zone, microphytobenthos can develop on sand grains and provide a potential food resource for oligochaetes down to about 11 m depth only. The microalgae could have originated from sedimented phytoplankton, ingested with silt particles by oligochaetes. This problem requires further study.

Kube and Powilleit (1997) presume that a reduction in *P. elegans* density offshore in the Pomeranian Bay is primarily associated with a decrease in the phytoplankton concentration with increasing distance from the shore. Those authors suspected that the maximum concentrations of *P. elegans* were related to a possibility of enriching the polychaete diet with faecal pellets and agglutinates produced in quantities by the bivalves abundant in that zone, e.g., *Mytilus edulis.* In our opinion, the reduction in *P. elegans* abundance in the Pomeranian Bay with increasing distance from the shore could be, similarly to other coastal Baltic areas, related to the reduced density of oligochaetes (the basic food item of *P. elegans).* As shown by Warzocha (1994), the highest oligochaete abundances in the southern Baltic occur within the depth range of 10-20 m, similarly to the abundances of *P. elegans* (Żmudziński 1982). The bivalves (*Mytilus, Mya, Cardium*) and the "filtering" crustaceans (*Corophium, Bathyporeia*) that form faecal pellets and agglutinates (pseudo faeces) that may be used as an additional food for oligochaetes, occur at the maximum densities within the depth range of 10-20 m as well (Warzocha 1994). It may be then contended that the reduction in phytoplankton concentration with increasing distance from the shore (nutrient depletion) affects the abundance of *P. elegans* in an indirect manner, the intermediate links in the chain being suspension feeders (bivalves and crustaceans) that transfer the bioseston from the water column to the sediment (bio sedimentation). The sedimented bioseston, ingested by the Baltic oligochaetes (typical detritivores) and transformed into their biomass is then only utilised by *P. elegans.*

Analysis of detailed data reported by various authors on macrozoobenthos producing patches of abundance and the adjacent bottom areas scarcely populated by the benthic animals (non-patch) or the bottom overgrown with macrophytes and that lacking them demonstrates the presence of interesting interactions between seafloor dwellers (Bolam and Fernandes 2002, 2003, Norkko and Bonsdorff 1996). Noteworthy is the fact of a quantitative; paucity of oligochaetes, accompanying patches of high abundance of *P. elegans,* and vice versa. This is conducive to concluding that the oligochaete population density in the coastal areas may be, at least in part, controlled by *P. elegans.* The results obtained and quantitative data on the *P. elegans* – oligochaete correlations, reported by various authors allow to contend that *P. elegans* is not a typical suspension/deposit feeder and should be classified as an omnivore in-

stead. The problem merits further studies to gain more insight into the place of *P. elegans* in the food web of marine ecosystems.

CONCLUSIONS

Analysis of gut contents of *Pygospio elegans* in the Polish coastal zone of the Baltic Sea (Central Pomerania) showed oligochaetes to be the basic food resource of the polychaetes in question. The oligochaete frequency in the gut content of *P. elegans* increased with the polychaete size from 30% in the 5 mm long *P. elegans* to 100% in the 16 mm long individuals. The predatory behaviour of *P. elegans* demonstrates that the polychaete should be assigned to omnivores rather than to suspension/deposit feeders.

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CZY WIELOSZCZET *PYGOSPIO ELEGANS* CLAPAREDE (SPIONIDAE) NAPRAWDĘ ŻYWI SIĘ MATERIAŁEM ZGROMADZONYM W OSADACH?

Streszczenie

Analizowano zawartość przewodu pokarmowego *Pygospio elegans* Claparede (Spionidae) żyjącego w polskiej strefie przybrzeżnej Bałtyku. Jelita *P. elegans* zawierały prawie wyłącznie (89-100%) piasek i szczątki organiczne. Microalgae (Bacillariophyta, Chlorophyta, Flagelant) wystąpiły w jelitach *P. elegans* w ilościach od 8 do 100%. Godne uwagi było odkrycie, wewnątrz zawartości jelit *P. elegans*, resztek oligochaeta, co wskazuje na drapieżne zachowania tego wieloszczeta. Udział skąposzczetów w diecie *P. elegans* był w niektórych badanych rejonach znaczny (33-100%). Dlatego też *P. elegans* powinien zostać zaliczony do zwierząt wszystkożernych, a nie, jak dotychczas, do filtratorów eliminujących bioseston.