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A survey of nematode fauna associated with some marine algae in Newfoundland

Paulette Reynolds and Jean R. Finney-Crawley

Department of Biology, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1B 3X9.

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Summary. Nematodes associated with 19 genera of marine algae on the Avalon Peninsula of Newfoundland were studied. Forty-seven species of nematodes in 31 genera were identified. Most nematodes were found on *Lithothamnium glaciale, Fucus* spp. I & II, *Pilayella littoralis* and *Dictyosiphon foeniculaceus*. Other algae had fewer nematodes, while none were found on five species of brown algae. Each algal growth form was dominated by different nematode species. The calcareous, filamentous and shrub-like algae had the greatest whereas the tuft-like algae and those with prominent blades had the smallest species diversity, respectively. Epigrowth feeders and predators were the dominant nematode feeding types found on all algal groups. The difference in algal structure provided varying degrees of shelter, food and refuge from predators and therefore contributed to patterns of nematode abundance and diversity.
Key words: marine algae, nematodes, diversity, abundance.

Around the coastal region of Newfoundland there are approximately 300 species of marine algae (R. Hooper, Canada, pers. comm.). Although there are a variety of different modes of growth, many different species of algae are similar in structure and therefore can be grouped based on their general form. Differences in the structural characteristics of algae result in varying degrees of shelter and food abundance which consequently determine patterns of nematode abundance and nematode feeding types (Wieser, 1952; Moore, 1971).

Much of the information on algal-associated nematodes is derived from the work of Wieser (1952, 1959) at Plymouth, England and of Warwick (1977) on the Isles of Scilly. Their work identified the major nematode genera found on different algal types. Other studies have focused on particular algae such as the kelp *Macrocystis integrifolia* in Barkley Sound, British Columbia (Trotter & Webster, 1983). Moore (1971) studied the holdfasts of *Laminaria hyperborea* in Britain and Mukai (1971) the thalli of *Sargassum serratifolium* in Northern Japan. Little information is available of the nematodes associated with marine algae in the North American area and no information has been documented in Newfoundland. In this study the algae in Bay Bulls, Portugal Cove and St. Phillips on the Avalon Peninsula of Newfoundland were collected in order to identify the composition of the associated nematode fauna.

MATERIALS AND METHODS

Algal samples were collected from Bay Bulls, Portugal Cove and St. Phillips, Newfoundland between June and September, 1996 (Fig. 1). The sampling area at Bay Bulls was an exposed rocky shore. Algal samples were collected at various depths ranging from high tide pools to a depth of 15 m. At Portugal Cove, the sampling area was located North of the ferry breakwater. Here, algae were collected within the depth range 1 to 13 m. At 1 m, samples were removed from a cobble-stone bottom located in the surf zone. At other depths the bottom was either sand or rhodolith covered. At St. Phillips, sampling was carried out on the rocky shore at low tide (0 m). A summary of the collection data is presented in Table 1.

Algae were transported from the collection sites to the laboratory in plastic bags containing seawater. In the laboratory, algae were shaken in the seawater and the water was transferred to Petri dishes and examined for nematodes. The algae were also examined under a stereo microscope and any nematodes remaining attached were removed. Some algal species were chopped-up using a blender and checked for intracellular parasites. Nematodes were heat-killed and then transferred to a formalin-seawater solution (F.A. 4:1) with several drops of Rose Bengal. Subsequently they were processed by the Seinhorst method (1959) and mounted in glycerine.

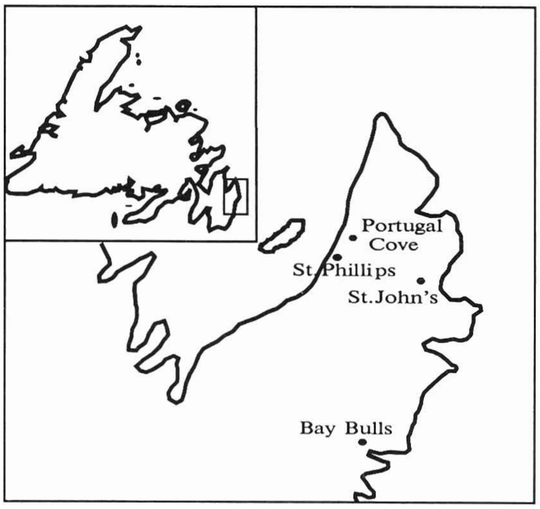

Fig. 1. Location of three sampling sites on the Avalon Peninsula, Newfoundland, from which algae were collected and examined for the presence of nematodes.

All nematodes were identified to genus, and many to species, using the identification keys by Platt and Warwick (1983, 1988), Tarjan (1980) and Allen and Noffsinger (1978). Nematodes were also sorted into four feeding types according to Wieser (1959).

With duplicate algal samples, the total numbers of nematodes were averaged. The number of nematodes on individual algal species were pooled for the purpose of presenting percentage abundances of nematode species and feeding types on the five algal growth-forms. Percentage abundance of a nematode species was calculated as the total number of specimens of that species divided by the total number of nematodes in the sample, multiplied by 100. Percentage abundance of a nematode feeding type was calculated in a similar manner using the total number of nematodes belonging to a particular feeding type as the numerator.

RESULTS

Twenty-two algal species were collected, identified and categorized by growth form. There were 18 genera of algae, each represented by a single species, and 4 species of *Fucus*. Five growth forms were represented in the collection: calcareous, filamentous, shrub-like, tuft-like and algae with prominent blades. The filamentous and prominent blade algae groups were each represented by 5 species, whereas the calcareous, tuft-like and shrub-like growth forms were represented by 1, 4 and 7 species.

A total of 3041 nematodes representing 47 species in 31 genera were identified. In Table 2 the nematode species present on each algal species are listed. The total number of nematode species on each algal species varied considerably, from 1 on *Ulva lactuca* to 28 on *Lithothamnium glaciale*. When algal growth-forms were compared, calcareous algae had the greatest nematode species diversity (28), filamentous and shrub-like algae had 25 and 23 nematode species, respectively, and those with prominent blades and tuft-like algae had fewer (9 and 8 species, respectively).

Figure 2 shows the percentage abundance of individual nematode species on each algal growth form. On calcareous algae, the most abundant species were *Enoplus communis* (24.6%), *Anticoma acuminata* (16.8%), *Monoposthia* sp. (16.1%), *Desmodora sanguinea* (12.7%) and *Monoposthia mirabilis* (11.0%).

On filamentous algae, the most abundant species were *Chromadorina germanica* (38.4%), *Theristus acer* (13.1%), *Steineridora adriatica* (12.2%), *Enoplus paralittoralis* (10.6%) and *Prochromadorella ditlevseni* (9.6%). *Chromadorina germanica* and *T. acer* were not found on calcareous algae.

On algae with prominent blades the most abundant species were *Enoplus paralittoralis* (23.5%), *Enoplus communis* (20.6%), *Chromadorina germanica* (20.6%), *Euchromodora vulgaris* (11.8%) and *Pontonema vulgare* (11.8%). *Euchromodora vulgaris* and *P. vulgare* occurred only infrequently on other algal growth forms.

On shrub-like and tuft-like algae the most abundant species was *Chromadorina germanica* (86.1% and 43.9%, respectively). However, *Prochromadora* sp. (28.1%) and *Steineridora adriatica* (15.8%) were also found in relatively large numbers on the tuft-like algae.

Figure 3 shows the percentage abundance of the nematode feeding types on each algal growth-form. The nematode species present on each algal growth form and their corresponding feeding types are listed in Table 3. Calcareous algae (Fig. 3) had an abundance of epigrowth feeders, predators and selective deposit feeders (43.2%, 35.7% and 19.9%). Very few (0.7%) non-selective deposit feeders were present.

Epigrowth feeders (57.5%) and predators (27.7%) were relatively abundant on filamentous algae, with selective and non-selective deposit feeders present in much lower abundances (1.1% and 13.8%, respectively). Prominent blade algae predators (58.8%) and epigrowth feeders (35.3%) were relatively abundant whereas selective and non-selective deposit feeders were much less abundant (2.9% each). Shrub-like algae had mainly epigrowth feeders (94.0%) present with selective (2.4%) and non-selective deposit feeders (2.0%) much less frequent and predators being present in the smallest abundance (1.8%). Tuft-like algae had principally epigrowth feeders (49.1%) and predators (43.9%) present with selective and non-se-

Table 1. The location, depth and growth form for algal samples collected at Bay Bulls, Portugal Cove and St. Phillips, Newfoundland.

Algae	Key	Site	Date	Depth	Growth form
Lithothamnium glaciale	A	Portugal Cove	3-July	13 m	calcareous
Spongamorpha aeruginosa	B	Bay Bulls	11-June	0 m	filamentous
Dictyosiphon foeniculaceus	C	Portugal Cove	3-July	1 m	filamentous
Pilayella littoralis	D	Portugal Cove	5-August	0 m	filamentous
Cladophora rupestris	E	St. Phillips	19-August	0 m	filamentous
Bonnemaisonia hamifera	F	St. Phillips	19-August	0 m	filamentous
Ptilota serrata	G	Bay Bulls	11-June	15 m	shrub-like
Fucus spp. I & II	H & I	Portugal Cove	5-August	0 m	shrub-like
Fucus vesiculosis	J	St. Phillips	5-August	0 m	shrub-like
Ascophyllum nodosum	K	St. Phillips	5-August	0 m	shrub-like
Fucus spp. III	L	St. Phillips	5-August	0 m	shrub-like
Chondrus crispus	M	St. Phillips	19-August	0 m	shrub-like
Agarum cribrosum	N	Bay Bulls	11-June	15 m	bladed
Alaria esculenta	O	Bay Bulls	11-Juny	2 m	bladed
Saccorhiza dermatobea	P	Portugal Cove	3-July	1 m	bladed
Ulva lactuca	Q	Portugal Cove	19-August	0 m	bladed
Palmaria palmata	R	St. Phillips	19-August	0 m	bladed
Melanosiphon intestinalis	S	Bay Bulls	11-June	H.tide pool	tuft-like
Acrothrix novae-angliae	T	Portugal Cove	12-September	10 m	tuft-like
Scytosiphon lomentaria	U	St. Phillips	5-August	0 m	tuft-like
Chaetamorpha linum	V	St. Phillips	19-August	0 m	tuft-like

lective deposit feeders being much less but equally abundant (3.5%).

DISCUSSION

The diversity of growth-form in marine algae inhabiting the seashore ranges from a filament of a few cells joined end-to-end to more complex leaf-like structures or encrustations found on rock surfaces (South, 1981). Algae undergo seasonal changes in growth and population density (Boney, 1966). Consequently, over the course of the year, not all algae are present at the same time and different species predominate at different times. Nineteen genera of algae were investigated for the presence of nematodes in this study. The fucoid algae such as *Fucus* and *Ascophyllum* were abundant along the shore at St. Phillips and Portugal Cove and together with *Ptilota serrata, Lithothamnium glaciale, Saccorhiza dermatobea* and *Agarum cribrosum* are perennial and occur for several years (South & Hooper, 1980). In addition to the perennial algae, *Pilayella littoralis, Bonnemaisonia hamifera, Ulva lactuca, Palmaria palmata, Dictyosiphon foeniculaceus, Alaria esculenta, Melanosiphon intestinalis* and *Scytosiphon lomentaria* also are commonly found throughout the year (South & Hooper, 1980). *Spongamorpha aeruginosa, Cladophora rupestris, Chondrus crispus, Acrothrix novae-angliae* and *Chaetamorpha linum* are usually found during the spring and summer months (South & Hooper, 1980). The species of algae collected in this study were not present together at all sites.

The species composition of nematode faunas associated with marine algae have been documented (Wieser, 1952, 1959; Moore, 1971; Warwick, 1977) and these studies showed that many of the same nematode genera were repeatedly dominant in the algae examined. The most abundant genera found in the present study are typical of those found in previous studies, with the exception of the genera *Desmodora, Steineridora* and *Prochromadora*. These genera were present on algae in the previous studies, but were not dominant.

A representative of the nematode genus *Draconema*, a non-selective deposit feeder, was found only on *Lithothamnium glaciale* and *Ptilota serrata* in relatively low numbers. The presence of *Draconema* was recorded by Moore (1971) in his study of the holdfasts of the kelp *Laminaria hyperborea* in north-east Britain. However, as in this study the abundance of this nematode was low (0.1%).

In the present study, nematodes were found only on the surface of the algae. Moore (1971) and Wieser (1959) found nematodes also associated with the holdfasts of various species of algae. In the present study, holdfasts of *Agarum cribrosum, Alaria esculenta* and *Saccorhiza dermatobea* were examined but nematodes were not found.

Table 2. Nematode species present on each algal specimen collected from Bay Bulls, Portugal Cove and St. Phillips, Newfoundland.

N	Nematode species	A*	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	*Anticoma acuminata*	X			X	X	X	X			X										X		
2	*Anticoma* sp.							X											X				
3	*Araeolaimus* sp.							X															
4	*Bathylaimus* sp.	X																					
5	*Choanolaimus* sp.	X																					
6	*Chromadorina germanica*				X	X	X	X	X	X	X		X	X					X				X
7	*Chromadorina tenuis*				X		X	X													X		
8	*Crenopharynx* sp.							X															
9	*Desmodora communis*		X				X	X			X								X				
10	*Desmodora sanguinea*	X						X	X														
11	*Desmoscolex* sp.	X																					
12	*Diplopeltis* sp.	X																					
13	*Draconema* sp.	X						X															
14	*Enoplus communis*	X					X	X											X				
15	*Enoplus paralittoralis*	X					X	X						X					X				
16	*Enoplus* sp.							X															
17	*Epsilonema* sp.	X																					
18	*Euchromadora* sp. I	X			X	X	X	X		X											X		X
19	*Euchromadora* sp. II							X															
20	*Euchromadora vulgaris*				X			X											X				
21	*Eurystomina* sp.	X																					
22	*Halalaimus gracilis*	X																					
23	*Halichoanolaimus robustus*	X					X																
24	*Hypodontolaimus* sp.		X																				
25	*Leptosomatum elongatum*	X																					
26	*Monhystera* sp.							X															
27	*Monoposthia mirabilis*	X	X	X																			
28	*Monoposthia* sp.	X																					
29	*Notochaetosoma* sp.	X					X	X															
30	*Oncholaimus attentuatus*		X				X																
31	*Oncholaimus oxyuris*		X																				
32	*Oncholaimus* sp. I		X																				
33	*Oncholaimus* sp. II		X																				
34	*Oxystomina* sp.	X																					
35	*Paracanthonchus caecus*	X																					
36	*Phanoderma* sp. I	X					X	X															
37	*Phanoderma* sp. II							X															
38	*Pontonema simile*	X																					
39	*Pontonema vulgare*	X			X		X	X											X				
40	*Prochromadora* sp.		X			X																X	
41	*Prochromadorella ditlevseni*						X																
42	*Prochromadorella* sp.	X																					
43	*Steineridora adriatica*	X	X	X	X		X	X		X								X			X		X
44	*Theristus acer*		X	X	X			X	X	X									X		X		
45	*Theristus* sp.	X			X			X															X
46	*Viscosia glabra*	X	X				X																
47	*Viscosia* sp.	X	X				X																

Key to algae as on Table 1: A - calcareous; B-F -filamentous; G-M - shrub-like; N-R - prominent blades; S-V - tuft-like.

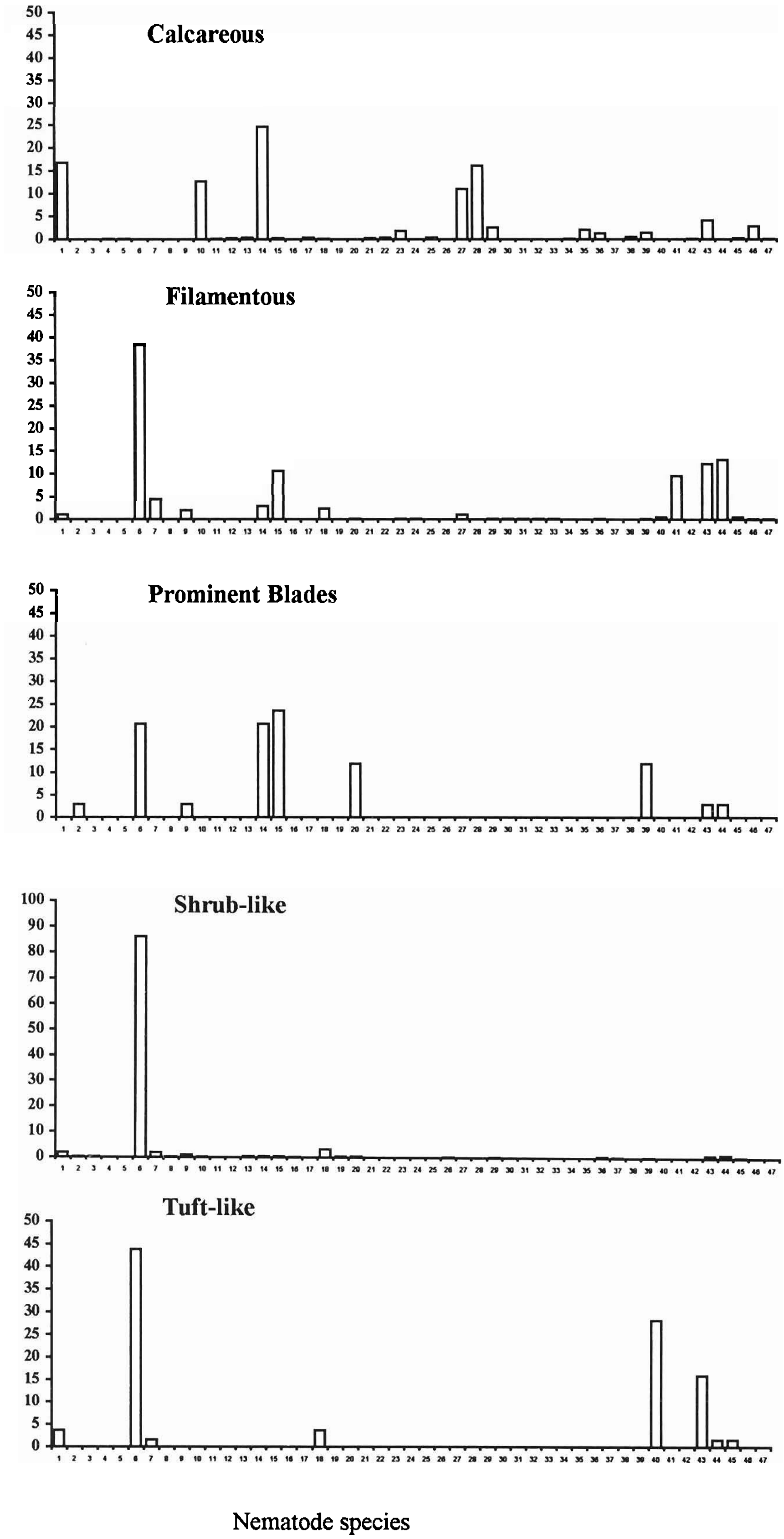

Fig. 2. Relative abundance of nematode species found on algal growth forms at Bay Bulls, Portugal Cove and St. Phillips, Newfoundland. Nematode species see in Table 2.

Table 3. Nematode species and their corresponding feeding types associated with algal growth forms collected from Bay Bulls, Portugal Cove and St. Phillips, Newfoundland.

Algal Growth Form	Feeding types			
	1A	1B	2A	2B
Calcareous	*Anticoma acuminata* *Halalaimus gracilis* *Leptosomatum elongatum* *Notochaetosoma* sp. *Oxystomina* sp.	*Bathylaimus* sp. *Desmoscolex* sp. *Diplopeltis* sp. *Draconema* sp. *Epsilonema* sp. *Theristus* sp.	*Desmodora sanguinea* *Euchromadora* sp. I *Monoposthia mirabilis* *Monoposthia* sp. *Paracanthonchus caecus* *Phanoderma* sp. I *Prochromadorella* sp.	*Choanolaimus* sp. *Enoplus communis* *Enoplus paralittoralis* *Eurystomina* sp. *Halichoanolaimus robustus* *Pontonema simile* *Pontonema vulgare* *Steineridora adriatica* *Viscosia glabra* *Viscosia* sp.
Filamentous	*Anticoma acuminata* *Notochaetosoma* sp.	*Theristus acer* *Theristus* sp.	*Chromadorina germanica* *Chromadorina tenuis* *Desmodora communis* *Euchromadora* sp. I *Euchromadora vulgaris* *Hypodontolaimus* sp. *Monoposthia mirabilis* *Phanoderma* sp. I *Prochromadorella ditlevseni*	*Enoplus communis* *Enoplus paralittoralis* *Halichoanolaimus robustus* *Oncholaimus attenuatus* *Oncholaimus oxyuris* *Oncholaimus* sp. I & II *Pontonema vulgare* *Prochromadora* sp. *Steineridora adriatica* *Viscosia glabra* *Viscosia* sp.
Prominent blade	Anticoma sp.	*Theristus acer*	*Chromadorina germanica* *Desmodora communis* *Euchromadora vulgaris*	*Enoplus communis* *Enoplus paralittoralis* *Pontonema vulgare* *Steineridora adriatica*
Shrub-like	*Anticoma acuminata* *Anticoma* sp. *Araeolaimus* sp. *Crenopharynx* sp. *Notochaetosoma* sp.	*Draconema* sp. *Monhystera* sp. *Theristus acer* *Theristus* sp.	*Chromadorina germanica* *Chromadorina tenuis* *Desmodora communis* *Desmodora sanguinea* *Euchromadora* sp. I & II *Euchromadora vulgaris* *Phanoderma* sp. I & II	*Enoplus communis* *Enoplus paralittoralis* *Enoplus* sp. *Pontonema vulgare* *Steineridora adriatica*
Tuft-like	*Anticoma acuminata*	*Theristus acer* *Theristus* sp.	*Chromadorina germanica* *Chromadorina tenuis* *Euchromadora* sp. I	*Prochromadora* sp. *Steineridora adriatica*

Although the prime focus of this study was to survey nematode populations associated with marine algae, the results can be interpreted to provide insight into possible causes of patterns of nematode abundance and composition. There is a correlation between the morphology of seaweed and the composition of the associated nematode fauna, with algal shape, consistency and degree of branching being important factors affecting nematode composition and abundance (Wieser, 1952, 1959; Moore, 1971; Warwick, 1977). Complex algal growth forms provide more surfaces on which nematodes can live, feed and find refuge from predators (Hicks, 1985). Differences in the shape and structure of the algae may account for the variation in the total number of nematodes present on each alga. Density values differed between algal species and cannot be compared based on the variability of the algal structure (Wieser, 1959). However, increasingly complex algal structure, together with the accumulation of sediments and detritus as a food resource, increases the attractiveness of the algae as a suitable habitat. According to Moore (1971), the amount of sediment trapped and held amongst the fronds is a function of algal complexity.

The results of this study showed that nematode species diversity varies among algal growth forms. The largest number of species was found on calcareous algae, represented by *Lithothamnium glaciale*, which is a hard coralline algae of a rock-like consistency (Bold & Wynne, 1985). It has a system of crevices and depressions that provide shelter for a diversity of organisms, including nematodes and their potential food species. Also, this type of alga can easily trap sediment and detritus within the crevices and thus provide a food resource for deposit-feeding nematodes. It has been demonstrated (Wieser, 1952, 1959), that an increase in the amount of detritus on algae is correlated with an increase in the number of nematodes. Mukai (1971) showed that nematodes

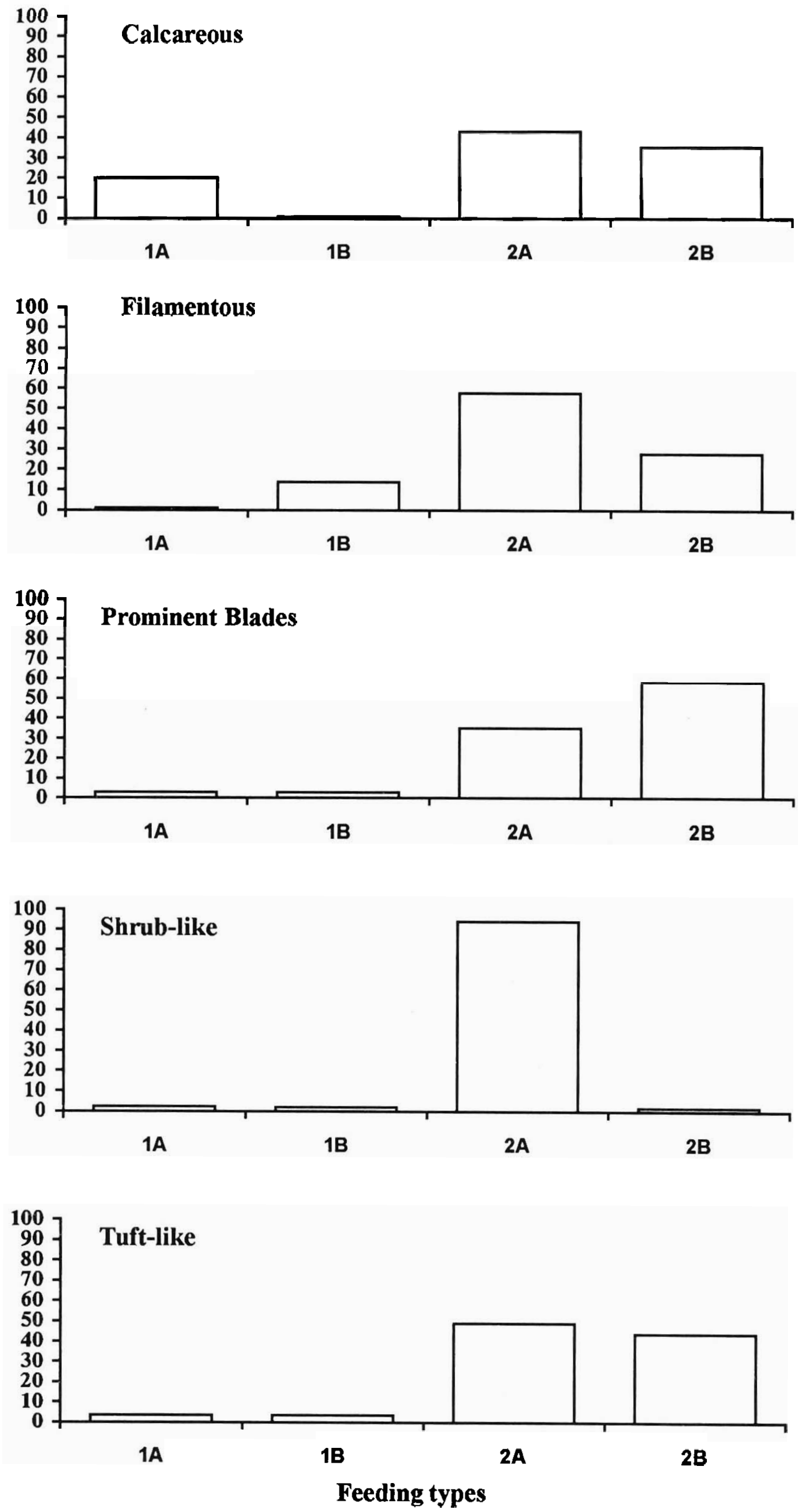

Fig. 3. Relative abundance of nematode feeding types found on each algal growth form collected from Bay Bulls, Portugal Cove and St. Phillips, Newfoundland.

were most abundant on *Sargassum serratifolium* when there was an increase in detritus resulting from the decomposition of *Sargassum*. Also, Wing and Clendenning (1971) showed that on totally encrusted blades of *Macrocystis pyrifera* the nematode population was much greater than on clean growing blades.

Shrub-like algae occur in bushy clumps and usually have small flattened blades with various branching patterns, whereas the filamentous algae consists of tangled, delicately branched filaments (Bold & Wynne, 1985). This provides shelter and refuge from predators as the nematodes can coil around branches or filaments, enabling species to maintain their position on the algae when subjected to wave action (Hicks, 1985). Tuft-like algae and algae with prominent blades had a relatively smaller number of nematode species present. The tuft-like algae in this study were unbranched filaments attached together at the base and loose at the top (Bold & Wynne, 1985). The smaller numbers of nematodes found on this algae group may be the result of its unbranched nature which makes it difficult for nematodes to remain attached. Flattened leaf-like blades provide a surface from which nematodes can feed, but offer little protection from predators or from tidal exposure (Hicks, 1985).

Seasonal variation is another important factor controlling nematode faunal composition and abundance. Studies by Warwick (1977) and Mukai (1971) showed pronounced seasonal changes in the numbers of nematodes associated with algae. These changes tended to be the result of seasonal availability of food (Warwick, 1977) and the different growth and decay cycles which algae undergo (Mukai, 1971). In the present study, samples were collected only in summer, therefore seasonal changes in nematode composition could not be determined.

Epigrowth feeders and predators were the most abundant nematode feeding types within all algal growth-forms. This is consistent with the observations of Wieser (1959) and Moore (1971). This indicates that microorganisms such as diatoms, bacteria, blue-green algae, and animal prey are the most important food source on the algae for nematodes. Epigrowth feeders have small teeth that can pierce cells enabling them to suck out the contents as well as scrape organisms off the surfaces of the algae. Predators have large teeth that allow them to seize their prey (Platt & Warwick, 1988). Warwick (1977) found that in spring and early summer carnivore-omnivores or deposit feeders dominated the fauna. On calcareous algae, which retain a lot of deposits, there was also an abundance of selective deposit feeders. However, the low abundance of deposit feeders in all other groups of algae suggests a scarcity of suitable deposits (Moore, 1971).

On the shrub-like algae, 94% of the nematode population were epigrowth feeders, mainly due to the abundance of a single species, *Chromadorina germanica*. Tietjen and Lee (1977) found that *Chromadorina germanica* reached its highest abundance during the early and mid-summer months, which is the period when the algae in the present study were collected. These authors suggested that the increase in the epigrowth feeder *C. germanica* during the summer months corresponded with an increase in epiflora such as diatoms which are a major food source for this species.

A microbial film is associated with the surface of algae. Trotter and Webster (1984) isolated several species of diatoms and bacteria from the blades of *Macrocystis integrifolia*. These authors showed that different species of nematodes had a preference for various diatoms or bacteria, therefore the composition of the microbial film may help determine the nematode species found on the algae. Also, Jensen (1984) suggested that a preference for a particular alga by certain predatory nematodes may result from their feeding on other meiofauna that are restricted to the algal species.

Nematodes were absent on 5 species of algae, all of which were from Division Phaeophyta, the brown algae. Several reasons may be suggested for this observation. With the exclusion of *Melanosiphon intestinalis*, all these algae have a large, prominent blade that may be less suitable for the attachment of nematodes. *Melanosiphon intestinalis* was collected from a high-tide pool and desiccation during low tide may make it a less attractive habitat for nematodes. Also, it is well documented that brown algae are capable of producing compounds such as polyphenols, tannins and terpenes that deter feeding by herbivores (Steinberg, 1984; Ragan & Glombitza, 1986; Hay & Fenical, 1992). These compounds may directly affect the nematodes or deter other organisms which nematodes feed upon.

Many factors contribute to variations in composition and abundance of nematodes on marine algae and it seems unlikely that any single factor is dominant. The primary emphasis of this study was descriptive as no information had previously been recorded on the algal-associated nematodes present in Newfoundland. Further studies should focus on elucidating those factors which contribute most to nematode abundance and diversity.

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REFERENCES

Allen, M.W. & Noffsinger, E.M. 1978. *A Revision of the Marine Nematodes of the Superfamily Draconematoidea* Filipjev, 1918 (Nematoda: Draconematoidea). University of California Press, Berkeley, Los Angeles. London. 133 pp.

Boney, A.D. 1966. *A Biology of Marine Algae.* Hutchinson Educational Ltd. 216 pp.

Bold, H.C. & Wynne, M.J. 1985. *Introduction to the Algae.* Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 720 pp.

Hay, M.E. & Fenical, W. 1992. Chemical mediation of seaweed-herbivore interactions. In: *Plant-Animal Interactions in the Marine Benthos.* The Systematics Association Special Volume No. 46. (D.M. John, S.J. Hawkins & J.H. Price. Eds.), pp. 319-333. Clarendon Press, Oxford.

Hicks, G.R.F. 1985. Meiofauna associated with rocky shore algae. In: *The Ecology of Rocky Coasts.* (P.G. Moore & R. Seed. Eds.), pp. 36-56. Hodder and Stoughton, London.

Jensen, P. 1984. Ecology of benthic and epiphytic nematodes in brackish waters. *Hydrobiologia* 108: 201-217.

Moore, P.G. 1971. The nematode fauna associated with holdfasts of kelp (*Laminaria hyperborea*) in north-east Britain. *Journal of the Marine Biological Association U.K.* 51: 589-604.

Mukai, H. 1971. The phytal animals on the thalli of *Sargassum serratifolium* in the *Sargassum* region, with reference to their seasonal fluctuations. *Marine Biology* 8: 170-182.

Platt, H.M. & Warwick, R.M. 1983. *Free-living Marine Nematodes.* Part I British Enoplids. Cambridge University Press. London. 488 pp.

Platt, H.M. & Warwick, R.M. 1988. *Free-living Marine Nematodes.* Part II British Chromadorids. E.J. Brill/ Dr. W. Backhuys. Leiden. 502 pp.

Ragan, M.A. & Glombitza, K.W. 1986. Phlorotannis, brown algal polyphenols. In: *Progress in Phycological Research*, Vol. 4 (F.E. Round & D.J. Chapman, Eds.) pp. 129-241. Biopress Ltd., Bristol.

Seinhorst, J.W. 1959. A rapid method for the transfer of nematodes from fixative to anhydrous glycerine. *Nematologica* 4: 67-69.

South, G.R. 1981. *A Guide to the Common Seaweeds of Atlantic Canada.* Breakwater. 57 pp.

South, G.R. & Hooper, R.G. 1980. *A Catalogue and Atlas of the Benthic Marine Alga of the Island of Newfoundland.* Memorial University of Newfoundland Occasional Papers in Biology. Number 3. 136 pp.

Steinberg, P.D. 1984. Algal chemical defense against herbivores: allocation of phenolic compounds in the kelp *Alaria marginata. Science* 223: 405-406.

Tarjan, A.C. 1980. *An Illustrated Guide to the Marine Nematodes.* Institute of Food and Agricultural Sciences. University of Florida. 135 pp.

Tietjen, J.H. & Lee, J.J. 1977. Life histories of marine nematodes: influences of temperature and salinity on the reproductive potential of *Chromadorina germanica.* Butschli. *Mikrofauna Meeresboden* 61: 263-270.

Trotter, D.B. & Webster, J.M. 1983. Distribution and abundance of marine nematodes on the kelp *Macrocystis integrifolia. Marine Biology* 78: 39-43.

Trotter, D.B. & Webster, J.M. 1984. Feeding preferences and seasonality of free-living marine nematodes inhabiting the kelp *Macrocystis integrifolia. Marine Ecology Progress Series* 14: 151-157.

Warwick, R.M. 1977. The structure and seasonal fluctuations of phytal marine nematode associations of the Isles of Scilly. In: *Biology of Benthic Organisms.* (B.F. Keegan, P. O'Ceidigh, & P.J.S. Boaden, Eds.). pp. 557-585. Proc. 11th. Europ. Mar. Biol. Symp. Pergamon Press, Oxford.

Wing, B.L. & Clendenning, K.A. 1971. Kelp surfaces and associated invertebrates. In: *The Biology of Giant Kelp Beds (Macrocystis) in California.* (W.J. North. Ed.) J. Cramer, Lehre. 600 pp.

Wieser, W. 1952. Investigations on the microfauna inhabiting seaweeds on the rocky coasts. IV. Studies on the vertical distribution of the fauna inhabiting seaweeds below the Plymouth laboratory. *Journal of the Marine Biology Association* 31: 145-174.

Wieser, W. 1959. *Free-living Marine Nematodes.* IV. General Part. Reports of the Lund University Chile Expedition. 1948-49, 34 pp.

Reynolds P, Finney-Crawley J. R. Изучение фауны нематод, ассоциированных с некоторыми морскими водорослями Ньюфаунленда.
Резюме. В Ньюфаундленде на полуострове Авалон проведено изучение нематод, встречающихся в ассоциациях с морскими водорослями 19-и родов. Всего было выявлено 47 видов (31 род) нематод. Наибольшее число нематод было обнаружено на *Lithothamnium glaciale*, двух видах *Ficus, Pilayella littoralis* и *Dictyosiphon foeniculaceus*. На других водорослях было обнаружено меньшее количество нематод, а на бурых водорослях нематоды вообще не были зарегистрированы. На каждой из ростовых стадий водорослей доминировали разные виды нематод. Обызвесткованные, нитевидные и кустистые водоросли имели наибольшее разнообразие нематофауны, тогда как водоросли, растущие в пучках, а также имеющие сильно выступающие пластинчатые части, имели наименьшее разнообразие нематофауны. Среди прочих нематод на водорослях доминировали формы, питающиеся обрастаниями, и хищники. Предполагается, что различия в морфологической структуре водорослей, обеспечивающие убежище и пищу для нематод, определяют особенности их разнообразия и распределения.