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THE NEMATODE COMMUNITY DISTRIBUTION IN TWO ESTUARIES OF THE ME KONG DELTA: CUNG HAU AND HAM LUONG, SOUTH VIETNAM

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ABSTRACT: The highest numbers of nematodes with a percentage ranging from 76.4% in Cung Hau to 77% in Ham Luong estuaries. There were 92 genera (71 genera in Ham Luong and 62 genera in Cung Hau) of nematodes recorded in both estuaries. The mean nematode densities varied between 90 ± 31 - 1524 ± 269 ind.10 cm² and 105 ± 79 - 1120 ± 534 ind.10 cm² in Ham Luong and Cung Hau estuary, respectively. The nematode communities were mainly composed of *Dichromadora, Daptonema*, *Oncholaimellus, Syringolaimus, Tripyloides*, *Parodontophora, Theristus* and *Halalaimus* belonging to several dominant families, such as, Oncholaimidae, Xyalidae, Chromadoridae, Oxystominidae, Axonolaimidae and Sphaerolaimidae. In both estuaries, nematode density decreased from inland towards the mouth before they increased again at the mouth stations.

Keywords: Biodiversity, estuary, meiofauna, nematode, Me Kong delta.

INTRODUCTION

The Me Kong river is one of the longest rivers in the world, beginning from Tibetan plateau and running through six countries into the Indo-China peninsula. The Me Kong river carries a lot of alluvium from upriver to the lower basin of the Me Kong river delta in South Vietnam. At the lower basin of the Me Kong delta, the habitat is characterized by mudflats and mangrove forest along the mouth of estuaries.

Ham Luong and Cung Hau estuaries are two branches of the Me Kong river in the southern Vietnam. They are the fourth and sixth estuary respectively from the first Cua Tieu estuary.

Estuary is also an important habitat for a large number and variety of organisms Day et al. (1989) [8]. The species composition and structure of the meiofaunal communities are different according to the specific characteristics of the different habitats: those organisms living in mud differ from meiofauna communities in sand: those in low salinity regions differ from those in high salinity. In general, primarily physical factors such as sediment grain size, temperature and salinity strongly effected on the species composition, abundance and density of the present meiofauna in estuaries [3, 36, 7, 1, 2].

The composition and distribution of estuarine meiobenthos has been investigated in different parts of the world from natural, pristine habitats as well as reforestation forests to anthropogenic stressed habitats. Characteristics of estuarine habitats such as mudflats or mangrove forests result in different composition of meiobenthos in different area. Differences in salinity and grain size of the sediments effects composition of meiofauna communities in their horizontal distributions [1, 2], whereas the bio-chemical characteristics are the main influential effect on the vertical distribution of meiofauna [10, 13, 16].

Up to now, records of free living nematodes species from estuaries and mangrove forest habitats in Vietnam provided by Doan Canh & Nguyen Vu Thanh (2000), Nguyen Dinh Tu (2004), Hoang et al. (2005), Quang et al. (2007) and Nguyen Dinh Tu (2009) [9, 20, 17, 27, 21]. According to Doan Canh & Nguyen Vu Thanh (2000) [9] 45 species belonging to 28 genera and 5 orders were recognized in Thi Vai river. In Can Gio mangrove forest, Quang et al. (2007) [28] found 80 genera of nematodes belonging to 24 families and Nguyen Dinh Tu, 2009 [21] recorded 115 species belonging to 25 families and 6 orders. Marine nematode species composition and distribution in the coastal area of central Vietnam are recorded by Nguyen Vu Thanh et al. (2002) [22], Nguyen Vu Thanh & Nguyen Dinh Tu (2003) [23], Pavlyuk et al.

(2008); Nguyen Vu Thanh, Gagarin, Nguyen Dinh Tu 2009 [24]; and Quang et al. (2010) [29].

This paper showed result of the studying composition and abundance of meiofaunal communities from Cung Hau estuary and Ham Luong estuary, with special focus on the nematode communities. The results of this study will illustrate the overall patterns in the species composition, density and diversity of meiofaunal communities in two estuaries Ham Luong and Cung Hau of Me Kong Delta in the Southern of Vietnam.

MATERIAL AND METHODS

Study area

The Ham Luong and the Cung Hau estuaries are respectively the fourth and the sixth estuary in the Me Kong river delta. Ham Luong estuary is located in the South of Ben Tre province and Cung Hau estuary is located in the North of Tra Vinh province. The geographic coordinates to coresspond sampling stations are presented in figure 1.

Sampling code	Samples coordinates	
	Latitude	Longitude
EHL.1	N 9°55'40.02"	E106°39'40.85"
EHL.2	N 9°59'0.31"	E106°33'55.53"
EHL.3	N 10° 03'11.2"	E106°26'52.5"
EHL.4	N 10° 6'47.97"	E106°23'36.96"
ECH.1	N 9°41'38.30"	E106°34'45.6"
ECH.2	N 9°44'7.7"	E106°34'03.6"
ECH.3	N 9°51'23.38"	E106°28'23.30"
ECH.4	N 9°53'32.0"	E106°26'18.3"

Figure 1. The geographic coordinates and sampling stations map in two estuaries

Sample collection and processes

The samples were collected from 20th to 27th of March 2009, during the dry season, along each estuary from the mouth to fresh water part. In each estuary four sampling stations were chosen along the salinity gradient from the mouth to the inland.: for Cung Hau estuary ECH1, ECH2, ECH3, ECH4 and for Ham Luong estuary EHL1, EHL2, EHL3, EHL4. The meiofauna was collected using cores of 3.5 cm diameter (10 cm² surface area) and 30 cm high, the cores were pushed down into the sediment for 10 cm. Three replicates for each station were collected and fixed with 60^{o}C hot 10% formalin solution or 4% Formaldehyde.

Samples were sieved through a 38 m mesh size and extracted by flotation with Ludox-TM50 (specific gravity of 1.18). For each subsample, a random set of 200 nematodes was used for making slides and identification. Meiofauna was identified to higher taxa level (phylum, class or order) under a stereomicroscope, based on Higgins R. P. and H. Thiel (1988) [16]. Nematodes were identified to genus level using high magnification microscopes, Axioskop-2 plus and Olympus CH30RF200, and, with the help of the taxonomy literatures for identification, nematode of Wieser (1956, 1959) [39, 40]; Platt and Warwick (1983) [26]; Platt and Warwick (1988) [27]; Warwick, Platt and Somerfield (1998) [38] and Lorenzen (1994) [19].

Data analyses

Data were analyzed using univariate and multivariate techniques. The nematode abundance, composition and biological indices Margalef richness , Shannon-Wiener diversity, Hill indices and Pielou's (J) evenness were used as univariate measures of the community structure using PRIMER VI software. The significant differences in univariate measures between sites were tested using one-way

ANOVA. In order to test the assumption of homogeneity of variances, Levene's tests were applied and data were log transformed. Tukey's multiple comparison tests were used when significant differences were detected ($p < 0.05$). Ranked lower triangular similarity matrices were constructed using the Bray-Curtis similarity measure on square root transformed data. Ordination was done by non-metric multidimensional scaling (MDS).

RESULTS AND DISCUSSIONS

Nematode density, abundance and composition

The densities of the nematode communities were rather different among stations in the two estuaries Ham Luong and Cung Hau. In Ham Luong, the mean nematode density varied between 90 ± 31 inds/10 cm² (EHL2) and 1524 ± 269 inds/10cm² (EHL4) on the average, while in Cung Hau, the mean nematode density was varying between 105 ± 79 inds/10 cm² (ECH2) station and 1120 ± 534 inds/10 cm² at station ECH1 (Figure 2). This result is much lower compared with the recent study by Quang et al. (2010) [29], where nematode density ranged from 454.0 ± 289.9 to 3137.7 ± 337.1 inds/10 cm². However at the same two stations in the mouth of Ham Luong and Cung Hau, the author recorded nematode densities in the rainy season of 454 ± 290 inds/10 cm² at ECH1 and 683.7 ± 374.4 inds/10 cm² at EHL1. These values are much lower (two to three times than in the dry season like shown by our study). The different nematode density can be explained by the different conditions between the rainy and the dry season. According to Nguyen Vu Thanh and Nguyen Dinh Tu (2003) [23], during the dry period, the mainland drain of fresh waters is reduced and in certain cases sea water can penetrate the numerous rivers and the streams. Salinity during this period varies from 30.0 to 33.4‰. The authors mentioned that during the rainy period there is a certain tendency observed in decreasing number of nematode species and reduction in the indices of species diversity. Probably, due to the changes between dry and rainy period there is an influence on density and taxonomical diversity of nematode communities. According to Udalov et al. (2005) [36], the distribution of animals in estuaries depends not only on salinity, but also on a variety of other factors, specific to that particular estuary. Sediment type was a key factor that determined the distribution of nematode densities.

The nematode densities of our study are comparable to the records of 67-1666 inds/10 cm² in the Westerschelde [32] 317-1002 inds/10 cm² in Shin River, Kasuga River and Tsumeta River in Takamatsu, Japan [35], 38.9 ± 5.3-1323.1 ± 398.5 inds/10cm² in Mondego and 109.0 ± 26.7 - 2234.0 ± 400.2 inds/10cm² in Mira [1]; but lower than 100-7100 inds/ 10 cm² in the Oosterschelde [31]; 130-14500 inds/10 cm² across five European estuaries (Ems, Westerschelde, Somme, Gironde and Tagus) as reported by Soetaert et al. (1995) [33]; 330-3200 inds/10cm² in Blyth estuary, UK [4], 15-5856 inds/10cm² in the Thames river [11]; but are higher compared to the study by Pavlyuk et al. (2008) [25] in Cua Luc estuary, who recorded densities of 74-150 inds/10 cm². Based on the Levene's test it was shown that the assumption of Homogeneity of the variances of nematode density was not fulfilled, hence the non-parametric Kruskal-Wallis test was used. Signification differences were found between stations for nematode density ($H (7,24) = 21,16$; $p = 0,0035$).

In total 92 genera belonging to 36 families and 10 orders of free-living marine nematodes were recorded in both Cung Hau and Ham Luong estuaries. In Ham Luong estuary, 71 genera of nematodes were found belonging to 20 families and 10 orders, while, 62 genera belonging to 28 families and 9 orders of nematodes were identified in the Cung Hau estuary. The total number of genera was lower than the 135 genera identified by Quang et al. (2010) [28] in the mouth of eight estuaries of Me Kong river, while the number of families is quite similar since 35 families were recorded. In another study on nematode communities in the Thi Vai estuary by Doan Canh and Nguyen Vu Thanh (2000) [9], only 45 nematodes species belonging to 25 genera were found, however in an area which was impacted by industrial sewage water and located approximately 37 km north of the Me Kong river. The number of taxa in our study is also higher compared with a study in the north estuary of Vietnam by Pavlyuk et al. (2008) [25], where 66 species belonging to 52 genera and 17 families were identified in Cua Luc estuary. The results are similar with the study by Soetaert et al. (1995) [33], where in total 220 species belonging to 102 genera and 35 families of nematodes in five European estuaries were found. This study found higher records on nematode genera compared with the study by Adão et al., (2008) [1] where 45 and 48 nematode genera were recorded belonging to 19 families in the Mondego and Mira estuaries, Portugal.

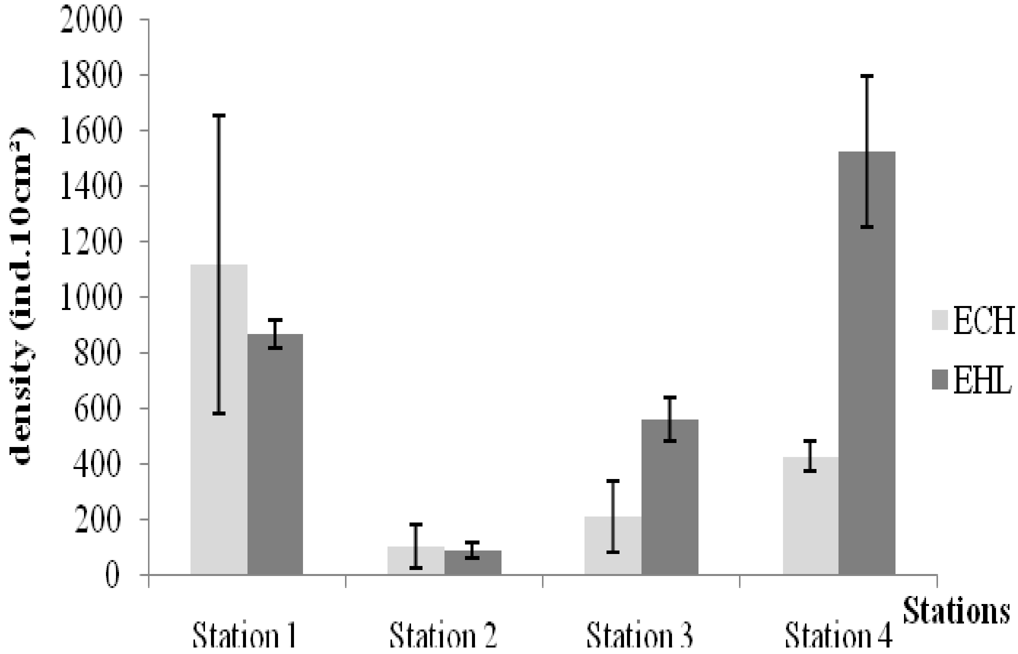

Figure 2. The average of nematode density at each station in Cung Hau and Ham Luong estuary

In both estuaries of this study, the dominant families were Oncholaimidae, Xyalidae, Chromadoridae, Oxystominidae, Axonolaimidae and Sphaerolaimidae. In Ham Luong estuary, among the 29 families, Xyalidae were most dominant in relative abundance (22.82%) and number of genera (11), followed by Chromadoridae (19.5%), Oncholaimidae (18.6%) and Axonolaimidae (8.9%), while in Cung Hau estuary, among the 28 families, Oncholaimidae and Xyalidae were most dominant in relative abundance (23.85%) and number of genera (6 and 4 respectively), followed by Axonolaimidae (11.78%), Sphaerolaimidae (7.21%), Chromadoridae and Desmodoridae (5.38%). The dominant families of this study are little similar compared with the study by Adão et al. (2008) [1] because of two dominant families Comesomatidae and Desmodoridae were not recorded in Ham Luong and Cung Hau estuaries while at the Mondego and the Mira estuaries the authors found the nematode dominant families were Comesomatidae, Desmodoridae, Chromadoridae and Xyalidae. This result is also quite similar with the recent study by Quang et al. (2010) [29] on the marine stations at the mouth of eight estuaries of the Me Kong delta. The authors recorded the family Xyalidae as the most important family in the nematode communities, followed by the Desmodoridae, Monhysteridae and Chromadoridae. Other families such as Siphonolaimidae, Oncholaimidae, Cyatholaimidae, and Comesomatidae occupy an important share as well. Soetaert et al. (1995) [33] also observed that Xyalidae and Chromadoridae were dominant in the five European estuaries.

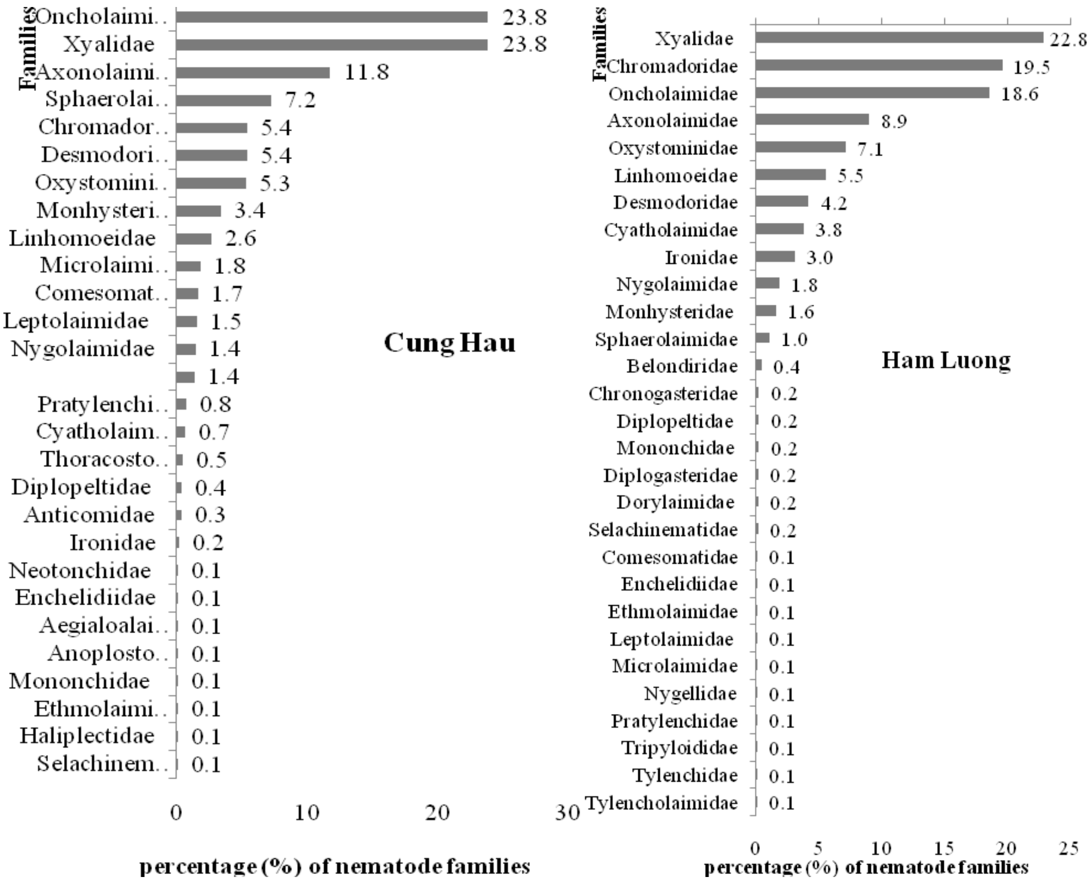

Figure 3. Percentage of nematode families in Cung Hau and Ham Luong estuaries

In the Ham Luong estuary, the genera *Dichromadora* (27.1%), *Daptonema* (18.0%), *Oncholaimellus* (12.1%), *Syringolaimus* (4.7%) and *Tripyloides* (4.1%) represented 66% of the total nematode densities, while at Cung Hau estuary, *Oncholaimellus* (35.0%), *Daptonema* (12.3%), *Parodontophora* sp1. (7.7%), *Theristus* (4.2%) and *Halalaimus* (4.1%) represented only 63.4% of the total nematode densities. This indicates a low similarity of dominant genera compared with the study by Adão et al. (2008) [1], where the nematodes composition of the investigated Portuguese estuaries included dominant genera as *Metachromadora* (19.3%), *Anoplostoma* (13.6%), *Daptonema* (9.8%), *Sabatieria* (9.8%), *Microlaimus* (8.1%), *Sphaerolaimus* (4.3%), *Axonolaimus* (3.8%), *Dorylaimus* (3.4%), *Prochromadorella* (2.8%), *Dichromadora* (2.8%) and *Viscosia* (2.6%) in Mondego and *Sabatieria* (24.5%), *Ptycholaimellus* (13.8%), *Metachromadora* (13.2%), *Terschellingia* (12.8%), *Daptonema* (9.2%), *Anoplostoma* (6.3%) and *Sphaerolaimus* (4.5%) in Mira estuary. However, at eight stations near the mouth of the Me Kong estuaries, the most dominant widely present genus was *Desmodora* (27.5% of total individuals over all eight estuaries), belonging to the Desmodoridae. Other dominant genera such as *Daptonema, Leptolaimus, Halalaimus, Theristus, Rhynchonema,* and *Parodontophora* were present in selected locations of the estuaries according to Quang et al. (2010) [29]. According to Heip et al. (1985) [14], several nematode genera are common in many estuarine areas in the world, such as Germany, United Kingdom, Belgium, Finland, South American, The Netherlands, and France. These worldwide nematode estuarine genera are *Adoncholaimus, Anoplostoma, Axonolaimus, Daptonema, Leptolaimus, Microlaimus, Monhystera,* *Metachromadora, Ptycholaimellus, Sabatieria, Theristus, Tripyloides,* and *Viscosia*. However, other genera were abundant in the Me Kong estuarine system, such as, *Halalaimus, Rhynchonema, Parodontophora, Terschellingia, Onyx, Leptolaimoides, Oncholaimellus, Omicronema, Rhinema, Haliplectus, Desmodora* as recorded Quang et al. (2010) [29]. The nematode communities in the Ham Luong and Cung Hau estuaries consist of mainly of the genera *Oncholaimellus, Daptonema, Desmodora, Dichromadora, Halalaimus, Paracanthonchus, Parodontophora, Sphaerotheristus, Syringolaimus* and *Theristus*; these were also the most common genera in the other intertidal estuarine mudflats systems as observed by Pavlyuk et al. (2008) [25] in Cua Luc, north Vietnam and Quang et al. (2010) [29] in the Me Kong delta. However, only a few similar dominant genera are observed in the other European systems [3, 18, 32, 23, 30] where the dominant common genera were found as *Sabatieria, Metachromadora, Daptonema, Anoplostoma, Sphaerolaimus,* and *Terschellingia.*

In this study, the nematode density was highest at the stations near the mouth of the river and the inland stations in both estuaries. The nematode density in Cung Hau and Ham Luong estuaries decreased from the inland stations EHL4, ECH4 to the stations EHL2 and ECH2, and increased again at the mouth stations EHL1 and ECH1. Both Ham Luong and Cung Hau estuaries were exceptional by the occurrence of high densities at the fresh water stations, consequently Nematode density here was not showing a clear correlation to the salinity gradient, a pattern that was not observed in several other estuaries [1, 31, 32, 33, 36].

The nematode density is higher in the oligohaline section (stations 4) in Cung Hau and Ham Luong compared with the mesohaline section (stations 2 and 3). This result can be explained by other environmental factors, such as sediment grain size, nutrient concentration, chlorophyll and sediment organic matter content since they were known to influence both density and diversity of nematode community in estuaries. The highest density was found in EHL4 where the environmental factors such as NH_4^+ concentration was very high and the total of Chlorophyll (CPE) observed also highest, corresponding to the increase of nematode density. This result also relatively similar with the study by Adão et al. (2008) [1] in Mira estuary where the highest nematode density was observed at the stations with a higher sediment organic matter content.

Nematode biological indices

In addition to the count of the number of genera, the nematode generic diversity was also calculated for all stations as, d-Margalef, H' (loge) Shannon-Wiener, J'-evenness and Hill's indices. The d-Margalef richness index varied from 2.17 ± 0.3 (ECH1) to 3.5 ± 0.3 (ECH4) in Cung Hau estuary and from 1.6 ± 0.5 (EHL1) to 3.7 ± 1.0 (EHL3) in Ham Luong estuary. The average of d-Margalef richness in Cung Hau (3.0 ± 0.3) was higher than in Ham Luong (2.5 ± 0.7) estuaries. The H'(loge) Shannon-Wiener diversity index increased from the mouth (ECH1) to upriver stations (ECH4) in Cung Hau estuary, ranging from 1.7 ± 0.4 to 2.6 ± 0.1. It fluctuated in Ham Luong estuary: being highest at station EHL3 and lowest at station EHL4 and equal at the two stations EHL1 and EHL2 near the mouth. The J'-evenness was quite low at all stations, ranging from 0.5 ± 0.01 (EHL4) to 0.6 ± 0.1 (ECH1), the highest value were calculated at three stations ECH2, ECH4 and EHL3 (figure 4).

The results for the Hill's indices presented in figure 4. In Ham Luong estuary, the species richness increased from mouth station EHL1 to station EHL3, and decreased at station EHL4. In the Cung Hau estuary, the N0 value decreased from the inland station ECH4 to station ECH2 before it slightly increased at station ECH1. The N_1, N_2 and N_{inf} varried in similar proportions with the N_0 value in both estuaries, except that the increased from ECH2 to ECH1 which was not found. In general, Hill's indices in Ham Luong were lower than in Cung Hau estuary except for stations 3.

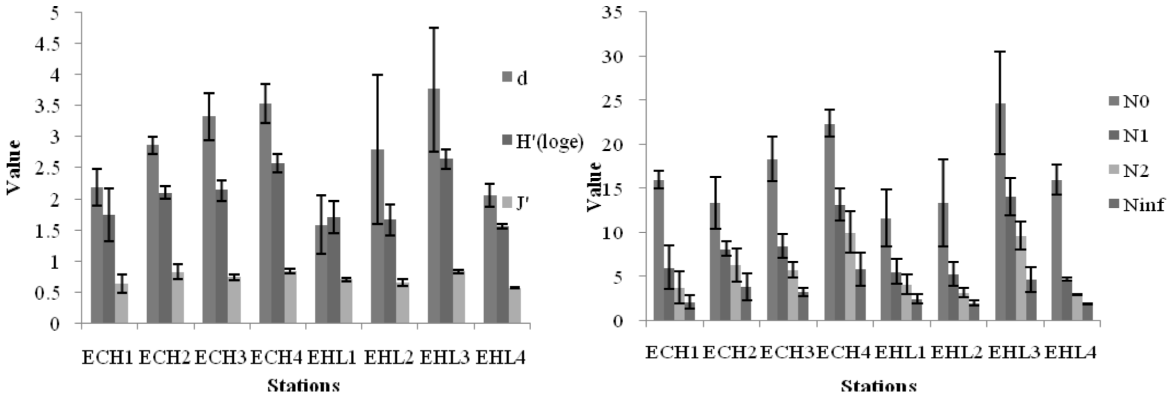

Figure 4. Nematode biological indice

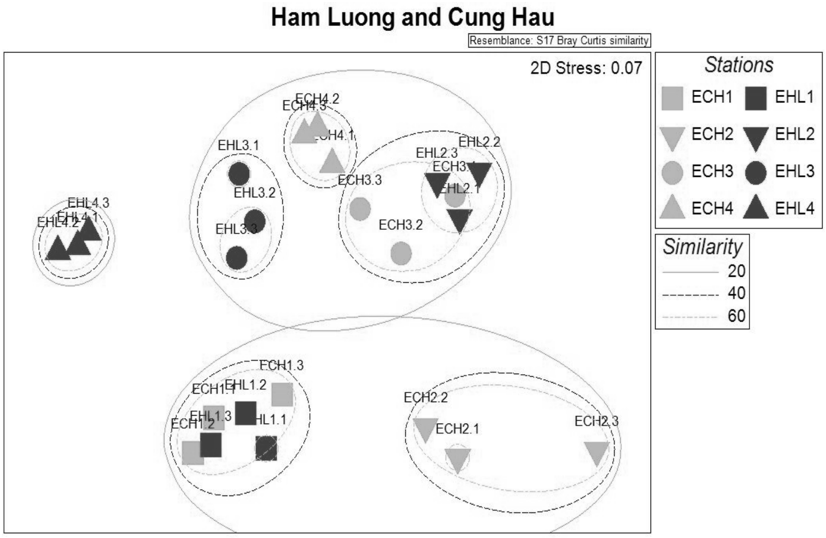

Figure 5. MDS of nematodes density in Cung Hau and Ham Luong estuaries

Multi dimension scaling (MDS) of nematode distribution

To investigate the distribution of the nematode's communities along the two estuarine gradients, a multi-dimension scaling (MDS) was used. The stress value was 0.07 indicating an excellent representation of the present similarities (figure 5). Therefore, the two-dimensional solution was enough to appreciate the overall structure of these communities.The MDS plots clearly reflected the spatial distribution of nematodes along the Ham Luong and Cung Hau salinity gradients. The nematode communities along the estuarine gradients can be differentiated into four differences group of stations respectively at the river mouth, the middle stations and the inland stations. Only the ECH2 makes a separate group and also the group of EHL4 is separated from the other stations. The biggest group of mainly mesohaline stations was situated in the middle of the estuaries (EHL2, EHL3, ECH 3 and ECH4 group). At the Ham Luong and Cung Hau estuaries when analysed separately, the MDS analysis revealed distinct assemblages corresponding to the present salinity gradients and the ANOSIM analysis showed significant differences between the different of the salinity ranges (Global R = 1, p = 0.1%) in Ham Luong and (Global R = 0.938, p = 0.1%) in Cung Hau. To combine the two estuaries, the ANOSIM analysis also showed significant differences between the stretches (Global R = 0.972, p = 0.1%).

The MDS bubble plots for the dominant genera reflectted the spatial distribution of dominant genera following estuarine gradients from inland to river mouth stations (figure 6). *Daptonema* and *Theristus* occurred throughout the entire estuarine gradient, with highest density of *Daptonema* and *Theristus* at stations ECH1 and EHL1 (figure 6E, F) and station 4 (EHL4) for *Daptonema*. *Syringolaimus* and *Dichromadora* were more abundant at the station (EHL1) compared with the other stations. While, *Oncholaimellus, Paracanthonchus,* and *Desmodora* were abundant at the mouth river stations (Figure 6A, H, B); *Halalaimus* and *Paradontophora* were more abundant in ECH4 (figure 6D, 6C).

CONCLUSIONS

In the two estuaries, 3695 specimens of nematodes were identified, belonging to 92 genera, 36 families and 10 orders. In the Ham Luong estuary 71 genera of nematodes, belonging to 29 families and 10 orders were identified, whereas 62 genera, 28 families and 9 orders nematodes were found in the Cung Hau estuary. The dominant families were Oncholaimidae, Xyalidae, Chromadoridae, Oxystominidae, Axonolaimidae and Sphaerolaimidae in both estuaries. The Ham Luong estuary was characterized by high abundances of the genera *Dichromadora* (27.1%), *Daptonema* (18.0%), *Oncholaimellus* (12.1%), *Syringolaimus* (4.7%) and *Tripyloides* (4.1%), while the Cung Hau estuary was characterized by *Oncholaimellus* (35.0%), *Daptonema* (12.3%), *Parodontophora* sp1. (7.7%), *Theristus* (4.2%) and *Halalaimus* (4.1%). The nematode diversity increased from the mouth towards the upstream stations in both estuaries. In Cung Hau and Ham Luong estuaries, the nematode density and composition distribution were correlated with the salinity gradient along the river. Mainly the polyhaline part differed from the meso and oligohaline parts of the estuaries. SIMPER was used to identify the nematode communities that discriminate between the salinity sections along the river:

Oligohaline section, characterised by the presence of freshwater taxa such as *Paravulvus*, the total nematode density was high (869-1120 inds/10 cm^2) while the diversity was rather low (12-16 genera) The dominant genera were *Dichromadora, Parodontophora, Halalaimus*. These stations characterized by the highest ammonium concentrations, high number of coliforms bacteria and high chlorophyll values, especially in Ham Luong estuary.

Mesohaline section, showed a low total nematode density (90-561 inds/10 cm^2) and diversity (13-25 genera), with the dominant genera such as *Parodontophora, Desmodora, Rhynchonema, Tripyloides* and *Theristus* . Polyhaline section, where nematodes reached the highest density, ranging from 428 to 1524 ind.10cm^2 and highest diversity (16-22 genera), and with the genera *Oncholaimellus, Daptonema, Paracanthonchus, Desmodora* being abundant. These stations were characterized by a sandy sediment in contrast to the silty sediments of the other stations.

The genera *Oncholaimellus, Desmodora, and Paracanthonchus* were clearly associated with the polyhaline section of the estuaries, while the group of *Halalaimus, Dichromadora, and Syringolaimus* abundanted in the oligo- and mesohaline section. The genera *Daptonema, Theristus, Parodontophora* were very common and widely distributed over the oligohaline to euhaline stations.

The survey allowed for an assessment of the current condition of the estuary and also provided a baseline for future monitoring of recovery, long-term changes or for impact assessment in the Cung Hau and Ham Luong estuaries in particularly and in general for the total of all Me Kong estuarine systems in the future .

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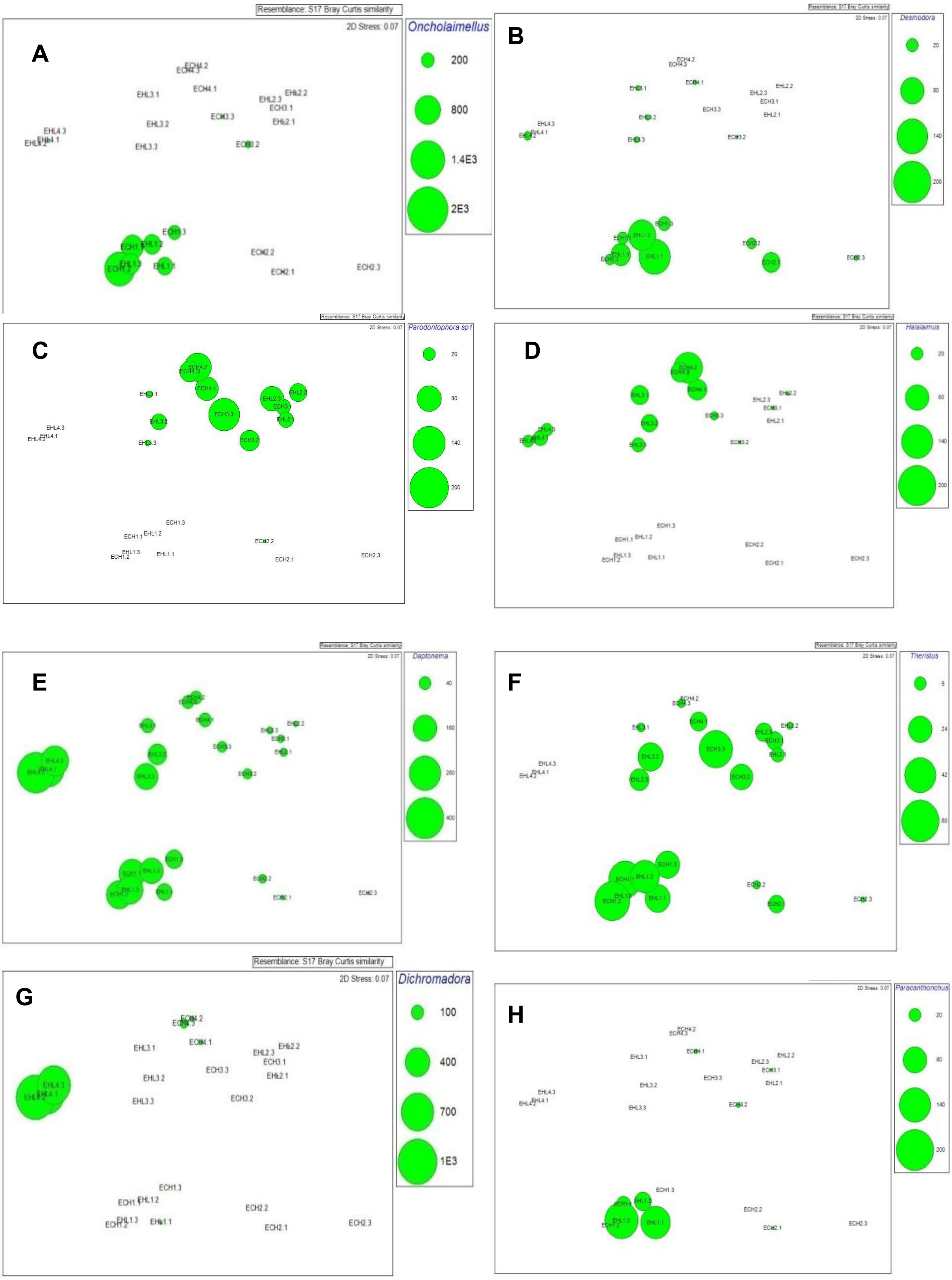

Figure 6. MDS of dominant genera base on density at each station

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QUẦN XÃ TUYẾN TRÙNG SỐNG TỰ DO PHÂN BỐ TRÊN HAI CỬA SÔNG CUNG HẦU VÀ HÀM LUÔNG, SÔNG CỬU LONG, PHÍA NAM VIỆT NAM

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TÓM TẮT

Sự có mặt của quần xã tuyến trùng sống tự do trên hai cửa sông Cung Hầu và Hàm Luông chiếm tỷ lệ 76,5% (cửa Cung Hầu) và 77,0% (cửa Hàm Luông) trên tổng số quần xã động vật không xương sống cỡ trung bình sống ở nền đáy. Có 92 giống tuyến trùng, trong đó đã ghi nhận 71 giống gặp ở cửa Hàm Luông và 62 giống gặp ở cửa Cung Hầu. Mật độ phân bố dao động từ 90 ± 31 đến 1524 ± 269 cá thể/10 cm^2 (cửa Hàm Luông) và 105 ± 79 đến 1120 ± 534 cá thể/10 cm^2 (cửa Cung Hầu). Một số giống tuyến trùng ưu thế trong khu vực gồm: *Dichromadora, Daptonema*, *Oncholaimellus, Syringolaimus, Tripyloides*, *Parodontophora, Theristus* và *Halalaimus*, thuộc các họ Oncholaimidae, Xyalidae, Chromadoridae, Oxystominidae, Axonolaimidae và Sphaerolaimidae. Mật độ tuyến trùng có xu hướng giảm theo chiều tăng nồng độ muối, tuy nhiên, mật độ tăng cao tại hai điểm cửa sông, nơi có nồng độ muối cao.

Từ khóa: Cửa sông, đa dạng sinh học, đồng bằng sông Cửu Long, tuyến trùng tự do.

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