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EFFECTS OF PREDATORS ON TWO OYSTER SPECIES (*CRASSOSTREA RIVULARIS* AND *CRASSOSTREA GIGAS*) FARMED IN CAN GIO COASTAL AREA

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Abstract:

Results of research on predator species on two oyster species (*Crassostrea rivularis* and *Crassostrea gigas*) from January to December 2022 in the Can Gio coastal estuary, have identified 22 predator species in 13 families belonging to 6 groups (Arthropoda, Coelenterata, Mollusca, Platyhelminthes, Polychaeta and Rhodophyta). Among them, the most diverse are Molluscs with 10 species, polychaetes with 5 species, arthropods with 4 species, Coelenterata, Echinaceans, flatworms and red seaweeds with only 1 species.

The highest frequency of encountering 10 enemy species of estuarine oysters is *Thalamita sima* with 18,52%, *Thalasina anomala* with a frequency of 15,74% of the total number of enemy species. Other species have low encounter frequencies (f < 15%); The highest frequency of encountering 12 species of predators of Pacific oysters is *Actiniidae* sp. with 18,13%, *Amphibalanus amphitrite* has a frequency of 17,54% of the total number of enemy species. Other species have low encounter frequencies (f < 16%).

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ẢNH HƯỞNG CỦA ĐỊCH HẠI TRÊN HAI LOÀI HÀU (*CRASSOSTREA RIVULARIS* VÀ *CRASSOSTREA GIGAS*) ĐƯỢC NUÔI Ở VEN BIỂN CẦN GIỜ

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Cần Giờ, Bivalvia, Nhuyễn thể, Địch hại, Hàu.

Tóm tắt

Kết quả nghiên cứu các loài địch hại trên hai loài hàu (*Crassostrea rivularis* và *Crassostrea gigas*) từ tháng 1 - 12/2022 ở vùng cửa sông ven biển Cần Giờ, đã xác định được 22 loài địch hại trong 13 họ thuộc 6 nhóm (Arthropoda, Coelenterata, Mollusca, Platyhelminthes, Polychaeta và Rhodophyta). Trong đó, đa dạng nhất là Thân mềm với 10 loài, Giun nhiều tơ có 5 loài, Chân khớp có 4 loài, Ruột khoang, Da gai, Giun dẹp và Rong đỏ chỉ có 1 loài.

Tần suất bắt gặp 10 loài địch hại với hàu cửa sông cao nhất là *Thalamita sima* với 18,52%, *Thalasina anomala* có tần suất 15,74% tổng số loài địch hại. Các loài khác có tần suất bắt gặp thấp (f < 15%); Tần suất bắt gặp 12 loài địch hại với hàu Thái Bình Dương cao nhất là *Actiniidae* sp. với 18,13%, *Amphibalanus amphitrite* có tần suất 17,54 % tổng số loài địch hại. Các loài khác có tần suất bắt gặp thấp (f < 16%).

1. Introduction

With more than 20 km of coastline running in the Southwest-Northeast direction, there are large river mouths including Long Tau, Cai Mep, Go Gia, Thi Vai, Soai Rap, Dong Tranh rivers. All rivers and canals are affected by the irregular semi-diurnal tide regime. Therefore, Can Gio (Ho Chi Minh City) is a locality with favorable natural geographical conditions for coastal aquaculture, with high economic value. In particular, oysters are one of the main seafood species that are currently being farmed and developed strongly. Oysters belonging to the bivalve group (Bivalvia) are one of the important species, bringing high economic

value, and are commonly farmed in many places around the world. According to the study of Wijsman et al., 2018 (in the period from 2010-2015), the average human consumption of Bivalvia is up to 15 million tons per year (accounting for about 14% of the total world production, of which 89% is from aquaculture). Can Gio has a mangrove ecosystem as a biosphere reserve (total area of 75,740 ha) and diverse and rich tidal flats, with favorable conditions for raising clams and oysters, creating favorable conditions for regional economic development.

The coastal area of Can Gio has high potential for economic development, this area has low tides, 2-3m depth, far from residential areas. Especially oyster species have large body size, suitable for hard mud bottom, when released they do not sink. Simple farming techniques, few diseases, fast growth rate are important factors for mass production of seeds for people. However, oyster farming develops rapidly in coastal areas, people have not controlled the origin of seeds, farming environment, diseases, ... so people's oyster farming faces many difficulties, disadvantages, many risks, diseases for the raised seeds. Therefore, the study "Effects of pests and diseases on some bivalve molluscs (Mollusca: Bivalvia) cultured in the coastal area of Can Gio" is one of the important and necessary research contents of the topic. Thereby, we can see the difficulties, advantages and propose effective solutions to prevent and control pests and diseases for people's livestock.

2. Material and Methods

2.1. Time and place of research

- *Time:* Qualitative and quantitative samples were collected from January to December 2022 in the coastal area of Can Gio.

- *Research object*: Oyster species (*Crassostrea rivularis* and *Crassostrea gigas*) cultured in cages using two methods (qualitative and quantitative) in the coastal area of Long Hoa commune, Can Gio district.

- *Location:* Oyster farms and oyster farms in the coastal area of Can Gio (Figure 1).

Figure 1. Location of pest sampling in oyster farming areas in Can Gio

Note: HCS - Estuarine Oysters, HTBD - Pacific Oysters

2.2. Research methods

Field research:

- Quantitative samples: Samples were collected in the culture stream (2m long). Quantitative locations were recorded in order corresponding to the culture area.

+ Mollusk individual samples were collected periodically once a month, then preserved and brought back to the laboratory.

+ Research in culture frames included: 2 research samples (Pacific oysters and estuarine oysters) x 5 collection points (culture streams) x 2 oyster farming areas x 12 months = 240 samples.

- Qualitative samples were expanded to cover the sampling area in the study area to supplement quantitative samples and avoid missing species composition.

Laboratory research:

- Research on pests and diseases using morphological methods for identification, including the following criteria: Quantity, shape, body structure...

- Build a database of common pests and diseases on bivalve mollusks: Host, attack method, damage season, origin.

Sample identification and storage: After cleaning, the samples are fixed in 70o alcohol. Sample locations are identified by numbered labels and quantitative or qualitative information is recorded on them. Sample identification by group is based on the following documents.

- Bivalves and Gastropod Molluscs: Kent E. Carpenter and Volker H. Niem, 1998; Han Raven, Jap Jan Vermeulen, 2006;

- Oligochaeta according to Blakmore, 2007.

- Frequency of occurrence (common): Calculated by Sharma formula (2003):

3. Results and discussions

3.1. Diversity of pests

The results of the investigation and survey in the coastal oyster farming areas of Can Gio identified 22 pest species, 18 genera, 13 families, belonging to 6 groups (Arthropoda, Coelenterata, Mollusca, Platyhelminthes, Polychaeta and Rhodophyta). Of which, the most diverse are Mollusca with 10 species, Polychaeta with 5 species, Arthropoda with 4 species, Coelenterata, Echinodemata, Platyhelminthes and Rhodophyta with only 1 species (Table 1). The most dominant pest species in the Mollusca group are represented by the Mytilidae family with 9 species, accounting for 40.9%, followed by Ostreidae and Amphinomidae with 2 species, accounting for 9.09%. The remaining groups have only 1 species, accounting for 4.55%.

Table 1. Composition of predators on oysters cultured in Can Gio

TT	Taxon	Crassostrea rivularis	Crassostrea gigas	Harmful	
				Ký sinh	Hunt
	Platyhelminthes				
	Callioplanidae				
1	*Koinostylochus ostreophagus,* (Hyman 1955)		x		Eat meat
	Annelida				
	Polychaeta				
	Eunicidae				
2	*Eunice aphroditois* (Pallas, 1788)	x	x	Live Free	Eat meat
	Amphinomidae				

TT	Taxon	Crassostrea rivularis	Crassostrea gigas	Harmful	
				Ký sinh	Hunt
3	*Chloeia parva* Baird, 1868	x	x	Live Free	Eat meat
4	*Chloeia* sp.	x		Live Free	Eat meat
	Nereididae				
5	*Nereidae* sp.	x	x	Live Free	Eat meat
	Sabellidae				
6	*Sabella* sp.	x	x	Stick to the shell	
	Arthropoda				
	Maxillopada				
	Balania				
7	*Amphibalanus amphitrite* Darwin, 1854	x	x	Stick to the shell	
	Thalassinidae				
8	*Thalasina anomala* (Herbst, 1804).		x	Live Free	Eat meat
9	*Thalamita sima* H. Milne Edwards, 1834		x	Live Free	Eat meat
	Xanthidae				
10	*Liomera venosa* (H. Milne Edwards, 1834)		x	Live Free	Eat meat
	Coelenterata (Cnidaria)				
	Anothozoa				
11	*Actiniidae* sp.	x	x	Stick to the shell	
	Mollusca				
	Bivalvia				
	Mytilidae				
12	*Brachidontes curvatus* (Dunker, 1857)	x		Stick to the shell	
13	*Brachidontes emarginatus* (Reeve, 1858)	x		Stick to the shell	
14	*Brachidontes senhousei* (Berson, 1842)	x		Stick to the shell	
15	*Modiolus philippinarum* Hanley, 1834)	x		Stick to the shell	
16	*Modiolus aratus* (Dunker, 1857)	x		Stick to the shell	
17	*Perna viridis* (Linnaeus, 1758)	x	x	Stick to the shell	
18	*Xennostrobus atrata* (Lischke, 1871)	x		Stick to the shell	
	Ostreidae				
19	*Saccostrea glomerata* (Gould, 1850)	x	x	Stick to the shell	
20	*Crassotrea* sp.	x	x	Stick to the shell	
	Trapezidae				
21	*Neotrapezium sublaevigatum* (Lamarck, 1819)	x		Stick to the shell	
22	**Rhodophyta**		x	Stick to the shell	
Tổng		**17**	**14**		

Of the total 22 pest species appearing in the estuarine oyster (Crassostrea rivularis) farming area, there were 17 species, accounting for 77,27%, and 14 species of Pacific oyster (Crassostrea gigas), accounting for 63,64%. The pest species have different habitats, compete for habitat, live attached to the host or use the host as food. Through research statistics, 14 species were identified as living attached (harmful) on the oyster shell (accounting for 63,64% of the total number of species), 8 species of free-living species using the host as food (harmful) (accounting for 36,36% of the total number of species), Figure 2.

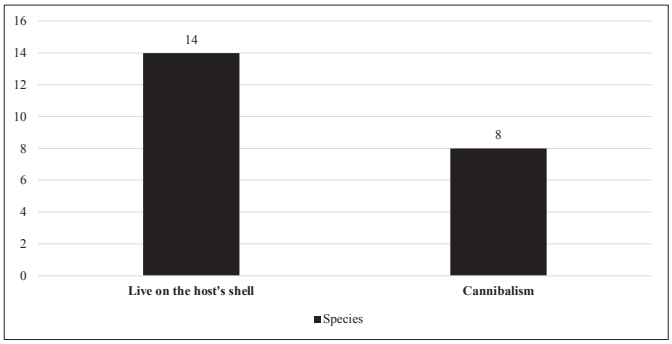

Figure 2. Number of pests and diseases in Can Gio oyster farming area

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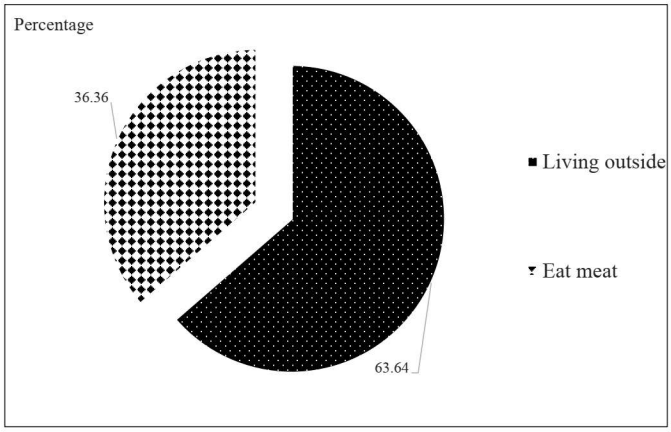

Figure 3. Percentage of harmful species in oyster farming areas in Can Gio

3.2. Frequency of encounter (f) of toxic species

Estuary oysters (Crassostrea rivularis):

The number of predators identified in the estuary oyster farming area is the highest with 10 species. The frequency of predators in most months/year ranges from high to very high density on the host shell or farming lines such as: Ha Sun (Amphibalanus amphitrite), 10 species of bivalve mollusks with year-round occurrence frequency (accounting for 50% of the total species), from high to very high, they live attached to oyster shells or farming lines. Other species have lower occurrence rates. Predators are parasitic, attached to oyster shells, causing the oyster shell to thicken, and at the same time compete for food with the host, leading to poor oyster growth or death.

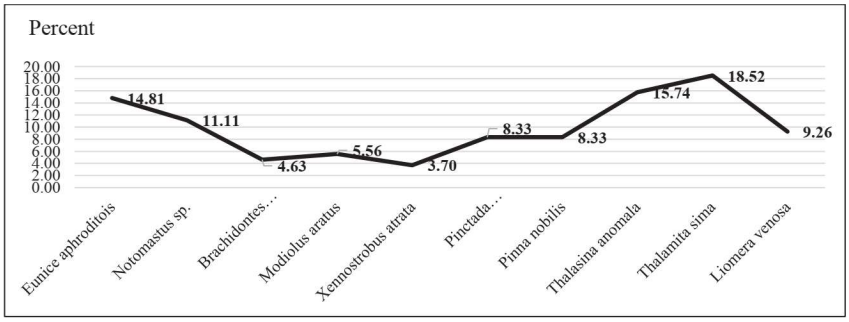

Figure 4. Frequency of pests and diseases in estuarine oyster farming areas

Frequency of predators in quantitative samples (culture streams) in the estuarine oyster farming area: The species with the highest frequency of occurrence (f) was Thalamita sima with 18.52% of the total number of predators, followed by Thalasina anomala with a frequency of occurrence of 15.74%, Eunice aphroditois with a frequency of occurrence of 14.81%, Notomastus sp. with a frequency of occurrence of 11.11%. The remaining species had low frequencies of occurrence (f < 10%).

Pacific Oysters (Crassostrea gigas):

There are 12 species identified as pests in the Pacific oyster growing area. The highest level of damage is the sun oyster (Amphibalanus amphitrite), followed by the fanworm (Sabella sp.). The form of damage is living on the oyster shell. The frequency of encounter is continuous, year-round. The frequency of occurrence is very high at most sampling locations. The level of damage caused by sun oysters to oysters is very large in the larval stage (small oysters attach to the sun oyster, preventing the oyster from developing). Arthropods (Liomera venosa, Thalasina anomala, Thalamita sima) live freely in the oyster growing area, they directly feed on the soft body of oysters in the larval and adult stages. Red algae are pests, belonging to the group of parasitic plants living on oyster shells, they have an impact on the vitality of oysters, they have the effect of gradually killing oysters. The frequency of occurrence of red algae in the sample was found to be high.

Frequencies of predators in quantitative samples (culture streams) in the Pacific oyster farming area: The species with the highest frequency (f) belonging to the family Actiniidae was Actiniidae sp. with 18.13% of the total predators, followed by Amphibalanus amphitrite with a frequency of 17.54%, Sabella sp. with a frequency of 15.2%, species belonging to the red algae group (Rhodophyta) with a frequency of 11.11%, Saccostrea glomerata with a frequency of 8.19%, Crassotrea sp. with a frequency of 7.02%, Nereidae sp. with a frequency of 5.26%. The remaining species had low frequencies of encounter (f < 5%).

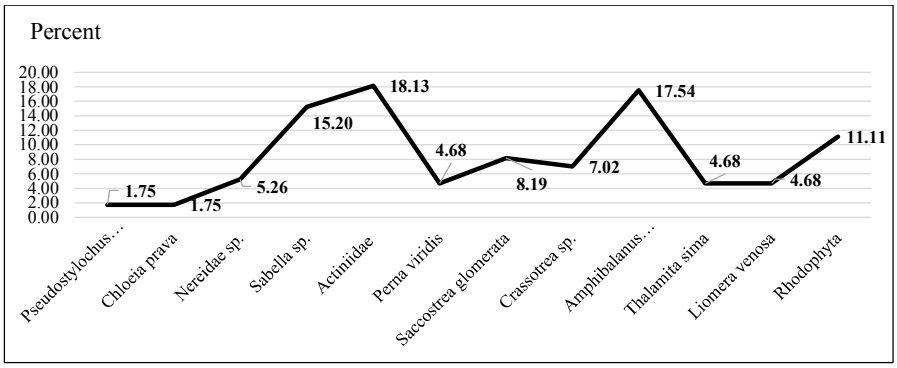

Figure 5. Frequency of predator occurrence in the Pacific

Comments: Overall, the most harmful predators of oysters are the sun oyster (*Amphibalanus amphitrite*), followed by bivalves that live and compete with oysters for food. These are followed by marine worms, fan worms, horseflies and small crabs that feed on the soft bodies of oysters. Parasitic red algae on oyster shells also affect the growth of Pacific oysters.

3.3. The Impact of Hate Groups and How to Stop Them

Through the field research process, along with the analysis process, determining the composition of carnivorous species has been identified: Amphibalanus amphitrite, Sabella sp., species in the red algae group (Rhodophyta), sea anemone family (Actiniidae), ... These groups, in addition

to causing the most harm to 2 oyster species (Crassostrea rivularis and Crassostrea gigas), also live parasitically on oyster shells, hindering the process of opening and closing the oyster lid. Carnivorous species, with the nutritional habit of eating phytoplankton in the form of filter feeding and competing for food with oysters, some species live freely and take mollusks (oysters) of the host as food. Therefore, to minimize the impact of carnivorous species on farmed oysters, farmers need experience and implement scientific measures such as:

Estuary oysters (Crassostrea rivularis):

- Natural oysters: Time to catch the seed is from April to May, then select good seeds (from 10-15 pieces/kg) to put in commercial cages. The Can Gio coastal estuary has low salinity, bivalve pests often reproduce before April. Seed oysters should be released after May to reduce pests on the shell.

- Sea worms and annelids are not found from November to February of the following year (low frequency), and sea worms (polychaetes) are adapted to grow in muddy environments. These species use the soft bodies of oysters as food, and they eat both young oysters and even adult oysters. Therefore, when releasing seeds, pay attention to the depth of the oyster platform.

Pacific Oysters (Crassostrea gigas):

- The level of damage caused by sun oysters to young oysters is very large, they stick to the shell, the mouth of the shell leading to death or not allowing the oysters to develop. Therefore, the release of oyster seeds must be after March and before October to limit oysters sticking to the shell.

- Arthropods such as: *Liomera venosa, Thalasina anomala, Thalamita sima*, they live freely in the farming area and eat young oysters directly. Therefore, when choosing the farming area and when farming, it is necessary to limit the appearance of this group by: Catching or trapping.

- Red algae is a parasitic pest that lives on oyster shells, they grow and develop strongly from June to October. Therefore, farmers need to pay attention to cleaning oysters regularly, removing algae, and drying oysters (4 - 8 hours/day) [3].

4. Conclusions

The results identified 22 species of pests appearing in the Can Gio oyster farming area, 18 genera, 13 families, belonging to 6 groups (Arthropoda, Coelenterata, Mollusca, Platyhelminthes, Polychaeta and Rhodophyta). Of which, the most diverse group is Mollusca with 10 species, Polychaeta with 5 species, Arthropoda with 4 species, Coelenterata, Echinodemata, Platyhelminthes and Rhodophyta with only 1 species. The most dominant species of pests is Mollusca, represented by the Mytilidae family with 9 species, followed by Ostreidae and Amphinomidae with 2 species. Other groups have only 1 species.

Frequency of predators in quantitative samples (culture streams) in the estuarine oyster farming area: The species with the highest frequency (f) was Thalamita sima with 18.52% of the total number of predators, followed by Thalasina anomala with a frequency of 15.74%, Eunice aphroditois with a frequency of 14.81%, Notomastus sp. with a frequency of 11.11%. The remaining species had low frequencies ($f \leq 10\%$).

Frequency of predators in quantitative samples (culture lines) in the Pacific oyster farming area: The species with the highest frequency (f) belonging to the family Actiniidae was Actiniidae sp. with 18.13% of the total number of predators, followed by Amphibalanus amphitrite with a frequency of 17.54%, Sabella sp. with a frequency of 15.2%, species belonging to the red algae group (Rhodophyta) with a frequency of 11.11%, Saccostrea glomerata with a frequency of 8.19%, Crassotrea sp. with a frequency of 7.02%, Nereidae

sp. with a frequency of 5.26%. The remaining species had low frequencies of occurrence (f ≤ 5%).

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