Available online at http://www.journalijdr.com

International Journal of DEVELOPMENT RESEARCH

IJDR

ISSN: 2230-9926

International Journal of Development Research
Vol. 4, Issue, 5, pp. 949-952, May, 2014

Full Length Research Article

HABITAT PREFERENCE BY THE MARINE AMPHIPOD *CYMADUSA FILOSA* (SAVIGNY, 1816) (GAMMARIDAE), USING DIFFERENT ARTIFICIAL SUBSTRATA FROM NORTHERN HURGHADA, RED SEA, EGYPT

[1]El Sayed A. E. Hamed, [1]Fatma A. Abdel Razek, [2]Mohamed M.A. Zaid and [3*]Tarek A. A. Mohammed

[1]National Institute of Oceanography and Fisheries, Hurghada, Egypt
[2]Faculty of Science, Al-Azhar University, Cairo, Egypt
[3]National Institute of Oceanography and Fisheries, Alexandria, Egypt

ARTICLE INFO

Article History:
Received 10th February, 2014
Received in revised form
25th March, 2014
Accepted 14th April, 2014
Published online 20th May, 2014

Key words:
Amphipods,
Cymadusa filose,
Different substrata,
Different habitats and
Hurghada - Red Sea

ABSTRACT

Three different artificial substrata (*Luffa egyptica*, *Leaf palm* and artificial fibers at each habitat) were used as artificial substrates and fixed on a stainless-steel frame model. *Luffa egyptica* recoded the highest individual numbers, while the artificial fibers did not record any individuals, with no evidence of any amphipod individuals attached. The most common algal habitats were *Sargassum dentifolium* and *Cystosaira crinite*. Moreover, the highest number of the individuals of *C. filosa* was recorded in the algal habitat with an average 57±17.1 individual per one substrata of the used *Luffa egyptica*; while the least number of individuals was recorded in the coral habitat with an average 17±7 individual per substrata. A general trend in the finding of the amphipod individuals from different habitat is in the following descending order: algae > seagrasses > rocky with algae > corals in both of *Luffa egyptica* and *Leaf palm*. This means that, *Luffa egyptica* is the most favorable and suitable for the attraction and collection of the amphipod *C. filosa* and is more appropriate than any other substrata for camouflage and defense.

INTRODUCTION

An amphipod is one of the most abundant invertebrates of the upper shore levels of temperate sandy beaches throughout the world (Dahl, 1952; Brown and Mclachlan, 1990; Mclachlan and Jaramillo, 1995). Amphipods have an ecological importance as they play a major role in the biological processing of macroalgal inputs and facilitate the transfer of nutrients from the ocean to the coastline. *Cymadusa filosa* has been considered as a polymorphic, pantropical species and has been recorded globally, from Southern Africa to New Caledonian waters (Peart, 2004). Jacobi and Langewin (1996) assessed the effect of the substratum complexity on the early stages of colonization by mobile epifauna through a comparative study based on the architecture of artificial substrata. They used six types of small plastic substrata placed in the low intertidal zone of an exposed rocky shore, for varied immersion periods (1, 2, 4 and 12 wk). They pointed out the use of artificial substrata allowed to independently manipulate structural and spatial features of the habitat, such as the total area, amount of folds, intercepting area, total volume, and interstitial volume. Ayala (2002) and Mohammed *et al.* (2013) found that the largest number of amphipods present in *Sargassum, Padina, Ulva* and *Laurencia* corresponds to the genus Hyale which had an abundance that was always greater than 60%, due to the presence of morphological adaptations because they exist in places characterized by a high wave action. Aikins and kikuchi (2001) suggest that, for the culturing of amphipods, such as fish feeding, the brush-like substrate structures are adequate as they can provide sufficient protection; and are also favorable for the attachment of tube-dwellers as well as free-living amphipods. They used a nylon plankton net (0.5 mm mesh) for the collection whenever brushes were used as a substrate substitute for natural algae, since they support a diatom species composition similar to that of macro-algae *Gracilaria vermiculophylla*. The brushes were providing a suitable habitat for the amphipods. Lowry and Myers (2009) illustrated that, some species are in-faunal burrowers in mud or sand, others are epi-benthic species that occur on the surface of the sediments or other substrates. Some other species are fouling that build tubes or domiciles on hard structures such as pilings, rocks, or ships. The remaining

***Corresponding author: Tarek A. A. Mohammed**
National Institute of Oceanography and Fisheries, Alexandria, Egypt

species are planktonic, spending all of their life period in the water column. Although most amphipod species are free-living, there are many other commensals or parasitic species on marine sponges (e.g., colomastigid and leucothoid amphipods) and other parasitic species on porpoises and whales (e.g., cyamid amphipods) Nelson 1980; Thomas 1993; Bellan-Santini 1998; Bellan-Santini & Ruffo 1998. The present study is aimed to investigate the habitat selectivity of the amphipod *Cymadusa filosa* depending upon its own preference among three different artificial substrates as a modified method for their collection from different natural habitats, such as algae, seagrasses, rocks and coral reefs to be cultivated with the purpose of food production for marine organisms like invertebrates and fish as well.

MATERIALS AND METHODS

The study location

The experiment was conducted in front of the National Institute of Oceanography and Fisheries, 5 km north of Hurghada (at 27° 17' 09 N, 33° 46' 07 E). About 30000 m^2 were surveyed and investigated; however, this area is characterized by the presence of various and different habitats such as different species of macro-algae, rocks substrata, sea-grasses, and coral reefs (Figure 1). The maximum depths in the studied area did not exceed 1.5m in the sub-tidal zone.

Figure 1. Map and diagrammatic sketch showing the area of study north of Hurghada in front of the National Institute of Oceanography and Fisheries (NIOF), Red Sea Branch

Methodology

Three different artificial substrates were fixed on a stainless-steel frame model to collect the different amphipod species from the area then isolate the *C. filosa* in the laboratory. The first substrate is prepared from the plant *Luffa egyptica*, the second one from the palm tree known as *Leaf palm*, while the third one is made from industrial fibers, an artificial textile (Fig. 2a, b & c) which used for the first time experimentally.

The temperature ranged between 26.91-29.38°C. and the pH value varied from 7.83 to 8.61 in the period of the experiment in the summer season.

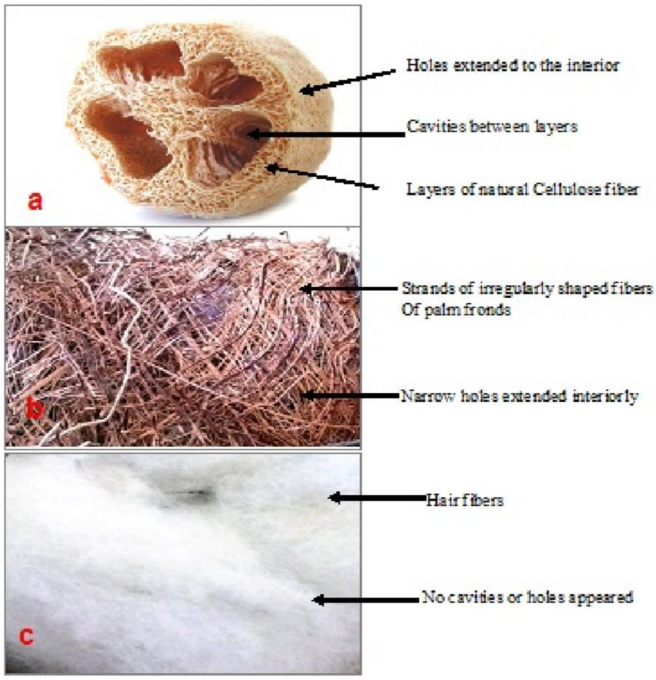

Figure 2. The different natural substrata used for collecting the amphipod *Cymadusa filosa* collection; *Luffa egyptica* (a), Palm fronds (b) and the artificial fiber pieces (c)

These different substrates (*Luffa egyptica*, *Leaf palm* and the artificialfibers) were fixed on stainless-steel frames with a steel network coated with insulation paints. These units, with the substrates, were then fixed in different habitats to recognize and select the best habitat for the amphipods collection as modified collectors of amphipods (Figure 3). The used frame models were prepared in a rectangular shape with dimensions of 40 X 50 cm and, were fixed for a period of 30 days. A weekly follow-up, for the different models, occurred to ensure and observe the assemblages of the amphipod *Cymadusa filosa*. At each marine habitat (algae, sea-grasses, rocks with algae and coral reefs), three modules were placed with the used substrate (*Luffa egyptica, Leaf palm* or the industrial fibers) to perform the collection process.; Units of each substrates are shown in (Figure 3a & b).

Figure 3. The used substrata fixed on the stainless steel model under water
(a); *Luffa egyptica* and the (b) *Leaf palm*

Substrates used

Luffa egyptica: it is both tropical and subtropical vines. It is characterized by its smooth surface with a yellowish color and cylindrical shape. Its average diameter ranges between 4 and 10cm. It consists of cellulose fiber layers with shallow holes extended interiorly in the form of pipes (Figure 2a & 3a). It is used in showers just like a sponge. The area used as substrate was calculated according to the following equation: [*Lateral surface area of the cylinder = 2л r L.* Where, (Л=3.14, r= Radius, L= Height) in cm].

Leaf palm**:** It is found on the palm tree stems with a flat-like sheet (brownish color). It has different sizes. The used parts have rectangular shapes, their lengths are ranged between 19 and 37 cm and their widths are ranged between 30 and 55 cm. They have rough surfaces which consist of strands of irregular shapes wrapped in a cylindrical form that become layers over each other, fixed with plastic ropes on the models (Figure 2b & 3b). The surface area of each part was calculated as: [Surface area = Length × Width in cm].

Artificial Fibers: These are fibers with smooth surfaces in the form of hair fibers (made of polyester, nylon or glass fibers) having a white color. These fibers are compiled in a circular form by threads. There are no cavities or holes either on the outer surfaces or inside the textiles. The average diameter ranges between 10 and 15 cm (Figure 2c).

RESULTS

The effect of different substrates in collecting *C. filose* in relation to the different habitats

During the present study, a total of 16 substrates of each *Luffa egyptica*, *Leaf palm,* and cylindrical parts of artificial fibers were placed in four different natural habitats: algae, seagrass, algal cover associated with rocks and coral reefs. The total surface areas of the used substrates are 8970cm^2, 19805cm^2 and 2410cm^2 for *Luffa egyptica*, *Leaf palm* and artificial fibers, respectively. The total number of individuals was recorded in all models which is about 924 in all different habitats. *Luffa egyptica* recoded the highest and the maximum value (605 ind,, representing 65% of the total individuals) (Table 1); while *Leaf palm* recorded a relatively low number of individuals (319 individuals representing 35% of the total individuals). There were no recorded amphipod individuals in the artificial fibers. The most common algal habitats tested were *Sargassum dentifolium* and *Cystosaira crinita*, then the seagrass *Halodule* sp. Moreover, the soft corals *Heteroxenia* spp. and the hard corals *Acropora* spp. were also tested. Finally, the common algal species associated with rocks are *Galaxaura rugosa* and *Dichotomaria*.

Luffa egyptica

It was observed that, *Luffa egyptica* is the most favorable substrata for the attraction of higher numbers of the amphipod *C. filosa* when compared to other substrates (Table 1). Moreover, the highest number of individuals of *C. filosa* (228 individuals) was recorded in the algal habitat followed by seagrasses (195 individuals), rocks with algae (116 individuals), and then corals with a number of (66 individuals). On the other hand, the trend of individuals' numbers per cm^2 ' in different habitats is in the descending order of: algae > seagrasses > rocky+algae > corals. The same sequence was observed in the numbers of individuals/cm^2 (15.49x10^{-2} > 6.94x10^{-2} > 4.34x10^{-2} > 3.27x10^{-2} respectively).

Table 1. Number of *C. filosa* individuals per cm^2 surface area of the used substrates in different marine habitats at a depth (0.5-1.5)

Types of Substrates	Types of habitats	Total No of individuals	Individual/cm^2
Luffa egyptica	Algae	228	15.49x10^{-2}
	Seagrass	195	6.94x10-2
	Rocky +algae	116	4.34x10-2
	Coral	66	3.27x10-2
	Total No of individuals	605	
Leaf palm	Algae	158	2.44x10-2
	Seagrass	79	2.12x10-2
	Rocky +algae	51	0.82x10-2
	Coral	31	0.92x10-2
	Total No of individuals	319	

Leaf palm

The *Leaf palm* recorded relatively low number individuals of *C. filosa*. However, the highest number of individuals of *C. filosa* (158 individuals) (Table 1) was recorded in the algal habitat followed by seagrasses (79 individuals), rocks with algae (51 individuals) and then corals with a number of (31 individuals). On the other hand, the trend of individuals' numbers per cm^2 ' in different habitats is in the descending order of: algae > seagrasses > rocky+algae > corals. The same sequence was observed in the numbers of individuals/cm^2 (2.44x10^{-2} > 2.12x10^{-2} > 0.82x10^{-2} > 0.92x10^{-2} respectively).

Artificial fibers

artificial fibers did not record any individuals. There is no evidence of any amphipod individuals inside the artificial fibers.

DISCUSSION

Sargassum dentifolium is the most important algal habitat which is invaded by more than 8 species of amphipods, especially the *Cymadusa filosa* which is the most common species in many different studies **(**Mohammed *et al.*, 2013). *C. filosa* recorded 228 individuals within the substratum *Luffa egyptica* and 158 individuals in the other substratum *Leaf palm* when captured from the algal habitats. *C. filosa* is attracted to these algal covers as preferable hosts. This may be due to their high ability as a defendable host (Duffy and Hay, 1991) because they are less palatable for larger herbivores such as fish that could incidentally consume the amphipods according to (Hay *et al.,* 1988, 1990). Moreover, these amphipods occur in such algae as suitable places for camouflage and defense. On the other hand, Jacobucci *et al.* (2008) pointed out that, another algal species of *Sargassum* is suitable for most amphipods and used three different methods for the amphipod capture and collection. In the present study, three substrates were used; *Luffa egyptica*, *Leaf palm* which are natural substrates and artificial fibers). These substrates were then fixed in the different habitats to recognize and select the best habitat for the collection of the amphipod, *Cymadusa filose*, as a modified collector of amphipods. The, use of natural substrates (*Luffa egyptica*, *Leaf palm*) gives the highest number of individuals of *C. filosa* through 60 days in different habitats, followed by *Leaf palm* which simultaneously recorded a lower number of individuals. (Shaban, 2012), in his experimental design of two artificial substrates, which consist of artificial filamentous algae and a net bag, and one natural substrate *Obelia spp* or red filamentous algae, used, in the collection of caprellid communities at Sites in Charleston, artificial substrates including a conical net bag and artificial filamentous algae which were made of longitudinal synthetic fibers gathered together. The *Obelia spp* natural substrate showed the highest total caprellids densities. Marine algae species (*Sargassum dentifolium and Cystosaira crinita*) showed the highest proportion of individuals from *Cymadusa filose*, in contrast to Jacobucci *et al*. (2008). The cages with the *Sargassum filipendula* biomass give a few numbers of *C. filose*.

Luffa egyptica is the most favorable substrata for the attraction of higher numbers of the amphipod *C. filose*; natural plants may be a good environment to live safely and not be subjected to any predators through the entry of the individuals of *C. filose* through the tube-building that stretches on all sides to the inside. The fertile environment for the bacteria is also used as food for amphipod individuals. In the present study, the artificial fibers did not record any individuals. There is no evidence of any amphipod individuals inside the artificial fibers because the body fibers do not have any cavities inside or outside which makes it difficult to handle the entry of individuals. On the other hand Shaban, (2012) used the structure of artificial substrate that closely resembles filamentous algae which provided the best shelter for both caprellid species.

REFERENCES

Aikins, S. and Kikuchi, E. 2001: Studies on habitat selection by amphipods using artificial substrates within an estuarine environment. *Hydrobiologia* 457: 77–86.

Ayala, Y. 2002: Relaciones entre la comunidad de anfípodos y las macroalgas asociadas a una plataforma rocosa Del Litoral Central. Tesis de Licenciatura. Universidad Simón Bolívar. 71p.

Bellan-Santini, D. 1998: Ecology. In: Ruffo S (Ed) the Amphipoda of the Mediterranean, Part 4. Localities and Map, Addenda to Parts 1–3, Key to Families, Ecology, Faunistics and Zoogeography, Bibliography, Index. Mém *Inst Océanogr, Monaco*, Vol 13, pp 869–893

Bellan-Santini, D., and Ruffo S 1998: Faunistics and Zoogeography. In: Ruffo S (Ed) the Amphipoda of the Mediterranean, Part 4. Localities and Map, Addenda to Parts 1–3, Key to Families, Ecology, Faunistics and Zoogeography

Brown, A. C., and McLachlan, A. 1990: 'Ecology of Sandy Shores.' (*Elsevier: Amsterdam*) 328 pp.

Dahl, E., 1952: Some aspects of the ecology and zonation of the fauna of sandy beaches. Oikos 4, 1e27. *Journal of Experimental Marine Biology and Ecology*, 329: 55-65.

Duffy, J.E. and Hay, M.E. 1991. Food and shelter as determinants of food choice by na herbivorous marine amphipod. *Ecology*, 72:1286‐1298.

Hay, M.E.; Duffy, J.E.; Fenical, W. and Gustafson, K. 1988. Chemical defense in the seaweed *Dictyopteris delicatula:* differential effects against reef fishes and amphipods. *Marine Ecology Progress Series*, 48:185‐192.

Hay, M.E.; Duffy, J.E. and Fenical, W. 1990. Host-plant specialization decreases predation on a marine amphipod: an herbivore in plant's clothing. *Ecology*, 71(2):733‐743.

Jacobia, C. M. and Langevinb, R. 1996: Habitat geometry of benthic substrata: effects on arrival and settlement of mobile epifauna. *Journal of Experimental Marine Biology and Ecology*, 206: 39-54**.**

Jacobucci, G. B.; Güth, A. Z. and Leite, F. P. P. 2008: Experimental evaluation of amphipod grazing over biomass of *Sargassum filipendula* (Phaeophyta) and its dominant epiphyte. *Nauplius* 16 (2): 65-71.

Lowry, J.K. & Myers, A.A. (Eds) 2009:- Benthic Amphipoda (Crustacea: Peracarida) of the Great Barrier Reef, Australia. Zootaxa, 2260, 1–930.

McLachlan A, Jaramillo E 1995. Zonation on sandy beaches. *Oceanogr Mar Biol Annu Rev* 33:305–335

Mohammed, T. A. A.; Elsayed, A. E.H.; Abou Zaid, M.M.; Fatma A. Abdel Razek 2013: Abundance, density and assemblages of the amphipod *Cymadusa filosa* in the different macro-algal habitats northern Hurghada, Red Sea, Egypt. *Blue Biotechnology Journal*, vol. 2 (3): (Accepted, In Press)

Nelson, W. G., 1980:- Reproductive patterns of gammaridean amphipods. Sarsia 65: 61-71.

Peart, R. A. 2004: A revision of the *Cymadusa filosa* complex (Crustacea: Amphipoda: Corophioidea: Ampithoidae). *Journal of Natural History*, vol. 38 (3): 301-336 DOI: 10.1080/0022293021000055441.

Poore, A.G.B., Watson, M.J., Nys, R .D, Lowry, J.K., and Steinberg, P.D, 2000:- Patterns of host use among alga- and sponge associated Amphipods, MARINE ECOLOGY PROGRESS SERIES, *Mar Ecol Prog Ser* Vol. 208: 183–196,

Shaban, W,M, El, 2012: Life history, reproduction and rearing of Caprellid Amphipods: Its possibility to use as live feed in mariculture Ph.D. Degree in Marine Biology and Ichthyology (Marine Invertebrates) Zoology Department, Faculty of Science, Al Azhar University p214-218.

Thomas, J.D., 1993: Identification manual for marine Amphipoda (Gammaridea): I. Common coral reef and rocky bottom amphipods of South Florida. Final Report, September 1993 (FDEP Contract No. SP290). Florida Department of Environmental Protection, Tallahassee, FL, 83 p.

****