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FEEDING HABITS OF *Hyale media* (DANA, 1853) (CRUSTACEA-AMPHIPODA)

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Synopsis

Feeding of males and females of the Gammaridea Hyale media at mature and immature stages were tested in laboratory experiments. Macro and microscopic algae as well as dead or alive animals were utilized as food. This gammarid is omnivorous, feeding by predation, scavenging, browsing and scraping. Feeding behaviour was discontinuous. Padina vickersiae was more utilized in winter and Ulva fasciata in summer. The feeding activity of all the animals showed great variability in relation to the type of food. Higher temperatures probably account for the higher consumption observed in summer.

Descriptors: Feeding behaviour, Experimental research, Developmental stages, Amphipoda, *Hyale media*, Itanhaem: SP, Brazil.
Descritores: Hábitos alimentares, Pesquisa experimental, Estádios de desenvolvimento, Amphipoda, *Hyale media*, Itanhaem: SP.

Introduction

Studies on gammaridean feeding have been made by several authors in the last ten years (Moore, 1975; Kititsyna, 1975; Sweiss & Johnson, 1976; Brenner *et al.*, 1976; Zimmerman *et al.*, 1979; Vassalo & Steele, 1980; Willoughby, 1983 and Moore & Francis, 1985).

The impact of the associated fauna on algae and the factors interfering on herbivorous food preferences have been discussed in the literature mainly by Nicotri (1977), Pomeroy & Levings (1980), Nicotri (1980), Brawley & Adey (1981), Shacklock & Croft (1981), Price & Hyllerberg (1982) and Shacklock & Doyle (1983).

In the northen and southern shores of São Paulo State, *Hyale media* (Dana, 1853), Talitridea, is the most abundant amphipod living on *Sargassum* plants, and shows a wide vertical distribution (Tararam & Wakabara, 1981; Tararam *et al.*, 1981; Wakabara *et al.*, 1983; Tararam *et al.*, in press). The present work reports the qualitative results of laboratory studies on *H. media* feeding.

Area of investigation

Algae samples were collected at Praia do Poço, Itanhaém, in the southern coast of São Paulo State, Brazil (24°12'S - 46°47'W).

Praia do Poço is partially sheltered from wave action by rocks and stones where *Sargassum* plants are very common. *Sargassum stenophyllum* and *S. cymosum* are abundant and *Ulva fasciata* and *Padina vickersiae* occur in smaller quantities. Associated to these algae, several Gammaridea such as *Cymadusa filosa*, *Ericthonius brasiliensis*, *Elasmopus pectinicrus*, *Sunamphitoe pelagica* have been found, besides *Hyale media* (Wakabara *et al.*, 1983). During the investigation period, from January to August 1979, the mean salinity, dissolved oxygen and water temperature recorded were 34.18°/oo, 5.00 ml/l and 24.0°C, respectively.

Material and methods

The macroalgae *Sargassum stenophyllum*, *Ulva fasciata*, *Padina vickersiae* and the microscopic algae *Phaeodactylum tricornutum*, *Skeletonema costatum*, *Chlorella* sp, *Isocrysis* sp were utilized as food by *Hyale media* in laboratory experiments. In addtion to plant food and in relation to their availability in the aquarium, animals as *Artemia* sp, harpacticoid copepod and dead individuals of either

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H. media, *Cymadusa filosa*, *Ericthonius brasiliensis* as well as fragments of Decapoda Reptantia were offered as food to *H. media*. The experiments were performed with animal and plant food collected at the sampling sites of *H. media* specimens.

The plant substratum (*Sargassum*) was scrapped from the rock and immediatly placed into containers with aerated seawater. In the laboratory, plants and their fauna were transferred to the aquarium (28 ℓ capacity) with aerated seawater. The water was changed every 20 days approximately. *Sargassum* plants when chopped off by gammarids were replaced periodically.

The animals utilized in the experiments were grouped according to their developmental stage and sex following the study of *H. media* life cycle (Leite, 1976). Stage 1 (males and females, generally immature) comprised individuals with 9 or 10 articles in antenna 1; stage 2 (mature males with large gnathopods, ovigerous females) comprised individuals with 11 or 12 articles in antenna 1. The specimens were acclimated for about 48 hours, followed by 12 hours of starvation.

Three individuals of the same sex and in the same developmental stage were placed into 500 ml containers with filtered, continuously aerated seawater and covered with aluminum foil to avoid light effect. Temperature was maintained at 21.1 ± 0.8°C in winter and 26.8 ± 0.6°C in summer and salinity at 34.18 ± 0.2°/oo. Three replicates were utilized for each group, summing 9 animals per group. The feeeding period was 22 hours. Following Lawton (1970), Zimmerman *et al.* (1979), Shacklock & Croft (1981) and Shacklock & Doyle (1983) one control was utilized to avoid overestimating consumption by loss of food weight.

Starvation, alimentary periods and number of individuals necessary for adequate replication were determined in previous experiments. The amount of food ingested was obtained by evaluating the differences between the food weight before and after the feeding period. Data given in Table 1 are the mean values of ingestion experiments. The average standar error is $S\bar{x}$ = 199.6.

In experiments with microalgae, aliquots of algal culture were placed into dark containers (500 ml) with filtered seawater. A flask, treated in the same way, but lacking amphipods, was considered as the control. The quantity of ingested microalgae was estimated by countings under a transmitted light microscope, before and after the feeding period.

Stomach contents of *H. media* specimens, fixed in 4% formaldehyde, were also analysed under a transmitted light microscope.

Results

Sargassum plants utilized as substratum were completly reduced to fragments by the *H. media* activity, requiring new plant supplies to the aquarium.

Hyale media accepted all the food offered excepting microalgae. Adults proved to be agile, efficient hunters and carried *Artemia* sp and harpacticoid copepod into the mouth by quick appendage movements. Scavenging was observed when pieces of Decapoda and dead gammarideans were ingested. Scraping behaviour was attributed to *H. media* because some epiphytic diatoms were found in the stomach contents of the specimens sampled from Praia do Poço (Fig. 1). *Cocconeis scutellum* was the major diatom and *Synedra* sp, *Licmorpha* sp, *Achnantes* sp and *Navicula* sp. were less frequent. The identification of these genera to species level was impossible because specimens were either decomposed or broken. Decomposed tissues of macroalgae and crustacean setae in the stomach contents of *H. media* were also observed, as well as unidentified amorphous material. Browsing was noted when *Sargassum stenophyllum*, *Ulva fasciata* and *Padina vickersiae* were ingested. Figure 2 shows three macroalgae scraped at the surface by *H. media*.

Animals weight in summer was generally greater than in winter, Table 1. Mean weight of males was greater than females in winter and summer. Food ingestion seemed to be higher in summer than in winter. Generally the species consumed mostly *Padina* in winter and *Ulva* in summer. Considering individuals in the same developmental stage, it seems that males ingested more food than females, excepting those in stage 1 in summer. In

Table 1. Mean values of *Hyale media* food ingestion (µg of food/individual/day) in winter and summer. ( ) = mean weight in mg of experimental animals

Stages	Animal Food (dead animals)	*Sargassum*	*Ulva*	*Padina*
		WINTER		
Males 2	(2.8) 759.9	(3.2) 1021.0	(2.6) 1003.2	(2.7) 1063.4
Females 2	(1.3) 613.3	(1.4) 925.3	(1.4) 871.0	(1.5) 1052.5
Males 1	(1.7) 615.8	(2.1) 960.5	(1.5) 1210.1	(1.6) 1319.4
Females 1	(1.0) 458.7	(1.2) 628.7	(1.0) 798.5	(1.0) 1041.1
		SUMMER		
Males 2	(3.1) 1131.7	(3.4) 1144.9	(3.4) 1545.9	(3.2) 1077.0
Females 2	(1.4) 997.5	(1.7) 876.5	(1.7) 1830.0	(1.7) 875.2
Males 1	(1.7) 788.3	(1.7) 893.1	(1.2) 1003.1	(2.0) 1332.2
Females 1	(1.1) 808.3	(0.9) 982.2	(1.2) 1284.0	(1.1) 1019.3

the case of individuals in different developmental stages, females 2 seem to have ingested greater amounts of food than females 1, excepting *Sargassum* and *Padina* in summer. The high standard error found was partially due to the great variability in weight of the experimental animals and to the fact that *H. media* does not utilize food continuously.

Discussion

The damage caused by gammarids to the sheltering plants, as *H. media* to the *Sargassum* in the present experiments, has been also observed by several authors (Nicotri, 1977, 1980; Brawley & Adey, 1981; Shacklock & Croft, 1981; Shacklock & Doyle, 1983).

Dennel (1933), Anraku & Omori (1963), Agrawal (1964) and McGrouther (1983) suggested a close relationship between feeding habits and mouthpart structure of some species. *H. media* mouthparts are not those of a filter-feeding species, because of their short and non-plumose setae. This fact was also observed in *H. rupicola* by McGrouther (*op. cit.*). The strong mandibular molar in *H. media* would allow the trituration of solid food and the partially broken diatoms in its stomach content is an evidence of this characteristic.

Epiphytic diatoms constitute one of food items ingested by gammarids according to results obtained by D'Antonio (1985). Behbehani & Crocker (1982) in laboratory experiments observed *Orchestia platensis* scraping diatoms off glass surfaces.

The present results indicate that *H. media* is omnivorous, feeding by predation, scavenging, scraping and browsing. Gammaridea, specifically talitrids studied by Agrawal (1964), Bowers (1964), Behbehani & Crocker (1982) and Moore & Francis (1985), are omnivorous although their food spectra usually consists mainly of macroalgae. In the present case, animal food was the least food item utilized by *H. media*, but predation was also observed when it hunted living copepod and *Artemia* sp. Although it is well known that talitrids feed on food of animal origin, the question wether it is utilized alive or dead remains unsolved. *Orchestia gammarellus* according to Moore & Francis (1985) does not eat living animals. *O. cavimana* (Dorsman, 1935 apud Moore & Francis, 1985) and *O. platensis* (Behbehani & Crocker, 1982) were observed eating living animals, a fact regarded as aberrant or an occasional behaviour.

Hyale media fed discontinuously. Discontinuous feeding behaviour was also found in *Gammarus pulex* by Willoughby

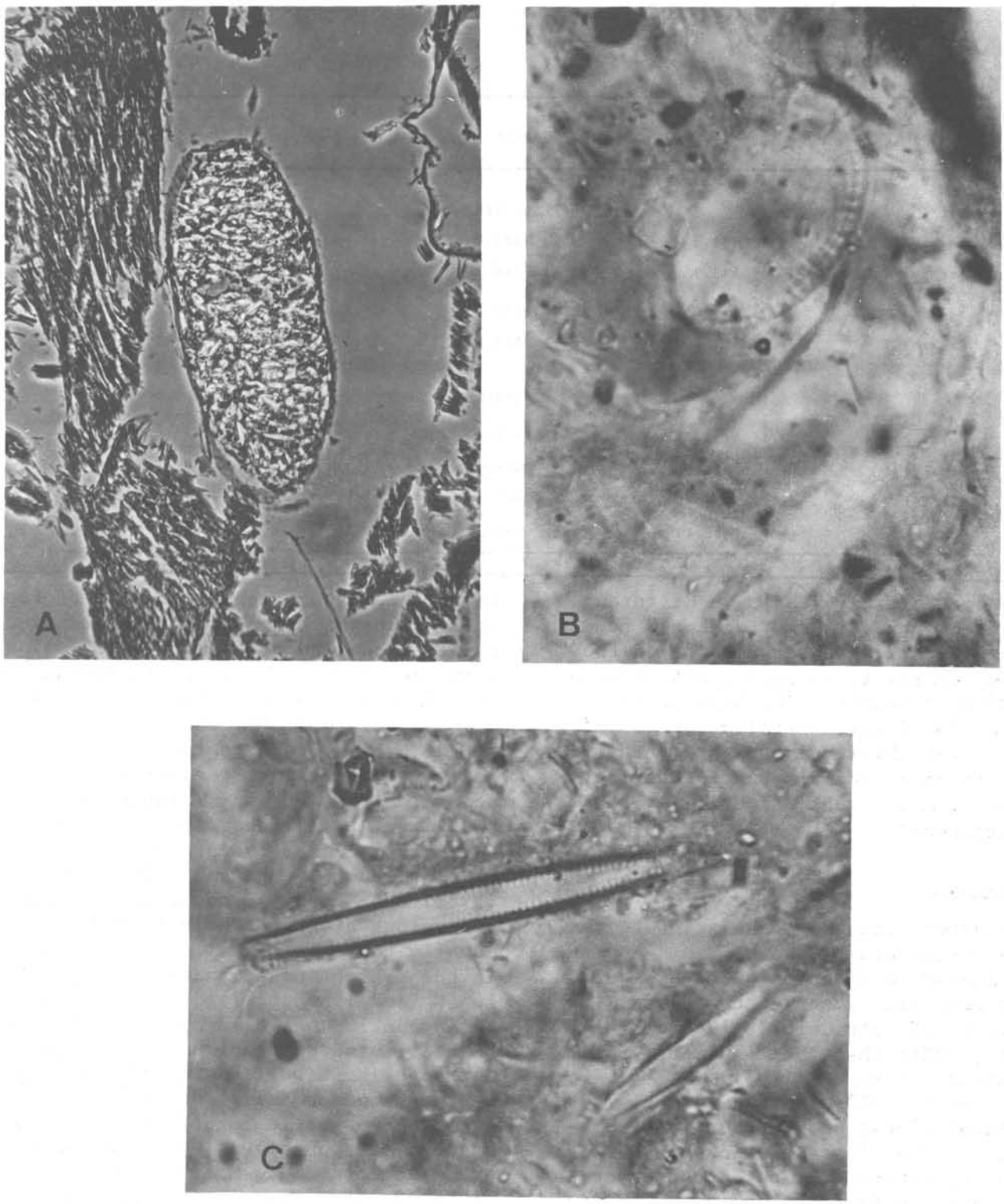

Fig. 1. Stomach contents of *Hyale media*. A - partial view of *H. media* stomach content (120X); B - *Cocconeis* sp (1200X); C - *Synedra* sp (1200X).

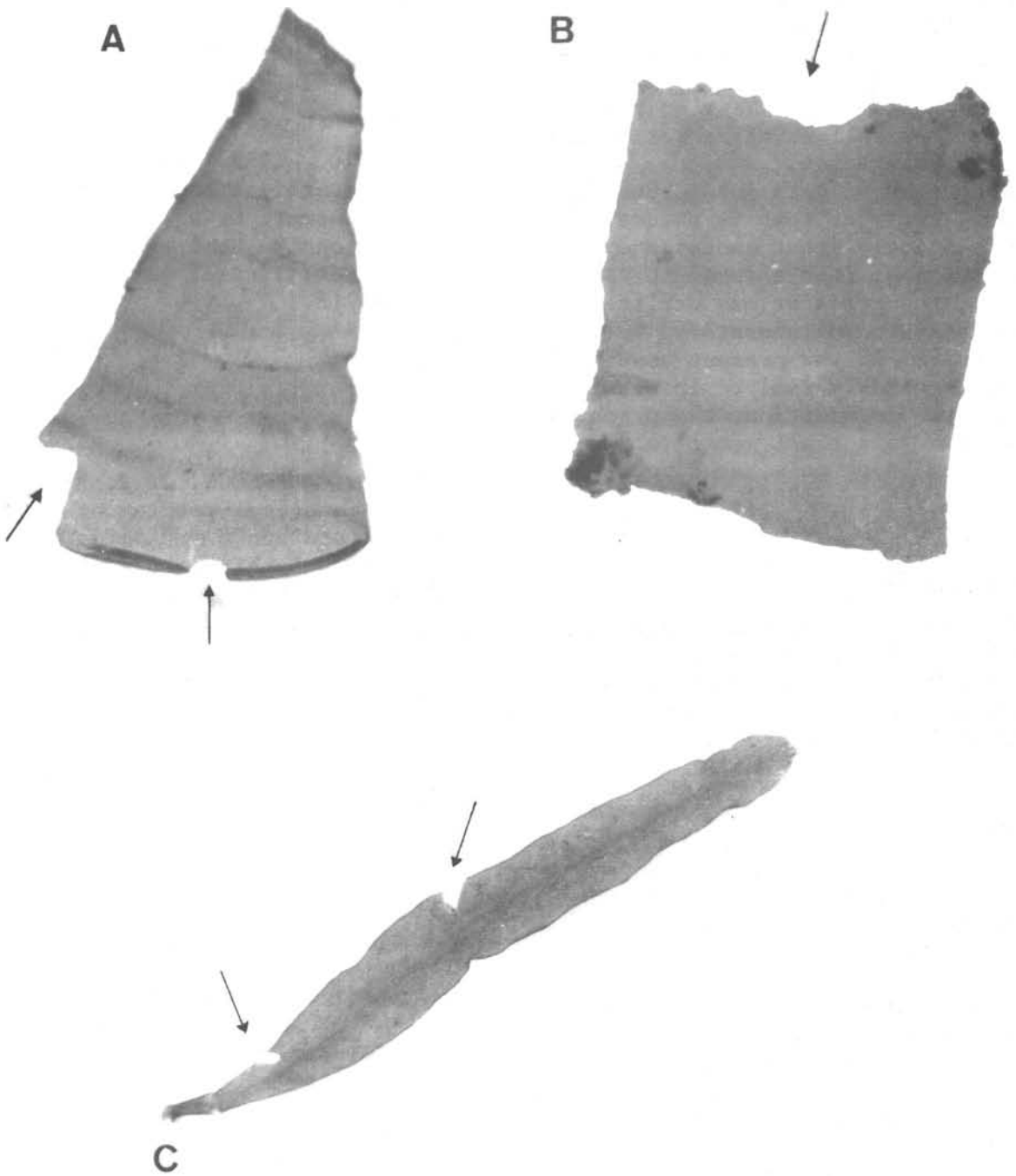

Fig. 2. A - *Padina*; B - *Ulva* and C - *Sargassum* after grazing period. Arrows indicate damaged sites by *Hyale media*.

(1983). Fish & Preece (1970) assured that the variation in alimentary habits may be due to the different quantities of reserved food and/or different age of specimens with the same weight.

The qualitative difference of ingestion in winter and summer (*Padina* is more utilized in winter and *Ulva* in summer) may be attributed to the different nutritional values of the food plants; Nicotri (1980) pointed out that the specimens graze faster on food containing more organic material.

The general higher consumption of food in summer may be related to a higher mean weight of the animals and higher temperatures occurring in this period; Kititsyna (1975) showed that the rate of food ingestion by *Pontogammarus robustoides* was influenced by animals

weight and temperature.

On the other hand, alga by itself may not meet the nutritional requirements of Gammaridea which need a complementary food. Vassalo & Steele (1980) assured that *Gammarus lawrencianus* requires animal food as well as algae for a rapid growth and maturation.

For the sake of data interpretation, one should remember that in nature, due to the relatively great amount and diverse types of food assumed to be available, the predator may utilize numerous preys. In laboratory experiments as in the present case, preys are generally limited in quantity and quality. In addition, the predators are confined to a small water volume with one food type only, as discussed by Price & Hyllerberg (1982).

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