

NOTES ON STRUCTURE AND PARASITISM OF *MUNIDA IRIS*
A. MILNE EDWARDS (DECAPODA, GALATHEIDAE) FROM
NORTH CAROLINA, U.S.A.

BY

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INTRODUCTION

From 27 to 29 June 1968, a training cruise aboard R/V "Eastward" of the Duke University Marine Laboratory was undertaken with the objective of sampling benthic fauna of the continental shelf off North Carolina. One product of this cruise was a large collection of the galatheid, *Munida iris* A. Milne Edwards (1897), which is analyzed here.

The authors thank Duke University Marine Laboratory, Beaufort, N. C., and the Cooperative Program of Biological Oceanography for the use of the R/V "Eastward" on cruise E-24-68 supported through National Science Foundation Grant GB-6868. We are indebted to Dr. Thomas E. Bowman and Mr. Henry B. Roberts of the U. S. National Museum, Dr. Arnold Ross of the San Diego Natural History Museum and Mr. John C. Markham of the University of Miami for aid in identifications. Records for distributional ranges are from literature and files of the U. S. National Museum.

MATERIALS AND METHODS

Decapod crustaceans were collected by means of a 40-foot otter trawl. Specimens were preserved in 10% formalin, and later identified and counted.

The following measurements were recorded for analysis of the sample of *Munida iris*: (i) length of carapace: straight-line distance from posterior edge of right orbit to posterior margin of carapace; (ii) length of attached chelipeds: straight-line distance from dorsal side of mero-ischial joint to tip of dactyl.

At "Eastward" Otter Trawl Station 9888, 35°05.0'N 75°11.5'W, 275 m, 251 specimens of *Munida iris* were collected. Known geographic range of this species

RESULTS

extends from southwest of Marthas Vineyard and Nantucket, Massachusetts, U.S.A., to near Cozumel Island, México, and off the mouth of the Amazon River at depths of 79 to 512 m. Off North Carolina the species has been found at depths of 90 to 292 m. Because of the number of large specimens obtained, some data concerning population structure are available from this sample.

Sex ratio. — The sample (160 females and 91 males) was 63.7% female. There is statistically a highly significant departure from a 1 : 1 sex ratio in this sample ($\chi^2 = 18.8$, $P < 0.01$). Among other members of the genus, male:female ratios

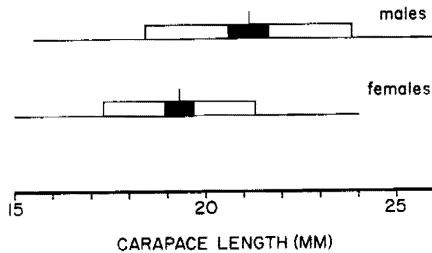


Fig. 1. Carapace length in 226 non-parasitized *Munida iris* A. Milne Edwards (81 males, 145 females) showing sexual dimorphism in body size. Vertical line represents sample mean, horizontal line the range of observed variation; solid and open blocks represent 95% confidence limits (approximately two standard errors) and one standard deviation, respectively, on each side of the mean.

of 52.9 : 47.1 for *Munida sarsi*, and 53.5 : 46.5 for *M. tenuimana* were summarized by Reverberi (1942) for non-parasitized populations. Our ratio (36.3 : 63.7) includes parasitized individuals, but sex determination is considered valid.

Reproduction. — Of 160 females, 135 (84.3%) were ovigerous. Based on a count of eggs attached to a single pleopod of one female, each ovigerous individual bore about 7900 eggs. Egg masses appeared to be in different stages of development, some dark brown, others blue (pink in preservation) and presumably at an earlier stage of development.

Size and sexual dimorphism. — Carapace lengths of males ranged from 15.5 to 26.0 mm, mean 21.3 mm. Females ranged from 13.1 to 24.1 mm in carapace length, mean 19.4 mm (fig. 1). As shown in fig. 1, the probability is 0.95 that 20.7 and 21.8 mm include the sample mean for males, and that 19.0 and 19.7 mm include the sample mean for females. There is a highly significant statistical difference ($P < 0.01$) between the mean size of males and females, males attaining a larger size. Chace (1942) provided data on sizes of males and females of several species of *Munida* showing that sexes of a few were equal in size, and, of the remaining species, half had larger males and half had larger females. Ovigerous females (mean length of carapace 19.4 mm) do not differ significantly ($P > 0.50$) in size from non-ovigerous females (mean length of carapace 19.6 mm) in this sample.

Sex determination was based on gross external structural differences: (i) modified 1st and 2nd pleopods in males (flattened, thickened and directed anteriorly), not so modified in females; and (ii) visible opening of oviduct at base of the third pereopod in females. In addition to these characters, size alone, especially when used in conjunction with cheliped length, is a useful criterion for sex determination in *M. iris*.

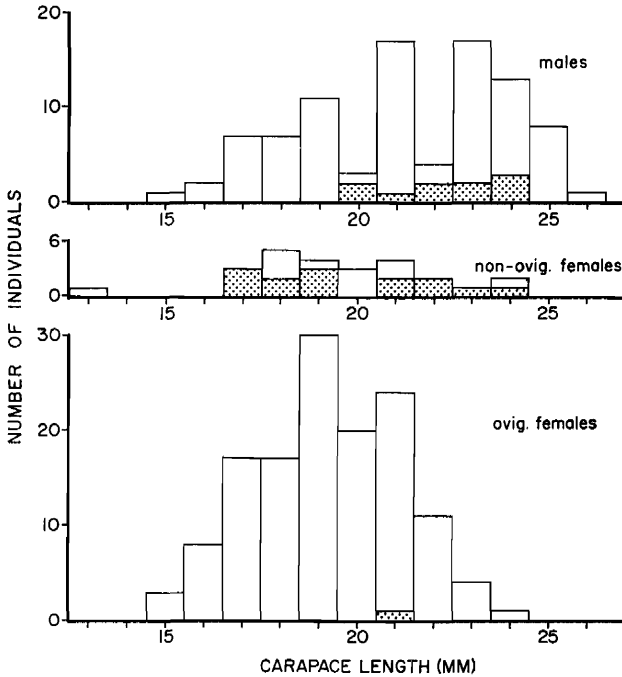


Fig. 2. Frequency distributions of body size in 251 *Munida iris* A. Milne Edwards by sex and reproductive condition. Sample includes 91 males, 135 ovigerous females, and 25 non-ovigerous females. Shading denotes individuals parasitized by bopyrid isopods.

Histograms of carapace length are shown for both sexes in fig. 2. Data for ovigerous and non-ovigerous females, although graphed separately, show no obvious differences in size class structure. Considering the sample of ovigerous females, the distribution approximates a normal curve with no major discontinuities. Thus, no major size or age classes are discernible. Males, on the other hand, may lend themselves more readily to size structure analysis. Three size groups of male *M. iris* appear to exist: (i) small, 19 mm or less in length of carapace; (ii) intermediate, 20-22 mm (including the mean size, 21.3 mm); and (iii) large, 23-26 mm.

Insight into a possible relationship between size and sexual maturity in males may be gained by considering the relationship between length of carapace and cheliped (fig. 3). Females show a positive correlation of length of cheliped to carapace, the chelipeds increasing in a uniform manner to a maximum length of

about 125 mm. Males, rather than showing a similar linear correlation, may be grouped roughly into small individuals with short chelipeds and large individuals with long chelipeds, the latter being well separated from the former. If an arbitrary cheliped size of 130 mm is chosen to delimit the two groups, and if this size cheliped is designated as a lower limit for size at sexual maturity in males, an interesting correlation results. Using the previous length of carapace size classes, males may be arranged as follows: (i) small (19 mm or less) — not distinguishable from females on the basis of carapace or cheliped length, probably immature; (ii) intermediate (20-22 mm) — most males not distinguishable from females and thus immature, but a few have enlarged chelipeds and may be sexually

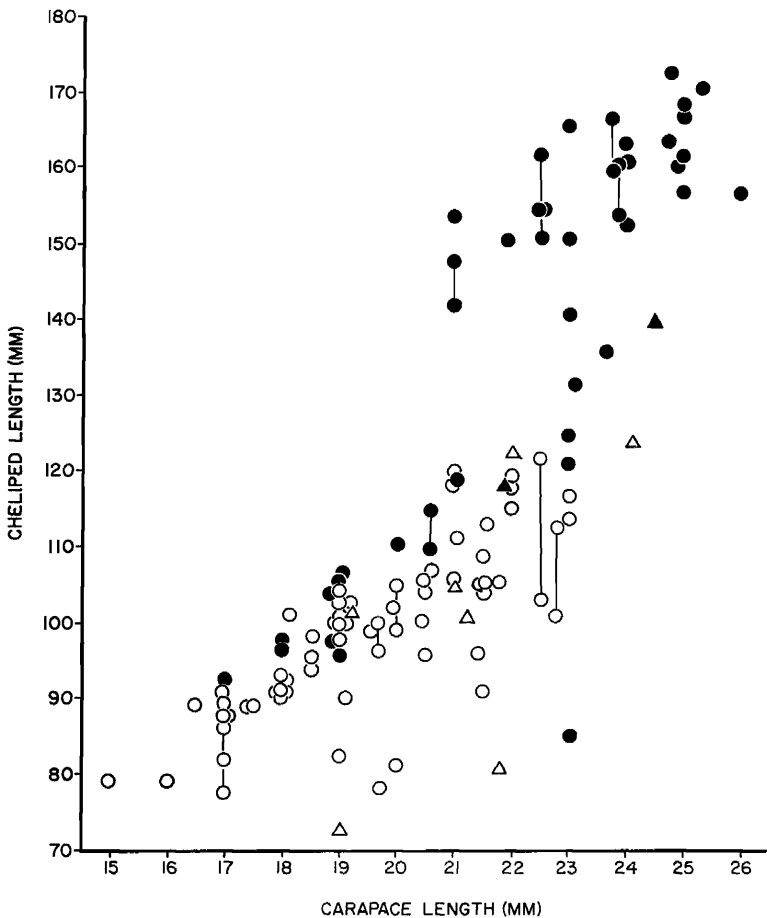


Fig. 3. Relationship between length of cheliped and carapace in 68 female (9 non-ovigerous, 59 ovigerous) and 42 male *Munida iris* A. Milne Edwards. Open circles represent non-parasitized females, solid circles represent non-parasitized males; open and solid triangles represent parasitized females and males, respectively. Vertical lines connect left and right chelipeds in a single individual possessing both appendages of different length; all other symbols represent either left or right cheliped, or both if equal in length.

mature; (iii) large (23-26 mm) obviously different from females in extreme enlargement of the chelipeds. In this largest size range, there is virtually no overlap between males and females with respect to either length of carapace or cheliped, and nearly all males may be considered sexually mature.

Ingrand (1937) showed much the same relationship in *Munida rugosa* (Fabricius) (= *M. bamffica* (Pennant), see Zariquiey, 1952), a species in which chelipeds of males increase in length more rapidly than the cephalothorax after a molt past a certain carapace length (11.5 mm) occurs. In females, an inverse effect was observed, chelipeds growing in length less rapidly than the cephalothorax at sizes beyond the 11.5 mm inflection point. The allometry observed was correlated with attainment of sexual maturity.

Parasitism. — Several *Munida iris* were hosts to various forms of ectoparasites or commensals. Three kinds of consorts were observed as follows:

(i) Two males harbored one and two small, attached barnacles, *Trilasmis* (*Poecilasma*) *inaequilaterale* (Pilsbry), on the chelipeds.

(ii) Two ovigerous females possessed long, thin, white-colored "parasitic" worms (unidentified) coiled within the egg masses on the underside of the abdomen.

(iii) Twenty-five specimens were parasitized by epicaridean isopods, *Anuropodione* sp. (family Bopyridae), identified as probably an undescribed species. *Anuropodione* were found consistently beneath the branchiostegite of the host, resting with the ventral side directed dorsally, head posteriorly, and dorsal side over the gills of the host. Female parasites approximately 10 to 12 mm in length carried small males in a posterior ventral position. The isopods occurred at random on either right or left side of the host. Of 91 males, 10 were parasitized; of 135 ovigerous females, only one was parasitized; and of 25 non-ovigerous females, 14 were parasitized. The overall incidence of parasitism was 10%.

Parasitized individuals showed various stages in modification of pleopods documented for other species of *Munida* (Reverberi, 1942; Reinhard, 1956; Zariquiey, 1958). The single parasitized ovigerous female showed little external evidence of distortion of the carapace, and was probably newly infested. Among non-ovigerous females, size of bopyrid, judged by distortion of the host carapace, did not bear a direct relationship to degree of alteration in the pleopods. On morphological grounds, it appears that there is differential response to *Anuropodione* in the gill chambers of *Munida iris*. Effectiveness of the parasite as a castrating agent may be reflected in the 56% incidence among non-ovigerous females.

RESUMEN

Se presentan datos en relación con la estructura de la población y el parasitismo en una muestra de *Munida iris*. La muestra de 251 individuos muestra (i) una relación mayor del 1 : 1 de hembras (63.7%) en comparación con machos (36.3%); (ii) 84.3% de hembras ovigeras conteniendo alrededor de 7900 huevos cada una; (iii) una tendencia marcada de los machos de mayor edad y presumiblemente más maduros, de sobrepasar a las hembras y a los machos inmaduros en tamaño de cuerpo y desarrollo de las quelas; y (iv) el 10% de la muestra parasitado por epicarideanos.

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