THE HERMAPHRODITE PRAWN *HIPPOLYSMATA ENSIROSTRIS* KEMP

P. V. KAGWADE

Bombay Research Centre of Centred Marine Fisheries Research Institu'e, Bombay.

ABSTRACT

Based on the presence of male and female reproductive systems in the same individual at all sizes and the functional nature of both the testicular and ovarian parte of the ovo-testis throughout, the prawn *Hippolysmata ensirostris* belonging to family Bippolytidae is deemed to be a heiroaiphrodilte. The hooks aind well-developed cl'Espere at the distal end of the endopodilte of the first pleopod suggest cross fertilization in this species.

INTRODUCTION

Protandric hermaphroditism is widely reported in deep-sea prawns of the family PandaMdae. Over a dozen species belonging to this family have been studied in detail by a number of authors from the North Atlantic and North Pecific oceanic regions where these prawns are widely distributed. Works of Butler (1964), Rasmussen (1965 a & b) and Hoffman (1972) are a few to mention in this regard.

In these protandric forms, the prawn is a functional male in die early part of life and later on transforms into a functional female and remains the same in the rest of life. At the functional male stage, the gonad is observed to be an ovotestis, ithe ovariian part of which remains non-functional, whereas at the functional female stage, the testis disintegrates and disappears due to sexual transformation and the gonad thus becomes a true ovary.

Sukumaran (1973) first reported the incidence of hermaphroditism in an Indian prawn. He observed in *Hippolysmata ensirostris,* protandric hermaphroditism, similar to the type described earlier in pandalids. His studies have shown that this species is a male in the early part of life and subsequently changes its

Further work is desirable to convincingly prove whether the species is truly hermaphrodite as claimed in the paper or protandric hermaphrodite (as- claimed in the paper immediately follows) in view of the fact that whle one of the authors has not succeeded in proving the presence of both male and female gonad® in the saime specimens *m* sizes below 30 mm length, ithe other admits that sperms are contained in the ovotestis of active female specimens in larger sizes. —Mg. Editor

sex completely and functions as female during the remaining period. This change in sex is reported to be accompanied by change in secondary sexual characters also.

In a detailed study of the species at Bombay during 1971-74, 'the process appendix masculina, the male secondary sexual character on the inner side of the appendix interna of the second pleopod of the prawn was observed in eveiy specimen of *H. ensirostris* collected. This lead to a closer examination of the gonads and secondary sexual characters of this species, the results of which are reported here.

MATERIAL AND METHODS

Specimens for this study came from the routine samples collected for the species-wise assessment and other biological details of prawns from 'Dol' catches, from the landing centres M'adih and Maihul, during November 1971 to December 1974. A small number of samples from Sassoon Docks and Vsrsova were also included.

The study covered specimens measuring between 20 and 100 mm in total length. Initially, over a thousand specimens were examined, in ail of which, appnedix masculina was noticed. Later on, 600 specimens were studied for their gonadial details under the microscope. At different stages of gonadial condition, micro-section of 5 *[*>• thickness were taken and stained with Delafield's hematoxylin and eosin. Details of appendix masculina in 277 specimens and of endopodite of the first pleopod in 186 specimens were observed under monocular and binocular microscopes.

Mierophotographs of gonadial sections and the secondary sexual characters were also taken.

THE REPRODUCTIVE SYSTEM

Every specimen of *H. ensirostris* (Fig. 1A) dissected was found to possess a pair of ovotestes. The reproductive system (Fig. IB) of this species consists of a pair of ovotestes (Fig. 1C and D), a pair of oviducts antero-laterally from the ovarian part and a pair of vasa deferenitia postero-laterally from the testicular part. The distal ends of the vasa deferntia enlarge into bulb-shaped vesiculae seminales.

The ovarian part lies above the hepatopancreas and beneath the pericardial sinus and heart. The .two ovaries are so closely placed that they appear to be a single mass of body. The shape, size and colour of the ovaries depend on their maturity stages. Slightly thick oviducts from the mid-lateral sides of the ovaries with wider lumen at the commencement, vertically descend downwards and ventrally open through the female genital pores on the coxae of third walking legs.

An ovotestis of *Panddus pWyeeros* is described to have a central medulla of ovarian tissue and a cortex of testicular tissue by Hoffman (1972). The cortical tissue is said to disappear in the female stage. The arrangement of gonadial tissue in an ovotestis of *H. ensirostris* differ from this. The ovarian and testicular tissues are placed one behind the other, the former preceding the latter. Both are enclosed in a common gonadial wall (Plate I, A). The developing spermatogonia and oocytes in an immature ovotestis and mature ova along with sperms in a mature ovotestis of an ovigenous specimen (Pilate I, B) indicate that the gonad remains and functions as an ovotestis at all stages. Sperms with long tails are sulnspberieal in shape (Plate I, C).

MALE SECONDARY SEXUAL CHARACTERS

Butler (1964) and Hoffman (1972) have observed in some pandalids copulatory organs in the form of hooked cincinnuli at the distal end of the endopodite of the first pleopod and a number of smaller spines along the inner margin of the appendix masculina in the second pleopod. These copulatory organs present during the earlier male stage in such pandalids get atrophied or disappear later in life when 'there is a change to female stage.

Sukuimaran (1973) noted similar type of morphological changes in the copulatory organs of *H. ensirostris,* which he has considered to be a protandrous hermaphrodite. According to him specimens in 20-30 mm size range are males, above 40 mm, females and the intermediate size, the transitory stages.

A closer study of the copulatory organs shows that endapodite of the first pleopod is short and broad (Plate I D) in similar individuals. With the growth, the endapodite looks slender due to its elongation (Plate I E & F). The distal end of the endopodite is rounded and often looks barren. However, 2.2% of the total number of 186 specimens examined are seen to possess hooks (Plate II G). The hooks noticed are one or two in number at the sides of the distal end of the endopodites in individuals between 43 and 63 mm in size. Further, in another 2.7% of the specimens examined, strong well-developed clasper like processes (Plate II H), either one or two in number at the end of this endopodite are noticed in individuals with sizes ranging from 55 mm to 83 mm. The distal end of this endopodite looking barren in majority of the specimens may be due to the reason that hooks and claspers are easily lost. This view is supported by Ae fact that sometimes either one or two hooks and claspers of either of the two sides alone are present.

At the apex of appendix masculina, Hoffman (1972) mentioned of the presence of a row of short spines running obliquely on its ventral surface, in addition to die strong, broad spines. In smaller specimens of *H. ensirostris* these structures at the apex are long filaments, 6-8 in number (Plate II, I & I) and pointed like needles. They bear very fine, short plumose setae at regular intervals along the distal half or a little earlier. The processes on the ventral surface

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are very long filaments, without pointed ends, most of 'them often extending up to the ones at the apex. The appendix masculina becomes shorter (Plate II, K & L) and remains either slender or stout and with or without a small number of filaments in larger size specimens. From table 1 it is seen that though appendix masculina is reduced in size at higher lengths, there still are some individuals, in very small percentage, in which it is well developed, rendering it difficult to iredy fully on this character to establish sex reversal in this species.

TABLE 1. *Percentage frequency of appendix masculina in relation *o its size and number of filaments at its apex at different sizes.*

Size group (mm)	No. of specimens	Appendix masculina (%)	
		Well developed and bearing 6-8 filaments	Short and slender or stout bearing a few or no filament
21-30	4	100	0
31-40	5	100	0
41-50	24	94	6
51-60	37	86	44
61-70	59	'. . . . . 5~6-	44
71-80	69	38	62
81-90	27	37	63
91-100	2	0	100

DISCUSSION

The detailed examinatioin of *H. ensirostris* does not reveal any kind of resorption of endopodite of the first pleopod at any stage, nor does the appendix interna in specimens of 20 mm in length as mentioned with illustrations by Sukumaran (1973). The present study does not support the theory of sex reversal in this species. All .the specimens from the smallest size of 20 mm to the largest of 100 *mm* are found to possess ovotestes ini addition to appendix masciitina, the male secondary sexual character. The vesiouiae seminales of all these individuals, when teased on a slide, had revealed sperms which often were in clusters. The presence of sperms is seen to bear no relationship with the size of the prawn or the maturity condition of the ovarian part. The simultaneous dtscuirrence of male and female reproductive systems is prominently seen in larger specimens. These elements of 'both the kinds are noticed' to be functional throughout. These, and also the presence of daspers in larger specimens, rule out the case of protandric hemaphroditism involving change in sex from early male to late female phases in this species.

The ovtestis of a specimen measuring 23 nun An length, when teased on a slide, had shown sperms in good abundance but oocytes only in very small number, measuring not more than 0.04 mm in diameter. This suggests that the testicular part attains maturity perhaps at a length, even earlier than 23 mm while the ovarian part matures at a later stage. Kagwade (1980) has reported that the smallest mature female measured 45 mm and that from the maturity curve, the size at maturity at 50% level was determined to be 60.5 mm. This difference in the size at maturity of testicular and ovarian parts should not be mistaken' for 'the two phases, namely, early male and late female, in its life because the testicular part continues to be functional at all the sizes. Moreover, in the development of gonads, it is always the testis that develops first and ovary later on.

From the fact that sperms are noticed in all prawns and the claspars in some immature as well as ovigerous specimens, it can be established that *H. emirostris* is a heirmaphrodite throughout its life. The simultaneous activities of ova and sperms, as judged by the sperm filled testicular part, when the corresponding ovarian part is mature in an ovigerous individual, show synchronous hermaphroditism in this species. The presence of claspers strongly suggests cross fertilization though both the sex elements in ripe condition were observed at the time in an individual.

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