

Relationship between Development of Secondary Sex Characters and Androgenic Gland in *Macrobrachium idella* (Hilgendorf)

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The secondary sex characters such as length of cheliped, length of appendix masculina and number of spines on it, and the width of vas deferens are under the control of the androgenic gland and have no relationship with the body size of the prawn, *Macrobrachium idella*. Of the 30 individuals randomly selected, 22 had a body length to cheliped length ratio below 1:1.5. The size of the androgenic gland and appendix masculina were not fully developed in them, indicating that they are reproductively inactive. Remaining 8 individuals, having a body length to cheliped length ratio above 1:1.5, had well-developed androgenic gland and appendix masculina showing that there is positive correlation between the biomass of androgenic gland and the degree of development of secondary sex characters.

Key words: Secondary sex characters, androgenic gland, *Macrobrachium idella*

Polymorphism has been reported among crustaceans in general and freshwater prawns in particular. Henderson & Mathai (1910) noticed dimorphism in the second chelipeds of males in three species of the genus *Palaemon*, viz., *P. malcolmsonii*, *P. dubius* and *P. scabriculum*. The androgenic gland has been known to play an important role in crustacean sex determination as well as in the regulation of primary and secondary sex characteristics. In the giant freshwater prawn, *Macrobrachium rosenbergii*, the growth rate of male is considerably higher than that of female (Sagi *et al.*, 1986). However, growth rates of male vary greatly due to the existence of different male morphotypes within the prawn population (Raanan & Cohen, 1985; Sagi & Raanan, 1988). Thampy & John (1973) have found that even among the males of *Macrobrachium idae* of same size, there was variation among cheliped length, size and spinuosity of appendix masculina and development of testis. They found that this variation was linked with the extent of development of androgenic gland.

An understanding of the mechanism that controls variation in the development of secondary sex characters of the prawn will be of great help in finding ways and means to get maximum growth and production of cultured freshwater prawn, by manipulating the stock and practising partial selective harvesting.

Materials and Methods

A random sample of 30 males of *M. idella* from the collection made during July-August 1998 was taken for the study. The sample was divided into (i) group A consisting of 22 individuals having body size to cheliped length ratio below 1:1.5, and (ii) group B having the ratio above 1:1.5. The body size, the size of the cheliped and appendix masculina and the number of spines were noted. These specimens were then dissected and the size of the androgenic gland and width of vas deferens were noted from the camera lucida diagrams. The biomass index of androgenic gland was determined from the area (in mm²) covered in the camera lucida diagram of the gland.

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Results and Discussion

Results of investigations are given in Tables 1 & 2. Highly positive correlation was observed between width of vas deferens and length of appendix masculina (Table 2). Significant correlation could be found between the length of second cheliped and biomass index of androgenic gland. The results of the study clearly indicated that the development of secondary sexual characters such as second cheliped and length and spinosity of appendix masculina, and primary sex characters as indicated by the

width of vas deferens were well correlated with the development of androgenic gland.

There was no direct correlation between the body length and the secondary sex characters such as cheliped length, length of appendix masculina and number of spines on it. It could also be seen that the length and biomass index of the androgenic gland of males also vary greatly in individuals having more or less similar body size.

Appendix masculina and androgenic gland were not fully developed in Group A, where the ratio of body length to cheliped length was below 1:1.5. Group B with a body length to cheliped length ratio of more than 1:1.5, had higher ratios of body size to length of appendix masculina and body size to length of androgenic gland. This indicates that the increase in the length of cheliped and appendix masculina is related to the increase in the biomass of androgenic gland.

In the breeding season, majority of males show different levels of hypertrophy of sex characters such as second cheliped, appendix masculina and vas deferens. The hypertrophy of these structures could be linked with the extent of development of the androgenic gland as suggested by Thampy

Table 1. Secondary sex characters and body length of *M. idella*

Characters	Range	Mean	SE
Length of prawn (mm)	78-92	85.2	0.38
Length of chelipeds (mm)	70-151	106.1	2.5
Length of appendix masculina (mm)	2.5-1.2	3.5	0.46
No. of spines on appendix masculina	35-55	45.7	5.87
Length of androgenic gland (mm)	3-5	3.83	0.63
Biomass index of androgenic gland	0.75-2.5	1.5	0.08
Width of vas deferens (mm)	0.76-1.3	0.97	0.24

Table 2. Correlation analysis of body length and secondary sex characters of *M. idella*.

Characters	Length of prawn	Length of cheliped	Length of androgenic gland	Biomass of androgenic gland	Width of vas deferens	Length of appendix masculina	No. of spines on appendix masculina
Length of prawn	1	0.1791	-0.0005	0.4093*	0.7710	0.0390	0.0509
Length of cheliped		1	0.1519	0.3821*	0.1942	0.0504	0.0814
Length of androgenic gland			1	0.2722	0.3093*	0.1236*	0.0581
Biomass index of androgenic gland				1	-0.1230	0.2330	-0.1913
Width of vas deferens					1	0.6770**	0.2560
Length of appendix masculina						1	0.5641**
No. of spines on appendix masculina							1

*Significant at 5% level; **Significant at 1% level.

& John (1973), in the case of *Macrobrachium idae*. Androgenic gland is known to secrete a hormone, which controls the primary and secondary sexual characters and also the behavioral sexual characters (Charniaux-Cotton, 1960; Nagamine *et al.*, 1980).

Thampy & John (1973) noted an increase in the biomass of androgenic gland with a corresponding increase in the length of second cheliped, during the periods of intense breeding activity. They found that in such individuals, androgenic gland showed signs of increased secretory activities as evidenced by an increase in the size of the cells, vacuolization of cytoplasm and presence of degenerative areas. In the present study, although histological study of the androgenic gland has not been conducted, it could be presumed that there was increased activity in the gland, as indicated by the increase in the biomass index of the androgenic gland.

Different male morphotypes are reported to be available among palaemonids. In the case of *Macrobrachium idae*, Henderson & Mathai (1910) have suggested the existence of two categories of males viz., the ordinary and feminized males. In the present study, on the basis of relationship between body size and cheliped length, it could be seen that a high ratio of body length to cheliped is shown by individuals who take part actively in the breeding

activity. In these individuals, the ratio of body size to the androgenic gland and the body size to length of appendix masculina were found to be high. These males can be considered to be ordinary males as suggested by Henderson & Mathai (1910). Individuals whose ratio of body length to cheliped length is low can be considered as feminized males.

This work formed part of the dissertation submitted to the Kerala Agricultural University for the degree of Master of Fisheries Science by the first author.

References

- Charniaux-Cotton (1960) in *The Physiology of Crustaceans* Vol.1, (Waterman, T.H., Ed.), p. 411
- Henderson J.R. & Mathai, G. (1910) *Rec. India. Mus.* 5, 277
- Nagamine, C. & Knight, A.W. (1980) *Crustacean* 39, 141
- Raanan, Z. (1982) Doctoral Dissertation, The Hebrew University, Jerusalem
- Raanan Z & Cohen D, (1985) *Rotterdam* 3, 277
- Sagi, A., Raanan, Z., Cohen, D. & Wax, Y. (1986) *Aquaculture* 51, 265
- Sagi, A. & Raanan, Z. (1988) *J. Crust. Biol.* 8, 43
- Thampy D.M. & John, P.A. (1973) *Acta Zoologica* 54, 193