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Effect of androgenic gland ablation on sexual characters of the male Indian white prawn *Penaeus indicus* H. Milne Edwards.

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Bilateral andrectomy was carried out in penaeid prawns. Results indicated that in the absence of androgenic glands male secondary sexual characters once lost cannot be regenerated. Andrectomy also appeared to block spermatogonial differentiation.

In decapod crustaceans, the androgenic glands (AG) are generally found associated with the terminal portion of the male gamete ducts. Earlier investigators[1-4], have noted the differences and/or uniformities in the functions of the AG among the various groups of crustaceans in general, and hermaphroditic and nonhermaphroditic decapods in particular. However, the androgenic glands of penaeids are not studied in detail. Hence during the present investigations an attempt was made to study the effects of AG ablation (andrectomy) on the primary and secondary sexual characters of the Indian white prawn *Penaeus indicus*.

Adult males of *P. indicus* (size TL 90-140 mm) were collected from the grow-out ponds at the Marine Prawn Hatchery Laboratory, Narakkal and maintained for 48 hr in circular plastic pools containing 250 l of filtered seawater for acclimation. The pools were well aerated and the water changed suitably to maintain the quality.

To study the effects of andrectomy the following experimental set up was designed. A total 30 animals were divided into two groups. In group I (control), 10 animals of average length 111.15 mm were kept individually in floating plastic cages (20 cm diam. × 10 cm height) in a circular pool. Their secondary sexual characters, viz. the petasma on the first pleopod and the appendix masculina on the second pleopod were excised with the help of a sharp scissors. Sham operations were not carried out because of the danger of damage to the AG which is filamentous. Animals were fed daily with fresh clam meat and examined for evidence of moulting. The lengths of the regenerated secondary sexual organs (if any) are measured using vernier calipers. Group II consisted of 20 experimental animals of average size 119.05 mm. In these animals, apart from the removal of secondary sexual organs of either side, the right and left androgenic glands were also ablated.

Since the AG lies inside the body cavity in close association with the terminal portion of the distal vas deferens, removal of the same required careful surgery and sealing of the wound to prevent blood loss. An incision was made on the coxa of the 5th pereiopod and with the help of a clean forceps, the bulbous terminal ampoule and the distal vas deferens with the AG was pulled out and removed. The wound was mildly cauterized immediately with the help of an electric cautery apparatus. A continuous gill irrigator[5] was used to keep the animal alive out of water while the surgery was being done.

Andrectomized prawns were kept individually in cages in circular plastic pools under conditions described earlier. Their moulting record as well as regeneration of secondary sexual characters (if any) were recorded. After 37 days (approximately 3 moult cycles), all animals were sacrificed and their testis lobes were fixed in Bouin's fluid and processed for histological preparations.

The androgenic gland in *P. indicus* is thin and cord-like, measuring 2-3 mm in length and 0.2 mm in width, and loosely wound around the region where the distal vas deferens dilates to form the bulbous terminal ampoule. The gland is enclosed in a thin connective tissue sheath and has loosely packed cells with indistinct boundaries. The hematoxylin positive nuclei which are 4-6 μm in diameter have a prominent nucleolus.

The results of the andrectomy experiments on *P. indicus* are given in Table 1. All control animals (group I) completed 2 to 4 moults without mortality and regenerated, albeit incompletely, their petasma and appendix masculina. After 37 days, the petasmal length ranged from 2.3 to 4.1 mm and the appendix masculina length from 0.5 to 1.2 mm. Histological examination of the testis revealed normal acini and lumen filled with spermatogonia, spermatocytes and spermatids (Fig. 1).

Andrectomized prawns completed 1 to 4 moults with 15% moult related mortality. Out of the 17 prawns which survived, 8 did not regenerate their secondary sexual characters. The remaining 9 prawns showed incomplete regeneration of their petasma and appendix masculina probably due to the

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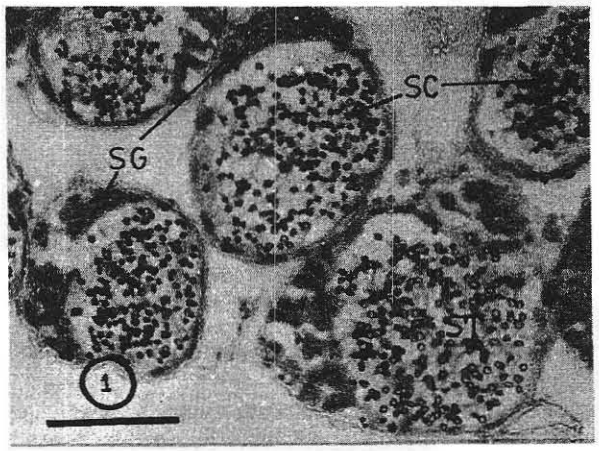
imperfect removal of AG. The length of the petasma and appendix masculina of these prawns ranged from 1.0 to 4.1 mm and 0.6 to 1.7 mm respectively. A histological study of the testis of those prawns which did not regenerate their secondary sexual characters showed almost empty acini (Fig.2). Spermtogenic stages like spermatocytes and spermatids were absent in the lumen of the testis lobes. The peripherally located spermatogonia appeared few in numbers with signs of atrophy (Fig.3). In the unsuccessfully andrectomized prawns, testicular acini were normal as in control animals.

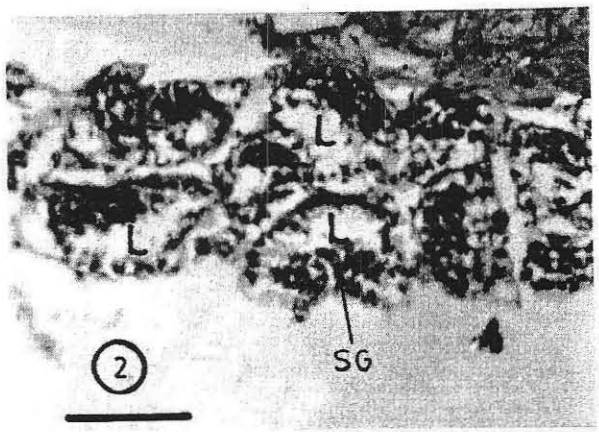
The position and cytomorphological features of AG in *P. indicus* are found similar to that of other decapod crustaceans descried by Charniaux-Cotton *et al*[1]. The experiments conducted in this study revealed that in the absence of

Table 1—Regeneration of secondary sexual characters in response to bilateral andrectomy in *P. indicus*

Sl No.	Total length of animal (mm)	No. of moults completed	Regenerated length (mm)		Testis development
			Petasma	Appendix masculina	
Group I (Control)					
1	91.0	4	3.5	0.5	Normal acini
2	101.0	4	3.9	0.5	do
3	121.0	3	2.9	0.8	do
4	115.0	3	2.6	0.5	do
5	126.5	3	3.0	0.9	do
6	128.0	3	3.1	1.2	do
7	107.0	2	2.3	0.8	do
8	121.0	3	3.2	0.8	do
9	95.5	4	4.1	0.6	do
10	105.5	3	2.9	0.6	do
Group II (Andrectomized)					
1	109.0	4	0	0	Empty acini
2	139.0	1*	1.0	0	Normal acini
3	138.0	2	2.8	1.6	do
4	122.0	3	0	0	Empty acini
5	133.0	3	0	0	do
6	97.0	4	0	0	do
7	129.5	1*	0	0	Normal acini
8	118.0	3	3.6	0.9	do
9	106.5	3	0	0	Empty acini
10	112.0	3	4.1	1.7	Normal acini
11	115.5	3	0	0	Empty acini
12	123.0	3	0	0	do
13	131.0	1*	1.0	0	Normal acini
14	126.0	3	3.8	1.1	do
15	93.5	4	3.5	0.6	do
16	101.5	4	0	0	Empty acini
17	127.0	3	3.9	0.8	Normal acini
18	132.0	2	3.2	0.9	do
19	104.5	3	3.8	0.8	do
20	123.0	2	3.7	0.8	do

* Died after the first moult





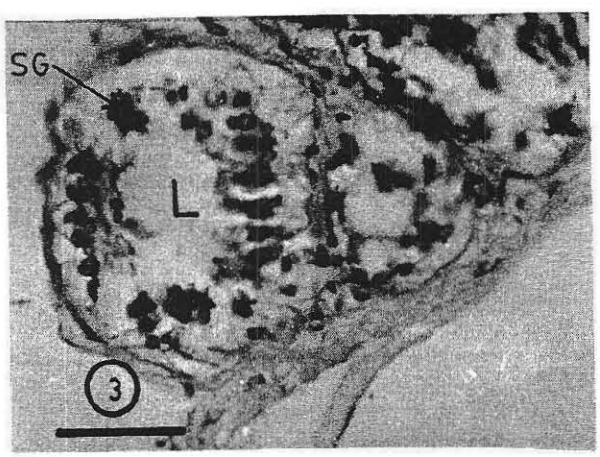


Fig. 1—T.S of testis lobes of control prawn showing normal spermatogonia (SG), spermatocytes (SC) and spermatids (ST), H&E, Bar = 50 μm

Fig. 2—T.S of testis of andrectomized prawn revealing testis lobes with empty lumens (L), H&E, Bar = 50 μm

Fig. 3—T.S of testis of andrectomized prawn showing atrophied spermatogonia (SG), H&E, Bar = 25 μm

the androgenic glands, the male secondary sexual characters once lost, do not regenerate. Therefore, the hormone secreted from the AG is apparently responsible for the regeneration of secondary sexual characters. This finding is consistent with the observation made on amphipods[6] and other decapods[3,4]. In *Macrobrachium rosenbergii*, Nagamine *et al*[4] observed that when a sexually dimorphic appendage is lost, andrectomized males were unable to regenerate the masculine form of the appendage. They also noted induced feminization in some younger andrectomized males after 21 months. Since the duration of the present experiment was very short the feminizing effect of andrectomy in penaeids could not be ascertained.

Successful andrectomization of *P. indicus* resulted in the absence of sperms in the lumen of the testicular acini. It has been previously demonstrated[3,4] that in decapods the androgenic glands are not necessary for the completion of spermatogenesis and that its absence results only in a reduction of the spermatogenesis intensity. In contrast, the inability of speremato cytes to complete meiosis in the absence of AG has been reported in the crayfish[7]. In the present study however, the lack of AG appeared to inhibit spermatogonial differentiation as evidenced by the total absence of spermatogenic stages other than spermatogonial cells in a state of atrophy in the testis.

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