INDUCED MATURATION AND SPAWNING OF *PENAEUS INDICUS* WITHOUT EYESTALK ABLATION

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Farm-grown *Penaeus indicus* > 32.5 mm in carapace length (> 150 mm T.L. and 25 g wt.) were induced to mature and spawn in captivity by merely maintaing the pH of the maturation pool at 8.1-8.2. The regulation of the pH was done by daily addition of adequate quantities of Na_2CO_3 to the recirculated seawater. 61.8% of the experimental prawns matured and spawned and 81% of the spawnings gave rise to normal healthy larvae. The average number of eggs obtained per female was 119,614 and the average hatching rate was 82.5%. This technique of inducing maturation eliminates the stress of eye-stalk ablation on the broodstock.

Several important species of penaeid prawns have been induced to mature and spawn in captivity by the well-known eyestalk ablation technique. However, some species such as *Penaeus setiferus* (Brown et al 1979), *P. vannamei* (Aquacop 1977, 1979), *P. stylirostris* (Aquacop 1977, 1979; Brown et al 1980), *P. indicus* (Emmerson 1980; Primavera et al 1982) and *Metapenaeus ensis* (Aquacop 1975) were induced to mature and spawn without eyestalk ablation in land-based maturation facilities with flow-through seawater systems. Further, Laubier-Bonichon and Laubier (1979) and Caubere et al (1979) succeeded in making unablated *P. japonicus* mature and spawn by stepwise increase of temperature and photoperiod. Moore et al (1974) obtained maturation and spawning of *P. californiensis* in raceways covered with inflated polythylene bubble canopy without resorting to eyestalk ablation. Similarly, unablated *P. merguiensis* were matured and spawned in rectangular concrete tanks where seawater was recirculated through subgravel biological filters (Beard et al 1977).

In the present study farm-grown *P. indicus* females were induced to mature and spawn at the Marine Prawn Hatchery Laboratory (MPHL) of the CMFRI by regulating the pH of the seawater, without recourse to eyestalk ablation.

Equal number of adult-size *Penaeus indicus* of both sexes (immature females and mature males) collected from the grow-out ponds at Narakkal were introduced without eyestalk ablation into the 10 M^3 maturation pools described

by Muthu et al (1984). The pH of the recirculated water was maintained at 8.1-8.2 by daily addition of adequate quantity of anhydrous Na_2CO_3. The The prawns were fed *ad libitum* with clam meat.

The salinity of the seawater in the pools was 30.5-34.2 ppt, the temperature 26.5-29.5°C, the ammonia-N level 0.015-0.03 ppm, the NO-N_2 concentration 0.003-0.008 ppm and the dissolved oxygen 6.1-6.5 ppm.

The females that matured were removed from the maturation pool to the spawner tanks; the number of eggs spawned and the number of nauplii that hatched out were estimated by counting aliquot samples.

Four experiments were performed (Table 1). Out of the 34 females introduced into the maturation pool, 21 (61.8%) matured and spawned and, of which, 17 (50%) produced viable nauplii. The details of successful spawnings are given in Table 2. The carapace length of 85.7% of the spawners was >32.5 mm (>150 mm in total length and >25 g wt). They matured and spawned 3-12 days (av. 6 days) after introduction in the maturation pools. Only 33.3% of the spawnings were partial (some eggs remained in the ovary after spawning); the rest were complete spawnings (ovary empty after spawning). The average number of eggs produced per spawner was 119,614 and average hatching rate 82.5%. Only 4 out of 21 spawnings (19.0%) resulted in non-viable eggs. It is interesting to note that the average number of eggs (119,614) produced by the non-ablated females was almost same as the average number of eggs (115,556) that had been produced by wild spawners of the same size (vide Muthu et al 1985 a MS).

TABLE 1. *Summary of experiments on maturation and spawning of farm-reared* P. indicus *without eyestalk ablation.*

Expt. No.	Duration of the experiment	No. of females introduced into the maturation pool	No.of females that matured & spawned	No. of females that spawned viable eggs
1	28.2.81-20.3.81	13	8	4
2	23.5.81-27.5.81	2	2	2
3	9.1.82-27.1.82	14	9	9
4	10.3.82-25.3.82	5	2	2
	Total	34	21	17

TABLE 2. *Details of successful spawnings of farm-reared* Penaeus indicus *without eyestalk ablation.*

	Carapace length	Date of introducing the prawn into the maturation pool	Date of spawning	Time taken to spawn (days)	Nature of spawning	No.of eggs spawned (x103)	No. of naupiii hatched (x103)	Hatching rate (%)	Remarks
1	33.0	28-2-81	3.3.81	3	Partial	7.5	3.5	46.7	
2	34.0	28.2.81	4.3.81	4	Partial	13.4	—	—	Eggs did not develop
3	34.0	28.2.81	4.3.81	4	Partial	92.6	86.4	93.3	
4	32.5	28.2.81	5.3.81	5	Full	84.8	—	—	Eggs did not develop
5	33.0	28.2.81	7.3.81	7	Full	120.1	110.1	91.7	
6	34.0	28.2.81	10.3.81	10	Partial	46.1	42.4	92.0	
7	34.0	28.2.81	12.3.81	12	Partial	82.8	—	—	Eggs did not develop
8	33.5	28.2.81	12.3.81	12	Full	83.6	—	—	Eggs did not develop
9	33.1	23.5.81	27.5.81	4	Partial	48.2	44.3	91.9	
10	33.2	23.5.81	27.5.81	4	Partial	44.7	42.3	94.6	
11	33.5	9.1.82	13.1.82	4	Full	181.6	162.5	89.5	
12	33.0	9.1.82	13.1.82	4	Full	172.4	158.1	91.7	
13	33.5	9.1.82	14.1.82	5	Full	179.4	168.4	93.9	
14	34.0	9.1.82	14.1.82	5	Full	182.1	178.2	98.4	
15	33.7	9.1.82	14.1.82	5	Full	171.5	168.3	98.1	
16	34.0	9.1.82	16.1.82	7	Full	266.4	241.2	90.5	
17	34.2	9.1.82	16-1-82	7	Full	268.6	261.6	97.4	
18	33.0	9.1,82	17.1.82	8	Full	186.4	162.4	87.1	
19	33.5	9.1.82	17.1.82	8	Full	198.2	181.6	91.6	
20	30.5	10.3.82	14.3.82	4	Full	23.4	18.7	79.9	
21	31.5	10.3.82	14.3.82	4	Full	58.1	44.7	76.9	

The importance of pH as a factor influencing maturation in eyestalk-ablated *P. indicus* had been demonstrated by Muthu et al (1984). The present experiments have shown that even unablated females of *P. indicus* can be made to mature in captivity by regulating the pH of the medium at 8.1-8.2. Although no simultaneous experiment with eyestalk-ablated *P. indicus* was conducted during the present study, work on production of *P. indicus* spawners for the Narakkal hatchery from unilaterally ablated females kept in identical maturation pools,

TABLE 3. *Comparison of maturation and spawning of* P. indicus *females with and without eyestalk ablation.*

	Without eyestalk ablation	With unilateral eyestalk ablation
Total No. females	34	27
% of females that matured and spawned	61.8	88.9
Av. time taken to mature and spawn	6 days	4 days
Av. number of eggs spawned per female	119,614	73,671
Av. % hatching rate	82.5	91.9
% of non-viable eggs	19.0	Nil
% of females with C.L. $>$ 32.5 mm	85.7	33.3

where the pH of the seawater was maintained by daily addition of Na_2CO_3, was being carried out during the months in which the present experiments were done. The data on ablated spawners are being published elsewhere. However, the data pertaining to the months of 3|81, 5|81, 1|82 and 3|82 are summarised in Table 3 for comparison.

The females without eyestalk ablation produced more eggs than the eyestalk-ablated females, but the percentage of successful spawners and the average hatching rate were better in the latter. The eyestalk-ablated females also took a lesser time to mature and spawn than the unablated ones. Further, smaller females (*c.* 30 mm C.L.) could be made to mature and spawn through eyestalk ablation, whereas the females had to be larger than 32.5 mm in carapace length for making them spawn without eyestalk ablation. In view of these advantages eyestalk-ablation technique was preferred at the MPHL for routine production of spawners from pond-reared adults for hatchery operations.

In the Philippines, Primavera et al (1982) also found that, while 100% of the ablated *P. indicus* matured and spawned, only 23.6% of the unablated females attained maturity and spawned in captivity. They had also observed that the unablated females produced a slightly larger number of eggs (26,990) than did the ablated females (23,480). However, unlike in the present experiments, they recorded a higher hatching rate (53.9%) for eggs produced by unablated females than by ablated females (37.8%). The considerably smaller number of eggs spawned by the Philippine specimens may be due to *P. indicus* in that country attaining maturity at a much smaller size, viz., 20-24 mm C.L. (Primavena et al 1982). The South African specimens of *P. indicus* used by Emmerson (1980) in his experiments were comparable in size and fecundity

to the ones used in the present study. Emmerson (1980) had also found that the unablated females produced grater number of eggs than the ablated females did, but the hatching rate was less in the latter. His specimens were, however, collected from the sea by trawling and were kept in a flowthrough seawater system whereas in the present study the animals were collected from brackish-water ponds and kept in a recirculation system.

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