

Studies on the Artificial Insemination and Fertilization of Grass Shrimp, *Penaeus monodon*

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The culture of grass shrimp, *Penaeus monodon* has become a fast-growing enterprise in Taiwan since formulated shrimp feed was successfully developed in 1978. In 1983, the total postlarval production for stocking reached 600 million at the price of 12.5 U.S. cents each. This high price of the postlarvae resulted from (1) limited availability of wild gravid females, (2) undesirable spawnings obtained by using the method of eyestalk ablation, manifested by a low average hatching rate of 20%, and (3) high demand from grow-out farms. The eyestalk ablated females induced to spawn were often found unmated which partly explained the poor spawnings and low hatching rates. Consequently, re-use of ablated females was not practised by farmers in the past.

The present paper describes the results of artificial insemination and fertilization of wild or pond-reared females whose gonadal development was induced by eyestalk ablation. The hatching rates from unmated soft-thelycum females implanted with two spermatophores are 84.7% and 43.7% while those implanted with only one spermatophore, 74.1% and 16.8%, for the first and subsequent spawning, respectively. These results positively confirm that the unmated condition of ablated females is the main reason for low hatching. Through artificial insemination, the spawning and hatching can be improved and ablated females can be reutilized. For unmated hard-thelycum females, artificial fertilization was done by releasing spermatozoa into the spawning tank right before spawning. Out of 15 attempts, three were successful with hatching rates of 63.1, 52.3, and 49.9%.

Induced maturation of pond-reared shrimps was attempted by manipulation of temperature and salinity. Under constant temperature of $22\pm 2^\circ\text{C}$, salinities ranging between 25 and 37 ppt were experimented. The best results with 67% success were obtained at salinities of 30 and 35 ppt. Continued efforts will be made to improve spawning performance through the technique of artificial insemination under controlled conditions.

Factors Affecting Maturation and Spawning of *Penaeus esculentus* in the Laboratory

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Adult tiger prawns *Penaeus esculentus* were held in laboratory tanks under varying conditions of tank size, den-

sity, temperature and photoperiod for assessment of ovarian maturation and spawning. Both eyestalk ablated and intact females were studied. Maturation and spawning of intact females was favored by conditions of warm temperature (26°C) and long days (14.5 hr), whereas ovary maturation did not occur at lower temperature (20°C) and short days (12 hr). Tank size was a critical factor with intact females as maturation and spawning required a large tank (4 m^2). Spawning did not occur in small tanks (1 m^2) despite ideal temperature and photoperiod conditions. Unilaterally ablated females matured and spawned under both short day-cold temperature conditions and in small tanks, but the success rate was greater under long day-warm temperature conditions in large tanks. Intact females required 40-60 days before onset of ovary maturation, whereas ablated females showed maturation to ovary stage III approximately 20 days after ablation. Mating success was severely limited under small tank conditions but occurred normally in the large tanks.

Induction to Ovary Maturation by Ablation in the Pink Shrimp *Penaeus notialis*

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A partial unilateral ablation was carried out on immature females of the pink shrimp *Penaeus notialis*. They were maintained in 1,600 l asbestos-cement tanks together with apparently mature males, not submitted to treatment, at a ratio of 2 females: 1 male. A quick development of the ovary was attained, which did not present significant differences in average diameter of the oocytes in the anterior, median, and posterior lobes, and with similar histological characteristics to those described for naturally mature females. Viable spawnings were obtained three days after the treatment and onwards. The larvae obtained showed normal activity and development.

Observations on the Nauplii Production from Wild, Cultivated and Mixed Populations of the Blue Shrimp (*Penaeus stylirostris*)

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Due to low nauplii production from cultivated broodstock and to minimize dependence on wild stock, an experiment was run in which four treatments, consisting of combina-