Regulation of ovigericity in a freshwater prawn Macrobrachium lanchesteri (de Man)

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Short Communication

Regulation of ovigericity in a freshwater prawn

*Macrobrachium lanchesteri* (de Man)

Ch. Narasimha Rao, Katre Shakuntala and S. Ravichandra Reddy

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**Summary**

The intermoult duration of ovigerous *Macrobrachium lanchesteri*, between the pre-spawning and the post-parturial moults, is significantly long, twice that of the adult non-ovigerous females. This intermoult duration is independent of mating, fertilization of eggs, presence/absence of eggs held in the brood as well as eyestalk principles. The possible role of specific endogenous factor(s) probably elaborated by the ovary, in the maintenance of the long intermoult duration as well as ovigericity of this prawn, is projected.

ovigericity; intermoult duration; regulation; *Macrobrachium lanchesteri*

The prawn *Macrobrachium lanchesteri* (de Man) (*Natantia: Palaemonidae*) is a land locked species, capable of completing its entire life history in freshwater. In local populations, ovigerous females are encountered in smaller or larger numbers throughout the year, indicating that, in one annual cycle, there is alternation of passive and active reproductive periods [1]. In some carideans, it has been shown that the process of ovigericity affects moulting [2–4]. However, except for the work of Kamiguchi [3], who proposed that the long intermoult duration of ovigerous *Palaemon paucidens* may be brought about by some endogenous factors, there has been no experimental evidence, either for the regulation of ovigericity or for the consequent delay in moulting during ovigericity of natantians.

As in other carideans, moulting in *M. lanchesteri* has a bearing on reproduction [5,6]. Adult non-ovigerous females moult once in 16.2 ± 2.16 days [1], the duration, presently defined as the intermoult duration, being independent of size especially in adults [7]. In Bangalore populations of *M. lanchesteri*, ovarian maturation is generally completed in 2 or 3 moult cycles, the number varying with the seasons. This is largely true of females engaged in reproduction both during passive (late November to early June) as well as active (late June to early November) reproductive periods of
the annual cycle. As in other natantians, ovarian maturation culminates in a pre-spawning moult succeeded by an ovigerous condition. The intermoult duration of an ovigerous female is extended to $33.0 \pm 1.54$ days, nearly twice that during an ordinary moult. Obviously, this is to accommodate the incubation of eggs and facilitate abbreviated development [8]. While this situation is comparable to that observed in *Palaemon paucidens* [3], ovigerous and non-ovigerous females of *P. xiphias* [9] are reported to exhibit no difference in the intermoult duration. Table I indicates the incubation time as well as the state of maturity of the ovary in relation to the developmental stages of eggs held in the brood of *M. lanchesteri*. It is apparent that there is considerable ovarian maturation during the ovigerous state (see Ref. 5). The process of vitellogenesis is initiated as early as in stage I, with the appearance of growing oocytes. The process gradually progresses through stage II and the vitellogenic activity continues during the rest of the incubation period (stages III to V). Finally vitellogenesis is generally completed only during the next moult cycle. These observations suggest that the growing ovary may play an important role in the maintenance of ovigericity and the consequent long intermoult duration of *M. lanchesteri* (see also Ref. 10).

There has been a long standing controversy as to whether or not the intermoult duration between the pre-spawning and post-parturial moults of natantians is controlled by the presence of eggs held in the brood. Table II presents the effects of removal of eggs from the brood pouch, on the time of occurrence of the post-par-

<table>
<thead>
<tr>
<th>Stage of eggs in the brood pouch *</th>
<th>Length of incubation (days ± S.D.)</th>
<th>Ovarian condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>$8.3 \pm 0.52$</td>
<td>Ovary with immature and very few growing oocytes, in primary vitellogenesis</td>
</tr>
<tr>
<td>II</td>
<td>$5.7 \pm 1.58$</td>
<td>Ovary with growing oocytes in primary vitellogenesis</td>
</tr>
<tr>
<td>III</td>
<td>$5.8 \pm 1.62$</td>
<td>Ovary with growing and maturing oocytes in active vitellogenesis</td>
</tr>
<tr>
<td>IV</td>
<td>$5.3 \pm 1.12$</td>
<td>Ovary with several maturing oocytes in active vitellogenesis</td>
</tr>
<tr>
<td>V</td>
<td>$4.6 \pm 1.00$</td>
<td>Ovary with maturing oocytes in active vitellogenesis</td>
</tr>
<tr>
<td>Females soon after hatching the eggs into zoeae and prior to the post-parturial moult</td>
<td>$3.3 \pm 1.91$</td>
<td>Ovary with maturing oocytes in active vitellogenesis</td>
</tr>
<tr>
<td>Total duration of ovigericity</td>
<td>$33.0 \pm 1.54$</td>
<td>-</td>
</tr>
</tbody>
</table>

* See Refs. 1 and 5 for details.
tural moult of ovigerous *M. lanchesteri*. Irrespective of the stage of incubation of eggs, removal of eggs appears to have no bearing on the time of occurrence of the post-parturial moult which suggests that the length of intermoult duration in an ovigerous *M. lanchesteri* is independent of the presence/absence of the eggs in the brood. Kajishima [11] and Pandian and Balasundaram [4] have also indicated that removal of the eggs from the pleopods of ovigerous females did not bring about shortening of the intermoult duration in *Palaemon pacificus* and *M. nobilii* respectively. On the other hand, Hess [2] has reported that removal of eggs from the brood pouch shortens the duration of intermoult in *Crangon armillatus*. Presently, the intermoult duration of ovigerous *M. lanchesteri* was also found to be independent of mating and/or fertilization of eggs (average 30.3 ± 1.86 days). It is of further interest that none of the factors, viz. mating or fertilization of eggs or removal of eggs, altered the normal brooding behaviour of *M. lanchesteri* [12]. This suggests that in *M. lanchesteri*, during egg incubation, the extended intermoult duration may be regulated by endogenous factors (see Ref. 3). While no comparable data on the neuroendocrine regulation of the process is available, in amphipods some evidence for the elaboration of an ovarian hormone in the maintenance of secondary sexual characters, including brooding, has been reported [13,14]. In some natantians and macrurans, it has been reported that the eyestalk hormones (moult-inhibiting hormone) might be responsible for the prolonged intermoult duration of ovigerous females [4,15,16]. However, in the present work it was observed that even bilateral eyestalk ablation did not alter the long intermoult duration of ovigerous *M. lanchesteri* (Table II), suggesting that the ovigerous state (as well as the long intermoult duration) is independent of the eyestalk hormones.

The above experimental evidence together with the observation that there is considerable ovarian maturation during the ovigericity of *M. lanchesteri* (see Table I) suggest that the long intermoult duration of these females as well as the ovigerous state may be regulated through specific principle(s) elaborated by the growing ovary (see Ref. 6). While the moult control mechanisms of natantians are fairly well known, it is intriguing how the long intermoult duration of an ovigerous female is

**TABLE II**

Effects of removal of eggs from the brood and destalking on the time of occurrence of the post-parturial moult of *Macrobrachium lanchesteri*

<table>
<thead>
<tr>
<th>Stage of eggs in the brood</th>
<th>Time required to undergo post-parturial moult (days ± S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal females</td>
</tr>
<tr>
<td>A (I &amp; II)</td>
<td>29.8 ± 4.21</td>
</tr>
<tr>
<td>B (III &amp; IV)</td>
<td>23.8 ± 3.03</td>
</tr>
<tr>
<td>C (V)</td>
<td>12.0 ± 1.63</td>
</tr>
</tbody>
</table>

The Roman numerals in column 1 correspond to those in Table I.
brought to a sudden completion affecting the post-parturial moult, once the zoeae are released. The involvement of specific feedback mechanisms in the regulation of the process needs to be studied.

Acknowledgement

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References