Effects of temperature and tank color on post larvae release and survival of freshwater Prawn *Macrobrachium nipponense*

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Abstract

Berried females of *Macrobrachium nipponense* were incubated under four different temperatures (20,23,26 and 28 ºC) and two types of tanks with different background coloration (dark and transparent tanks) to determine the best larval release and the post larvae survival were observed. The results show best larval release were 124 ind./L achieved at 26 ºC at dark color tanks, while 68 ind. / L larvae were released at the transparent color tank at the same temperature, while only 16 ind./L were released from berried females incubated at 20 ºC at dark color tanks and 6 ind./L at the transparent tanks. The best survival of larvae was 80 % at 23 ºC at dark color tanks and 75 % at transparent color tanks. Four stages for eggs development were discriminated based on color, size and eyes.

Key words: Prawn *Macrobrachium nipponense*, temperature.

Introduction

The freshwater prawns of the genus *Macrobrachium* are found mostly in inland fresh water and brackish water, including ponds, lakes, rivers as well as in estuaries (New, 2002). This genus includes approximately 243 species spread worldwide in tropical and subtropical coastal and inland water (Wowor, *et al.*, 2009). The Oriental River prawn *Macrobrachium nipponense*, is belong to the family

Palaemonida (Yu and Miyake, 1972). This prawn had been recorded recently in Shatt Al-Arab river and marshes (Salman, *et al.*, 2006). For many reasons, we found that study of reproduction and the larval development of this prawn is of great importance firstly it's a high fecundity species, each gravid female can lay thousands of eggs after mating, secondly, its well adaptive species to a wide range of environmental conditions. Thirdly, reared easily in a laboratory and can be survive in fresh water for their entire life cycle (Feng and Gheng, 2008). In Basrah during the year 2002, specimens of *M. nipponense* appearing frequently in the benthic samples from the Garmat - Ali River, near the Al-Hammar Marshes (Salman *et al.*, 2006). Originally this is a habitat of the native migration shrimp Metapenaaeus affinis (Salman, *et al.,* 1990).

The aim of the present study is to test the effects of temperature and tanks colorations on the eggs development, larval release and survival of *M. nipponense* at laboratory conditions.

Materials and methods

Berried females of *M. nipponense* were collected by a hand net of 1 cm mesh size during November 2015 to April 2016 from Al - Mashab River. The location of the sampling site is Lat. (30° 39´ 34.27" N , 47° 39´ 13.81" E), which is at about 2 km down Al - Hammar Marsh and connected to Shatt Al - Arab Estuary.

Berried females were isolated directly to avoid loss of eggs and transported to the laboratory in a clean plastic cool box and water temperature was taken during sampling. In laboratory prawns were acclimated to the field temperature 23 °C ± 1 °C , with 10 h :14 h light -dark cycle. Berried females were incubated in two types of tanks color (dark and transparent tanks), each tank containing 80 litters water with continuous aeration. Tanks were cleaning to remove over food, and exchange of water were done daily to maintain good water quality. Four temperatures levels were investigated, (20, 23, 26 and 28, °C) by using heater

supplied thermostat. Prawns females were fed on live adult *Artemia*, and the excess food and fecal were continuously siphoned out. Eggs diameter was obtained by measuring the average of 25 eggs from each females with aid compound microscope.

Results

The results of investigation revealed that prawns eggs hatching was increased at dark color condition and with increasing temperature to the optimal range. The highest number of larval release (hatching) was at 26 ºC for both the dark and transparent color tanks as they were 124 ind./L and 68 ind./L, respectively with significantly different between tow tanks ($P<0.05$). There was a slight decrease of hatching at 28 ºC to 120 ind./L under dark condition and 55 ind./L at the transparent condition with significantly different ($P < 0.05$) between tow tanks and the same temperature. The lowest number for larval release were in at 20 ºC in both the dark and transparent tanks, (16 ind./L and 6 ind./L respectively, did not differ significantly ($P>0.05$) between tanks. (Fig.1).

On the other hand, the lowest survival was occurred at high temperature for both types of tanks, and the highest survival was at temperature 23 ºC, it was 80 % in the dark tanks and 75 % in the transparent tanks, did not differ significantly ($P> 0.05$) between two different tanks in these temperature. (Figs 2 and 3.)

Fig (4) shows discrimination of four stages of eggs development were recognized are: Stage (I), the color of the eggs was light - orange, with a eggs diameter 675 $\pm$ 28.50 µm, eyes were unpigmented. Stage (II), the color changed to yellow and eggs diameter 689 $\pm$ 32.31 µm and eyes still unpigmented. Stage (III), the color become pale brown with a eggs diameter of 705 $\pm$ 35.18 µm and the eyes are pigmented as spot. Finally, at stage (IV), the color become deep brown the eggs diameter 763 $\pm$ 31.22 µm and the eyes become very easy visible (Fig.5).

Table 1: Arbitrary egg development at stages of *M. nipponense* with their diagnostic characters incubated under 26 °C at dark color tanks for 96 hours (No. of eggs= 25 for all stage)

Stage development	Color	Egg diameter (µm)	Eyes
I	Light - orange	675 ± 28.50	Unpigmented
II	Yellow	689 ± 32.31	Unpigmented
III	Pale brown	705 ± 35.18	Pigmented
IV	Deep brown	763 ± 31.22	pigmented

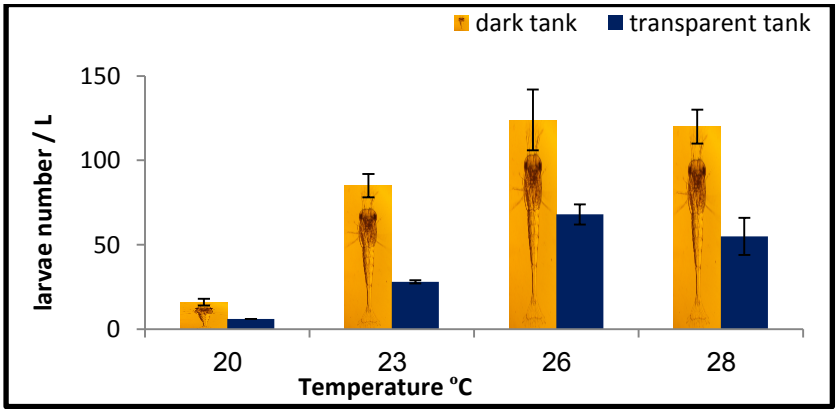

Figure 1: Number of larvae released by berried females of *M. nipponense* after 96 hours incubation period under different temperatures and tank color.

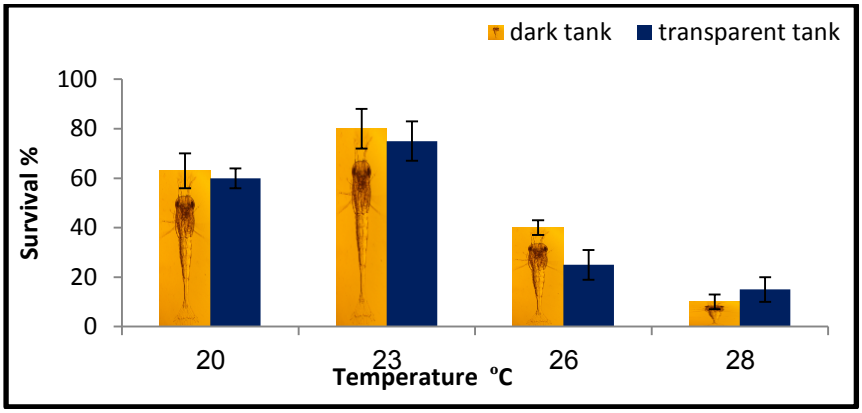

Figure 2: Larval survival (%) of *M. nipponense* until the post-larval stage under different temperatures and tank color.

Figure 3: Post – larval staged reared under laboratory conditions for 96 hours

Figure 4: Gravid female of *M. nipponense* carried their eggs on the pleopods, eggs show different in color depending on degree of development

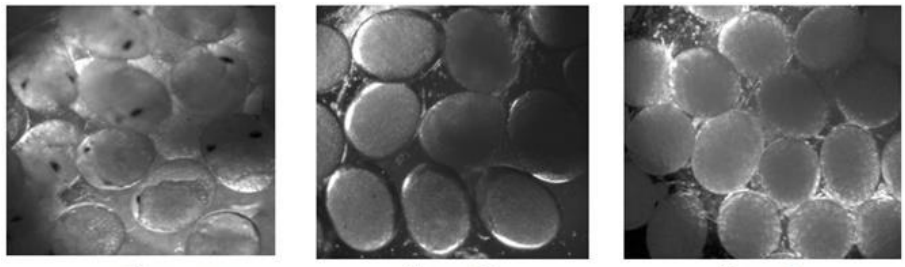

Figure 5: Egg developmental stages of *M. nipponense* incubated at 26 ºC for 96 hours

Discussion

In *Macrobrachium* as in the Caridean shrimp incubated their eggs on pleopods of the legs abdomen until hatching time to protect theirs from physical and chemical stresses (Sudhakar *et al.,* 2014). Temperature plays an important role in the reproductive cycle of shrimp in both wild and aquaculture, effects of temperature on crustacean or shrimp, especially during embryogenesis, which is very important for successful hatchery operation and seed production (Dinakaran *et al*., 2013). The results in present study, indicate that higher temperatures increase the speed of eggs development but within optimal range that between 22 to 26 ^{0}C, this is in agreement with Veera, (1994) who suggested that eggs development and metabolic rate in crustacea increase with increasing temperature, moreover temperature is affecting on growth and survival of organisms (Choudhury,1971a). However, extreme temperatures could cause high mortality or serious deformities during eggs incubation (Ling, 1969).

The present results show that survival was lower at high temperature and slightly decreasing with decreased temperature, and the best rate was achieved at optimal range of temperature from 20 – 23 ^{0}C. In general the survival and incubation time decreased with increasing temperature (Ajith, 1990). As expected, higher temperature caused faster development because it had a direct effect on the physiological and biochemical processes, and this leads to a decrease in the duration of embryonic or larval development (Bressan, 1999).

Maciel and Valenti, (2014) evaluated the effects of hatchery tank coloration (white, yellow, red, blue, green and black) on the performance of larval culture of *Macrobrachium amazonicum,* the results indicate that

rearing of larvae of this species in black tanks will improve larval rearing. A similar results were obtained in the present study on the larvae of *M. nipponense*.

The results of the present investigated concluded that the optimal thermal condition for the best number of larval release is occur in incubating females at 26 ºC and in dark tanks colored, while the better survival reached when these larvae were rearing at 23 ºC and in dark tanks too.

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تأثير درجة الحرارة ولون حوض الاستزراع على إطلاق اليرقات ونسب بقاء الطور قبل اليرقي في الروبيان النهري *Macrobrachium nipponense*

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الخلاصة

حضنت الإناث الحاملة للبيض في أربع درجات حرارية مختلفة (20 و 23 و 26 و 28°م واستخدم لكل درجة حرارة نوعين من الأحواض مختلفة باللون (معتم وشفاف)، طرحت الإناث التي حضنت تحت درجة حرارة 26°م أفضل عدد يرقات وفي كلا الحوضين، اذ بلغ العدد 124 يرقة/ لتر في الحوض المعتم و 68 يرقة/ لتر في الحوض الشفاف. بينما سجل اقل عدد لليرقات في الإناث التي حضنت تحت 20°م، وبلغ العدد 16 يرقة/ لتر في الحوض المعتم و 6 يرقة/ لتر في الحوض الشفاف. اما أفضل معدل للبقاء فتحقق في اليرقات التي حضنت تحت 23°م وكان 80% في الحوض المعتم و 75% في الحوض الشفاف. سجلت أربع مراحل تطورية للبيض اختلفت فيما بينها في اللون والحجم ووجود الصبغات في العيون من عدمها.

كلمات مفتاحية: *Macrobrachium nipponense*، درجة الحرارة.