Although *Limnodrilus hoffmeisteri* Claparede, 1862 is widely recognized as an effective indicator of organically polluted aquatic environments (PAOLETTI & SAMBUGAR 1984, ALVES & LUCCA 2000, ALVES et al. 2006), little is known about its biology. Research on this species’ life cycle concentrates mostly on temperate latitudes, yet there is a lack of studies in the tropical regions. KENNEDY (1966), ASTON (1973) and PASTERIS et al. (1999) are some of the few authors who concentrated their efforts on investigating both the reproduction and growing rates of *L. hoffmeisteri*. Among those authors, only ASTON, (1973) evaluated the effect of the temperature on the reproduction rate of this species. The author found that temperature, rather than the dissolved oxygen concentration, most affected reproduction, even though he did not provide the precise temperature at which the species showed the highest reproduction rate.

Despite this information, resulting from research in temperate regions, studies on the reproductive attributes of tropical populations of *L. hoffmeisteri* are necessary because different populations may also have different biologies, as observed by REYNOLDSON et al. (1996) when studying *Tubifex tubifex* (Müller, 1774) from Canada and Spain. They observed differences in cocoon production, growth rate and resistance to different contaminants.

In Brazil, ecological studies have shown that *L. hoffmeisteri* could be found in aquatic environments in which water temperature ranges between 14 and 26°C (CARVALHO & UIEDA 2004, RIBEIRO & UIEDA 2005, ALVES et al. 2006, FUSARI & FONSECA-GESSNER 2006, PIEDRAS et al. 2006, ALVES et al. 2008).

The present work compares the reproduction rate of *L. hoffmeisteri* raised at three different temperatures, and, hence tests the hypothesis that it exhibits greater reproduction rate at higher temperatures.

*Limnodrilus hoffmeisteri* were obtained from the São Pedro stream, in the city of Juiz de Fora (21°45'46"S and 43°22'00"W), southeastern Brazil. The sediment of this stream is predominantly sandy and, in agreement with DIAS et al. (2007), the physical and chemicals properties of the water were: dissolved oxygen 5.19 mg.l⁻¹, pH 8.24, conductivity 161 µS.cm⁻¹ and temperature 21.2°C. A sample was made by selecting 75 fully clitellate adult individuals. The worms were then weighted using a 0.1 mg precision balance and transferred to 250 ml beakers containing 100 ml of 0.25-1.00 mm sand, 100 ml of dechlorinated tap-water and 0.1 g (dry weight) of fish food supply used in fish culture. Five individuals were placed in each beaker, for a total of 15 beakers. The beakers were arranged so that to form three groups of five. Each group was kept in a given temperature for 21 days. Results show that worms raised at 25°C produced a significantly larger number of eggs compared to those raised either at 15 or 20°C, as observed in the tropical tubificid *Branchiura sowerbyi* Beddard, 1892.

KEY WORDS. Cocoons; eggsper cocoon; reproductive rate; tubificid.
microscope. It was possible to determine important reproductive characteristics of *L. hoffmeisteri*, such as the weight of individuals at adulthood and the number of cocoons-adult\(^{-1}\)-day\(^{-1}\) as well as the number of eggs cocoon\(^{-1}\).

The Kruskal-Wallis test was used to compare the final weights of adults, number of eggs per cocoon, young per adult and number of young, among the tested temperatures (non-parametric distribution showed by the Shapiro-Wilk normality test, \(p < 0.05\)). To compare the number of cocoons and eggs and the relation cocoons per adult per day, among the temperatures, the ANOVA test, followed by Tukey test, was used (Shapiro-Wilk normality test: \(p > 0.05\)).

The survival rates of the worms raised at 15, 20 and 25°C were 96, 92 and 100%, respectively. The average weights of the worms, initial and final, were: 6.63 ± 1.28 and 8.01 ± 1.60 mg; 6.84 ± 1.86 and 7.51 ± 2.38 mg; 6.87 ± 2.49 and 9.37 ± 2.96 (at 15, 20 and 25°C, respectively). The final weights did not differ significantly according to the temperature (\(H = 4.8530\), \(p > 0.05\)).

Both the number of cocoons and the number of eggs are shown in figure 1. The ANOVA comparing the total number of cocoons showed significant differences between the temperatures (\(F = 17.78\), \(p < 0.05\)), and the Tukey test showed that only the differences between 15 e 20°C were not significant (\(p > 0.05\)).

![Figure 1. Total number of cocoons (black column), and eggs (white column) produced by *Limnodrilus hoffmeisteri* raised at 15, 20 and 25°C.](image1.png)

The number of young and the relations eggs-cocoon\(^{-1}\), cocoons-adult-day\(^{-1}\) and young-adult\(^{-1}\), with the temperature, are shown in table I. No significant difference was found in the number of eggs-cocoon\(^{-1}\) among the tested temperatures (Tab. I), as observed by Aston (1973). However, in his work, Aston (1973) found an average of five eggs per cocoon, while in the present study we obtained an average of 3.25 eggs per cocoon. Both Marchese & Brinkhurst (1996) and Nascimento & Alves (2008) have observed that Branchiura sowerbyi Beddard, 1892 produced fewer eggs per cocoon at 25°C in relation to *L. hoffmeisteri* in this study (1.94 ± 0.13 and 1.21 ± 0.08, respectively).

![Figure 2. *Limnodrilus hoffmeisteri* cocoon. Bar = 1 mm.](image2.png)

Figure 2 shows a cocoon of *L. hoffmeisteri*. By the end of the experiment, the greatest number of young was found at 25°C. The presence of young individuals of *L. hoffmeisteri* suggests that the species needs less than 21 days to complete the full embryonic development. Nascimento & Alves (2008) have observed that the embryonic development of *B. sowerbyi* took 15 days at 25°C.

The present study shows that, similarly to what Aston (1973) has previously observed under laboratory conditions, the largest production of eggs and cocoons of *L. hoffmeisteri* occurred when the worms were raised at 25°C. Aston et al. (1982) and Bonacina et al. (1994) observed, at the same temperature, a larger production of cocoons for the tropical *B. sowerbyi*. For

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Statistical test</th>
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</thead>
<tbody>
<tr>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Eggs-cocoon(^{-1})</td>
<td>2.78 ± 0.35</td>
</tr>
<tr>
<td>Coccons-adult-day(^{-1})</td>
<td>0.109 ± 0.04*</td>
</tr>
<tr>
<td>Young-adult(^{-1})</td>
<td>0.00 ± 0.00*</td>
</tr>
<tr>
<td>Number of youngs</td>
<td>0*</td>
</tr>
</tbody>
</table>

Table I. Mean values (± standard deviation) of eggs-cocoon\(^{-1}\), cocoons-adult-day\(^{-1}\) and young-adult\(^{-1}\) and total number of young of *L. hoffmeisteri* raised at 15, 20 and 25°C. In the lines, equal letter means that there's no significant difference between the values. Statistical test: (H) Kruskal-Wallis test, (F) ANOVA test. *p > 0.05, **p < 0.05.
The effect of temperature on the reproduction of *Limnodrilus hoffmeisteri*


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