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Parhyale hawaiensis: A Regeneration Model and Its Viability as a Chronic Endpoint in Ecotoxicology

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Abstract
Parhyale hawaiensis is a marine amphipod of circumtropical distribution and has been used in acute ecotoxicological tests. However, sub lethal responses are important endpoints in ecotoxicology because they allow the assessment of effects at environmental concentrations. P. hawaiensis has the ability to regenerate its appendages, limbs and tissues after an injury or loss during their entire life. Data on effects of toxicants on appendages regeneration of marine organisms are still scarce. Regeneration can be used as an ecotoxicological endpoint to assess potential teratogenic compounds and their impact on stem cells. Thus, the aim of this study was to obtain data on regeneration of antennae of P. hawaiensis to determine the viability this endpoint on toxicity tests.

Key words:
Crustacean, teratogenic, marine organisms.

Introduction

The antennae, in amphipods, can be involved in sensing food or detecting signals, such as reproduction and excretion. Morerover, endocrine glands, in crustaceans, can be located at the base of appendages, so if they are removed and the regeneration not occurs, this alters the ability of the hormones to affect the animal, thus physiological processes may be inhibited or stimulated. [1]
Parhyale hawaiensis has some characteristics that make it an interesting model for ecotoxicological and regeneration tests. [2][3][4]
The aim of this study was to assess the regeneration dynamics of the antennae of *P. hawaiensis* and to determine if it could be used as an endpoint in toxicity tests.

Results and Discussion

Left antennae of six months old organisms were amputed with sterilized tweezers, each organism transferred to recipients containing 100 mL salt water. Each test consisted of 20 organisms, 10 males and 10 females. During this period, organisms were feed three times a week, and all the necessary conditions were provided. Four independent experiments were performed. The organisms were monitored daily until all of them undertook full regeneration.
The regeneration time was recorded individually and the median, mean and standard error of each case were calculated, the number of regenerated organisms by day was predicted by a sigmoidal curve, aiming to determine the time that 50% of population were regenerated ($T_{50\%}$). Data were tested for parametric attributes, followed by Analysis of Variance and Tukey post-hoc test, with significance level $p<0.05$.
Antennae regenerates completely between 5 and 23 days after amputation, most of them close to the 12th day (Figure 1).
To allow testing of toxicants with low water solubility usually DMSO is used as solvent. To verify its non effect concentration, 20 organisms per treatment, with amputated antennae were exposed individually in different concentrations of DMSO using the same conditions described before.

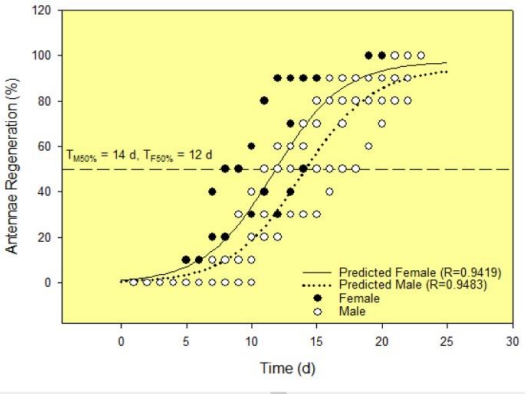

Figure 1. Antennae regeneration (%) of *P. hawaiensis*

Conclusions

Males and females behaved statistically differently, although the difference was not biologically relevant ($T_{50\%}$=14 days for males, $T_{50\%}$=12 days for females and $T_{50\%}$=13 days for both). The regeneration time of fifty per cent of the population seems to be viable endpoint for chronic evaluation. DMSO can be used as a solvent for toxicants at a maximum concentration of 0.2%.

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