Salomão José Cohin de Pinho

Estudo da viabilidade do cladócero tropical *Macrothrix elegans* Sars, 1901 (Cladocera, Macrothricidae) como organismo-teste em ensaios ecotoxicológicos.

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Dissertação apresentada ao Instituto de Biologia da Universidade Federal da Bahia, para a obtenção de Título de Mestre em Ecologia e Biomonitoramento.
Orientador: Prof. Dr. Eduardo Mendes da Silva.
Co-orientadora: Drª. Carla Chastinet

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Dedico este trabalho à minha
esposa, amiga e companheira,
Yukari Figueroa Mise

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Sumário

Introdução geral

A água é fundamental para o desenvolvimento humano, entretanto, a sua qualidade pode ser influenciada por muitas das atividades humanas (industrial, agro-pastoril, urbanização), perturbando a condição biológica de ecossistemas aquáticos e sendo prejudicial para a saúde humana (Primack & Rodrigues, 2002; Durusoy & Kambur, 2003). A degradação na qualidade da água gera incertezas em relação ao custo-benefício desses avanços, devido à criação de novas substâncias químicas lançadas no ambiente a cada dia, sem sequer saber quais efeitos essas substâncias terão no ambiente e no ser humano (Esteves, 1998; Espíndola *et al*., 2000; Knie & Lopes, 2004).

O desenvolvimento da sociedade atual veio seguido de uma série de dependências, trazendo, em conjunto, efeitos diretos e indiretos ao meio ambiente e ao próprio ser humano, muitos deles irreversíveis, em todo o planeta (Moss,1980; Esteves, 1998; Espíndola *et al*., 2000; Chastinet, 2002; Knie & Lopes, 2004).

Algumas das formas mais comuns de degradação deste ecossistema são os despejos de efluentes em rios, lançamento de esgoto tratado de forma ineficiente, dragagem, construções de hidrelétricas e a mineração, que causa a liberação de metais para o ambiente (Lewis et al., 1999).

Cada vez mais, o homem sofre as conseqüências do uso inadequado dos recursos naturais, sendo que um dos mais preocupantes atualmente é a contaminação da água por metais, que além de causar graves doenças, também afeta de forma geral os organismos aquáticos, reduzindo a capacidade dessas comunidades de se reproduzir e manter a espécie no local, gerando um grave desequilíbrio (Krane,1999; Brooks, 2004).

Atualmente, uma ferramenta muito utilizada para avaliar os riscos e perigos que o ambiente corre é a análises de risco ecológico (ARE) (CEO, 2003), onde a integração dessa ARE à avaliação de risco à saúde humana segue como a abordagem mais atual e poderosa (Pereira *et al.*, 2004). Esta avaliação ocorre em três etapas, (i) a identificação e formulação do problema que gera dois produtos (i.i) determinação dos *endpoints* (alvos fisiológicos) e (i.ii) modelos conceituais), (ii) a fase de análise e (iii) a fase de caracterização do risco (U.S. EPA, 1998).

A utilização de espécies de alta relevância ecológica, representatividade e função ecológica, para esses ecossistemas, possibilita à Ecotoxicologia tropical maior autonomia, deixando de ser apenas uma extensão da Ecotoxicologia desenvolvida nos países temperados, visto que são ecossistemas com características bem diferenciadas (Ricklefs, 2003; Zagatto & Bertoletti 2006).

Atualmente, existe uma grande preocupação em relação a estes impactos no ambiente aquático, fazendo com que uma série de medidas sejam tomadas, dentre elas resoluções (CONAMA357/05, por exemplo) e normas visando proteger e preservar este ambiente (Espíndola et al., 2000; Knie & Lopes, 2004). No entanto, para as regiões de clima tropical, em termos de ensaios ecotoxicológicos, ainda existe uma dependência muito grande dos países de clima temperado, principalmente no Brasil, fazendo uso de espécies exóticas, reduzindo a relevância ecológica dos resultados obtidos (Zagatto & Bertoletti 2006). Sendo assim, é de suma importância o estudo de organismos que sejam representativos e endêmicos de regiões com clima tropical. O presente trabalho visa avaliar a viabilidade do cladócero tropical *Macrothrix elegans* como potencial organismo-teste em ensaios ecotoxicológicos em ambientes tropicais.

Conclusão geral

Após todos os experimentos com as substâncias de referência, *M. elegans* demonstrou ser sensível a ambas, apresentando um coeficiente de variação baixo, estando este apto a ser utilizado como organismo-teste para ambientes contaminados por cádmio.

M. elegans demonstrou ter um grande potencial para ser utilizado em ensaios ecotoxicológicos dos mais variados tipos, mesmo quando comparado outros cladóceros com ensaios já padronizados. No entanto, ainda é necessário que sejam realizados mais investigações para que este cladócero possa ser incluído em normas de padronização.

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MACROTHRIX ELEGANS SARS, 1901 (CLADOCERA, MACROTHRICIDAE): A VIABLE ALTERNATIVE FOR ECOTOXICOLOGICAL TESTS IN TROPICAL FRESHWATER

SALOMÃO J. COHIN-DE-PINHO,*† CARLA B.A. CHASTINET,† SHEILA J. BONFIM,† RUI RIBEIRO,‡ ISABEL LOPES,‡ LILIANA SARO,‡ ALICE A. M. S. ANDRADE,† BRUNO ABDON,† EDUARDO M. DA SILVA†

† Instituto de Biologia da Universidade Federal da Bahia, Campus Universitário, CEP 40170-115 Salvador, BA, Brazil

‡Instituto do Ambiente e Vida, Departamento de Zoologia da Universidade de Coimbra, Largo Marquês de Pombal, 3004-517 Coimbra, Portugal

*Corresponding author: Tel.: +55 71 3263-6525; fax: +55 71 3245-3126

E-mail address: salpinho@gmail.com (S.J. Cohin-de-Pinho)

Abstract

The current study investigates the suitability of a tropical cladoceran species, *Macrothrix elegans* Sars (1901) for toxicity testing in ecotoxicological tests at 25^0C involving two reference substances, cadmium chloride ($CdCl_2$) both in natural and artificial media, and potassium chloride (KCl) in natural medium. The work provides a comparison among other cladoceran species from tropical and temperate environments, and discusses the potential of *M. elegans* as a bioindicator of stress in tropical waters. An experiment on the animal's life-span has been included to assess its reproductive potential. On average, at 25^0C, *M. elegans* lives 38.2 ± 4.4 days and each female produces 211.8±30.4 neonates. The criterion of toxicity adopted in the bioassays was mortality/immobility using neonates up to 24-h old. The $CdCl_2$ 48-h EC_{50} mean values and their confidence intervals were 0.035 $mg.l^{-1}$ [0.020-0.050 $mg.l^{-1}$] in natural medium, and 0.018 $mg.l^{-1}$ [0.012-0.024 $mg.l^{-1}$] in the artificial medium. The KCl 48-h EC_{50} mean value (natural medium only) was 749.08 $mg.l^{-1}$ [625.32-872.76 $mg.l^{-1}$]. The work demonstrates the great potential of *M. elegans* as a test organism in ecotoxicological tests involving these substances in tropical freshwater ecosystems.

***KEY WORDS*:** Cladoceran; Life-table; Ecotoxicological tests; EC_{50}; Cadmium chloride; Potassium chloride.

1- INTRODUCTION

Aquatic ecosystems present high biodiversity in comparison to terrestrial ecosystems (Ricklefs, 2004), however due to the attraction human settlements feel for water resources, aquatic ecosystems are severely endangered, as far as biodiversity is concerned (Moss,1980; Esteves, 1998; Espíndola et al., 2000; Chastinet, 2002; Knie & Lopes, 2004). Loss of biodiversity is mainly caused by habitat reduction, alteration or destruction, introduction of foreign species and pollution (Primack & Rodrigues, 2002; Ricklefs, 2004). As a result of industrial discharges in water bodies, many aquatic organisms are frequently exposed to complex mixtures (Brooks et al., 2004), sometimes of unknown composition (Knie & Lopes, 2004), that may reduce the natural ability of populations to remain adaptable and productive in their ecosystems (Krane et al., 1999; da Silva et al., 2000).

A variety of test organisms and endpoints have been used to assess the relative toxicity of a certain pollutant or mixture (Rand *et al.*, 1995). Mortality is usually the most applied response criterion and acute tests are still of great importance for legal reasons to control the emission of toxic substances in the environment (Moss, 1980; Abel & Axiak, 1991), in spite of its low ecological relevance (Gray, 1989; Lacher Jr. & Goldstein, 1997). Invertebrates have been largely used in the assessment of pollutant-induced stress in aquatic ecosystems (Oliveira-Neto & Botta-Paschoal, 2002; Sarma *et al.*, 2005). In addition to their biological and genetic characteristics and pivotal position in the food chain, these organisms are also sensitive to a variety of pollutants normally found in aquatic environments (Lagadic & Caquet 1998; Kast-Hutchenson *et al.*, 2001; Chastinet, 2002). Among aquatic invertebrates, cladocerans play an important role in the ecotoxicological assessment of chemicals in freshwater ecosystems, as they are easily maintained in laboratory at low costs, showing also a low genetic variability in laboratory

cultures (parthenogenesis), and are susceptible to a variety of toxic chemicals (Buikema & Cairns, 1980; Maciorowski & Clarke, 1980). Moreover, cladocerans represent an important link for the transfer of energy between primary producers and the secondary and tertiary consumers (Moss, 1980; Sarma *et al.*, 2005). According to Gray (1989) and Chapman (2002b) the choice of an organism for using in ecotoxicologial tests should be based on ecological parameters, considering that different species may exhibit different levels of tolerance to a pollutant, and that tolerance may also vary among individuals of the same species. Ecologically speaking, this is of extreme importance, as several ecotoxicological tests using aquatic temperate organisms, such as *Daphnia magna* and *Ceriodaphnia dubia* are largely used in the tropics. (CETESB, 1998; ABNT, 2005; Beatrici, *et al.*, 2006).

Tropical and temperate ecosystems differ in many aspects. Generally, tropical ecosystems present specific challenges for research and conservation due to their inherent ecological characteristics (Lacher & Goldstein, 1997). Variations in parameters such as luminosity, temperature, food quality, competition and predation, together with the complex trophic relationships among organisms (Ricklefs, 2004) are essentially important to understand the natural restrictions of ecotoxicological tests in tropical aquatic ecosystems. The strategies of life adopted by tropical and temperate cladocerans suffer direct influence of biotic factors (predation, intra- and inter- specific competition) and abiotic (temperature, luminosity, and oxygen saturation), although temperature seems to be the most significant factor (Sarma, 2005). Despite the tropics shelter about 75% of the biodiversity on the planet, and are under process of economical, social, urban, and industrial expansion thus, naturally requiring more ecological attention, the largest amount of ecotoxicological tests, however, have been carried out in temperate climate (Lacher Jr. & Goldstein, 1997). In this way, it may be unsuitable to apply a standardised bioassay with an exotic species in detriment of finding a local and sensitive species,

which would certainly provide more realistic and ecologically relevant results (Gray, 1989). Therefore, it is necessary the standardisation of ecotoxicological tests using adequate tropical organisms (Gray, 1989; Zagatto & Bertoletti 2006). On the other hand, legal instruments require the attainment of ecotoxicological tests standardised by institutions internationally recognised. In this sense, there is a great demand towards the development of tests involving tropical organisms.

The present work examines the biology, laboratory cultures, and the suitability of the tropical cladoceran *Macrothrix elegans* Sars (1901) in ecotoxicological tests. The study aims to determine the potential of this animal as a test organism investigating its sensitiveness to two reference substances (cadmium chloride and potassium chloride) tested in natural and artificial media, thus demonstrating its viability as a test-organism of pollution in tropical freshwater ecosystems.

2- MATERIALS AND METHODS

M. elegans was collected from a dam at the Capivari Creek (12°38'24"S; 39°04'25"W) in a district of Cruz das Almas (Ba, Brasil). The animals have been cultured in the laboratory since year 2000 and maintained in water from the Capivari Creek (Andrade, 2003) until 2004. Thereafter, *M. elegans* has been cultured in water from the Jauá Lake (12°49'12"S; 38°13'11"W) located in (Camaçari, Ba) which has been used as a reference water in other studies (e.g. da Silva *et al.*, 2000; Abdon, 2005; Araújo *et al.*, 2006) thus, justifying its choice. The water was collected monthly, left in the dark to age for about one month, and filtered through a 10-µm net before use.

In the laboratory, *M. elegans* organisms were maintained in 600-ml glass vessels containing 450 ml of medium. The temperature was set at 25°C±1°C along with a photoperiod of 16:8 h (light: dark). Approximately 50 individuals were placed in each vessel, feeding (daily) on an algae (*Pseudokirchneriella subcaptata*) suspension with a final density of 10^6 cells $ml^{-1}.day^{-1}$. Filtered water from Jauá Lake (no adjustments) was used as natural medium. The ASTM hard water medium (ASTM, 1980) was diluted at 50% in ultra pure water (USFilter) to obtain the artificial medium (1:1). Once a day, all neonates were removed from each culture flask, until the sixth brood, when the adults were then discarded, and new cultures of *M. elegans* started from neonates of the sixth generation using the procedure of Chastinet (2002) slightly modified. Every three-day, all animals were transferred to a clean flask holding fresh medium and algal suspension at the pre-established density of cells.

A life-table experiment was carried out to examine biological and reproductive aspects of *M. elegans* (Shrivastava *et al.*, 1999). A single neonate (up to 24-h old) was placed individually in

each of the 11 150-ml glass jars each holding 80 ml of the natural medium (filtered water from Jauá Lake). The number of neonates produced per adult day^{-1} was counted, and the longevity of each animal was recorded. These data was then used to build a life-table. The animals were then submitted to the same experimental conditions of temperature, photoperiod, and feeding described above for the stock cultures. The neonates were removed and counted daily, and the number of broods per individual recorded. The trial was ended after 44 days following the death of the last *M. elegans* individual.

Ultra pure water (USFilter) was used for dilution throughout the experiments, excepting for those involving natural medium. The *Daphnia similis* standard bioassay (ABNT, 1993) and the work by Araújo (2005) with some modifications were used as reference in all ecotoxicological tests and only animals up to 24-h old were used for testing. A $CdCl_2$-stock solution at 80 mg l^{-1} and 10 g l^{-1} for KCl was prepared and kept at 4ºC until required. All tests were carried out in 50-ml glass flasks containing 40 ml of the test solution. In all 11 tests, four replicates, each holding five animals were used per each of the six concentrations tested per assay. Experimental controls (four replicates each) were set to account for the quality of the natural and artificial media. All tests were performed with neonates of daily controlled broods obtained from the stock cultures. The cadmium 48-h EC_{50} for *M. elegans* was determined in eleven tests for animals tested in natural medium (*N*=11) and in seven tests for animals in the artificial medium (*N*=7). The KCl 48-h EC_{50} was determined in nine tests only in natural medium (*N*=9). The pH and conductivity in the test vessels were measured at the beginning of each assay. Mortality/immobility was the endpoint adopted in all tests and under these conditions, the dissolved oxygen was not a limiting factor for testing (Abdon, 2005). The tests lasted for a 48-h period when the number of living organisms were recorded. Animals immobilised for a period of at least 15 consecutive seconds were assumed as dead.

EC_{50} mean values and their 95% confidence limits were calculated using the Probit analysis. Significant statistic differences among $CdCl_2$ and KCl 48-h EC_{50} values obtained in this study for *M. elegans* and values for other organisms in comparison with *M. elegans*, were determined applying the Student *t*-test (Zar, 1996). The coefficients of variation were also calculated for the reference substances to evaluate the precision level of the results (Zagatto & Bertoletti, 2006).

3- RESULTS AND DISCUSSION

Tests aiming to define adequate species of cladocerans to assess pollution in tropical freshwater ecosystems are still in a crescent demand. At the moment, only a test with *Ceriodaphnia silvestrii* has been included in the Brazilian norm (NBR 13713, 2005).

M. elegans is a small tropical cladoceran which the total body length ranges from 605 to 1015 µm (Kotov, 2004). Hence, taking into account the epibenthic behaviour of *M. elegans*, these animals may be potentially used in a larger range of ecotoxicological tests than daphnids, for example, which the habits are naturally restricted to the water column. In general, these animals are associated with the macrophytes of the margins of lakes and rivers, occurring sporadically as planktonic (Elmoor-Loureiro, 1997). At laboratory conditions, *M. elegans* presented in natural medium an average life-span of 38.2±4.4 days with a maximum longevity of 44 days, and primiparous between the 5^{th} and 6^{th} day of life (Figure 1). On average, each female produced 211.8 ± 30.4 neonates, and the maximum number of neonates per female was 262 thus, showing the high reproductive capacity of *M. elegans* in 44 days. In addition, this tropical cladoceran presents: (i) parthenogenetic reproduction allowing small genetic variation among individuals, (ii) large number of neonates per brood, (iii) short life cycle, (iv) the cultures demand small areas, and (v) the animals are easily maintained in the laboratory at low costs. These characteristics are usually some of the requirements for the use of particular specie in ecotoxicological tests (Buikema & Cairns, 1980; Gray, 1989).

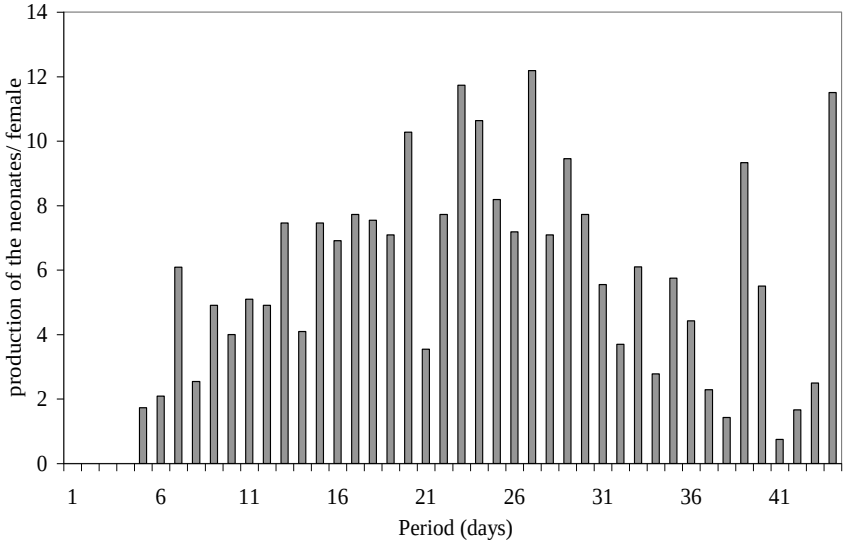

Figura 1: Average of neonates production for female along a life cycle of *M. elegans* in natural medium.

M. elegans is a common neotropical species, widely distributed from Argentina to Mexico, normally found in lakes and ponds (Kotov *et al.*, 2004). Araújo (2005) employed *M. elegans* to monitor a metal-contaminated acidified pond (pH 3.1) in a district of Camaçari (Ba, Brazil), comparing with results from fingerlings of *Poecilia reticulata* Peters (1859). The cladoceran bioassay produced excellent results and there was no significant statistic difference between the sensitivity levels obtained for *P. reticulata* and *M. elegans*. Saro *et al.* (2006) studied the same pond carrying out an *in situ* microcosm test to compare the re-colonisation ability of *M. elegans* in relation to three other tropical cladocerans (*Ceriodaphnia silvestrii*, *C. cornuta* and *Latonopsis australis*). The authors verified that *M. elegans* was able to re-colonise the studied area in a more efficient way than the other three species, thus showing its ability as a suitable biomonitor.

The mean value obtained for the cadmium 48-h EC_{50} test with *M. elegans* in natural medium was 0.035 $mg.l^{-1}$ [0.020-0.050 $mg.l^{-1}$] (Figure 2). The pH and conductivity varied from 6.45 to 7.25 and from 100 to 250 $\mu S.cm^{-1}$, respectively. In general, the water quality of a natural medium is

more susceptible to alterations than that of an artificial medium, which is produced and maintained under laboratory controlled conditions. Therefore, the use of natural media in ecotoxicological tests should be carefully thought about (Knie & Lopes, 2004). Nevertheless, the coefficient of variation in the tests using natural medium was only 15.4%, demonstrating a negligible interference of the medium and a good reproducibility of results. Abdon (2005) used the same natural medium, laboratory conditions, and general procedures to assess the toxicity of cadmium ($CdCl_2$) to the tropical cladoceran *C. cornuta* obtaining a 48-h EC_{50} value at 0.103 $mg.l^{-1}$ [0.030-0.141 $mg.l^{-1}$].

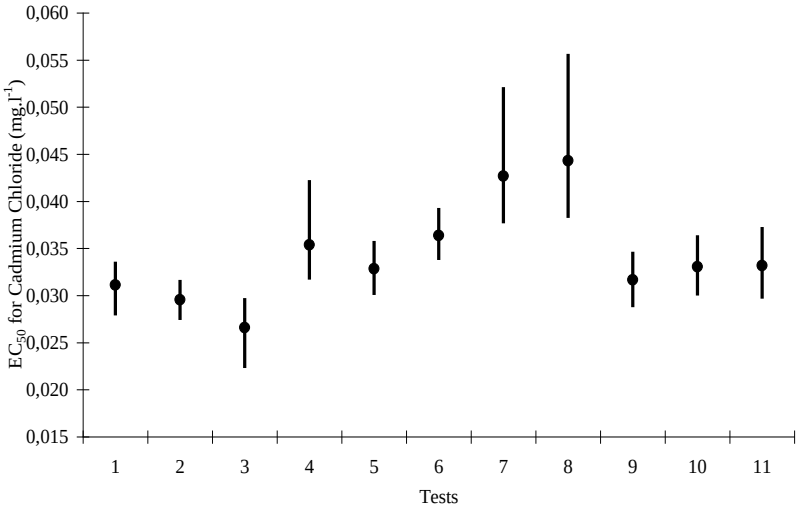

Figure 2: Cadmium toxicity ($CdCl_2$) to neonates of *M. elegans* exposed in natural medium at 25°C.

Despite the recommendation of the ISO standard (6341: 1989), that the ASTM medium being used as an appropriate medium for cladoceran cultures, this artificial medium without diluting was not well adequate for the growth of *M. elegans*. Nevertheless, once diluted in ultra pure water at a ratio (1:1) the animals presented a satisfactory growth. In our toxicity tests, *M. elegans* revealed a higher sensibility to cadmium when exposed to this metal in artificial medium - cadmium 48-h EC_{50} at 0.018 $mg.l^{-1}$ [0.012-0.024 $mg.l^{-1}$] (Figure 3). The pH and conductivity in

the artificial medium varied from 7.0 to 7.7 and from 220 to 320 µS.cm^{-1}, respectively. According to the results obtained here in artificial medium, *M. elegans* showed to be more sensitive toward Cd than *C. silvestrii*, which presented a 48-h LC_{50} mean of 0.062 mg.l^{-1} [0.016-0.110 mg.l^{-1}] (Oliveira-Neto & Botta-Paschoal, 2002) and *D. magna* (48-h LC_{50} at 0.033 mg.l^{-1} (Schuytema *et al.* 1984). Furthermore, the Cd 48-h LC_{50} obtained for *C. silvestrii* was also determined in an artificial medium and was significantly different from that obtained here for *M. elegans* with a coefficient of variation of only 15.8% ($p<0.0001$). These results reinforce the great potential of *M. elegans* as test organism in the assessment of pollutant-induced stress in tropical freshwater ecosystems.

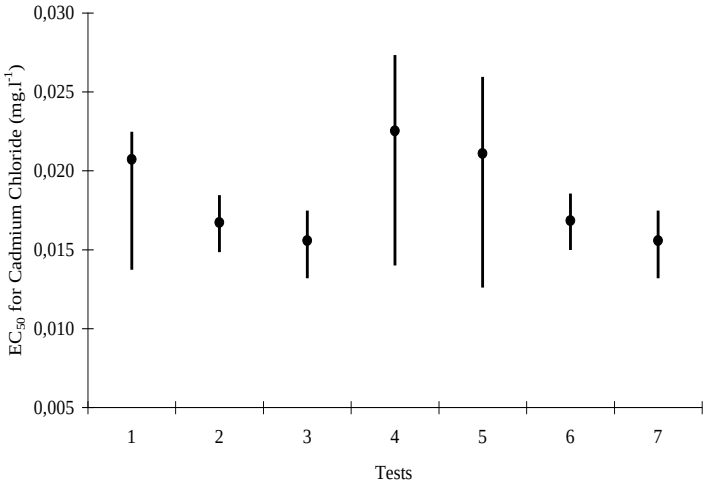

Figura 3: Cadmium toxicity ($CdCl_2$) to neonates of *M. elegans* exposed in artificial medium at 25^0C.

According to Buikema & Cairns (1980) and Orr *et al*. (1990) a safe procedure to assure the quality of a certain culture aimed to produce healthy specimens for a reliable experimental control in ecotoxicological tests, consists in testing a reference substance which is expected to affect the organism independently of small variations in the composition of the medium used in the tests. Hence, results obtained by different laboratories following a pre-established

methodology may be more easily compared allowing ecotoxicological tests to be standardised in due time (Soares & Calow, 1993; Knie & Lopes, 2004). Boluda *et al.*, (2002) and Manusadžianas *et al.*, (2003) comment that variation in results of toxicity tests due to chemical interactions (other pollutants or experimental medium) may amplify or reduce the toxic effects of some pollutants, such as the case of chelanting agents, for example, which toxicity may be influenced by dissolved organic matter and water hardness. Knie & Lopes (2004) argue that there is a controversy involving the use of natural and artificial medium in ecotoxicological tests, although it seems agreeable that both are important according to specific situations. Artificial medium are of great important for the standardisation of ecotoxicological tests. On the other hand, tests involving natural medium may produce results of great ecological relevance, as they resembles more the environmental reality of the study area.

Natural and artificial media used in this work presented a difference between their dissolved organic matter content, with larger concentration in the natural media. Conversely, the hardness, measured as $CaCO_3$, is much higher in the artificial medium (80 $mg.l^{-1}$) than in the natural medium (20 $mg.l^{-1}$). Our results, regarding the toxicity of cadmium to *M. elegans* shows that this tropical cladoceran is significantly more susceptible to cadmium in artificial medium (48-h EC_{50} at 0.018 mg l^{-1}) than in natural medium (48-h EC_{50} at 0.035 mg l^{-1}) ($p < 0.0001$) (Figure 4). Similarly, Penttinen *et al.* (1998) found that the sensibility of *Daphnia magna* towards Cd is higher in artificial medium (48-h LC_{50} at 0.037 $mg.l^{-1}$) than in natural medium (48-h LC_{50} at 0.058 $mg.l^{-1}$). A possible explanation for the higher toxicity of cadmium to *M. elegans* recorded in this work in the artificial medium is the large contents of dissolved organic matter 19.54 $\mu g.l^{-1}$ (De Santana, 2004) and humid acids in the natural medium, which may have reduced the toxicity of Cd to the animals tested in the natural medium. The presence of organic compounds in the artificial medium was almost negligible. Akkanen & Kukkonen (2001) found a direct

relationship between increasing values of water hardness and reduced levels of complexation of cadmium by dissolved organic matter due to a preference in binding between ions of calcium and cadmium. The water hardness in our toxicity tests was four-fold higher in the artificial medium than in the natural water. Nevertheless, this difference did not seem to be enough to suppress the affinity of the dissolved organic matter and humic acids to the metal which presumably was responsible for the reduction in the bioavailability of cadmium and thus, its toxicity to the cladocerans in the natural medium (Rand *et al* 1995; Lewis *et al.* 1999; Kalis *et al.* 2006).

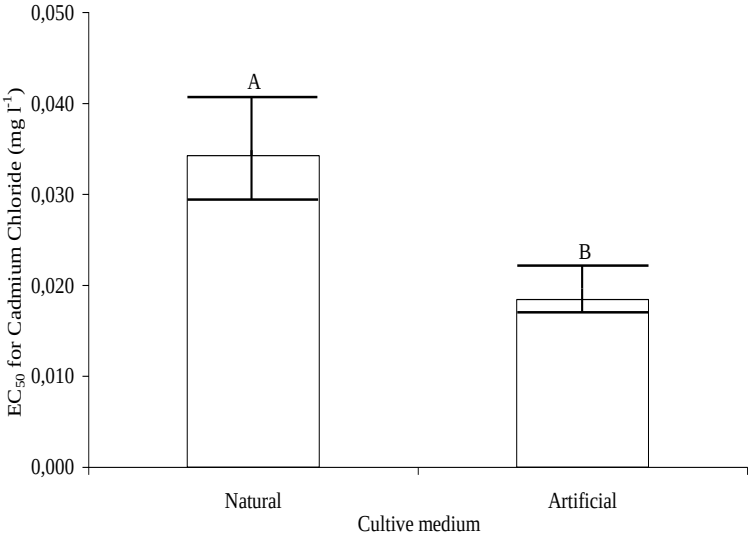

Figura 4: Toxicity of cadmium ($CdCl_2$) to neonates of *M. elegans* exposed at 25^0C in natural medium and artificial medium. Mean 48-h EC_{50} values and their 95% confidence limits (bars).

The tests to assess the toxicity of potassium chloride to the tropical cladoceran *M. elegans* were carried out in natural medium only. The mean value obtained for the KCl 48-h EC_{50} was at 749.08 $mg.l^{-1}$ [625.32–872.76 $mg.l^{-1}$] with a coefficient of variation of 8.2%, indicating a low variability and high precision of the results (Figure 5). The pH values varied between 6.63 and 7.00 while the conductivity ranged from 96 $\mu S.cm^{-1}$ in the controls, which showed no mortality, to 1900 $\mu S.cm^{-1}$ in the highest concentration tested. Comparing the results obtained in this work

for the toxicity of KCl to *M. elegans* with toxicity data determined for *D. magna* (48-h LC_{50} at 660 $mg.l^{-1}$) and *C. dubia* (48-h LC_{50} at 630 mg l^{-1}) (OECD, 2001), it is noticed that the values are reasonably close to each other.

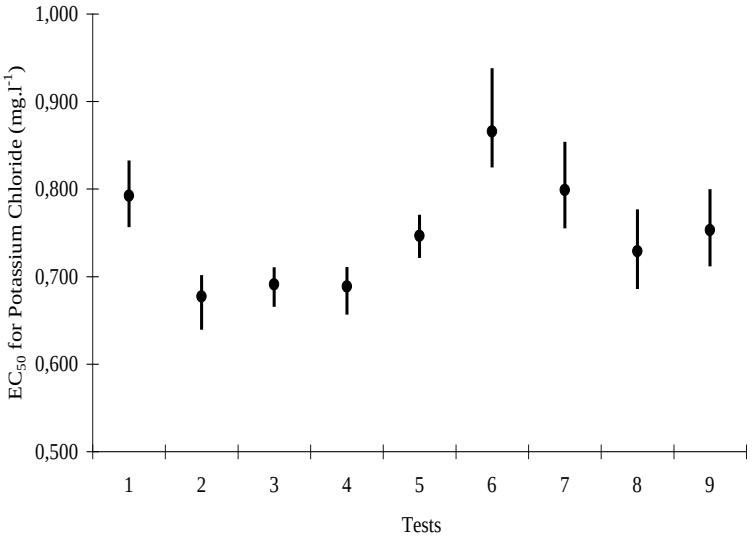

Figura 5: Toxicity of potassium (KCl) to neonates of *M. elegans* exposed in natural medium at 25^0C. Values of 48-h EC_{50} and their 95% confidence limits (bars).

4- CONCLUSIONS

The study showed clearly that the tropical cladoceran *M. elegans* is highly sensitive towards Cd either exposed in natural or artificial medium, even when compared with toxicity levels obtained for other tropical or temperate cladocerans in standardised tests. The variation in susceptibility levels observed between the two media tested may be attributed to differences in their composition. The higher organic matter content in the natural medium may have suppressed the cadmium toxicity to *M. elegans*. The results obtained either in the natural or artificial medium, however, were highly reproducible. *M. elegans* showed a great advantage as the animals are well adaptable to both, the natural and artificial medium thus, facilitating the standardisation of tests with this tropical cladoceran. *M. elegans* was also sensitive to potassium chloride and could be used in the quality control of cultures, particularly considering that these animals do not produce toxic residues, thus avoiding risks to researchers and the environment. The epibentthic behaviour of this tropical cladoceran may represent an advantage over other species considering that these animals could be potentially used in toxicity tests for the evaluation of the interface sediment-water. Overall, the tropical cladoceran, *M. elegans*, displays a great potential as a test organism in ecotoxicological tests. Nevertheless, more studies are required providing data on the characteristics of this animals and its sensibility to other potential toxic substances.

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