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Acute Toxicity of Cadmium to Eight Species of Marine Amphipod and Isopod Crustaceans from Southern California

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Amphipods and isopods are important components of the marine intertidal and subtidal fauna where they are found on or in the substrate or among spaces between larger, attached organisms. However, in spite of their abundance and importance, the use of these two endemic marine groups has been limited in comparison to decapods in marine toxicological research (Martin and Holdrich 1986). The purpose of this study was to investigate the effect of a single metalic salt, $CdCl_2$, on six species of amphipods and two species of isopods under similar experimental conditions. Cadmium was selected as the toxicant in this comparative study since this metal is an important constituent in municipal wastes discharged into southern California marine waters (Young et al. 1978).

MATERIALS AND METHODS

Amphipods and isopods were selected primarily on the basis of the availability of large number of specimens which would survive under laboratory conditions. Amphipods were collected from a variety of habitats. Jassa falcata was collected from the blue mussel (Mytilus edulis) community attached to floating boat docks in Los Angeles Harbor. Corophium insidiosum and Grandidierella japonica were collected from an intertidal muddy sand beach in Shoreline Aquatic Park in Long Beach. Rhepoxynius abronius was collected by benthic sampling at Newport, Oregon, by Dr. Richard Swartz and were transported to southern California. Elasmopus bampo was taken from a laboratory population maintained in California State University, Long Beach. This species had undergone about five generations since the initial establishment of the colony in 1984. Chelura terebrans and the isopod Limnoria tripunctata were collected from wood floating in Los Angeles Harbor; both species are marine wood borers. The

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isopod Jaeroposis sp. was collected from the green alga Cladophora trichotoma present in the rocky intertidal environment at Point Fermin, California. All species collected from the field were maintained in the laboratory for a minimum of one week prior to experimentation. All species but the wood borers were provided with appropriate food including ground alfalfa, the green alga Enteromorpha or fish flakes. All animals were examined under a dissecting microscope prior to use. Neither injured nor female specimens carrying embryos were used as experimental animals.

Salts of cadmium chloride were dissolved in distilled, deionized water to a concentration of 1000 mg/L. Test concentrations were made up by serial dilutions of the stock solution with natural seawater which had been previously filtered through a 0.45 membrane filter.

Static acute bioassays were carried out using four test concentrations plus a control series. Each series consisted of three replicates consisting of five 20 X 60 mm polystyrene petri dishes per replicate. Two test animals were placed in each container. No food was supplied during the course of the experiment nor test solutions changed. Temperature was maintained at 19.5 C, salinity was 35.0 ppt and dissolved oxygen was over 7.0 mg/L. Each container was examined daily and any dead specimens removed. A computer program was used to determine the 96-h and 7-day LC50's utilizing probit analysis which tested for level of significance by chi-square (Finney 1971).

RESULTS AND DISCUSSION

The 96-h and 7-day LC50 values of cadmium to seven species of peracaridean crustaceans are summarized in Table 1. The survival of Jassa falcata was less than 80 percent in the controls, and the results were excluded from Table 1. The amphipod Rhepoxynius abronius was the most sensitive species tested and Limnoria tripunctata was the most tolerant. The isopod Jaeropsis was the most sensitive species at seven days and Limnoria was the most tolerant.

Statistical analysis (chi-square) of the 96-h LC50's indicated four significantly separated groups according to their survival to cadmium. The most sensitive group included Rhepoxynius and Jaeropsis; next were Elasmopus and Chelura; followed by Grandidirella and Coropohium; Limnoria was the most tolerant of the seven species.

Two sets of two species each were collected from the same habitat. The amphipods Grandidierella and Corophium were both collected from the same intertidal

habitat and their 96-h LC50's were similar (1.17 and 1.27 mg/L, respectively); whereas Chelura and Limnoria were both collected from the same pieces of wood; their 96-h LC50's were one order of magnitude different (0.63 and 7.23, respectively). These comparisons indicate that similar or different results can be measured with animals living in the same niche. It would be of interest to know if the same relationship of these two pairs would apply to other toxicants.

Table 1. The 96 hour and 7 day LC50 values of $CdCl_2$ to seven species of amphipods and isopods.

	Mean and 95% confidence interval(mg/l)	
Species	96-h hour LC50	7 day LC50
Amphipods		
Rhepoxynius abronius	0.24(0.19-0.32)	*
Elasmopus bampo	0.57(0.47-0.7)	0.2(0.13-0.32)
Grandidierella japonica	1.17(0.94-1.46)	0.5(0.35-0.72)
Corophium insidiosum	1.27(0.88-1.83)	0.51(0.35-0.74)
Chelura terebrans	0.63(0.46-0.85)	0.2(0.14-0.28)
Isopods		
Jaeropsis sp.	0.41(0.26-0.65)	0.11(0.07-0.15)
Limnoria tripunctata	7.12(5.49-9.23)	2.14(1.64-2.8)

*Survival of control less than 80%

Comparisons of these results to previous tests with peracaridean crustaceans to cadmium indicate the data reported herein fall within the range of 0.01 to 13.3 mg/L reported in the literature (Ahsanullah 1976; Bellan-Santini and Reish 1976; Wright and Frain 1981; Sundelin 1983, 1984; Martin and Holdrich 1986). The 96-h LC50 for R. abronius to cadmium (0.24 mg/L) was similar to that measured for Allorchestes compressa (0.2-0.4 mg/L) by Ahsanullah (1976). The 96-h LC50 value of 0.41 mg/L for Jaeropsis sp. is the lowest result measured for isopods. The high value measured with L. tripunctata was still less than the 10 mg/L figure that Jones (1975) measured for four species of isopods. The 96-h LC50 of 0.24 mg/L reported herein for R. abronius is less than the value of 1.61 mg/L found by Swartz et al. (1985). Since the specimens used in both experiments were from the same collecting

site, these differences may be attributed to different collecting periods, air travel to Long Beach, different experimental salinities (35 compared to 25 ppt), different size containers (petri dishes compared to 1-L beakers), and different laboratory conditions. These data are similar to what have been reported for other crustaceans but are generally lower than that measured for polychaetes, pelecypods, echinoderms or fish (Eisler 1971; Nimmo et al. 1978; Portmann and Wilson 1971; Reish 1980).

These studies with amphipods and isopods indicate the usefulness of these animals in toxicity testing. Their small size makes them a convenient test organism. Their abundance in the field and their ease in culturing makes it possible to use large numbers of specimens per replicate giving greater statistical validity to the results. By pooling specimens within a replicate, it is possible to obtain sufficient tissue for body burden analysis.

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