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RESEARCH REPORT
Mortality and Reproduction in Earthworms Pheretima posthuma Exposed to Chromium (VI)

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The earthworms *Pheretima posthuma* were exposed to chromium (VI) levels varying from 0 to 100 ppm in three sets of experiments. In two sets the time required for 100 percent mortality was found to decrease with increase in chromium concentration but no trends were observed relating intermediate (< 100 percent) mortality to toxin concentration or time of exposure. The incidence of sexual reproduction and regeneration was higher in chromium-treated media compared to controls. The results indicate that attempts to use tannery effluents for irrigation will be harmful to the soil environment even if the effluents are diluted seven times before use.

rthworms play an influential role in increasing e fertility of the soil.[1] They aid in the mainten- ce of aeration, water permeability and organic d mineral turnover of the soil. An estimated 18 ns of earth per acre is brought to the surface by rthworms every year.[1] Earthworms are also imary consumers in food chains, and provide portant food for small mammals and birds.

A search of literature[2–10] reveals that the inter- pollution biology of earthworms with heavy metals has begun to grow only The initial studies have revolved round nickel, lead, and zinc, with a recent to include a study on the accumulation of copper and iron.[11]

Considering the large number of sources which chromium enters the environment[12] sence of any report on the effect of on earthworms,[12] the present study may

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were collected from the paddy fields adult, *Pheretima posthuma* were iso- they were kept in beakers in paddy-field eeing them from other macro-fauna. rface of the beakers was covered with to cut off light from the sides and to a real-life environment for the

Three sets of experiments were conducted, beginning respectively in May, June and July. In each set, after accumulation for two weeks, the worms were treated with chromium (VI) by mixing a known volume and concentration of aqueous solution of hexavalent chromium (as potassium dichromate) with the soil containing earthworms. The soil was changed and treated with fresh chromium solution every week.

RESULTS

Unlike our observations with different varieties of fishes and tadpoles (unpublished work) no consistent trends were observed in case of earthworms, relating intermediate mortality (percent death, < 100 percent) to chromium concentration or time of exposure. In sets I and II (Table I) the time required for 100 percent mortality decreased with the increase in chromium concentration. In set II the time required for 100 percent death decreased with the chromuim level, became constant for chromium levels of 20, 40 and 60 ppm, and then decreased further for 80 ppm. These observations establish the intolerance of earthworms for chromium (VI). Soil fauna other than earthworms are also likely to be effected by chromium toxicity by the use of chromium-contaminated waters. Tannery effluents, which are rich in nutrients but which also contain up to 70 ppm of chromium[15] have been tried in irrigation. The present studies

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TABLE I

Mortality and reproduction in earthworms *pheretima posthuma* exposed to hexavalent chromium

	0 ppm			10 ppm		20 ppm		40 ppm		60 ppm		80 ppm	
Chromium (VI)	Set I	Set II	Set III	Set I	Set III	Set I	Set III	Set I	Set III	Set II	Set III	Set II	Set III
Mortality after 27–28 days	2.5%	1.25%	0%	25%	16.6%	0%	100%	25%	100%	0%	100%	37.5%	100%
Mortality after 56–61 days	2.5%	1.25%	0%	50%	100%	50%	100%	50%	100%	75%	100%	100%	100%
Juveniles (Total found)	2	1	0	1	0	0	2	1	0	0	0	0	0
Bits (Total found)	1	3	0	3	3	4	0	2	0	0	0	4	0
100% mortality (In days)	Nil	Nil	Nil	116	56	109	27	85	27	78	27	56	6

indicate that such attempts are likely to cause serious harm to earthworms and consequently to various other components of the soil environment, even if the effluents are used after diluting them seven times with chromium-free water.

The observations on the formation of juveniles and bits indicate that the incidence of sexual reproduction (juvenile formation) and regeneration (through bit formation) was higher in case of chromium-treated worms compared to controls—three juveniles/three sets, and four bits/three sets were found in controls as against four juveniles/three sets and 16 bits/three sets in the chromium treated systems. A linear relationship was, however, not evident between chromium levels and the tendency of reproduction. Thermal pollution has previously been reported[14] to increase sexual reproduction and the rhythm of occurrence of juveniles in worms, but there is no such previous report concerning heavy metal toxicity.

For future studies it is desirable to study the bio-accumulation of chromium in earthworms and its effect on their reproductive system.

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