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RESIDUAL MERCURY ACCUMULATION IN EXPOSED MULBERRY PLANTS

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THE hazards of uncontrolled release of industrial and agricultural wastes have been clearly revealed by several serious incidents of mercury poisoning[1,2]. In each case the deaths were caused by consumption of food contaminated with high levels of mercury and pesticides incorporated through biological magnification in food chains. Considerable attention has been focused on mercury and mercury-based pesticides. Some of the mercury-based pesticides find use in mulberry cultivation. The literature on residual accumulation of mercury and its effects on mulberry plantation is scanty. The present work was undertaken to study the residual accumulation of mercury by the use of mercury-based pesticides and mercury-containing solid waste on mulberry plants.

A branch of mulberry (*Morus alba*) was cut into pieces 10 inches long. These were planted in different pots containing 6 kg manured soil (manure to soil 1:2). Care was taken to avoid flooding or drying of the pots. Pesticides and solid wastes were applied after the sprouting of 8–10 leaves on each mulberry cutting.

Solid waste of a chlor-alkali industry containing mercury was applied in one set of experiments. The solid waste contained 748.6 ± 32.3 mg of mercury/kg dry weight. Six concentrations were prepared, viz. 1.5, 3, 4.5, 6, 7.5 and 9%, and were applied in 6 pots at a time.

In the second set, $HgCl_2$ was applied. The application of the chemical was by two routes, i.e. application through the soil and by foliar spray. In one group of pots, $HgCl_2$ was applied through the soil and in another, $HgCl_2$ was applied by foliar spray. Three different concentrations of $HgCl_2$, viz. 0.02, 0.50 and 2 mg/l, were employed in each group.

In the third set, Emisan-6 at 1000, 2500 and 5000 mg/l was applied through the soil and by foliar spray. The concentrations selected were based on the studies of Mohapatra[3]. A set of control plants were maintained for comparison in each case.

Leaves from both control and treated plants were collected. The treated leaves were washed thoroughly to remove materials adhering to the waxy coat. A set of leaves was processed separately for dry weight determination.

Residual mercury was measured with a (cold vapour atomic absorption) mercury analyser using $HgCl_2$ (Analar) as the standard following the basic principle of Wanntrop and Dyfverman[4], which has undergone substantial modification in the light of recent developments[5]. The process of analysis has been described elsewhere[6].

Figure 1 shows residual concentrations of accumulated mercury (μg/g dry wt) in leaves after application of different concentrations of chlor-alkali solid waste, $HgCl_2$ and Emisan-6.

At lower doses of the solid waste there was a low amount of retention. With increase in solid waste concentration the residual mercury level showed a significant increase and at 9% the highest value (2.06 ± 0.32 μg/g dry weight) was recorded 30 days after exposure.

There were significant differences in residual concentrations between application of $HgCl_2$ by foliar spray and application through soil. The recorded residual level of Hg on leaves after foliar spray of 0.2 mg/l $HgCl_2$ was 120.16 ± 8.16 μg/g dry weight, and at 2 mg/l of $HgCl_2$, the residual Hg was 139.42 ± 18.42 μg/g dry weight. Soil application gave corresponding residual mercury levels on leaves of 3.7 ± 0.5 μg/g and 3.90 ± 0.33 μg/g dry weight.

In the case of Emisan-6 the differences in residual Hg levels between foliar spray and soil application were similar to those in the case of $HgCl_2$.

Control plants did not show any trace of mercury in the leaves.

It has been reported earlier[7–9] that mercury can be accumulated in different biotic systems to a dangerous level. Uptake and accumulation of chemicals may prove to be most important aspect of pollution dynamics. Since the leaves of the mulberry plant are the food of silkworm larvae, accumulation of mercury and pesticides in the leaves can cause damage to the sericulture industry. Larvae fed on contaminated leaves accumulate the pollutants within the body. Mercurial compounds are known to affect the growth and efficiency of animals[7,9]. It can be presumed that because of the drastic decline in growth and metabolism silk production by the

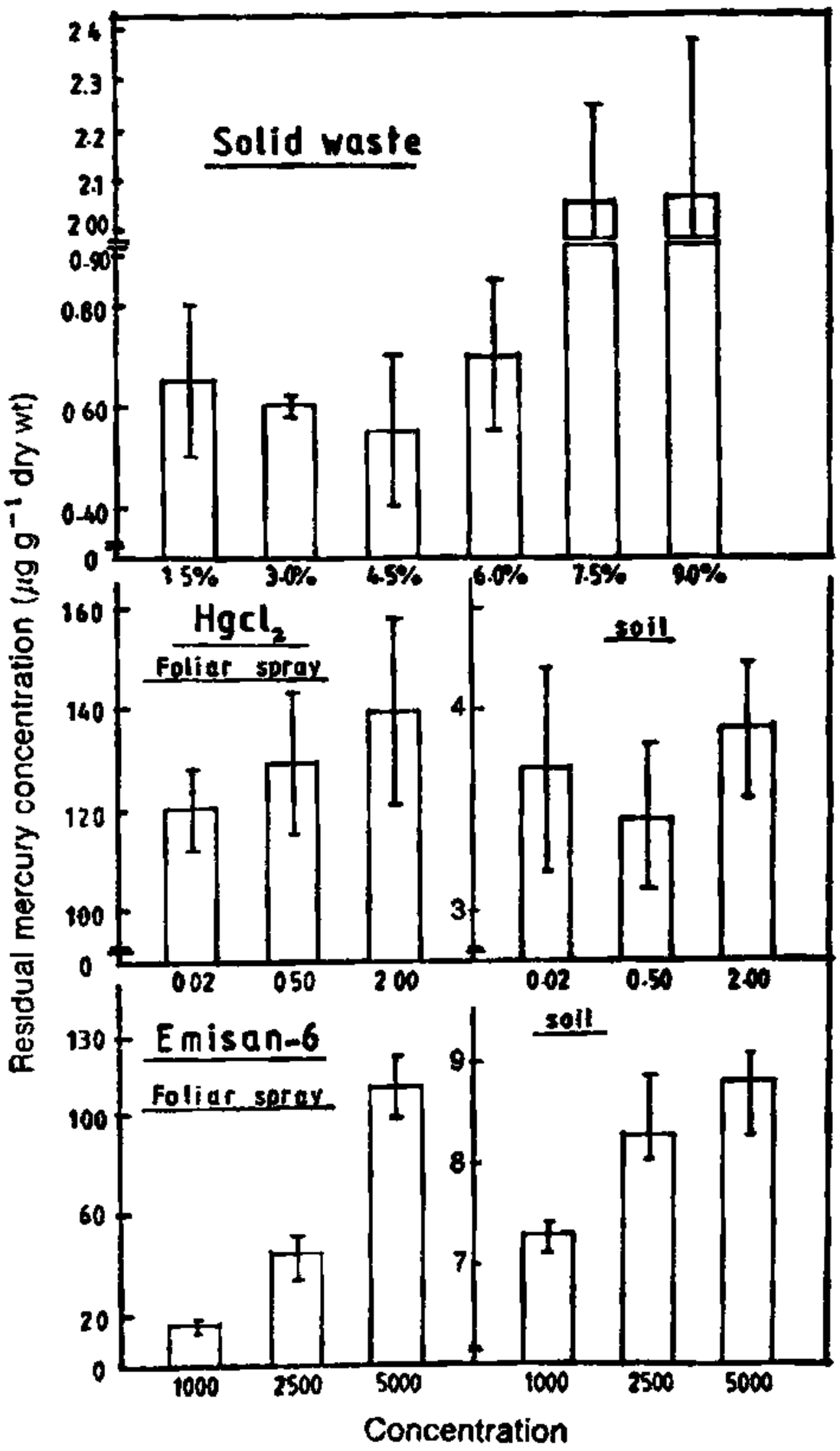

Figure 1. Residual mercury concentration (μg/g dry wt) in leaves of treated mulberry plants 30 days after application. Bars show mean of 10 samples; standard deviations are also shown.

larvae will be affected and the silk fibre may be very weak and of low quality.

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INHIBITION OF PHOTOSYNTHESIS IN LEAF DISCS BY HERBICIDES

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HERBICIDES are known to inhibit photosynthesis at metabolic sites[1]. Recently, work on photo-inhibition by herbicides at low concentrations on leaf discs has been described[2].

Developed leaves of rice (cv. IET-7633), maize (cv. VL-16), soybean (cv. Lee) and groundnut (cv. JL-24) were collected from field-grown plants grown with recommended levels of nutrients. Leaf discs (1 cm diameter) were treated overnight in different concentrations of simazine (0, 3, 6, 9 and 12 ppm), butachlor (0, 80, 160, 400 and 800 ppm) and glyphosate (0, 80, 160, 400 and 800 ppm). Photosynthesis inhibition was estimated on the basis of permanent submergence of leaf discs placed afloat in 0.05 M $NaHCO_3$ solution in light[2].

Photosynthesis inhibition by the herbicide simazine was more pronounced in soybean and groundnut leaf discs than in rice and maize (table 1). Fifty per cent inhibition was recorded in rice and maize at a concentration of 12 ppm. But at that concentration, the inhibition in soybean and groundnut was 70%. This is in agreement with the results of earlier workers[3,4]. Simazine effects are by inhibition of electron transport, and disorganization and rupture of the tonoplast and chloroplast envelope[5,6].