Technical Papers

Toxicity of Cellulose Acetate Sheets to Plants and Fish

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In a series of experiments on insect transmission of plant viruses carried out in 1949, cellulose acetate cages were used for confining the insects on plants. Transparent cellulose acetate sheets, 0.020 in. thick, obtained from a commercial house, were used. When crimson clover plants (*Trifolium incarnatum* L.) were placed under the cages they developed characteristic lesions on the leaflets within 3 days (Fig. 1, *a, b, c, d*), and most of them died within 2 weeks.

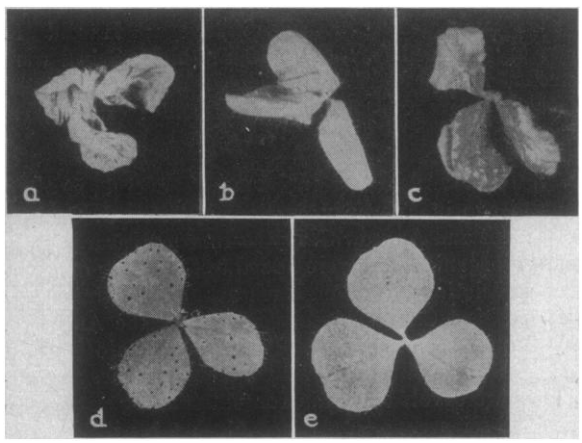

FIG. 1. *a, b, c, d*: Leaflets of crimson clover showing lesions and burning symptoms caused by toxic cellulose acetate sheets; *e*: normal leaflet. (Photographs by A. J. Carlile.)

Sheets of cellulose acetate from other sources were tested, and the material from one proved to be nontoxic. A spectrophotometric analysis[1] of different kinds of cellulose showed that the toxic sheets contained diethyl phthalate.

On inquiry it was learned that most manufacturers of cellulose acetate sheets used diethyl phthalate as the plasticizer. A comparison of the effects of toxic cellulose acetate cages and c. p. diethyl phthalate was therefore made. Crimson clover plants were caged under bell jars with small vials containing diethyl phthalate. Lesions similar to those produced by the toxic cages appeared on the leaflets. When a single leaflet was brought in contact with diethyl phthalate, the plant developed characteristic lesions and died within 3–5 days. The toxic effect was also tested on aster (*Callistephus chinensis* Nees) and tobacco (*Nicotiana tabacum* L.). Aster plants were found less susceptible, whereas tobacco proved to be more sensitive.

[1] The author is indebted to George I. Lavin and Herbert Jaffe for the spectrophotometric analyses.

Storage, or soaking the sheets in water, had little or no effect on the toxicity of cellulose acetate. Since toxic cellulose acetate tasted bitter it could easily be distinguished from the nontoxic material. Diethyl phthalate is bitter, has a boiling point of 295° C, and is nearly insoluble in water. It was found that soaking toxic cellulose acetate cages in alcohol, in which diethyl phthalate is miscible, removed most of the toxicity but caused so much shrinking of the material that it became unsuitable for use in the construction of insect cages.

The toxic effects of diethyl phthalate and of cellulose acetate sheets containing it are not limited to plants. Fish were exposed to the cellulose acetate material known to be toxic to plants, by confining them in water in a fishbowl in which small pieces of the material were immersed. They died within a few hours, despite the low solubility of diethyl phthalate in water. For a more precise test, sheets were cut into pieces, approximately 300 mg each, and 1–50 pieces were immersed in Erlenmeyer flasks containing 50 ml water. Three g of the material killed a 1½-in. goldfish within 45 min, 0.3 g within 4½ hr, and 1 drop of diethyl phthalate in 50 ml water within 30 min. Cellulose acetate powder and sheets of nontoxic cellulose acetate, as well as cellulose nitrate sheets, had no toxic effects on plants or fish. The results indicate that small amounts of diethyl phthalate are highly toxic to both fish and plants.

In a limited number of tests with mice, adding toxic cellulose acetate sheets to their drinking water produced no harmful effect.

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The Distribution of S^{35}-Labeled L-Methionine Sulfoximine in the Rat[1]

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It has been shown by various investigators (*1–3*) that methionine sulfoximine is the toxic agent produced by treating prolamines with nitrogen trichloride. The sulfoximine has been isolated from agenized flour and recently synthesized (*4, 5*).

When injected or fed to susceptible animals, convulsions may develop after a period of several hours, and the animals may die if the dose is high enough. There is evidence that methionine sulfoximine is a methionine antagonist, and Reiner (*6*) has shown that the convulsions produced by the drug in rabbits may be delayed or suppressed by feeding excess methionine.

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