Ethylene Dibromide for Destroying Fruit Fly Infestations in Fruits and Vegetables

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Three species of fruit flies[1] are established in Hawaii and constitute a serious threat to mainland agriculture. Losses caused by these flies to Hawaiian agriculture consist both in direct damage to crops by larval feeding and in the restrictions imposed by quarantines on the free movement of crops to mainland markets.

In the event of even an incipient infestation on the mainland by one or more of these flies, quarantine restrictions would probably involve the greater losses, unless satisfactory commodity treatments for eliminating fly infestations were available for the large quantities of fresh fruit and vegetables that might be grown in the infested area.

Vapor-heat and methyl bromide treatments have been developed and used successfully in the export from Hawaii of papaya, pineapple, tomato, bell pepper, and zucchini. However, recurrent injury has been reported occasionally even where the treatment has been carefully controlled. The cause of such injury is not clear. It has been variously attributed to season, rainfall, location, soil, varietal differences, and cultural and agronomic practices. Many quarantined commodities, such as bananas, avocados, string beans, and cucumbers, would not tolerate either treatment.

In the course of screening various materials as fumigants on naked eggs and larvae of the oriental fruit fly, it was found that ethylene dibromide was the most toxic of 53 compounds tested.[2] The LD_{95} concentrations at 70° F were 0.43 mg/l for eggs and 0.95 mg for third-instar larvae. Concentrations of methyl bromide required to give the same mortality were 24.5 and 18.5 mg/l.

In large-scale tests ethylene dibromide was used successfully as a fumigant to destroy the immature stages of the oriental fruit fly in papaya and guava and the melon fly in cucumbers and tomatoes. Complete mortality was obtained at dosages of ½ lb/1,000 cu ft for 2 hr at 70° F for the oriental fruit fly and at ¼ lb for the melon fly. In these studies 11,459 fruits with fruit fly infestations of 137,077 eggs and larvae were used. The liquid fumigant was volatilized by heating. Phytotoxicity tests with papaya, pineapple, avocado, Cavendish banana, bell pepper, zucchini, cucumber, and string beans showed no injury from the gas concentrations required to produce complete fruit fly mortality. A comparison of mortality curves shows that ethylene dibromide is approximately 17 times as effective as methyl bromide in destroying the immature stages of the oriental fruit fly in papaya.

Preliminary data indicate that ethylene dibromide shows the same order of toxicity to the Mediterranean fruit fly and the oriental fruit fly.

[1] The Mediterranean fruit fly, *Ceratitis capitata* (Wied.), the melon fly, *Dacus cucurbitae* Coq., and the oriental fruit fly, *Dacus dorsalis* Hendel.

[2] These screening tests were made by the author and D. L. Lindgren, University of California Citrus Experiment Station, Riverside, Calif.

Formation of a Competitive Antagonist of Vitamin B_{12} by Oxidation

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In the course of an investigation of the effect of various chemical procedures on vitamin B_{12} it was found that treatment of the vitamin in strong acid solution with hydrogen peroxide caused a decolorization of the solution. Tests of this solution showed that the reaction product exhibited a competitive antagonism to vitamin B_{12}.

To 10 ml of a B_{12} solution containing 100γ/ml was added 5 ml of concentrated HCl. A few drops of a 30% solution of hydrogen peroxide were added, with stirring at room temperature. The solution decolorized. It was allowed to stand for about an hour at room temperature and was then neutralized with NaOH. The activity of this solution was then assayed directly on *Lactobacillus leichmanii* 4797, using the method of Skeggs *et al.* (*1*).

The results, presented in Table 1, showed an inhibitory effect of the substance on the microorganism, which could be counteracted by vitamin B_{12}. Only at the highest level of inhibitor tested was there incomplete counteraction.

TABLE 1

EFFECT OF A B_{12} OXIDATION PRODUCT ON *Lactobacillus leichmanii*

Vitamin B_{12} (γ/tube)	B_{12} oxidation product (γ/tube)				
	0	5	10	25	50
0	0	0	0	0	0
0.001	210	175	140	25	0
0.005	270	200	220	137	0
0.05	300	310	282	230	0
0.5	286	295	275	240	0
5.0	298	310	305	280	25

Figures representing the concentration of the B_{12} reaction product are based on the original concentration of B_{12} in the starting material. The figures for bacterial growth are direct readings on the Klett-Summerson colorimeter, which was set at zero with the organism control.

The solution was also tested on *Staph. aureus, S. typhosa,* and *Ps. aeruginosa,* three organisms that do not require preformed vitamin B_{12} as a growth fac-