

dog in an effort to detect any circulating toxin. The transfused dog showed no evidence of paralysis.

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¹ Gregson, J. D., *Proc. Ent. Soc. British Columbia*, **40**, 19 (1943).

² Ross, I. C., *Aust. Coun. Sci. and Ind. Res.*, **8**, 8 (1935). Oxer, D. T., and Ricardo, C. L., *Aust. Vet. J.*, **18**, 194 (1942).

³ Hindmarsh, W. L., and Pursell, R. T., *Aust. Vet. J.*, **11**, 229 (1935).

Insecticidal Synergism with Valone

THE insecticidal properties of valone (2-*isovaleryl* 1,3-indandione) were being investigated some years ago¹, when the material was apparently eclipsed by the discovery of DDT. Recent tests on insect pests of stored products have shown that, although not outstandingly insecticidal by modern standards, valone has an unusual combination of properties; namely, (1) if the dose is high enough to be lethal, it kills the insects rapidly, (2) in sub-lethal doses it produces a paralysis from which insects afterwards recover, and (3) the percentage mortality is unusually sensitive to changes in dose. (2) indicated that insects can detoxify valone. By analogy with the probable mode of action of synergists for pyrethrins² and DDT³, that is, depression of the normal detoxification of the insecticide, it seemed possible that the insecticidal action of valone could be intensified by a suitable synergist. Furthermore, (3) suggested that the synergist need not be highly efficient in order to increase the mortality considerably.

A number of compounds were therefore tested in the laboratory for synergism with valone, using the flour beetle, *Tribolium castaneum* Herbst, as the test species. Most, including pyrethrin synergists, did not synergize valone appreciably, but certain insecticides did so, especially pyrethrins and gamma-BHC (gamma-hexachlorocyclohexane). Table 1 gives results obtained with these insecticides applied as direct sprays⁴ in refined kerosene. That synergism occurred is supported by the fact that the mixtures combined an enhanced toxicity with the rapid lethal action of valone. Kerr⁵ gave data suggesting that synergism occurs between valone and pyrethrins applied to houseflies.

The larvæ of the Khapra beetle, *Trogoderma granarium* Everts, are exceedingly resistant to the contact insecticides in general use⁶, and even lethal

Table 1. TOXICITY* TO FLOUR BEETLES, *Tribolium castaneum*, OF MIXTURES CONTAINING VALONE, AND OF THE SEPARATE CONSTITUENTS

Spray (concentrations, per cent w/v)	Spray deposit (mgm./10 sq. cm.)		
	2.5	3.7	5.4
2.0 per cent valone	0	0	32
0.3 per cent pyrethrins	0	2	10
2.0 per cent valone + 0.3 per cent pyrethrins	10	20	92
2.0 per cent valone	0	0	30
0.4 per cent gamma-BHC	0	4	20
2.0 per cent valone + 0.4 per cent gamma-BHC	12	58	88

* As shown by mortalities (per cent) in batches of 50 beetles kept at 25° C. for three days after spraying.

doses of these are very slow to kill. Mixtures containing valone with pyrethrins or gamma-BHC were therefore applied to larvæ, to discover whether the rapid action of valone might be useful in their control. As sprays in refined kerosene, the lethal action on the larvæ was rapid, but the synergism only moderate. However, as a dust on tale, a mixture of valone with gamma-BHC showed both a rapid lethal effect and marked synergism. Table 2 illustrates this. Even if mixtures of valone with gamma-BHC or pyrethrins should prove inapplicable to the practical control of *Trogoderma*, the existence of a formulation so toxic and swiftly lethal encourages the hope that a contact insecticide effective against these resistant larvæ can be found.

Table 2. TOXICITY* TO LARVÆ OF THE KHAPRA BEETLE, *Trogoderma granarium*, OF A MIXTURE CONTAINING VALONE AND GAMMA-BHC, AND OF THE SEPARATE CONSTITUENTS

Dust (concentrations, per cent w/w)	Temperature	
	25° C.	30° C.
5.0 per cent valone	11	20
0.5 per cent gamma-BHC	0	0
5.0 per cent valone + 0.5 per cent gamma-BHC	77	100

* As shown by mortalities (per cent) in batches of 100 larvæ after four days exposure to the dusts.

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¹ Kilgore, L. B., et al., *Indust. Eng. Chem. (Indust.)*, **34**, 494 (1942). Eddy, G. W., and Carson, N. B., *J. Econ. Ent.*, **39**, 763 (1946).

² Winteringham, F. P. W., *Proc. 3rd Int. Cong. Phytopharmacy*, Paris, 1952 (in the press).

³ Perry, A. S., and Hoskins, W. M., *Science*, **111**, 600 (1950).

⁴ Hewlett, P. S., *Ann. App. Biol.*, **34**, 357 (1947).

⁵ Kerr, R. W., *Bull. Commonwealth Sci. Indust. Res. Org., Aust.*, No. 261 (1951).

⁶ Cotterell, G. S., and Howe, R. W., "Insect Infestation of Stored Products in Nigeria" (H.M.S.O., 1952). Parkin, E. A. (unpublished).

Relation between the Quality of Soybean Oil Meal and the Requirements of Vitamin B₁₂ for Chicks

VARYING results from some experiments with chicks, using pure vitamin B₁₂ in all-vegetable diets, have led to the conclusion that the quality of the soybean oil meal used must be taken into consideration.

In two series of experiments, carried out in the early months of 1953, the addition of pure vitamin B₁₂ to an all-vegetable diet gave ample and significant growth responses. In addition, the chicks in these experiments responded significantly to lowered calcium content in the diet, iron supplement or added vitamin D, although these factors were thought to be adequate in the diet.

In two further series, there was no growth response at all. The chicks fed the basal vitamin B₁₂-free diet grew at the same rate as the vitamin B₁₂-supplemented chicks. The other factors mentioned above also failed to give growth responses.

As a standard procedure in vitamin B₁₂-experiments on chicks at this animal experiment station, the method adopted by Rubin and Bird¹ is used. Day-old chicks from non-depleted hens are fed an all-vegetable diet for the first two weeks, and then