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insecticide. Similar results have been obtained using the bug *Dysdercus fasciatus* Sign.

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ENTOMOLOGY

Diffusion of Oil Films over Insects

CONTACT insecticides are often formulated as solutions in oil and presented as deposits sprayed on to surfaces. The spread of oil on to insects walking over superficial films is an essential process in the action of such a deposit, though the quantities of oil involved are extremely small. Using a radioactive tracer technique, measurements have been made of the rate of uptake of oil by active flies of the species *Phormia terraenovae* R-D from deposits of 3 μ l./cm.² of a refined mineral oil ('Risella 17') on Whatman No. 1 filter paper. Traces of a radioiodine preparation (¹³¹I) di-iodo-octadecane were added to the oil and the specific activity adjusted to 2 mc./ml. of oil. The flies were exposed to the oiled substrate by the method of Lewis and Hughes¹. After exposure the insects were washed three times in ether to remove the superficial oil from the cuticle, and the tissues later extracted with ether followed by 10 per cent sodium hydroxide.

From measurements of the radioactivity of the washings and extracts, estimates of the rates of contamination with oil and of subsequent absorption of tracer were obtained. Autoradiographs of dissected parts of exposed insects were also made in order to obtain information about the location of the oil film on the body. It was found that, when walking continuously at 25° C., the flies steadily accumulated oil on the tarsal segments at a rate averaging 3×10^{-7} ml./min. per fly, the rate remaining substantially constant for periods of up to 20 min. of exposure. An appreciable fraction of the oil migrated from the tarsi to other parts of the body; for example, the flow of oil on to the wings averaged 1.5×10^{-8} ml./min. so long as the fly remained active.

Autoradiographs confirmed that oil films were established over the whole of the integument within a very few minutes of the initial exposure. The surface area of the cuticle of the wings of this strain of *Phormia* has been measured by gas adsorption techniques². From these measurements, assuming an even spread of oil, it can be calculated that a monomolecular film of oil was established over the wings within a period of 5–15 min. from the first contact of a fly with the oil deposit.

It is significant that the oil film advanced only when the integument was part of a living, active insect. The film ceased to spread after the death of an animal. This finding leads to the hypothesis that on the epicuticle of this insect a thin film of oil progresses as a result of very small elastic movements of the cuticle surface of the active insect. It is known that stresses in the cuticle of insects do occur and are perceived by campaniform sensilla³. The results of the present investigation suggest that such movements facilitate the spread of oily solutions and may thus be a factor in the mode of action of oily deposits of

Synthesis of Ascorbic Acid by the Normal Fat-Body of the Cockroach, *Leucophaea maderae* (F.), and by its Symbionts

Filosa¹, Cordero² and Rousell³ found that homologates of the normal fat-body of the American cockroach, *Periplaneta americana*, can synthesize ascorbic acid with D-mannose as the substrate. Similar results were obtained by Lisa⁴ with the fat body of the normal cockroach, *Leucophaea maderae*. Since the fat-body of these insects contains intracellular symbionts, it was suspected that the synthesis of this vitamin may be due to the presence of these micro-organisms. Hence, the present experiments were performed with the aposymbiotic fat-body and the symbionts of *Leucophaea maderae* to determine whether or not this is the case.

Cockroaches were kept in glass jars at room temperature. The bottom of each jar was covered with sawdust to a height of 3 in., and the necks of the jars were smeared with 'Vaseline' to prevent the insects from escaping. A piece of muslin, secured with a tight rubber band, was placed over the tops of the jars. The food was placed in glass dishes on the sawdust, and a vial filled with water and plugged with moist cotton served as a water supply. The normal insects were fed a diet of 37 gm. Gaines's dog biscuits, 1 gm. dextrose and 2 gm. brewer's yeast. However, those insects rendered aposymbiotic had this amount of diet ground up and mixed with 1 gm. each of the antibiotics, aureomycin and terramycin. These diets were fed to the two groups of insects for 105 days, with weekly changes of food and water.

Symbionts were isolated from the normal fat-body of cockroaches according to the method of Begg and Sang⁵. The method called for an inactivation of the insect with ether for about 30 sec., and then external cleaning with 70 per cent ethyl alcohol. The insect was then placed in a paraffin tray which had been previously flooded for 1 hr. with 70 per cent ethyl alcohol, but which now contained a sterilizing solution of 0.5 gm. mercuric chloride, 6.5 gm. sodium chloride, 1.25 ml. concentrated hydrochloric acid, 500 ml. absolute ethyl alcohol, made up to 1 litre with distilled water. It was kept in this solution for 20 min. At the end of that time it was placed in a fresh solution of 70 per cent ethyl alcohol, and kept there for 35 min. Finally, it was laid in a Petri dish of distilled water, and allowed to remain there for 5 min. Since the above treatment of the insect was carried out under the strictest aseptic conditions, and transference from solution to solution was done with sterile forceps, it was now considered sterile enough for the operation, which also was performed under sterilized conditions.