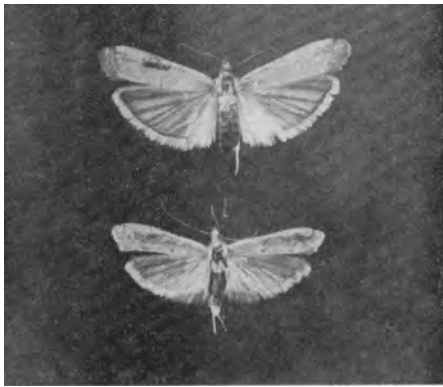


The Sunflower Moth

preliminary experiments indicate

parathion, DDT effective controls

P. F. Knowles and W. H. Lange



Wingspread of adult sunflower moths, slightly enlarged. Upper, adult female moth 1"; lower, adult male moth 13/16".

Among the many insects attacking sunflowers in California the most serious is the sunflower moth, *Homoeosoma electellum* (Hulst).

In the caterpillar stage the moth also damages safflower, wild sunflowers and certain cultivated composite flowers.

Larvae of this insect are observed in the heads shortly after flowering commences, usually appearing first about the margins of the head. Weblike material and a granular frass are produced on the face of the head, the amount depending on the number of larvae present. In addition to superficial damage to the seeds, the larvae often bore inside the developing seeds. Seed losses may run as high as 60%.

The sunflower moth caused considerable damage in 1950 and 1952, but very little in 1951 and 1953. No explanation can be offered for its erratic behavior, although it is known that natural enemies often play an important part in the control of the pest.

The life cycle of this insect has been worked out in some detail for the Great Plains. The eggs are laid between and within the individual flowers of the sunflower head, where they remain 40 to 72 hours before hatching. After hatching and for a period of eight days, the young larvae often feed on the flowers and then feed on the green seed, bracts, and receptacles. The larval stage lasts a total of 25 days, after which the insects pupate in cocoons among or within individual seeds. There are about four generations a year in the Great Plains and probably several in California, although the exact number has not been determined. There appears to be no information on how the insect overwinters.

A preliminary experiment to determine the effectiveness of insecticides in the control of this pest was carried out in 1952. The data obtained from this experiment indicated that some measure of control could be obtained, if the right insecticides were applied and if the applications were timed correctly.

Four insecticides, parathion, toxaphene, lindane and DDT, were each applied as a dust to 100 sunflower heads when about two-thirds were in bloom. Applications were made directly to the

face of the heads with a rotary hand duster, but this was difficult to accomplish because of the tall stature of the plants, and much of each application was lost. This wastage necessitated application rates of three pounds per 100 plants, or about 300 pounds per acre. A second application of each insecticide was made to 50 heads 14 days later, at which time almost all the heads had opened. When each head was treated, a record was made of its stage of development.

When the sunflower heads were almost mature, an estimate was made of the damage to each head. Damage was considered to be the area of the face of the head that was discolored in any way by the larvae. The accuracy of these estimates was checked by counting the number of damaged seed in each of 100 heads taken from the entire experiment. It was found that average estimates of head damage approximated very closely the average amount of actual seed damage, so long as the estimates were below 40%. Estimates of head damage above 40% usually were higher than the actual damage to the seed. Estimates of 50, 60, 70 and 80% damage to the heads would

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Estimated Damage to Sunflower Heads at Maturity by Larvae of the Sunflower Moth Following Insecticide Dust Applications.

Treatment	Stage of development when treated	
	Heads in bud	Heads open
	%	%
One application August 5		
Toxaphene 10%	41	7
Parathion 2%	40	6
DDT 10%	20	4
Lindane 1%	60	14
Two applications August 5 and 19		
Toxaphene 10%	9*	6
Parathion 2%	6*	12
DDT 10%	7*	2
Lindane 1%	16*	13
No treatment		
Check	51	61

* Most of heads open at time of second treatment.

Left, deforming of sunflower head by larvae of sunflower worm; Right, head cut open to show mature larvae and extensive webbing and frass exudation.



MOTH

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indicate about 40, 45, 50 and 55% damage to seeds.

Where no treatment was given, the estimated damage was above 50%, and the damage appeared to be more severe in those heads that were open at the time the first treatment was given. The actual damage to seeds probably would have been less than the estimated damage by about 10%. It is believed that many commercial fields in 1952 suffered similar losses.

A single treatment of opened heads gave good control of the pest, DDT being most effective and lindane the least. A second treatment of such heads gave no consistent improvement in control.

Insecticides applied to heads in the bud stage gave very little control, except DDT which reduced the injury from 51% to 20%. The heads that were in bud at the time of the first treatment had opened for the second, and control of the larvae in such heads from the second application was similar to that achieved in open heads by one application.

It might be argued that insecticides should be applied after all the heads had opened. Two circumstances, however, make this an unwarranted recommendation. First: the larvae would accomplish much of their damage in early heads before the insecticide was applied, and they might be deep enough in the head to escape injury. Second: the heads tend to face downward shortly after they open, and dust or spray applications by air would fail to reach the face of the heads.

Growers have found that the use of insecticides on this pest has not given consistent results. More often than not DDT has not been too successful. Lack

of success is believed to have been due to late applications when the sunflower heads have been facing downward. One seed company has reported excellent control when the insecticide—40 pounds of 2% parathion and 5% DDT—was applied when the heads had just opened. The dust was flown on with a plane going in an east to west direction, because sunflower heads always face eastwards after they open.

Because these investigations were limited, no unconditional control recommendations can be made.

However, if the larvae are present in the head, and about 60% of the heads are in bloom, a mixture of 5% DDT and 2% parathion applied at 40 pounds per acre should be effective.

If two applications are intended, a 10% DDT dust at 40 pounds per acre can be used for both treatments, with the first applied when the heads are about 20% in bloom and the second applied about 10 days later.

Equivalent amounts of insecticides in liquid form may be used, although no comparative results with dusts seem available. After the florets have dropped from the heads and the seeds are exposed, parathion only should be used because DDT will contaminate the seeds.

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Normal seeds, left; and damaged by sunflower moth, right.

EXOCORTIS

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establish the Morton top, and the lemon inoculation bud again took over. These two trees have been eliminated from *E* and included in *D* for the Morton citrange. There were no visible external symptoms of exocortis on any of these seedlings.

Seedlings of all three rootstock varieties—check *F*—appeared healthy in every respect. There were no visible external symptoms of exocortis.

Because the three rootstocks included in these trials did not show exocortis—when budded to nucellar Frost Eureka lemon tops—it suggests that the nucellar lemon is not carrying exocortis.

Apparently the old line Eureka lemon in *C* was carrying exocortis but it ap-

pears to have been filtered out in passing that particular strain of lemon through the nucellar seedling process.

The fact that the nucellar line *A* was apparently not carrying the virus at the time buds for this experiment were obtained—35 years of age from seed—might suggest that exocortis may not be readily transmissible to lemon by an insect vector. The parent trees of the nucellar line and old line are adjacent trees. The lemon strain in *D* also carried exocortis.

Because none of the check seedlings of trifoliate orange, Morton citrange, or Troyer citrange are showing exocortis—nor showing the disorder when budded to a nucellar Eureka—it suggests that exocortis is not an inherent character in these rootstocks.

The fact that the inoculated seedlings

of trifoliate orange, Morton citrange, and Troyer citrange are severely stunted but—in September 1953—were showing no visible symptoms of exocortis might indicate that a combination with a lemon top is a more favorable host for the virus than the inoculated seedlings. However, it is anticipated that these inoculated seedlings will show symptoms in time. The trifoliate orange appears to be more sensitive to the inoculation than the Morton citrange, and the Troyer citrange appears to be the least sensitive.

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