TENTATIVE RESISTANCE TO THE LARVAE OF HOMOEOSOMA ELECTELLUM IN HELIANTHUS

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In the central Blackland area of Texas, which is one of the areas where we would like to grow sunflowers, the larvae of the sunflower head moth (Homoeosoma electellum) often causes complete destruction of the domesticated sunflower seed crop. In this area wild sunflowers (Helianthus annuus), which are not only a roadside and small grain field weed but also an extremely serious row crop weed, provide a tremendous reservoir for the insect. They germinate and start growth as early as January, but seldom flower before June 15. At this time the moth emerges in almost unlimited numbers ready to lay eggs on sunflower heads.

About two years ago the U. S. Department of Agriculture sunflower research program, conducted co-operatively with the Texas Agricultural Experiment Station at College Station, Texas, was allowed to expand from a small sustaining program to one designed specifically for breeding for resistance to insect and disease pests to avoid, or at least reduce, the need for pesticides. At College Station we have relatively few wild sunflowers, and insects seldom cause complete destruction. We can plant isolated plots in cotton fields and obtain seed. The plots are sprayed regularly in the same program used to control the cotton insects.

In 1965 and 1966, we planted the U.S. regional yield test and a large number of inbred lines at McGregor, Texas, and the regional test at Temple, Texas; both of these locations are in the area with a high population of wild sunflowers. At McGregor in 1965, we found that inbred lines, descended from a single plant selected from the Morden line 953-102-1-1-22-12, showed a lesser degree of susceptibility than other material. In a number of these lines, 10 to 15% damage occurred when other material flowering at the same date was completely destroyed. These lines, which we have designated HA 6, HA 7, HA 42 and HA 43, are mixed or used interchangeably as the male parent of the hybrid T 56002. S-37-388T, the female parent of this hybrid, is completely susceptible.

Data on flowering date, estimated damage by Homoeosoma electellum larvae and seed yield of regional tests at Temple and McGregor are shown in Table 1. At Temple the planting dates in 1965 and 1966 were similar, and there was a group of entries which flowered at about the same time (i.e., T 56002, Peredovik, Smena, VNIIMK 8931 and VNIIMK 1646). In 1965 the hybrid had 22.5% damage (and a much higher yield) versus 52.5 to 65.0% for the Russian varieties. Damage was more severe in 1966, presumably because of earlier emergence of the moth, but the difference between T 56002 and the other material was still apparent.

In 1965 at McGregor, the results were similar to those observed at Temple. Due to delayed planting at McGregor in 1966, the infestation of

the insect was much more severe than at Temple so that in the unsprayed test the effects of differential reaction of varieties were nearly eliminated. As measured by seed yields, differences due to early flowering were apparent. Differences did occur in the sprayed test, and early flowering varieties which were protected during the entire flowering period sustained little damage. Visual estimates of damage by the larvae were apparently too high for some of the early flowering entries in this test. At least one and perhaps more additional spray applications would have been necessary to adequately protect later flowering entries. Unfortunately, the spray is one which could never obtain clearance for use on sunflowers.

The breeding material grown at McGregor in 1965 contained some F_3 lines from crosses between HA 6 and some of the Russian varieties. Some of these lines had damage as low as the HA 6 parent or other 953-102-1-1-22-12 derivatives, and we observed very evident segregation. We also had collections of wild material in this nursery. Two collections of H. debilis (W 141 and W 142) were susceptible to some degree. Two rust resistant collections of H. petiolaris (W 47 and W 140) appeared immune to attack by the larvae of the sunflower head moth; in 1966, with more severe infestation, only W 47 was grown, and it sustained some damage.

It does appear that there are genetic differences with respect to susceptibility to this insect with reduced susceptibility being dominant. How we can use these genetic differences remains to be determined. Also we need information on the nature of the difference; whether it is preferential oviposition, physiological resistance or slower growth of the insect.

DISCUSSION

Westdal: Do you know if there are any parasites of the Homoeosoma? Have you reared any parasites?

Kinman: I am not an entomologist, and I cannot speak with any degree of comfort on this matter. There does appear to be a Dipterous insect that parasitizes the larvae of the head moth, but I have yet to see that it had any affect at all on the damage. Actually, we do not even know how the moth overwinters, nor do we understand how it can emerge at the time it does in such tremendous numbers. Entomologists tell me that it must have some alternate host that flowers earlier upon which a previous generation is reared. I have looked and looked, but I cannot find it. It is a serious problem and could take a lot of work to solve it.

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Table 1 Estimated damage by the larvae of Homoeosoma electellum of sunflower varieties grown at 2 locations in Texas during 1965 and 1966 as influenced by differences in level of susceptibility, planting date, date of flowering, and spray treatment. (No spray treatments in 1965, nor at Temple in 1966.)

Variety	Temple						McGregor								
	1965			1966			1965			1966					
										Sprayed 2/			Unsprayed		
	50% Bloom date	Damage, % 1/	Seed yield Lbs./A.	50% Bloom date	Damage, %	Seed yield Lbs./A.	50% Bloom date	Damage, % 1/	Seed yield Lbs./A.	50% Bloom date	Damage, %	Seed yield Lbs./A.	50% Bloom date	Damage, % 1/	Seed yield Lbs./A.
T 56002	6/4	22.5	752	6/12	37.5	428	6/7	30.0	674	6/15	35.0	949	6/16	90.0	230
Peredovik	6/4	65.0	283	6/12	91.2	198	6/10	70.0	308	6/17	67.5	592	6/17	97.5	156
Smena	6/4	52.5	---	6/8	71.2	192	6/6	85.0	254	6/16	40.0	790	6/16	98.0	220
VNIIMK 8931	6/5	60.0	---	6/12	87.5	213	6/8	67.5	240	6/16	78.8	434	6/16	99.0	160
VNIIMK 1646	6/10	62.5	---	6/14	92.5	156	6/12	85.0	---	6/20	85.0	306	6/19	97.5	125
Armavirec	5/25	22.5	381	6/3	72.5	104	5/24	40.0	402	6/3	7.5	940	6/5	80.0	665
Kubanec	---	---	---	6/5	90.0	213	---	---	---	6/7	16.2	1143	6/7	85.0	567
Mingren	5/29	17.5	328	6/4	81.2	95	5/29	72.5	220	6/7	20.0	1044	6/7	90.0	169
Commander	6/2	47.5	214	6/8	91.2	54	6/2	80.0	167	6/10	27.5	730	6/14	97.5	239
Arrowhead	5/26	17.5	---	5/31	80.0	174	5/24	85.0	316	6/4	20.0	966	6/5	85.0	571
Planting date	3/22			3/21			3/23			4/6			4/6		

1/ Mean of 2 replications, rest of data based on mean of 4 replications.
2/ Sprayed with 4-2-1 (Toxaphene, DDT, Methyl parathion) on 6/4, 6/11 and 6/17.