

V.T. Piven, USSR

HEMIPTERA - SUNFLOWER SEED
PESTS

Hemiptera from the Miridae and Pentatomidae family contaminate sunflower crops at the beginning of plant vegetation but they appear en masse during the flowering period, feeding on the tissue content of the back of the sunflower head and its leave cover. Later sunflower bugs come to the right side of the head and damage seeds from formation to full maturing.

According to our data sunflower seeds are damaged by 12 bug species from the Hemiptera order; six from the Miridae and six from the Pentatomidae family. However *Dalycoris baccorum* L, *Lygus pratensis* L and *Adelphocoris linealatus* coez are most dangerous tarnished plant bugs for sunflower seeds.

Studies of plant bugs population on sunflower crops showed that their massive attack begins in the head flowering period and lasts for 15-20 days after flowering (Table 1).

A sharp increase in bugs' numbers during this period is accounted for by a high nutrient value of sunflower seeds and easy accessibility of food thanks to a thin and tender pericarp. 35-40 days after mass flowering seeds have matured completely and husk becomes rough, and plant bugs consequently migrate to other crops.

Weeds play an important part in plant bugs settling on sunflower crops. Before they move to sunflower crops bugs multiply in and eat *Stellaria media* L, *Thlaspi arvense* L, *Atuarantus albus* L, *Cirsium arvense* L and other weeds. In contaminated sunflower crops there are 2-3 times more bugs than in weed-free crops.

It is difficult, as a rule, to find pricks made by plant bugs and we therefore examined seeds by the roentgenographic apparatus

Table 1

Tarnished Plant Bugs Population on
Sunflower Crops in 1970-1973

Period	Bugs per 1000 heads		
	Dolyco- ris bac- carum L	Lygus preten- sis L	Adelphoco- ris lineol- latus coez
Mass flowering	66	196	32
Five days after mass flowering	99	301	59
Ten days after mass flowering	88	408	65
Fifteen days after mass flowering	70	283	38
Twenty days af- ter mass flow- ering	27	181	22

ARS-1. Regime of getting sunflower seed radiograms has been devised. The roentgenographic method helps shorten the seed analysis 6-7-fold as compared to the mechanical opening of the pericarp. An important advantage of this method is that damaged seeds can if necessary be used for the following studies and for growing plants from them.

Hemiptera make harm by sucking out the achene content. Sunflower seeds damaged at the beginning of formation die shaped in a thin plate. Being damaged later, sunflower seeds become weakend but preserve some viability.

The degree of damage done to sunflower seeds depends the density of individuals

per head (Table 2). The table shows a clear dependence of the percentage of damaged seeds upon the bugs numbers.

Table 2

Sunflower Seed Damage Depending
Upon the Bugs Numbers, 1970-1973

Number per head	Seeds damaged by bugs, %		
	Dolycoris baccarum L	Lygus pratensis L	Adelphocoris lincolatus coez
2	12.4	6.1	4.4
4	35.3	13.5	9.2
6	54.8	19.2	12.8
Check (wit- hout bugs)	2.6	2.4	2.2

Damaged seeds have lower specific gravity and other physical indices which results in the yield losses per unit of area. Thus the mass of 1000 damaged seeds decreases by 25% and specific gravity by 13% as compared to healthy seeds.

Sowing qualities decrease considerably too: seed germination energy by 44% and the ground germination rate by 45% as compared to healthy seeds; the growth strength drops sharply.

Commercial qualities are also worsening. Biochemical analyses showed considerable shifts in the accumulation of substantially important organic compounds by seeds damaged by plant bugs. The fat content in an absolutely dry nucleus decreases by 8% at the strong rate of seed damage, by 5% at the average rate and by 3-4% at the weak rate.

The decrease of the oil content of sun-

flower seeds damaged by plant bugs results in protein content growth and a change in the qualitative correlation of some amino acids. Heavily damaged seeds have 6% more raw protein than healthy seeds. The protein of damaged seeds has less lysine, histidine and treonine.

Natural antioxidants for plant oils are tocopherols (Vitamins E) inhibiting the self-oxidation process. However, when sunflower seeds are damaged by plant bugs the tocopherol accumulation process is also broken (Table 3).

Table 3

A Change of the Oil, Acid Number and Vitamin E Content Depending upon the Rate of Seed Damage

Rate of damage	Oil content, %	Acid number mg KOH per 1 g of fat	Vitamin E, %
Small	47.0	3.232	47.6
High	42.3	5.096	46.7
Check (healthy seeds)	50.6	0.157	61.0

The tocopherol content decrease and linoleic acid increase in oil manufactured from damaged seeds result in its self-oxidation and a sharp growth of the oil acid number.

In standard commercial batches of sunflower seed the number of damaged seeds varies from 2 to 20% on average. With the increased proportion of damaged seeds from 0 to 20%, the acid number of oil naturally increases from 0.293 to 2.111 mg/KOH.

The harm made by plant bugs to breeding and seed sunflower crops is so considerable that it necessitates a rational system of cont-

rolling this group of insects.

The maximum plant bugs concentration in early winter is observed on weeds vegetating on roadsides and the field ends in which pests multiplied en masse a year before. In our conditions such fields are lucerne, soya and maize. Consequently, breeding and seed sunflower crops should be located in crop rotation as far as possible from previous year plots and from the fields sown with lucerne, soya and maize, because this hinders the bugs' settlement on crops.

Timely and thorough main and pre-sowing tillage, row-spacing cultivations and the extensive use of herbicides for weed control are the necessary measures reducing pest attacks on sunflower.

Sunflower treatment with 20% metaphos emulsion in the 0.3% concentration or with 80% technical chlorophos or 40% phosphamid emulsion in the 0.2% concentration are all effective measures of bug control on breeding and seed crops in order to increase the sowing and yield qualities of seeds. When sunflower is treated with chemical preparations the quantity of seeds damaged by tarnished plant bugs decreases 84-94%.

A simple and effective method making it possible to separate sunflower achenes damaged by bugs is purifying seed material according to the specific gravity on the pneumatic sorting table. The bulk of bug-damaged seeds comes out in the first three phases together with seeds having low specific gravity. Owing to this the germinating power and germination of seeds of the main fractions grow by 6% as against the initial energy.

Plant breeding assumes further importance in the comprehensive system of reducing the insects' harmfulness. Searching for forms immune to plant bugs we evaluated sunflower varieties and entries selected by VNIIMK. So-

me varieties and entries showed quite high pest resistance. The differences are caused by diverse conditions under which plant bugs penetrate into the forming seeds.

Density of location of bases of tubular corolla flowers is of particular importance. Continuousness of this layer is determined not only by the diameter of tubular base and head density, but also by the form of the latter.

Thus sunflower breeding for enhanced resistance against tarnished plant bugs is quite possible, and what is more, plant breeding material can be evaluated roughly, according to gaps between foundations of tubular corolla flowers in heads.