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THE VIRULENCE AND THRESHOLD NUMBERS OF CLICK BEETLES (ELATERIDAE) ON SUNFLOWER CROPS

Click beetles (Elateridae) are larvae often doing great harm to sunflower crops. In some cases the losses are so great that the crops must be re-sown.

Data contained in writings on the subject concern the general principles and methods of defining the quantity of larvae settled on the crops and the estimate of the data obtained. For the southern steppe zone, areas with the density of two click beetles per one square metre are considered weakly settled, and of more than seven beetles are thickly settled. It is not indicated, however, what losses can the pest inflict on the sunflower crops with its particular numbers and, on this basis, what means and methods should be used to ensure that chemical treatment be effective.

To answer these questions the VNIIMK section of plant protection has conducted a series of experiments in recent years to investigate the patterns of the larvae's distribution in the field, category and size of crops damaged, influence of the settlement density on the crop spareness and also the effectivity of various chemical preparations applied against various backgrounds according to the pest's density (chemicals such as 12% and 25% HCCH; basudine in all its industrial forms; 2% granulated gamma-isomer HCCH; 50% gamma-isomer HCCH and 90% technical gamma-isomer HCCH).

Having analysed the data of surveying the fields settled with click beetles and the results of the experiments testing various preparations we came to the conclusion that it is necessary to make additional imitation experiments to define the influence of spareness on sunflower crops.

The latter method boils down to the following. Five gradations of crop spareness were artificially set up on experimental plots of 49 sq m which were not settled with pests, each gradation having its own unevenness in the distribution of fallen-off plants. Sproutings were destroyed during the appearance of real leaves according to special charts compiled on the basis of data obtained when surveying fields settled by click beetles. Plots with an optimal density of plants were taken as control ones. The experiment was repeated seven times and the data obtained were used to define the crop losses depending on the spareness of plants (Fig., quadrant II).

The investigations in the field helped find that larvae were distributed rather unevenly in the crop area. The less the average density of settlements the higher the unevenness. Damages inflicted on the sprouts depend not only on the pest numbers (virulence increases with the growing numbers), but also on the microecological conditions in which larvae live. The latter circumstance is most manifest with small and middle densities (Fig., quadrant I). For instance, under unfavourable conditions two beet clicks per one square metre may cause the same spareness as five beetles per one square metre if there are favourable conditions for their development, such as weeds and high soil moisture. When the average density grows differebce in respective damages tend to obliterate and with 12-14 individuals per square metre the crops are completely destroyed.

The experimental data obtained served as the basis for graphs (Fig.) characterizing the link between the crop spareness and the probable crop losses, depending on the density of larvae settled. Such graphs may help forecast the average losses incurred to the crops by a particular number of the pests and also establish a tentative deviation from this average magnitude.

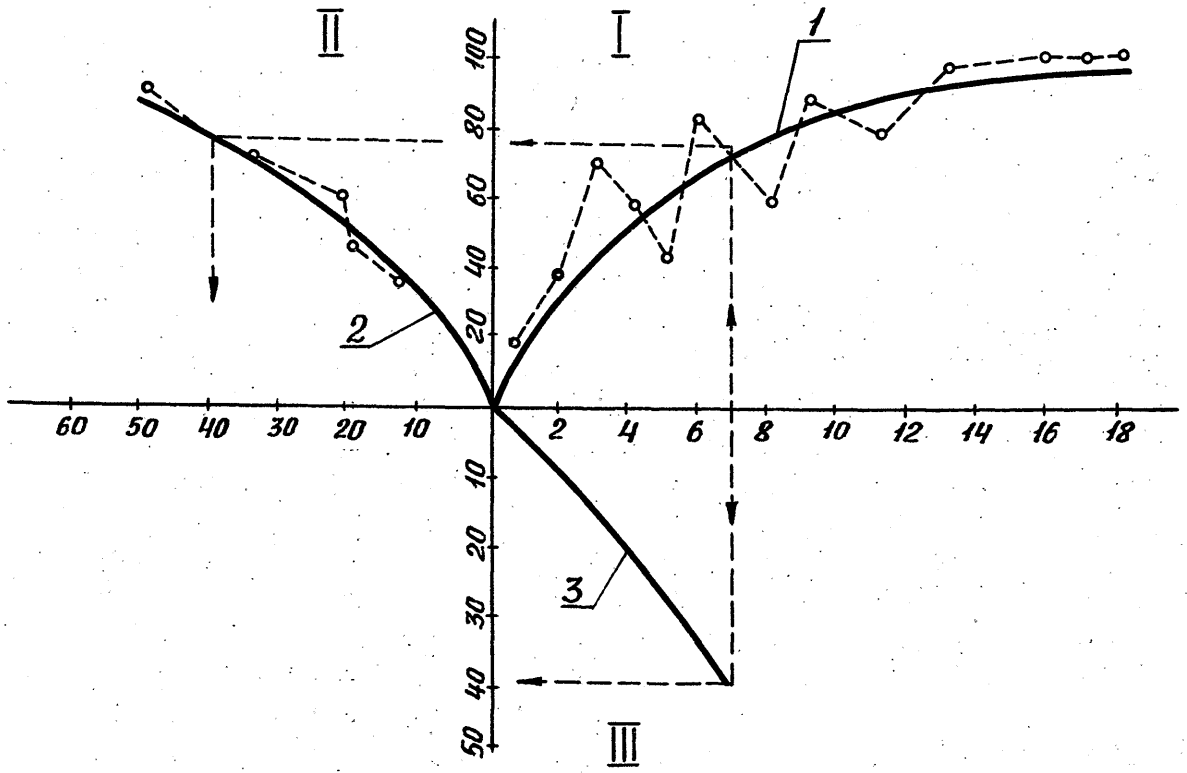

Fig. 1. Influence of click beetles (Elateridae) settlement density on crop spareness and sunflower yield. Theoretical correlations: 1 - spareness upon settlement density; 2 - yield decrease upon spareness; 3 - yield decrease upon settlement density

Given such character of the distribution and virulence, a high effect can only be yielded by a highly toxic preparation, such as, as experiments showed, the 90% technical gamma-isomer of the HCCH. When powdering the seeds at the 6 kg/ton rate the preparation actually ensures a full protection of the plant against the pest. Both the sprouts and the adjacent soil (1-1.5 cm around the achene) become highly toxic. Calculations show that the preparation is also effective under minimal densities, when crop losses are not more than 1 or 2%.