T. Pl.ziekten 64 (1958): 301–306

CONTROL OF *LYGUS CAMPESTRIS* ON CARROT SEED CROPS IN NORTH HOLLAND [1])

Met een samenvatting: De bestrijding van Lygus campestris *in zaadwortelen in Noordholland*

DOOR

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INTRODUCTION

Carrots (*Daucus carota* L.), cultivated for seed production, suffer often from yield reduction. Several unfavourable circumstances may be the cause of this, e.g. the fungus *Phomopsis dauci* VON ARX, but it has been known for some time that the habit of some species of *Lygus* bugs of sucking the young fruits is the main reason for the damage. HANDFORD (1949) describes *Lygus campestris* (L.)[2]) as a new pest of carrot seed crops in British Columbia. After ARNOTT (1955), however, not *Lygus campestris*, but *Lygus scutellatus* (UHL.) is responsible for the damage in British Columbia. There is much doubt whether *L. campestris* occurs in North America. The overwintering adults caused retardation of growth of the young plants in the spring, but the main injury was done by the second generation which sucked the seeds. Treatments with DDT resulted in a good control.

Suchlike seed injuries which are often seen on several crops, e.g. Umbelliferae, beans, lucerne, were investigated thoroughly by Mrs. FLEMION and co-workers at the Boyce Thompson Institute (FLEMION & MACNEAR, 1951; FLEMION, LEDBETTER & SCHAEFFER-KELLEY, 1954; FLEMION, WEED & MILLER, 1951). Their investigations concerned *Lygus oblineatus* (SAY). Direct observations through the microscope as well as records on a motion picture film showed that the stylets were frequently plunged into and withdrawn from the plant tissue, travelling intra- as well as intercellularly, causing considerable mechanical injury. The bugs seem to feed on various tissues of the seed and locate the ovule in a haphazard manner. As the injury caused by *Lygus* has been reported to appear greater than the mere withdrawal of fluids of the plant cells would warrant, injection of toxic secretions has been postulated. Experiments, whereby *Lygus* bugs were made highly radioactive by allowing them to feed on sucrose solutions to which P^{32}-ions had been added, offer strong evidence that these insects on feeding inject oral secretions into host tissue. No evidence is given, however, to prove that these secretions are toxic.

The occurrence of embryoless seeds due to damage of *Lygus* bugs is recorded also from Denmark by WAGN (1954).

In the Netherlands this pest has been studied by KHO & BRAAK (1956). The injury to carrot seed by *Lygus campestris* was observed on carrot crops near

[1]) Accepted for publication 22 July 1958.

[2]) After a recent publication (COBBEN, R. H., T. Ent. 101:1–45, 1958) the name *Lygus campestris* (L.) has to be changed into *Orthops campestris* (L.).

Hoorn (Province of North Holland) and demonstrated by cage experiments in a greenhouse with and without bugs. Carrot plants, injured by bugs, showed two kinds of losses: 1. reduction in the seed production due to abortion of endosperm and embryo; 2. reduction in the germination percentage of full-grown seeds due to embryolessness. These reductions were more serious if the bugs were placed on the plants early (during flowering) than if the bugs were placed later on.

Control measures have been investigated by CARLSON (1956) in North California with respect to *Lygus hesperus* (KNIGHT) on carrot seed. Cage tests demonstrated that one adult per flower head may give 60 % loss of seed, nine adults giving a total loss. Nymphs cause about twice as much damage as adults. One adult bug per two seed heads is enough to cause minor economic carrot seed damage, and if this number is found, control measures are advisable. Three treatments with 10 % DDT dust, beginning when 25 to 50 % of the seed heads were flowering with an interval of 10 to 15 days, proved to result in a highly effective control. CARLSON observed minor populations of two predacious bugs, *Nabis* sp. and *Cercoris* sp. which were killed also by the treatments and a red spider predator, *Orius* sp. which proved fairly tolerant to DDT.

FIELD EXPERIMENT

Lygus campestris hibernates in the adult stage and has at least two generations a year in this country. The first generation is of minor importance, the population never being so high that growth retardation of young plants may be feared. The second generation may be very injurous, as it occurs during flowering and seed ripening. Oviposition occurs at the beginning of July; the first nymphs of the second generation hatch after five days and grow up to adults after moulting four times. No predators have been found so far.

The eggs are very difficult to detect; they are $\frac{2}{3}$ mm long and found in the young carrot fruits; only 0.2 mm of the egg is visible. Detecting an egg in a carrot seed head is more difficult than finding a needle in a haystack. Newly hatched nymphs are very small, only 0.5 mm in length. As they are able to walk very quickly, they are easily distinguishable from aphids. Counting the number of nymphs and adults per seed head is possible, as they are easily caught by shaking off.

An experiment was done in July 1957 near Venhuizen (Province of North Holland). Carrots, sown for seed production, contained a fair number of bugs rather uniformly spread throughout the field. Two areas of each 24 × 5 m were chosen and each was divided into six plots of 4 × 5 m (fig. 1).

Adults and nymphs on ten seed heads of each plot were caught and counted to have an insight about the population before the treatment. The mean number of bugs (adults and nymphs) per seed head was 1.9. These counts were continued for seven weeks.

The plots A, E, I and L were left untreated; B, D, G and K were treated twice, on 5 and 17 July with DDT (10 g of 75 % wettable powder per 1 l per plot, i.e. 0.75 % in the amount of 500 l per hectare); plots C, F, H and J were treated in the same way with dieldrin (2 ml of „Dieldrex 15" per 1 l per plot). At the days of the treatment respectively 25 and 50 % of the heads were flowering.

G DDT	H DIELDRIN	I CONTROL	J DIELDRIN	K DDT	L CONTROL
A CONTROL	B DDT	C DIELDRIN	D DDT	E CONTROL	F DIELDRIN

FIG. 1. Scheme of the field experiment.
Schema van de veldproef.

The results of the counts are given in fig. 2 and 3. In all plots it is shown that the population of the bugs decreased during the first weeks after treatment, possibly due to adverse weather conditions. About 18 days after the first treatment the number of nymphs in the check plots increased very quickly, followed by those in the dieldrin plots. In the DDT plots, however, there was only a very slight increase of nymphs after a considerable time (about three weeks). The curves of the adult counts show that the increase started later there, and occurred in all plots, being fastest, however, in the untreated ones, and slowest in the DDT plots. The increase of adults in the DDT plots must be mainly due to migrating adults, flying from the adjacent plots.

On the advice of the "Proefstation voor Zaadcontrôle" at Wageningen, 4 × 100 seeds from each of the 11 quantities were used for a germination test (The crop of one of the control plots was lost). The seeds were placed in dishes on moist filter paper, desinfected with germisan and given intermittantly light at 30 °C during eight hours, and darkness at 17 °C during 16 hours. Dormancy of the seeds in the autumn is broken in that way, and the seeds germinate normally in November within 21 days. Three categories of germination were distinguished: 1. normal germination; 2. poor germination, mainly due to slight fungus attack; 3. no germination. The results are given in table 1.

TABLE 1. Results of the germination test. Means of four replicates of crops treated with DDT and dieldrin, respectively, and of three replicates of the untreated crop.
Resultaten van de kiemproef. Gemiddelden van vier herhalingen van het gewas, behandeld met respectievelijk DDT en dieldrin en van drie herhalingen van het onbehandelde gewas.

	normal germination *normale kieming*	poor germination *slechte kieming*	no germination *geen kieming*
DDT treated/*beh. met DDT* . .	89.5%	6.0%	4.4%
dieldrin treated/*beh. met dieldrin*	65.1%	19.1%	15.8%
untreated/*onbehandeld*	53.2%	20.2%	26.6%

Both treatments resulted in better yields than the control plots. There is also a significant difference between the yields of the DDT plots and those of the dieldrin plots, those of the DDT plots being better. Moreover it is remarkable that the percentages poorly germinated seeds in the DDT plots are lower than those in the other plots. Poor germination is mainly caused by fungi which are

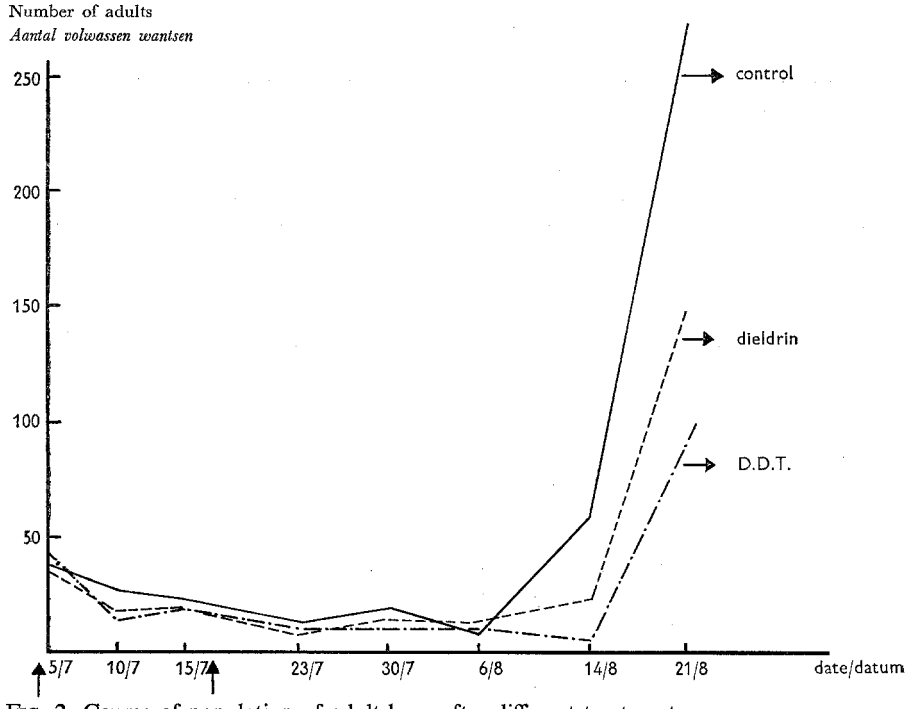

FIG. 2. Course of population of adult bugs after different treatments.
Verloop der populatie van de volwassen wantsen na verschillende behandelingen.
↑ : date of treatment / *datum der behandeling.*

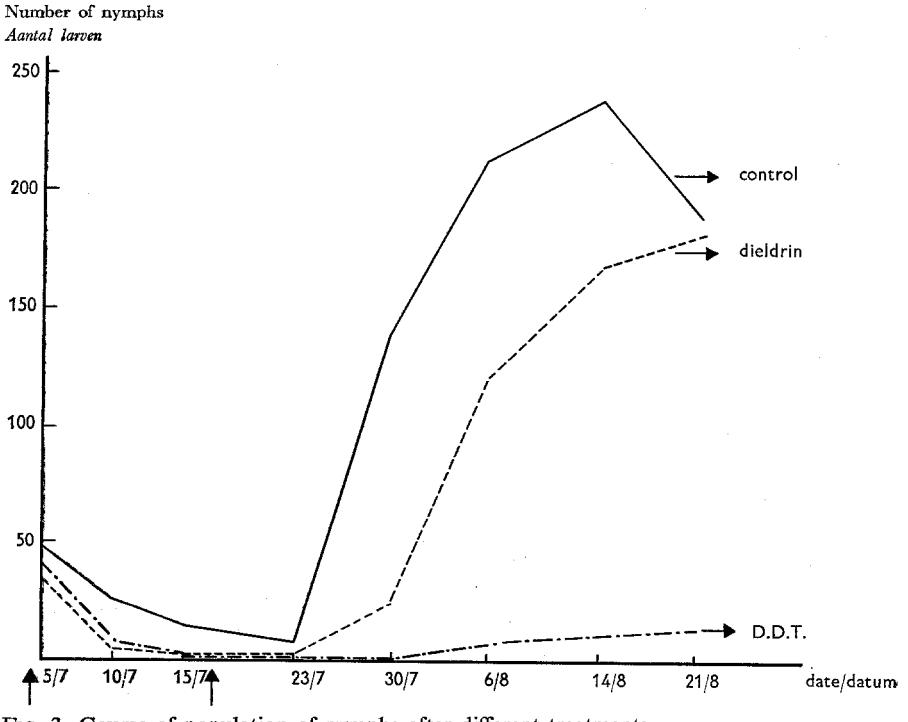

FIG. 3. Course of population of nymphs after different treatments.
Verloop van de populatie van de larven na verschillende behandelingen.
↑ : date of treatment / *datum der behandeling.*

killing the already germinated seeds. This appeared to be correlated with the damage done by the bugs. Perhaps slight damage is done to those seeds, resulting in larger susceptibility to fungus attack after germination.

The crop of the control plots produced significantly more non-germinating seeds than the dieldrin plots, which produced on their turn significantly more non-germinating seeds than the DDT plots.

ACKNOWLEDGEMENTS

The authors should like to thank Mr. G. HOUTMAN (Hoorn) for the initiation of this work, Mr. P. HUISMAN (Hoorn) for technical assistance and Dr. K. MELLANBY (Harpenden) for critical review of the English text. This work has been financed by the "Algemene Vereniging van Tuinzaadtelers in Noord-Holland".

SUMMARY

In a field experiment against *Lygus campestris*, attacking the young seeds of carrots cultivated for seed in North Holland, two treatments with an atomized spray of 0.75 % DDT prevented an increase of the population of the bugs which started 18 days after the first treatment. Dieldrin-spray, 0.2 % Dieldrex 15, had less effect. DDT raised the yield of the treated crop from 53 to 89 per cent., dieldrin from 53 to 65 per cent., estimated by counting the well-germinated seeds per plot.

SAMENVATTING

In Noordholland werd een veldproef opgezet om de werking van DDT en dieldrin na te gaan op de populatie van *Lygus campestris* (L.). Deze wants tast de zaden aan van wortelen, die in de omgeving van Hoorn gekweekt worden voor zaadwinning en veroorzaken daarbij embryoloosheid. Op 5 en 17 juli 1957 werd gespoten met 0,75 % DDT en 0,2 % Dieldrex 15. DDT bleek lange tijd de wantsenpopulatie sterk te drukken, terwijl dieldrin veel minder effectief bleek.

Kiemproeven met het aldus behandelde en onbehandeld zaad toonden aan dat, waar de controleveldjes een kiemingspercentage gaven van 53 %, dit op de DDT veldjes verhoogd was tot 89 % en op de dieldrinveldjes tot 65 %. Op de DDT-veldjes bleek ook het percentage slecht gekiemde zaden, te wijten aan schimmel- en bacterieaantasting na de kieming, in vergelijking met de controleveldjes sterk te zijn gedaald.

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