Reducing the Spread of Aphid-Transmitted Viruses in Peppers by Trapping the Aphids on Sticky Yellow Polyethylene Sheets

S. Cohen and S. Marco

Virologists, Virus Laboratory, Agricultural Research Organization, The Volcani Center, Bet Dagan, Israel.

Contribution from the Agricultural Research Organization, The Volcani Center, Bet Dagan, Israel. 1972 Series, No. 2274-E.

The technical assistance of Mrs. Rachel Joseph and Mr. K. Joles is gratefully acknowledged.

ABSTRACT

The spread of aphid-transmitted viruses in peppers was reduced by using sticky sheets of yellow polyethylene located outside the field with the aim of trapping winged aphids. In five tests, an obvious reduction in the spread of cucumber mosaic virus and potato virus Y was achieved in the treated plots in comparison with the degree of spread found in untreated control plots. With additional development of this new technique, some of the limitations of the methods hitherto used to control the spread of stylet-borne and circulative viruses might be overcome.

Phytopathology 63:1207-1209.

The spread of plant viruses in most crops cannot be controlled satisfactorily by using insecticides to kill the insect vectors (1). Promising results were obtained in preventing the spread of stylet-borne viruses by spraying the plants with light oils (1), but repeated sprays and complete cover of the foliage were required to secure good results. In addition, the oils caused some foliar damage. Another approach in the control of insect-transmitted viruses was developed by utilizing the repellent effect of reflective surfaces to aphids. Thus, growing the plants in an area mulched with such surfaces greatly reduced the spread of aphid-transmitted viruses in the crop (3). Some of the limitations of this method are the need to cover most of the soil area, and the loss of repellency which occurs when the surface is covered by the crop foliage.

In the work reported herein we tested the possibility of controlling the spread of aphid-transmitted viruses in peppers (*Capsicum annuum* L.) by the use of "color baits" based on the findings that aphids are strongly attracted to reflected light in the spectrum range 500-700 nm (2). Five separate tests were carried out during different seasons in the years 1970-1972. Four of the tests were made at Bet Dagan, on a field divided into two equal plots of 10 × 10 m and separated by a distance of at least 10 m. One plot was left untreated and used as the control; whereas, at a distance of 4 m from each side of the other plot, a 4 X 0.5-

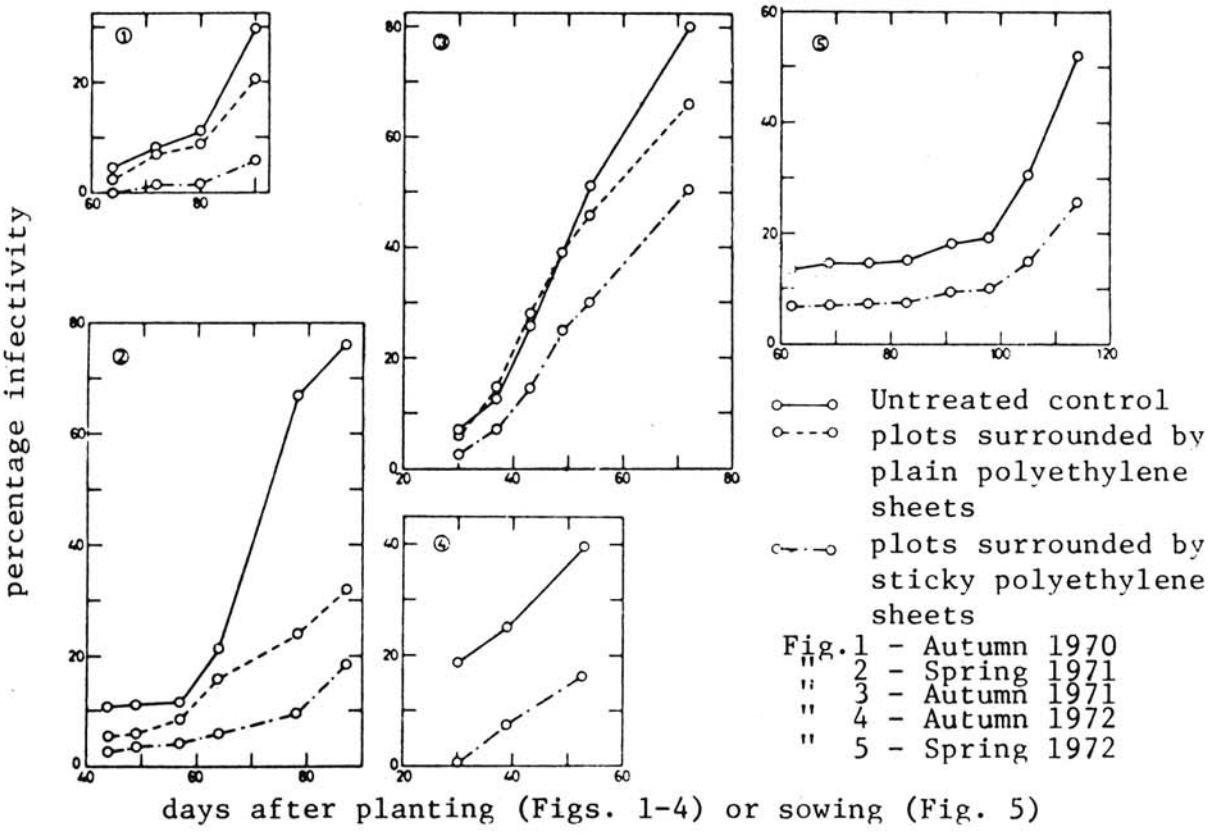

Fig. 1-5. Spread of aphid-transmitted viruses in peppers.

m yellow polyethylene sheet was stretched at a height of 0.7 m from the soil surface. The sheets were then covered with "Rimi-foot" glue (R. Jewnin & M. Joffe, Technochemical Factory, Tel Aviv, Israel). This glue is transparent and remains sticky for about 4 weeks. Therefore, it was repeatedly applied to the sheets at 3-week intervals. Most of the light spectrum reflected from the yellow polyethylene sheets was in the range of 520-690 nm, as recorded by a Bausch & Lomb Spectronic 20 spectrophotometer equipped with a reflectance attachment. To three trials an additional control plot was added. The plan was the same as for the above-mentioned treated plot, with the exception that no glue was applied to the polyethylene sheets. In each plot, 12 rows (at least 200 plants) of pepper seedling, cultivar 'Zahov Naharia' were planted. The seedlings had previously been grown in an insect-proof greenhouse. No insecticides were applied to the crop. The incidence of virus-infected plants was determined at regular intervals and calculated as percentage infectivity out of the total number of plants grown in the different plots.

The fifth trial (Fig. 5) was carried out in a commercial field at Bror Hail on a 100 × 200 m plot of peppers, cultivar 'Vinedale'. Four days before seed germination, sticky yellow polyethylene sheets at the same size as those used in the previous experiments were stretched at a distance of 6 m from the west side of the field. It should be noted that the wind direction in this region is from west to east. The baits were located at intervals of 4 m from one another; thus, 60 m out of the 100 m of the west side of the field were protected while the remaining 40 m were left as untreated control. In this case the incidence of infected plants was counted in ten 10-m-long rows in each of the treated and control plots. Five of these rows were found near the yellow baits and the other five at a distance of about 25 m from the baits.

For the identification of the viruses, 130 diseased samples were collected from the different trials (10 samples from each plot) and inoculated by mechanical means to a series of differential hosts.

In all five experiments (Fig. 1-5) a much lower percentage of infectivity was found in the plots treated with the "color baits" than in the untreated controls. Thus, 80, 77, 38, 60, and 51% protection was obtained 90, 87, 72, 53 and 114 days after the planting or sowing date in trials 1-5, respectively. Percentage protection expresses the rate percentage of reduction in infectivity of the treated plots when the infectivity found in the controls is considered as 100%. In trial No. 3, the treated plot was located about 5 m from a field where all of the pepper plants were infected.

The reduction in the spread of the viruses was greater in the plots surrounded by "sticky" baits than in those treated with yellow polyethylene alone, although with the latter treatment lower infectivity was found than in the control plots without polyethylene (Fig. 1-3). This point should be investigated further in order to determine whether the yellow polyethylene sheets act also as a

mechanical barrier to the insects or whether the aphids which are actively attracted to them lose their virus charge in attempts to feed on it.

Potato virus Y (PVY) was the most prevalent virus in all of the tests, being found in 90% of the samples; in the remaining samples cucumber mosaic virus (CMV) was identified, but was limited almost completely to the experiments carried out during the spring. It should be remembered that both PVY and CMV are aphid-transmitted, stylet-borne, viruses.

With further development of the "color baits" technique, it is possible that some of the limitations of the other above-mentioned methods used for the control of plant viruses could be overcome. Thus, this technique could be effective against stylet-borne and circulative viruses; there is no contact between the baits and the crop, which avoids both damage to the crop and shading of the yellow sheets by the foliage.

LITERATURE CITED

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