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REDUCING THE SPREAD OF CHILLI VEINAL MOTTLE VIRUS USING REFLECTIVE SURFACES

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RINGKASAN

Tiga cara sungkupan, iaitu dengan menggunakan keping politena yang telah dicatkan dengan warna aluminium, lapis logam aluminium dan keping politena yang terang, telah diuji untuk menilaikan kesannya bagi mengelakkan afid.

Keping politena yang bercatkan aluminium telah dapat memberi daya penolakan yang berkesan sebanyak 87% terhadap afid.

Di dalam percubaan lain, cara yang sama juga telah didapati lebih baik berbanding dengan perangkap kuning takongan air yang digunakan untuk mengurangkan populasi afid, dan juga jangkitan virus alor daun ini ke atas tumbuhan cilli.

INTRODUCTION

Chilli veinal mottle virus (CVMV) was first reported by ONG, VARGHESE and TING, (1979). It attacks all *Capsicum annuum* and *C. frutescens* cultivars grown in the lowland of Peninsular Malaysia.

Control of non-persistent aphid-borne viruses such as CVMV is possible by controlling the vector population. Direct control of plant viruses is still not possible. BROADBENT (1969) grouped the various control methods under three broad headings: cultural changes, chemical protection and vector elimination. A new control method using reflective surfaces to repel aphids gave promising control of aphid-transmitted plant viruses (MOORE, SMITH, JOHNSON and WOLFENBARGER, 1965; JOHNSON, BING and SMITH, 1967; ADLERZ and EVERETT, 1968; SMITH and WEBB, 1969; BLACK and ROLSTON, 1972). COHEN and MARCO (1973) introduced the 'colour bait' technique since aphids are strongly attracted to reflected light within the yellow spectrum (MOERICKE, 1969).

This paper reports the results of two field experiments conducted to evaluate the effectiveness of the aluminium foil and a few other modifications in reducing aphid population and CVMV incidence.

MATERIALS AND METHODS

Experiment A

Three soil coverings or mulches: aluminium foil, translucent polyethylene sheet, and polyethylene sheet coated with aluminium paint, were used in the present study. Mulch strip (30 cm wide and 6 m long) was used to cover the ground of each row of chilli plants. The strip was held in place by nailing onto pieces of wood. Square holes (15 cm x 15 cm) were cut at intervals of 1 metre. Chilli seedlings were then transplanted into the holes. Unmulched plots served as controls. Two yellow-pan water traps (diameter 15 cm, depth 8 cm) were placed in the central row of each plot. Water in the traps was changed every alternate day. Trapped aphids were collected and counted at every change.

The experiment was arranged in a 4 x 4 Latin square design to reduce row and column variations. Each plot consisted of 15 plants of *C. annuum* (variety C–10) which were planted at a spacing of 1 m x 1 m in three rows. Spacings between treatment plots were 4 m along the row and 3 m along the column.

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These wide spacings were used so as to reduce interference between treatments.

Experiment B

The treatments tested in this study were polyethylene sheet coated with aluminium paint, yellow water trough, and unmulched controls. The first treatment and its method of application were as described in experiment A. The yellow water troughs (30 cm wide and 15 cm deep) were placed around the treated plots. The troughs were half filled with water which was changed every fortnight. Three yellow-pan water traps were placed in the central row of each treatment plot. Sampling of aphid catches were carried out as described previously and monthly incidences of CVMV were recorded.

The experiment was conducted in a 3 x 3 Latin square design. Each plot had 45 chilli seedlings (variety C−10) arranged in 3 rows. Spacings between and within rows were 1 metre. To reduce interference between treatments, plots along the row were separated by 17 m of vacant land and those along the column were spaced at 6 m apart.

In both the experiments, tests for the presence of other viruses and the routine management of plants were done as described previously (ONG *et al.*, 1980).

RESULTS

Experiment A

Table 1 and *Figure 1* show that the largest number of aphid catches was over the unmulched control plots. Aluminium foil, translucent polyethylene sheet, and polyethylene sheet painted with aluminium colour repelled aphids throughout the present investigation. The differences in the number of aphids trapped between each of the three treatments and the control were significant at the 5% probability level. Differences in aphid catches between the three treatments were however not statistically significant because of the large variation in this experiment. Nevertheless, polyethylene sheet painted with aluminium colour mulch (87% aphid repellency) seemed to be superior to the other treatments.

Experiment B

The experiment was designed to compare the effectiveness of polyethylene sheet painted with aluminium colour and the yellow water trough treatment, a variation of the 'colour baits' technique used by COHEN and MARCO (1973), in reducing aphid population and CVMV infection.

Results of the experiment are summarised in *Table 2*. Polyethylene sheet

Table 1. Comparison of the effectiveness of aluminium foil, translucent polyethylene sheet, and polyethylene sheet painted with aluminium colour mulches to repel aphids.

Soil mulch	Total aphids trapped[a]	Aphid repellency[b] (%)
Aluminium foil	247[y]	76.52
Translucent polyethylene sheet	343[y]	67.40
Polyethylene sheet painted with aluminium colour	140[y]	86.69
Unmulched (control)	1052[x]	

[a]Differences between numbers are significant at the 5% probability level when compared values have no letter in common.

[b]Aphid repellency (%) = $(1 - \frac{\text{aphid catches in treatment plot}}{\text{aphid catches in control plot}}) \times 100$

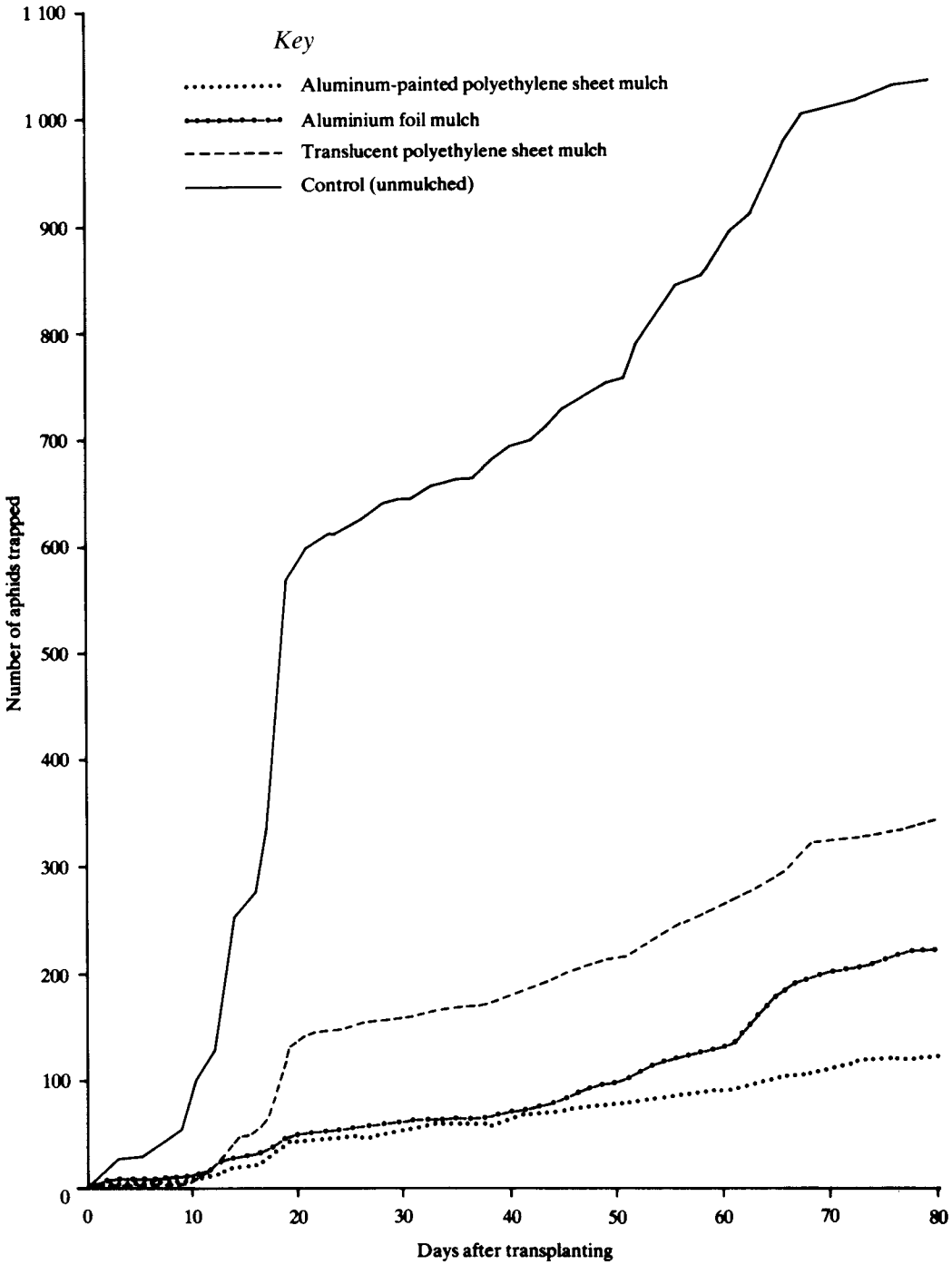

Figure 1. Effects of soil mulch treatments on aphid catches

painted with aluminium colour was again more effective (85% aphid repellency). The yellow water trough treatment also reduced the number of aphids, although it was less effective than the former treatment. The number of aphids trapped was 34% less than that of the unmulched controls.

At four months after transplanting, incidences of CVMV in the polyethylene

Table 2. Comparison of the effectiveness of polyethylene sheet painted with aluminium colour mulch and yellow water trough to reduce aphid population and chilli veinal mottle virus incidence.

Treatments	Total[a] aphid trapped	Aphid[b] repellency (%)	Plant infected / Plant planted	% diseased plant
Polyethylene sheet painted with aluminium colour	195[x]	80.30	31/131	23.66
Yellow water trough	653[y]	34.04	55/130	42.31
Unmulched (control)	990[z]		92/129	71.32

[a]Differences between numbers are significant at the 5% probability level when compared values have no letter in common.

[b]Aphid repellency (%) = $(1 - \frac{\text{aphid catches in treatment plot}}{\text{aphid catches in control plot}}) \times 100$

painted with aluminium colour, yellow water trough, and unmulched control plots were 24%, 42% and 71% respectively. CVMV infection was significantly reduced in the first two treatments.

Together with reduction in aphid population and CVMV infection, increase in chilli yield was recorded when the two treatments were employed. Total yield in plots with polyethylene sheet painted with aluminium colour was 21.7% more than that in plots surrounded with yellow water troughs and 33.9% more than that of the unmulched control plots.

DISCUSSION

Studies on the effectiveness of mulch treatments in reducing aphid population and virus incidences have been conducted mainly with aluminium foils. Polyethylene sheet coated with aluminium paint and yellow water trough used in the present studies were effective in reducing aphid population and CVMV incidence.

The aluminium foil was highly repellent to aphids initially; but its effectiveness diminished within a week when it became less reflective. In the hot humid tropics, aluminium foil not only tarnished rapidly but is also torn easily. Another objection to its possible use is its prohibitive high cost. It is because of these disadvantages that other cheaper modifications and variations of this method were evaluated in the present study.

Polyethylene sheet coated with aluminium paint was the most effective in reducing aphid vector population and CVMV disease incidence. It is also comparatively cheap, not easily torn, and can be used over a longer period. The sheet can be reused when it is given a new coat of paint.

The findings that reduction of CVMV disease incidence could be brought about by repelling winged aphid population substantiated the report by ONG, TING and VARGHESE, (1978) that winged aphid vectors were mainly responsible for transmitting the CVMV in chilli.

It must also be pointed out that the observed yield increase could not be solely attributed to the reduction of CVMV disease incidence. Other well known ameliorating

effects of mulching such as the reduction of weed competition, the conservation of soil moisture, the reduction of soil temperature and the prevention of the leaching of fertilizers have also contributed in part to the overall increase in yield as reported here.

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SUMMARY

Three mulch treatments, polyethylene sheet coated with aluminium paint, aluminium foil, and translucent polyethylene sheet, were evaluated for their effectiveness to repel aphids. Aluminium-painted polyethylene sheet mulch with a maximum aphids repellency of 87% was the most effective.

In another experiment, the same treatment was again superior when compared to yellow water trough trap in reducing aphid population as well as chilli veinal mottle virus infection on chilli crop.

REFERENCES

ADLERZ, W.C. and EVERETT, P.H. (1968). Aluminium foil and white polyethylene mulches to repel aphids and control watermelon mosaic. *J. econ. Ent.* **61**, 1276–1279.

BLACK, L.L. and ROLSTON, L.H. (1972). Aphids repelled and virus disease reduced in peppers planted on aluminium foil mulch. (Abstr.) *Phytopathology* **62**, 747.

BROADBENT, L. (1969). Disease control through vector control. In *Viruses, Vectors and Vegetation.* (ed. Maramorosch, K.), pp. 593–630. New York: Interscience Publishers.

COHEN, S. and MARCO, S. (1973). Reducing the spread of aphid-transmitted viruses in peppers by trapping the aphids on sticky yellow polyethylene sheet. *Phytopathology* **63**, 1207–1209.

JOHNSON, G.V., BING, A. and SMITH, F.F. (1967). Reflective surfaces used to repel dispersing aphids and reduce spread of aphid-borne cucumber mosaic virus in gladiolus plantings. *J. econ. Ent.* **60**, 16–18.

MOERICKE, V. (1969). Host plant-specific color behaviour by *Hyalopterus pruni* (Hem-Hom., Aphididae). *Ent. Exp. appl.*, **12**, 524–534.

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MOORE, W.D., SMITH, F.F., JOHNSON, G.V. and WOLFENBARGER, D.O. (1965). Reduction of aphid populations and delayed incidence of virus infection on yellow straightneck squash by the use of aluminium foil. *Proc. Florida Hort. Soc.* **78**, 187–191.

ONG, C.A., TING, W.P. and VARGHESE, G. (1978). Role of aphid vectors in the spread of chilli veinal mottle virus. Proc. Plant Protection Conference, Kuala Lumpur. 1978, pp. 53–60.

ONG, C.A., VARGHESE, G. and TING, W.P. (1979). Aetiological investigations on a veinal mottle virus of chilli (*Capsicum annuum* L.) newly recorded from Peninsular Malaysia. *MARDI Res. Bull.* **7**, 78–88.

ONG, C.A., VARGHESE, G. and TING, W.P. (1980). The effect of chilli veinal mottle virus on yield of chilli (*Capsicum annuum* L.). *MARDI Res. Bull.* **8**, 74–78.

SMITH, F.F. and WEBB, R.E. (1969). Repelling aphids by reflective surfaces: new approach to control of insect-transmitted viruses. In *Viruses, Vectors and Vegetation* (ed. Maramorosch,K.), pp. 631–639. New York: Interscience Publishers.