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AVOCADO SUNBLOTCH

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RESEARCH REPORT

OPSOMMING

Ontwikkeling van sonvleksimptome op Collinson-indikatorsaailinge was betekenisvol vinniger in 'n warm (30°C) as in 'n koel (20°C) glashuis. Indekserlng van simptoomvrye besmette borne was verder bespoedig deur die snoei van indikatorsaailinge 3 maande na inokulasie, in plaas van 6 maande daarna. Dit is nou moontlik om die indeksering in 9 maande te voltooi, in plaas van 2 jaar.

Elektronmikroskopie van geïnfekteerde plantmateriaal net die teenwoordigheid van 'n groot aantal plasmalemmasoom-agtige struktuur aangedui wat 'n ooreenkoms met die van exocortis viroied-gei'nfekteerde plante getoon bet,

SUMMARY

Development of sunblotch symptoms in Collinson indicator seedlings was found to occur significantly faster in a hot glasshouse (30°C) compared to a cool (20°C). Indexing of symptomless carrier trees was further speeded up but cutting the indicators back 3 months after inoculation instead of 6 months. It is now possible to complete indexing in 9 months, instead of 2 years.

Electron microscopy of infected leaf material revealed the presence of numerous plasmalemmasome-like structures, similar to those seen in exocortis viroid-infected plants.

INTRODUCTION

In 1978 it was reported that higher glasshouse temperatures appeared to increase the rate of sunblotch symptom development in indicator seedlings (Da Graca, JV. 1978). Therefore a large-scale experiment was conducted to see if this observation could be used to speed up indexing for this disease.

Very little electron microscopy has been conducted on sunblotch-infected material. Alper et al. (1975) reported that no viruses particles were seen in ultra-thin sections, while Desjardins (pers. comm.) did not find much of interest, and in hardened off tissue the fine structure was so altered that it was difficult to identify organelles. The following

report contains preliminary observations of an EM study on sunblotch-infected leaf tissue.

MATERIALS AND METHODS

a). Glasshouse temperature study

Ninety 3-month old Collinson avocado seedlings were used as indicators; 45 were placed in a hot glasshouse (30°/28°C daylnight), and the remaining 45 in a cooler glasshouse (20°C/18°C daylnight). Three sources of sunblotch were used. One was from symptomed branches of infected Edranol trees, the second from "recovery growth" branches of the same trees, and the third from shoots of their Mexican rootstocks. The last two are both symptomless carriers.

The three sources were inoculated into 15 indicators from each glasshouse. After 3 months the new growth of 10 plants in each group was cut back, and half of these transferred to the other glasshouse. The remaining five plants not cut back at 3 months, were cut back at 6 months. All the plants were observed for symptom development for one year.

b). Electron microscopy

Pieces of tissue were taken from the yellow areas of young and mature avocado leaves with sunblotch symptoms as well as from healthy leaves, fixed with 6% glutaraldehyde and post-fixed in 2% osmium tetroxide. After dehydration ¡n 2,2-DMP the samples were embedded in Spurr's resin, sectioned and viewed in the electron microscope.

RESULTS

a). Glasshouse temperature experiment

Table 1 shows the numbers of plants with symptoms, and the time taken for symptom development. At the end of one year 28 of the 30 plants kept at 30°/28°C had developed symptoms, all within 8 months, while only one of those which was kept in the cool glasshouse developed symptoms. Those plants which spent some time in the hot glasshouse began to develop symptoms towards the end of the experiment; three were amongst those moved from 30° to 20°C, and five in the 20° to 30°C group.

The influence of the timing of cutting back was interesting. Cutting back at 3 months caused those inoculated with the symptomless carrier sources to develop symptoms more rapidly, but it slowed down development in the symptomed-source plants.

A similar experiment with Mass seedlings as indicator is yielding similar results.

b). Electron microscopy

Numerous plasmalemmasome-like structures were seen in cells in mature infected leaves (Fig. 1). Less were found in young leaves and none in healthy. In addition, chloroplast structure was found to be grossly affected by sunblotch infection (Fig. 2). Other organelles did not appear to be affected.

DISCUSSION

The results obtained in the glasshouse temperature experiment clearly show that indexing for sunblotch can be carried out in a shorter time than used previously. It is now recommended that Collinson or Hass seedlings be used as indicators in a hot glasshouse set at about 30°C (day). The indicators should be cut back three months after inoculation to force more young growth. Indexing is used mainly to detect symptomless carriers, and this step was found to speed up symptom development. The indicators should be observed for 9 months, and if no symptoms have developed, the chances are very good that the tree is uninfected. Five indicators are sufficient.

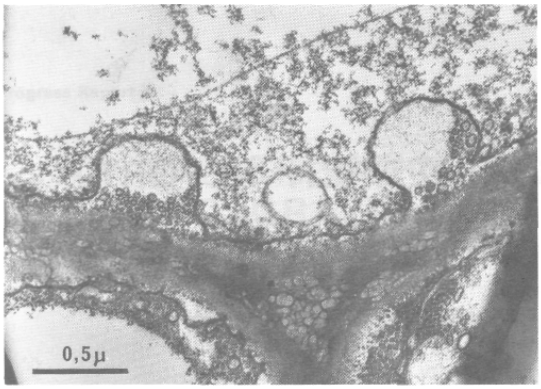

FIG. 1: Plasmalemmasome-like structure in a cell of a mature avocado leaf with sunblotch symptoms

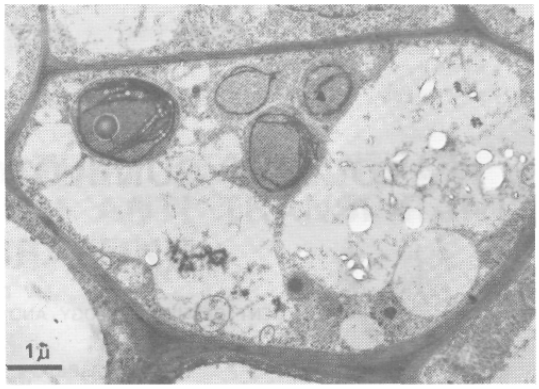

FIG. 2: Abnormal chloroplasts in a sunblotch-infected leaf cell

Recently evidence has been presented suggesting that sunblotch may be caused by a viroid (Dale, JL & RN Allen. 1979; Thomas, W & NA Mohamed. 1979). If this proves to be the case then a very rapid laboratory technique using polyacrylamide gel electrophoresis will be able to be used.

A search of the literature has revealed only one ultra structural study on a viroid-infected plant, Gynura infected with citrus exocortis viroid (Semancik, JS & WJ Vanderwoude. 1976). These workers observed numerous plasmalemmasome-like structures in infected cells. The presence of similar structures in sunblotch-infected tissue may provide supporting evidence for the viroid theory. The alterations in chloroplast structure are not surprising since chlorophyll loss is part of the symptomology.

TABLE 1: The number of plants with symptoms and the time taken for symptom development

Treatment	Sunblotch source		
	Symptomed	"Recovery growth"	Rootstock shoot
	no. +/5 (av. no. days for symptom development)		
30°C cut 6 mths	5 (90)*	5 (269)	5 (174)**
30°C cut 3 mths	5 (158)*	5 (159)**	5 (158)*
30°C cut 3 mths; move to 20°C	4 (347)	1 (329)	0
20°C cut 6 mths	2 (350)	0	0
20°C cut 3 mths	0	0	0
20°C cut 3 mths move to 30°C	4 (199)	0	1 (329)

*All positive within 6 months
**All positive within 8 months

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