WARM WATER TREATMENTS TO ELIMINATE THE GALL MITE *PHYTOPTUS RIBIS* NAL. FROM BLACK CURRANT CUTTINGS

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Abstract

Dormant black currant cuttings were treated in warm water to eliminate the gall mite *Phytoptus ribis* Nal. in infested buds. Treatment at 40° C for 40 min., at 42·5° C for 30-40 min., at 45° C for 15-20 min. or at 47·5° C for 5 min. killed all mites without affecting plant growth. Mites survived milder treatments and bud or root development was delayed or prevented by more extreme conditions.

Black currant reversion virus causes the most important disease affecting the crop in Britain and is transmitted by the gall mite *Phytoptus ribis* Nal. Spread occurs early in the growing season, when mites move from buds infested the previous season to buds of the new growth. Infested buds usually become recognizable as rounded galls, but some are missed because they are very small or of normal appearance. Thus it is difficult to check that cuttings for propagation are free of mites. To eliminate any which are present it has been suggested that cuttings should be immersed for 10 min. in 0·2% fluoroacetamide (2, 3). Although this treatment is effective, it has not been used extensively because some failure or delay in rooting and decreased growth have been reported.

A fumigation technique has been used in Germany (8) and warm water in Russia (4) and Holland (7) as alternative methods of disinfesting black currant cuttings. This paper describes recent work in England on the possibilities of warm water treatment.

Materials and methods

All the experiments were started between January and March 1962 or between October 1962 and February 1963. An electrically heated water bath with a thermostat control sensitive to ± 0·2° C was used for all treatments. Galled shoots were collected as required from very heavily infested bushes of the varieties Baldwin, Cotswold Cross and Wellington XXX in old fruiting plantations at East Malling or Mereworth. Uninfested shoots were collected from stool bushes at East Malling, which annually are inspected thoroughly and sprayed intensively with endrin to control mites.

Treated cuttings were planted 6 in. apart in rows 4 ft apart at East Malling, or with the co-operation of growers at commercial nurseries in Hampshire, Lincolnshire, Norfolk or Suffolk. In some experiments unfavourable weather delayed planting for several weeks and the cuttings were placed on moist peat and kept outside or in an unheated store. Some cuttings of each treatment were placed in water and forced-on in the laboratory or glasshouse at 15-20° C.

Mites killed by fluoroacetamide did not decompose for several weeks (3) and they behaved similarly after lethal warm water treatments. Consequently, survival was estimated by the number which were still active when galled buds containing several thousand mites were sliced open and dissected under the binocular microscope. Dissections were made immediately after treatment and at weekly intervals for at least two months.

Results

In a preliminary experiment done in January 1962, many active mites were found immediately after infested shoots were treated for up to 40 min. at less than 40° C. Cuttings treated for more than 5 min. at temperatures above 50° C did not develop and eventually rotted. These temperatures were selected as the upper and lower limits for all subsequent experiments involving exposure for up to 40 min.

Table I summarizes the results of several experiments, in each of which ten infested cuttings of the three varieties were treated at each combination of time and temperature. The minimum times necessary to kill all mites decreased steadily from 40 min. at 40° C, to 5 min. at 50° C. Marginally effective treatments greatly decreased the number of active mites ; indeed, active mites were not found until two or three weeks after some treatments. The few mites found then were usually near the centre of very large buds, perhaps indicating some delay in heat penetration or the development of adult mites from surviving eggs or immature forms.

TABLE I

THE EFFECT OF WARM WATER TREATMENTS ON CUTTINGS INFESTED WITH BLACK CURRANT GALL MITE

Temperature		Time in minutes					
°C	°F	5	10	15	20	30	40
40·0	104	M	M	M	M	m	X
42·5	108	M	M	M	m	X	X
45·0	113	M	m	X	X	d	D
47·5	117	X	d	d	D	D	D
50·0	122	D	D	D	D	D	D

M Many active mites after treatment.
m A few active mites found three weeks after treatment.
X Lethal to mites without affecting cuttings.
d Delay in rooting and bud development.
D Delayed growth and many deaths.

In nursery and laboratory, damage appeared as a delay or total failure of buds and roots to develop. Such effects were obvious when cuttings were treated for 30 or 40 min. at 45° C, for more than 5 min. at 47·5° C and after all treatments at 50° C. These results are consistent with the Russian recommendations that cuttings should be treated at 45-46° C for 13-15 min. and that 49-50° C for 5 min. is effective but may cause damage.

Each of the treatments which controlled mites without affecting subsequent growth was applied to batches of at least 100 uninfested cuttings of the nine most important commercial varieties in March and October 1962. The few losses were comparable to those in untreated controls and at the end of the growing season there was no evidence of adverse effects on growth.

Discussion

Warm water treatments in general are unpopular with growers and advisory officers. However, the control of black currant gall mite in the nursery is so important as to warrant extensive trials on a commercial scale, at least for the propagation of specially selected stocks. The practical problems involved are likely to be similar to those experienced in the bulk treatment of bulbs and other planting material to control eelworms (1) and in treating sugar-cane sets to inactivate ratoon stunting virus (6). For example, it is necessary to check any fall in temperature which occurs when large amounts of plant material are added to a warm water bath (5). In some commercial apparatus two independent electric heating systems are used to do this. The more powerful one is controlled by a thermostat set slightly below the treatment temperature, which is maintained by the secondary heater. It is essential also to ensure rapid heating and cooling at the beginning and end of the treatment period. This can be assisted by adjusting the ratio of plant material to water and by packing the cuttings loosely to allow free and rapid circulation. Treatments involving short periods at high temperatures can be done rapidly but require very accurate control. Longer periods at lower temperatures are recommended for large-scale use, as they allow some latitude in temperature and time control.

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