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VIROLOGY

Increased Susceptibility to the Mite Vector (*Phytoptus ribis* Nal.) caused by Infection with Black Currant Reversion Virus

REVERSION virus of black currant (*Ribes nigrum* L.) is transmitted by the gall mite *Phytoptus ribis* Nal. It is now known that the relationship between virus and vector is unusually complex and that infection with reversion virus increases the host's susceptibility to mites. This was demonstrated by exposing healthy and virus-infected bushes of the variety 'Wellington *XXX*' to mites spreading from adjacent bushes.

In March 1963, 24 yearling bushes were planted 1 ft. apart in each of six rows 8 ft. apart, with large infested bushes at the ends of each row. Healthy bushes alternated in the rows with others propagated from sources infected with a virulent isolate of reversion virus. All the yearling bushes had been grown in an isolated nursery kept free of mites by spraying. The complete absence of mites was confirmed by microscopical examination of buds removed when the bushes were cut back after planting.

Mites invaded the buds of new growth in late April, May and June, causing shoots infested at the apex to develop malformed leaves[1]. By July, most of the shoots with reversion symptoms were affected, but few others (Table 1). This distribution explains why the effects on leaves, now known to be due to mites, were regarded previously as symptoms of reversion virus[2]. By October, there were fewer galls on virus-free plants than on infected ones (Table 1). Seven bushes, propagated from an infected source, presumably escaped virus infection as they were symptomless and behaved like the healthy bushes in their resistance to mites (Table 1).

Table 1. INCIDENCE OF THE BLACK CURRANT GALL MITE (*Phytoptus ribis* NAL.) ON HEALTHY AND VIRUS-INFECTED BUSHES EXPOSED EQUALLY TO INFESTATION IN 1963

Observations	Healthy bushes (72)	Virus-infected bushes (65)	'Escaped' bushes (7)
Percentage of shoots with mite-affected foliage (July 1963)	1·5	81·9	2·6
Mean No. of galls per bush (October 1963)	5·0	67·3	8·9
Percentage of buds infested* (October 1963)	7·0	70·2	8·3

* Based on dissections of all buds on a sample of one shoot from each bush.

Mites are dispersed passively by wind and insects. There is no evidence that they select suitable host plants or that they discriminate between suitable and unsuitable bushes. The data indicate, therefore, that healthy bushes of 'Wellington *XXX*', generally considered to be very susceptible to mites, have considerable resistance. Indeed, the known association between the incidence of mites and reversion[3] is partly explained by the observation that on healthy bushes more mites failed to reach or to enter susceptible buds than on virus-infected bushes. The heaviest infestations of mites are found on reverted bushes, and are difficult to eradicate. By comparison, mites rarely cause serious damage when reversion is absent and usually remain at a low level which fluctuates with season and the effectiveness of control measures.

An obvious difference between healthy and reverted black currants which affects susceptibility to mites is in the hairiness of leaves and young stems. The density of these hairs differs between varieties and is always much less on reverted bushes than on healthy ones. This facilitates infestation with mites which are impeded by hairs during the spring dispersal period. Hairs on the stipules and at the bases of the petioles are particularly effective in protecting the most susceptible buds, which are in the axils of young expanding leaves. The importance of hairiness was indicated also by comparing the susceptibility of different varieties; the very hairy 'Seabrooks Black' being the most resistant of eight varieties tested and the relatively glabrous 'Goliath' the least.

The effects of reversion virus on black currants are obviously beneficial to the mite vector; hairs are suppressed, whereas vegetative growth is unaffected or even increased. It is therefore very important to eradicate infected bushes in nurseries and plantations. Moreover, the health of bushes should be considered more carefully than hitherto in the design and analysis of field experiments on the spread and control of mites. The sensitivity of such experiments may be increased greatly by using virus-infected bushes.

Beneficial effects of plant viruses on their arthropod vectors have received little attention, despite suggestions that they may be of considerable ecological and evolutionary significance[4,5]. Aster yellows virus extends the limited host-range of a leafhopper[6]. Furthermore, some leafhoppers[7,8], thrips[9], aphids[10–13] and perhaps mites[14] live longer or multiply more rapidly on virus-infected plants than on healthy ones. Reversion virus appears to be unique in breaking down a natural resistance mechanism which decreases colonization by mites and their subsequent build-up.

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Use of Electron Autoradiography for investigating Viral Infection in Tissue Culture

ELECTRON autoradiography has recently been used in biological investigations[1–3]. We attempted to use the electron microscope in combination with the autoradiographic method for examining myxovirus infection in tissue culture.

A dermo-muscular tissue of human embryos was grown on object glasses placed in Petri dishes and after 4–5 days was infected with FPV (fowl plague virus), strain Wei, 10 ID_{50} per cell. Infected cultures were incubated in the 199 medium with 10 per cent calf serum and 0·4μ Cu ^{14}C-adenine per 1 ml. In 30 min after infection the cultures were fixed for 40 min in 1 per cent osmium tetroxide with Palade balanced solution[4] at 4° C and pH 7·5; then they were treated with alcohol solutions of increasing concentrations and placed for 35 min in a mixture of absolute alcohol with butyl methacrylate (1 : 1) and