CONGRESS ENTOMOLOGY

26

some long distance dispersal is achieved in addition to that resulting from the general fauna movement within bushes and from bush to bush.

Some mites are dislodged from the outsides of galled buds by rain and carried down shoots towards the bush base where new shoots are growing and many buds are available for infection.

Dispersal by rainwater streams along shoots is most commonly found after sudden showers in the flowering period.

Large numbers of mites disperse from single galled buds, and their spread falls broadly into two types: the initial infection of a plantation and the spread within a plantation.

Almost all mites in the initial infection of a plantation have been either windborne or carried by insects none of which live only on blackcurrants and so by neither method have the mites had any assistance in finding new plantations. A random distribution is almost invariably found and only rarely can a gradient of infection from the source be detected.

The spread within a plantation is most frequently to adjacent bushes and gradients of numbers of galled buds can more often be found. Such spread occurs since most migrants are below bush top level and not in a suitable site for wind dispersal to greater distances. However within a plantation only on bushes within a few yards of the infection source can a clear gradient of numbers of galled buds be found.

No evidence has been found for the theory that mites disperse predominantly in the direction of the prevailing wind. The spread of Reversion virus to healthy plants appears to be more restricted than mite spread and not to follow this closely. This might be explained by the death of some mites after virus transfer and by the inability of others to transmit the virus.

Control measures against the mite have been devised (Ann. appl. Biol. 1962, 50.) based on repeated applications of low concentrations of sulphur compounds which can be used at the blossom stage without hazard to pollinating insects and not presenting toxic residue problems when used at later stages.

THE VIRUS-INDUCED SUSCEPTIBILITY OF BLACKCURRANT BUSHES TO THE GALL MITE VECTOR (*CECIDOPHYOPSIS RIBIS* NAL.)

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The gall mite *Cecidophyopsis ribis* Nal. infests the buds of blackcurrant bushes and prevents the development of true leaves and flowers. It is also important as the vector of reversion virus. This is widespread in Britain and the most virulent strains cause bushes to become virtually sterile.

The relative susceptibility to mites of the main commercial varieties of blackcurrant was assessed in a field trial started in November 1961. One-year-old bushes which were free of mites were exposed equally in a randomised block design alongside reverted bushes with many galls. After two years of unrestricted spread there were significant differences between certain varieties in the number of galled buds found during the winter. However, the most striking feature of the results was that in all instances less than 10% of the buds were infested.

Some features of the natural resistance of blackcurrants to mites became obvious in April, May and June 1964 when shoots of the varieties Amos Black, Baldwin and Wellington XXX were exposed to infestation and dissected at weekly intervals throughout the dispersal period. On each occasion mites were found only on and around the youngest accessible buds, which were in the axils of the almost mature leaves. Younger buds and the apices were less readily accessible as they were protected by the overlapping bases of the subtending leaves. Moreover, the movement of mites towards the apex was impeded by hairy barbs on the leaf bases and by the dense down of surface hairs on the unexpanded laminae, petioles and stems.

Mites which reached axillary buds had great difficulty in penetrating to the meristematic apex and leaf primordia on which they feed and reproduce. Many died on the surface and only 9 of the 377 mites recorded on 27 shoots were inside the buds. The remainder were on the outside of the buds or on adjacent parts of the stems and subtending leaves. The resistance of the buds was associated with their stage of development. Those which were accessible to mites and which were successfully invaded had two or three recognisable leaves surrounding undifferentiated primordia. Mites were able to crawl between the developing laminae and down to the meristem, despite the difficulty of negotiating the hairy barbs already present at the bases of the developing petioles. The barbs and overlapping leaf scales of older buds made them virtually immune to mites.

These observations suggest that the only buds which become infested are the small proportion on each shoot which are vulnerable during the dispersal period of mites. The oldest buds are in the axils of the scale and transitional leaves and most develop sufficiently early to resist infestation. By comparison, the buds in the axils of the youngest leaves evade infestation because they are inaccessible. This explains the characteristic distribution of galls at the lower nodes of fully extended shoots on healthy bushes (1).

Infection with reversion virus greatly increases the susceptibility of blackcurrant bushes to the mite vector. This was demonstrated in 1963 (2) and confirmed in 1964 when reverted bushes which were free of mites were exposed to infestation. Dissections during the dispersal period revealed many mites on the stem and bud surfaces. Even more mites were inside the apical buds and in the axillary buds of all but the oldest leaves. The ability of mites to reach and to enter such a large proportion of the buds of reverted bushes is associated with the sparse distribution of stem and leaf hairs on reverted bushes compared with healthy ones. This facilitates the movement of mites and their entry into buds and also decreases the effectiveness of the barrier to mites reaching the apex and youngest leaves. Infested apices continue to grow and produce infested axillary buds, so that all but the lowest buds become heavily infested and there is a much more even distribution of galls than on healthy bushes.

The extreme susceptibility of reverted bushes to mites has important implications in experimental design and the health of bushes must be standardised more carefully than hitherto. Experiments on the spread and control of mites may be made particularly sensitive by using reverted bushes, although both healthy and infected ones must be used for a full evaluation of spray materials and methods.

The results also necessitate a reassessment of the direct damage caused by mites and emphasise the critical importance of removing reverted bushes as they occur, if mites and reversion are to be controlled effectively. Virus infected bushes often support a large mite population, impeding control by existing sprays and menacing healthy bushes in the vicinity. By comparison, in isolated plantations where infected bushes are removed promptly, mites are rarely sufficiently numerous to cause a serious problem, and they are vulnerable to chemical control as they fluctuate at a low level which varies with seasonal factors. It seems that the damage caused by mites as vectors of reversion virus is much more important than their effect on buds. Indeed, the direct damage due to mites alone may be insignificant unless infested bushes are rendered susceptible by the effects of reversion virus.

REFERENCES

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2. Thresh, J. M., 1964, Nature, 202: 1028.