THE EFFECTS OF GALL MITE ON THE LEAVES AND BUDS OF BLACK CURRANT BUSHES

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THE black currant gall mite *Phytoptus ribis* Nal. is widespread in many of the countries where the crop is grown. It directly damages infested buds and transmits black currant reversion virus, which causes the most serious disease affecting the crop in Britain. The microscopical examination of dissected buds or macerates of buds (Smith, 1961) is the most accurate method of assessing the incidence of mites, but it is a destructive procedure which is impracticable on an extensive scale. Macroscopic features are required for field identifications and were considered in these investigations.

MATERIALS AND METHODS

In 1961, 1962 and 1963 one- and two-year-old mite-free bushes were planted alongside heavily infested bushes and then pruned to leave 2–3 buds above ground. Mites invaded the buds of the new growth in the early part of the growing season and the leaf symptoms caused by mites in apical buds were recorded in June and July.

After leaf-fall in late autumn one shoot was selected at random from each bush and each intact bud was classed as rounded, pointed or intermediate. The buds were then sliced longitudinally and one half examined for mites under a binocular microscope. The position of each infested bud was recorded as the number of nodes from the base of the new shoot, ignoring the small buds at the base which had developed in the axils of scale leaves. The maximum breadth and length of 300 infested buds were recorded together with those of equivalent uninfested buds.

RESULTS

Mite-affected foliage. Leaves malformed by mites are seen commonly during routine inspections to identify reversion disease and varieties. At East Malling, affected leaves developed in late June and July and were recorded then, because the final leaves produced in August were often atypical. Symptoms were restricted to shoots with mites in the apex, which developed severely malformed leaves, often asymmetrical about the midrib (Thresh, 1963). Infested axillary buds could not be identified by these symptoms as their subtending leaves appeared normal unless the apical bud was infested.

Affected leaves provide a useful indication of mites, when they can be demonstrated otherwise only by dissection. Differences were found between the infestations on different sets of bushes var. Wellington XXX (Experiment 1, Table 1). However, serious limitations of the observations on healthy bushes were that few of the apical buds became infested and most of the galls were in the leaf axils. The apical buds of Cotswold Cross and Goliath were infested much more readily than those of other varieties (Experiment 2, Table 1), but even so the proportion infested was low compared with that of reverted bushes of Wellington XXX. This was the only material examined where the summer inspection gave a reasonable indication of the total infestation (Experiment 3, Table 1).

TABLE 1

Shoots with mite-affected foliage in relation to the total infestation present

Expt.	Variety	Mite affected foliage+	Total infested shoots+	Total galls
1	Wellington XXX sprayed	1/229	10/229	19
1	Wellington XXX unsprayed	5/193	86/193	154
2	Healthy Baldwin	0/339	89/339	137
2	Healthy Cotswold Cross	37/799	405/799	1,024
2	Healthy Goliath	31/309	220/309	659
2	Healthy Mendip Cross	4/298	104/298	160
2	Healthy Wellington XXX	2/832	253/832	402
2	Healthy Westwick Choice	0/261	85/261	126
3	Healthy Wellington XXX	4/276	188/276	384
3	Reverted Wellington XXX	274/372	370/372	4,424

+ Number of affected shoots as a fraction of the total shoots recorded.

Bud structure. Infested buds appeared normal until shoot elongation stopped in August; their characteristic shape was then obscured until the leaves fell. By October or November typical uninfested buds were elongated, pointed and bright green in section. There was a differentiation into scale, transitional and foliage leaves surrounding flowers (Plate II, 1). By comparison, infested buds were usually rounded and yellowish-green in section. Many active mites, often accompanied by numerous eggs, were distributed on the convoluted gall tissue which replaced the true leaves and flowers (Plate II, 4).

Mites had similar effects on the buds of the eleven main commercial varieties examined. The incidence of mites could usually be predicted accurately by the shape of the buds (Plate III, 1, 2, 3). In a few instances the prediction could be made only after determining the presence or absence of flowers and leaves with a hand lens. Table 2 shows the combined results of observation on young bushes of the varieties Baldwin, Cotswold Cross, Seabrook's Black and Wellington XXX examined during the winters of 1962–63 and 1963–64.

TABLE 2

The incidence of mites in buds of different shape

Result of dissection	Bud shape		
	Pointed	Intermediate	Rounded
Mites	4	7	181
No mites	8,004	2	0

Some of the few buds of intermediate shape had the internal structure of typical infested buds, but each contained a larva of a Chalcid predator *Tetrastichus* sp. and few mites (Plate II, 3). Other buds without the predator contained so few mites that some differentiation of leaves had occurred and one such bud contained rudimentary flowers.

When two or more elongated pointed buds developed from the same node and shared scale leaves, they had the proportions of a gall (Plate II, 2). However, the individual buds were recognizable by their separate pointed tips and normal structure. Double and multiple buds are common at East Malling on the varieties Malvern Cross, Mendip Cross and Cotswold Cross, which produces forked shoots by the simultaneous development of two buds at the same node. (Plate III, 4, 5).

Bud dimensions. The 600 buds examined varied in size and were ascribed to 73 different length/breadth categories. Differences were noted between varieties, localities, the age and type of shoots examined and node position. Uninfested buds ranged in length from 8·0 mm to 2·0 mm and in breadth from 4·5 mm to 1·0 mm. The range in size of infested buds was equally great. Consequently they were not distinguishable by their length or breadth alone and to refer to them by the frequently used term ' big bud ' is misleading.

The rounded appearance of most infested buds is expressed quantitatively in Fig. 1. All the buds with a low length/breadth ratio were infested, whereas all the buds with a high ratio were uninfested. The intermediate categories included 128 buds of which 80 contained mites. Despite their similar proportions most of the latter were distinguished from those without mites, because all the infested buds examined had a lower length/breadth ratio than uninfested buds on the same shoot. The difference was usually perceptible and often considerable.

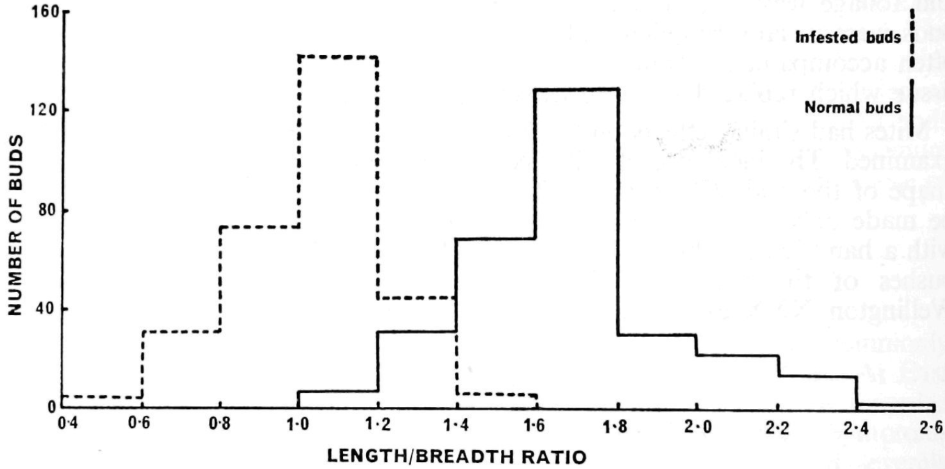

Fig. 1. Frequency distribution of length/breadth ratio for 300 infested and 300 uninfested buds.

The distribution of infested buds. The distribution of galled buds was similar on healthy bushes of different varieties examined in each of three seasons. Of the 5,199 galls recorded in eight different experiments 4·7 per cent were at the apex. Most of the others were in the axils of the lower leaves with maximum infestation around the fifth node from the base (Fig. 2). Few of the upper buds were infested, although most of the shoots had 20-25 nodes.

A similar distribution was recorded by Lees (1917) who considered that the basal buds evaded infestation as they were formed adventitiously after mites had dispersed. However, the lowest buds in recent experiments were in the axils of the oldest leaves and many were so well developed by the time mites dispersed that they resisted infestation. By comparison, many younger buds around position 5 were susceptible at the time. The upper buds evaded infestation as they were formed after dispersal had ended and the few which contained mites were usually on shoots infested at the apex.

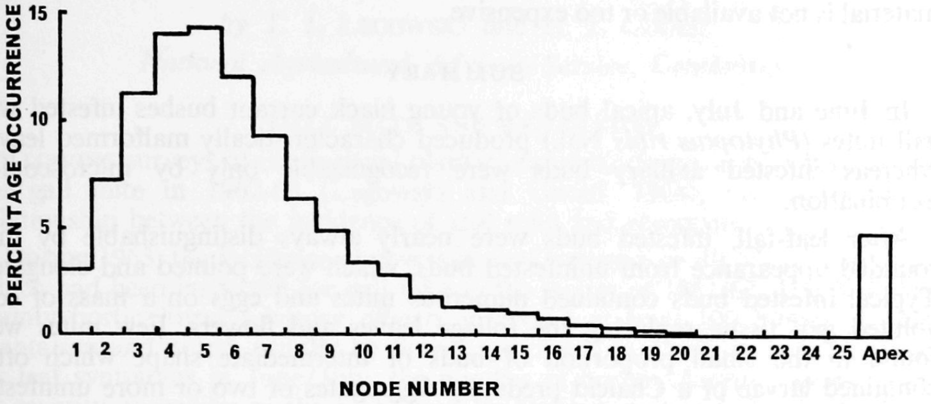

Fig. 2. The incidence of galls at each node and at the apex (data for a total of 5,199 infested buds).

The distribution of galls on Wellington XXX bushes which were completely affected by reversion virus was different from that on comparable healthy bushes. Most of the buds were galled and there was a less marked peak of infestation because of the facility with which mites invaded the apical buds of reverted shoots (Thresh, 1964a). Mites were cut off into axillary buds as the latter were differentiated from the apex, even when the normal dispersal of mites between bushes had been completed.

DISCUSSION

These results corroborate those of Jary, Austin and Pitcher (1938), who showed that counts of galled buds gave a reliable estimate of mite infestation. However, Massee (1927) found little association between the appearance of buds and the presence of mites, and Collingwood, Vernon and Legowski (1960) recorded mites in apparently normal buds. These discrepancies may arise in areas where Chalcid or other predators are common and when particular attention is given to bud *size* rather than *shape*. If double, multiple and small rounded buds are diagnosed correctly then a winter inspection for galls is feasible and desirable, as it enables growers and advisory officers to assess mite infestations and plan subsequent control measures and planting policy. A winter inspection as already practised in Scotland might become part of the official certification scheme to improve the present standard of nursery bushes. The inspection of fruiting plantations is much more difficult and is probably impracticable as a routine measure on large acreages. The bushes are often very large, with many buds which differ greatly in size according to their position. Inevitably many galls are overlooked, unless the inspection is prolonged or done on different occasions and from each side of the rows.

Inspecting bushes for galls is slow and tedious and efficiency is affected by the light conditions and background. Although inspections are practicable between leaf-fall in late autumn and the onset of spring growth, general experience is that galled buds are most conspicuous when they swell in February or March. Bushes which are to be lifted for sale must be inspected much earlier. On nursery bushes attention should be given to the apical and lower buds, particularly those on shoots to be used for cuttings. Immersion in warm water

(Thresh, 1964b) provides the only method of eradicating mites from cuttings before planting, now that fluoroacetamide (Collingwood, 1959) has been withdrawn. Warm water treatments may be invaluable when many cuttings are required for intensive systems of cultivation and where completely healthy material is not available or too expensive.

SUMMARY

In June and July, apical buds of young black currant bushes infested with gall mites *(Phytoptus ribis* Nal.) produced characteristically malformed leaves, whereas infested axillary buds were recognizable only by microscopical examination.

After leaf-fall, infested buds were nearly always distinguishable by their rounded appearance from uninfested buds, which were pointed and elongated. Typical infested buds contained numerous mites and eggs on a mass of convoluted gall tissue replacing the foliage leaves and flowers. Few mites were found in the small proportion of buds of intermediate shape which often contained larvae of a Chalcid predator. Aggregates of two or more uninfested buds at the same node were distinguishable from galls.

Most of the infested buds on the one-year-old wood of young healthy bushes were at the apex or at the lower nodes. A routine winter inspection of nursery bushes for galled buds is feasible and highly desirable.

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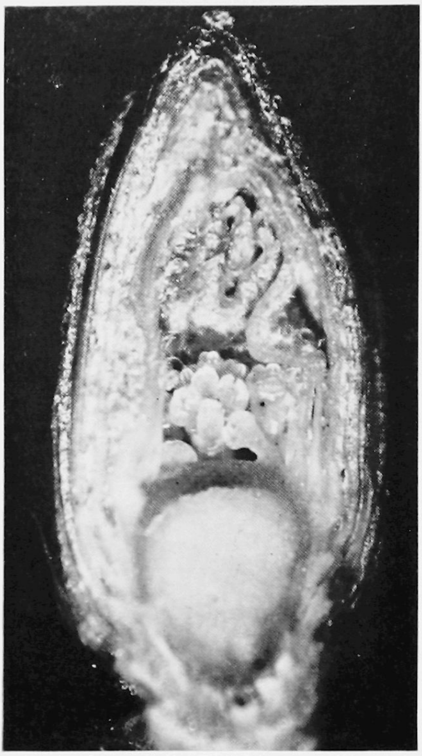
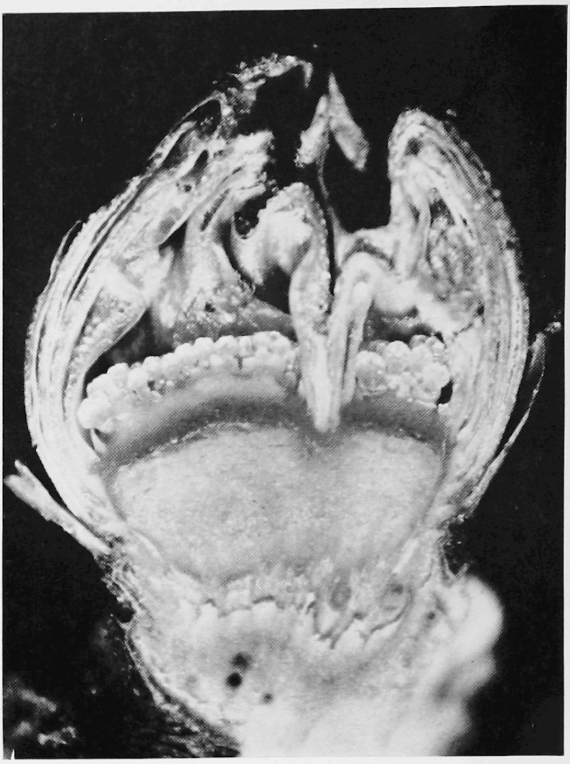


1. Uninfested bud with scale and foliage leaves surrounding flowers.



2. Two uninfested buds close together at a node.

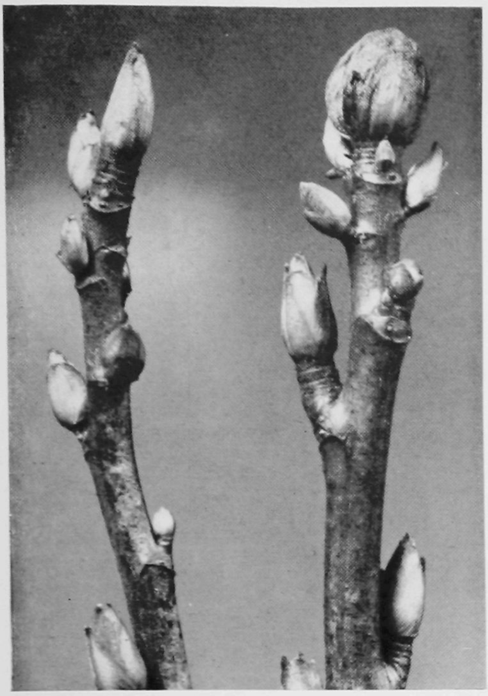
3. Infested bud with few mites and Chalcid predator at centre.

4. Infested bud with many mites on gall tissue which replaces leaves and flowers.

Photos: East Malling Research Station

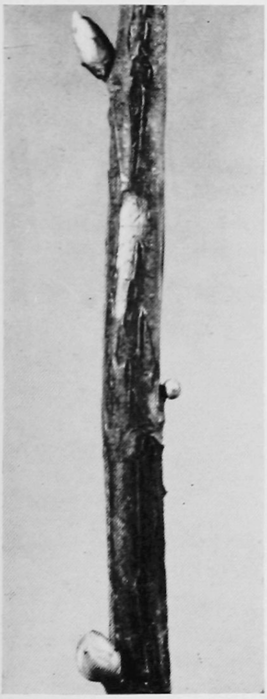
PLATE II

0 BUDS OF BLACK CURRANT (see p. 26)



1. *Left:* Pointed buds of uninfested shoot. *Right:* Infested shoot with apical gall.

2. *Left:* Typical uninfested axillary bud *Right:* Typical infested axillary bud.



3. *Above:* Typical uninfested bud. *Centre:* Small gall. *Below:* Typical gall.

4. Forked shoot of Cotswold Cross with two double buds resembling galls.

5. Multiple bud of Cotswold Cross.

Photos: East Malling Research Station

PLATE III