Leafroller Control and Disease Incidence in Hastings Vineyards.

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Executive Summary

Leafroller populations in two Hastings vineyards were measured monthly. Vineyard J used a single Mimic spray and obtained excellent control of leafroller. Records were made of the presence of rots in the Sauvignon blanc berries at harvest. Ninety percent of the harvested bunches contained rotting berries despite the complete absence of leafroller in this crop. The other vineyard contained a low leafroller population for most of the growing season that received modest attention from beneficial insects. A sharp increase in leafroller numbers and a high count of empty shelters was observed once the nets were placed over the grape vines as the grapes ripened. Half the harvested grape bunches contained rotted berries without any evidence of leafroller. Thirty seven percent of the bunches were completely clean. The rots in a further 9% of bunches were highly likely to be due to the presence of live leafroller. These bunches were very heavily damaged. The final 4% of the harvest contained evidence of the past presence of leafrollers and was divided equally into rotted and clean bunches. I conclude that the presence of healed leafroller activity makes little contribution to the development of rots. The difference between the incidence and severity of rots in the two vineyards not attributable to leafrollers suggests possible causes worthy of experimental investigation.

Introduction

There were two purposes to this project. Wine-grape growing is scattered over many of the regions of New Zealand. Visitors to New Zealand comment on the enormous variation that can be observed over short distances. This variation is also apparent in the grape growing conditions and the resultant pest and disease pressures. Building an understanding of the complex interactions between leafrollers, disease, pattern of rainfall, other aspects of the weather, nature of the sward and soil type for all of the major wine-grape growing districts is a important aim of this research effort. This study aimed to provide information on the biological control of leafroller in the Hawkes bay region.

Secondly, one of the vineyards chosen offered the opportunity to study an distinct type of leafroller-beneficial species interaction. The Fruit Fed monitoring of Vineyard J showed that this vineyard stood out as a place with an unusually high level of leafroller activity and a large population of *Glyptapanteles demeter*, a species suspected of being less efficient as a bio-control agent for leafroller or even as a species capable of interfering with or reducing the effectiveness of other wasp species. Operational pressures led to the manger of this vineyard applying a spray of Mimic while the manager of the reference orchard chose not to spray.

Methods

The two vineyards were from the Hawkes bay region, Vineyard I in Maraekakaho rd and vineyard J between Gimblett rd and Kirkwood road, a separation of 6km. Blocks of Sauvignon blanc were studied in both vineyards. Monthly samples began in October and finished in March with an early harvest due to deteriorating weather and disease conditions. A set of 30 vines from 10 rows in Vineyard J and 7 or 8 vines from four (very long) rows from vineyard I were sampled. All leafroller life stages were collected from all parts of the vine. Caterpillars were placed on artificial diet and reared to check whether a live adult moth or a beneficial wasp would emerge. Activity measures (empty shelters on the leaves and healed excavations in the bunches) were counted.
A sample of bunches was made at harvest. The number of diseased berries was counted in each bunch. Some berries were either afflicted solely with *Botrytis* or more frequently, solely with sour rot. Often they were difficult to unequivocally assign to either disease so all disease was scored as "rot".

Results

Moderate leafroller activity was observed in vineyard I (table 1). All leafrollers that completed development were *E. postvittana.*

Table 1 Leafroller activity in Vineyard I

	Leaf				**Bunch**			
Date	Egg batch	ES	LR	Reared	Excav	LR	Pup	Reared
13-Oct	0	0	0	0	0	0	0	0
14-Nov	0	0	0	0	0	0	0	0
13-Dec	0	0	0	0	1	0	0	0
16-Jan	0	24	2	0	8	0	2	2
14-Feb	6	14	0	0	0	4	0	4
16-Mar	2	26	7	3	0	0	0	0

Egg batches were seen only in February and March. Insufficient data was present to show clear generations in the bunches (table 1). No spring generation was present. All four caterpillars and two pupae from the bunches produced adult LBAM.

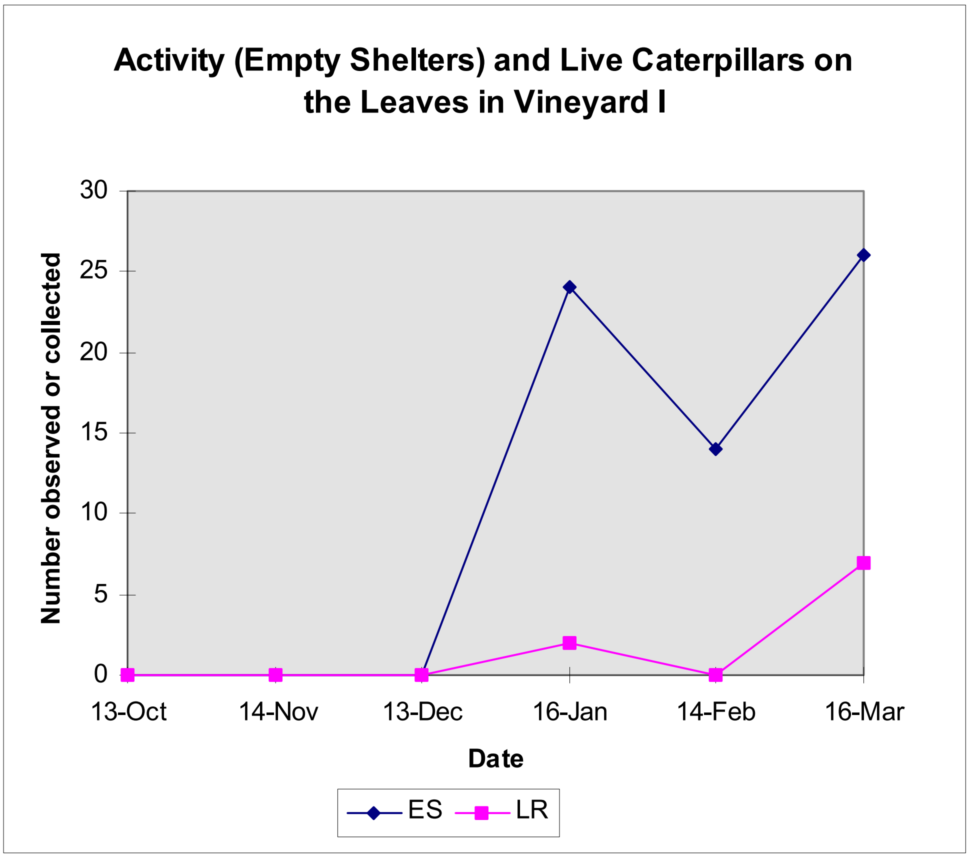

Fig.1 Activity and live caterpillars from the leaves in vineyard I.

Summer (January) and autumn (March) generations appeared to be present (fig.1). Each generation had a peak of caterpillar activity with an accompanying activity peak. The difference between the record of activity and the number of live caterpillars collected is large, greater than seen in any other vineyards.

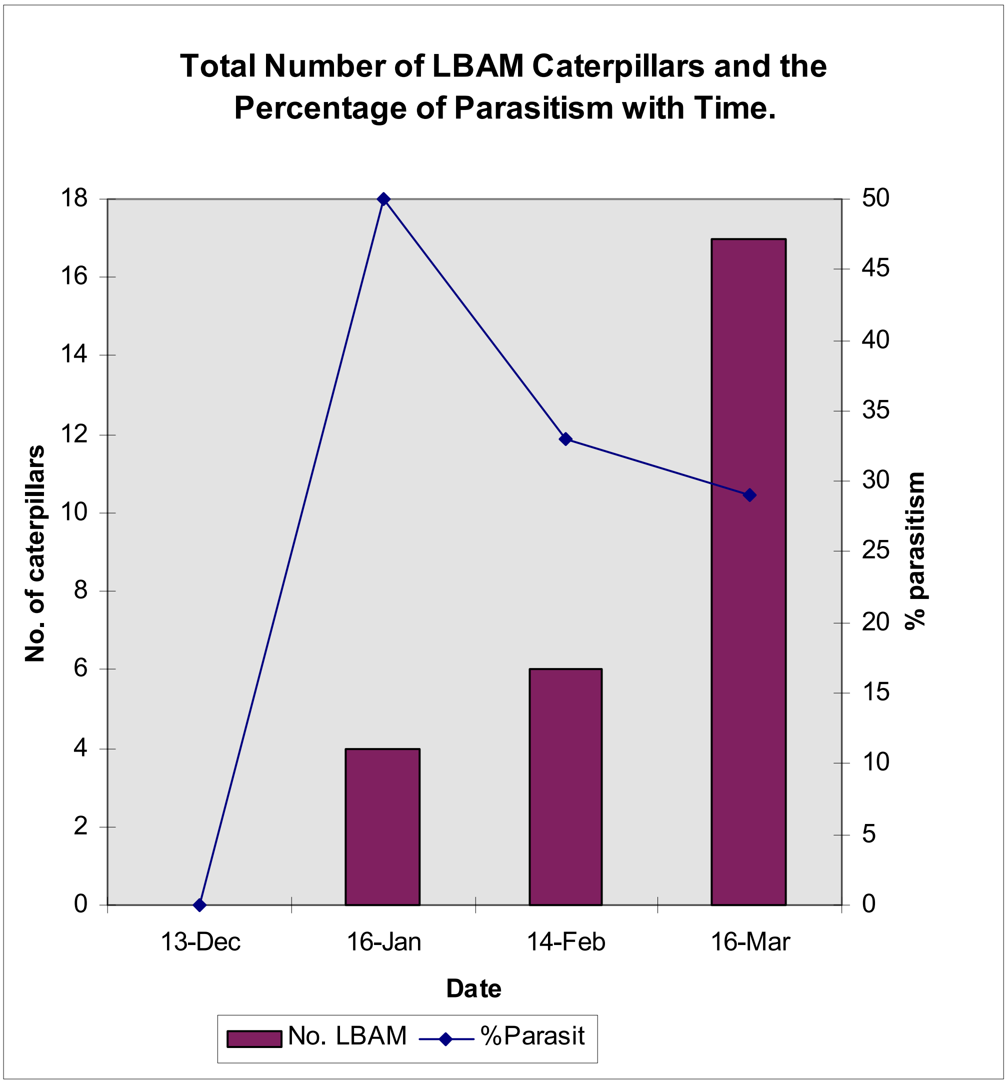

Fig.2 Numbers of leafroller caterpillars and the changing degree of parasitism with time in vineyard I. All of the available data has been combined in this figure. Leaf and bunch data are combined. The harvest data and the monthly data for March were collected on the same day (16^{th}) and were combined (effectively a double data set). Nine field records (seven caterpillars and two empty wasp cocoons) and eight records (all caterpillars) came from the harvested fruit. The only species of wasp parasitoid found was *Dolichogenida tasmanica*.

Numbers of caterpillars effectively increase from January to March. The percentage parasitism is stable in February and March at around 30%, well below the level needed for effective bio-control (see Wairarapa report).

The results from the 97 harvested grape bunches show that half of the bunches contained rotted berries without the presence of leafrollers. An average of 8.1 berries are rotted in this section. A further 37% have neither rotted berries nor leafrollers. Leafrollers or evidence of their past presence were found in the remaining 13% of the harvest. Two empty leafroller excavations were found in both the sections with rotted berries and without. The two excavations were associated with 4 and 5 rotted berries, ie. close to and indistinguishable from the average number (8.1) of rotted berries where no leafrollers were found and many fewer than the average 20.2 berries/bunch in the section where both leafrollers and rots were found (fig.). The only place where live leafrollers were found was in the section with leafroller and rots. Eight of the ten leafroller were associated with a large number of rotted berries in the nine bunches infested (two leafroller were in one bunch). These

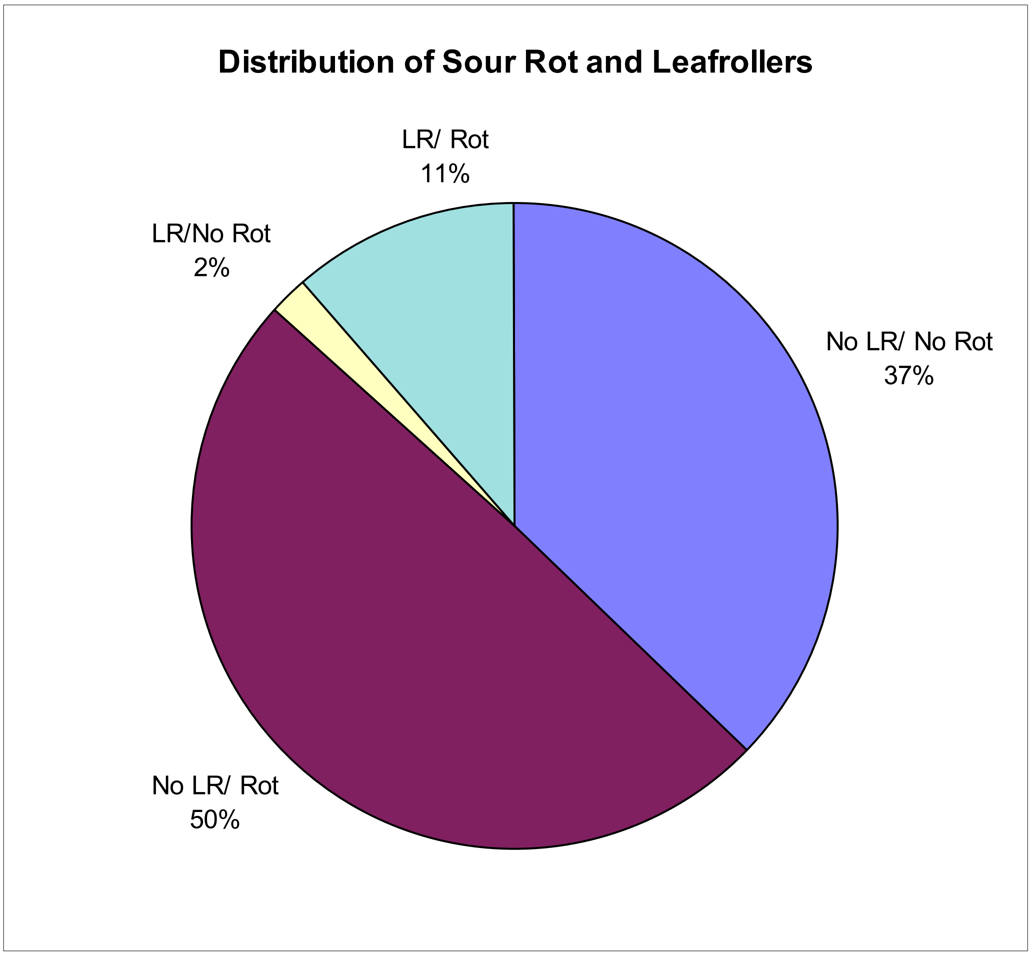

Fig. 3 Distribution of leafroller and rots in the harvested Sauvignon blanc berries form vineyard I. Sample of 97 bunches.

characteristics mean we can confidently state that leafroller have caused rot damage to nine bunches out of the sample of 97 bunches or 9.3% of the harvest. This is much less than the 61% of bunches that were rotted. If however the number of rotted berries is tallied, 222 rotted berries (36.3%) are found with leafroller present compared with 390 rotted berries when leafroller are absent. A smaller percentage of the bunches have leafroller generated rots, but where they occur, the damage is extensive.

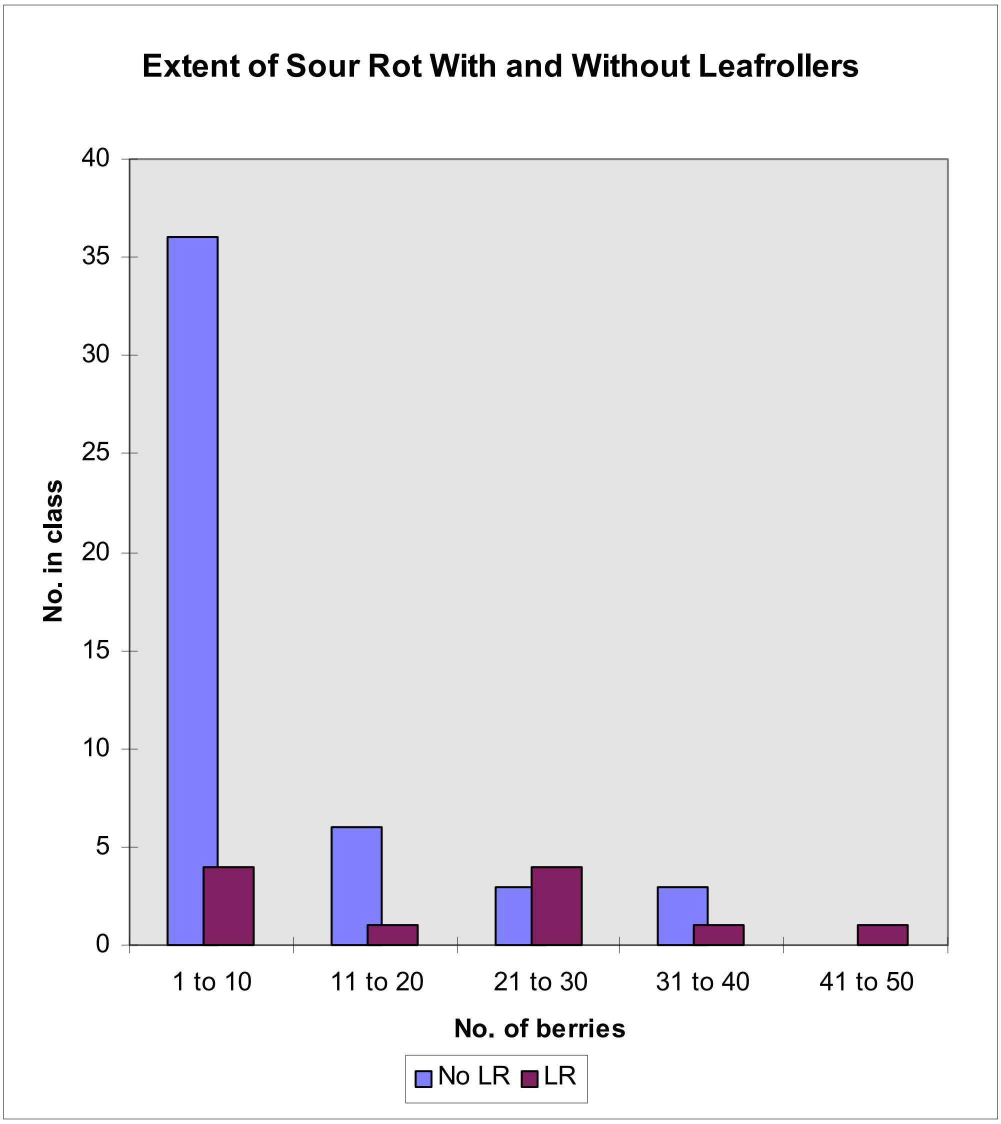

Fig 4 Number classes of rotted berries in harvested bunches in vineyard I. There was an average of 8.1 rotted berries in bunches without leafroller and an average of 20.2 rotted berries in bunches with leafrollers.

Very little leafroller activity was seen in vineyard J (table 2). All leafrollers that completed development were *E. postvittana.*

Table 2 Leafroller activity in Vineyard J

	Leaf			Bunch			
Date	ES	LR	Reared	Excav	LR	Pup	Reared
13-Oct	0	0	0				
14-Nov	1	0	0				
13-Dec	6	2	2	0	0	0	0
17-Jan	5	0	0	5	0	0	0
14-Feb	1	0	0	0	0	0	0
15-Mar	1	0	0	0	0	0	0

Cap-fall was complete on the 13th December. No egg batches, pupae or pupal exuviae were found. The two caterpillars caught in December produced two LBAM adults (E,Γ). One empty cocoon of *A. tasmanica* was found on a leaf sampled in March. The only activity found in the berries were five empty excavations in the January sample.

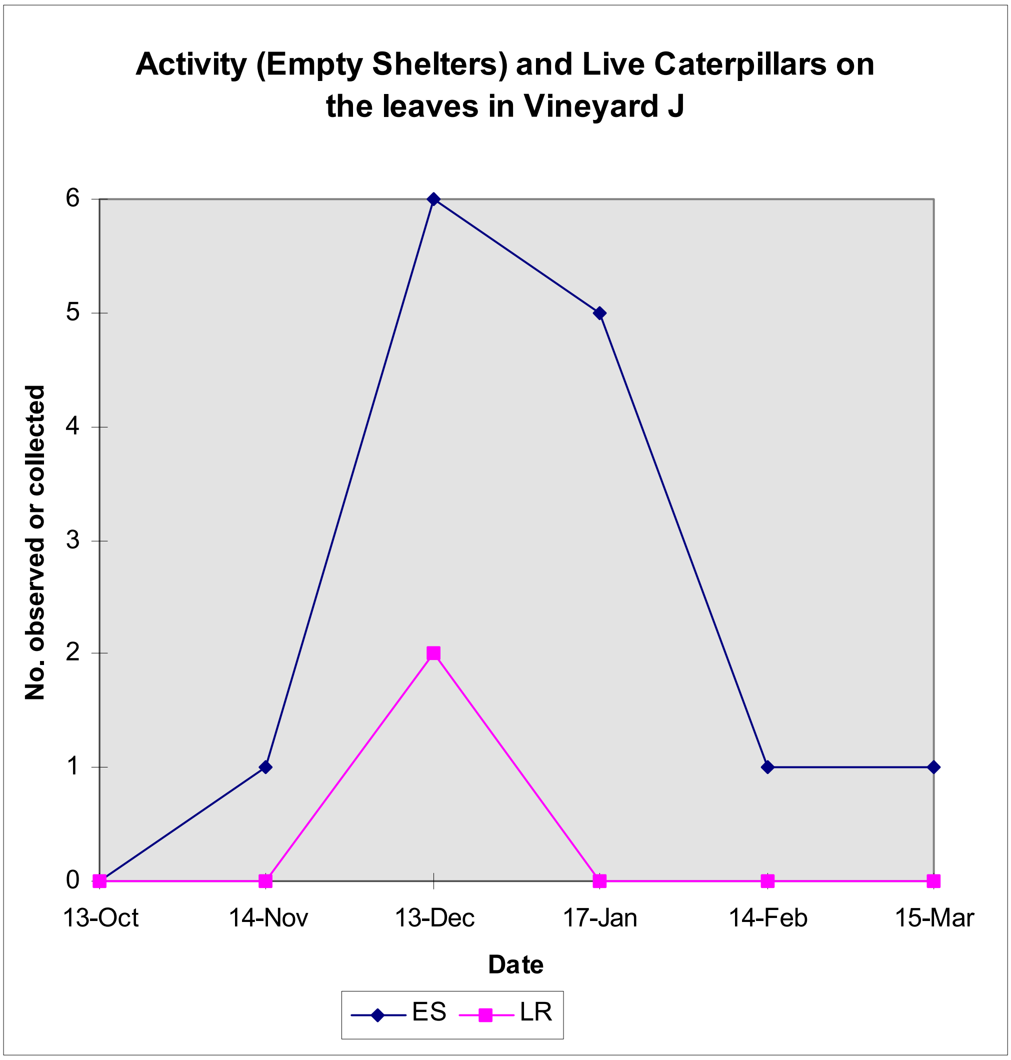

Fig. 5 Activity and live caterpillars from the leaves in vineyard J.

The only live caterpillars found were two collected in December (fig.5). There was no evidence of a spring or autumn generation. The activity measurements(fig.5) confirm the existence of only one generation, this is shown by the single, displaced "shadow" of empty shelters.

Though evidence of only one parasitic wasp was seen (above) there were many Tasmanian lacewings (*Micromus tasmaniae*) observed. One was found inside an empty leafroller shelter with fresh feeding marks. Cameron (1989) records this neuropteran as a predator on Tomato fruit-worm caterpillars (*Helicoverpa armigera*). The 11-spot ladybird (*Coccinella undecimpunctata*) was also commonly seen.

Extensive splits in the skins of the developing grapes were seen in February. These breaches were invaded and the crop was harvested early (mid-March) in a desperate effort to salvage useable fruit. Most (90%) of the bunches contained sour rot (fig. 6). No leafrollers were found, neither live caterpillars nor empty excavations were they had been.

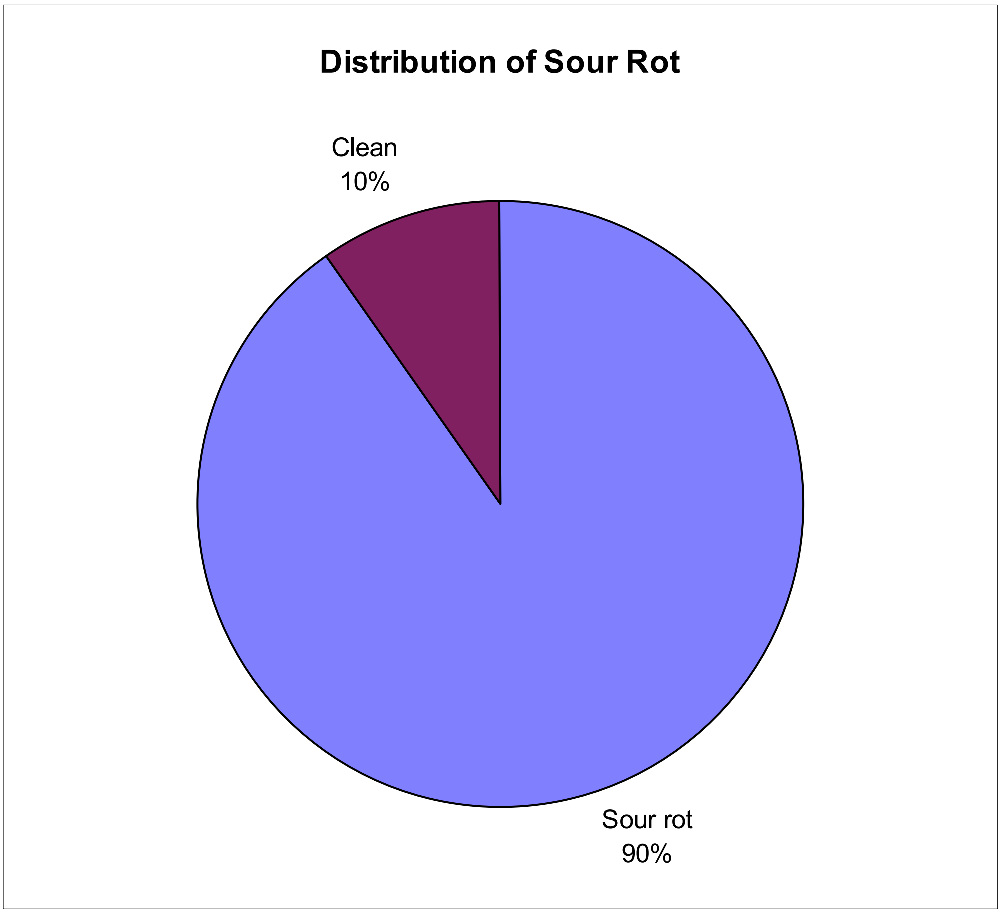

Fig.6 Sample of 83 Sauvignon blanc bunches from harvest (15th March 2001) in vineyard J. Ninety per cent contained rotten berries. An average of 16.6 berries per bunch were damaged. No sign of past or present leafroller activity was found. Six bunches (7.2%) contained mealybugs (*Pseudococcus longispinus*).

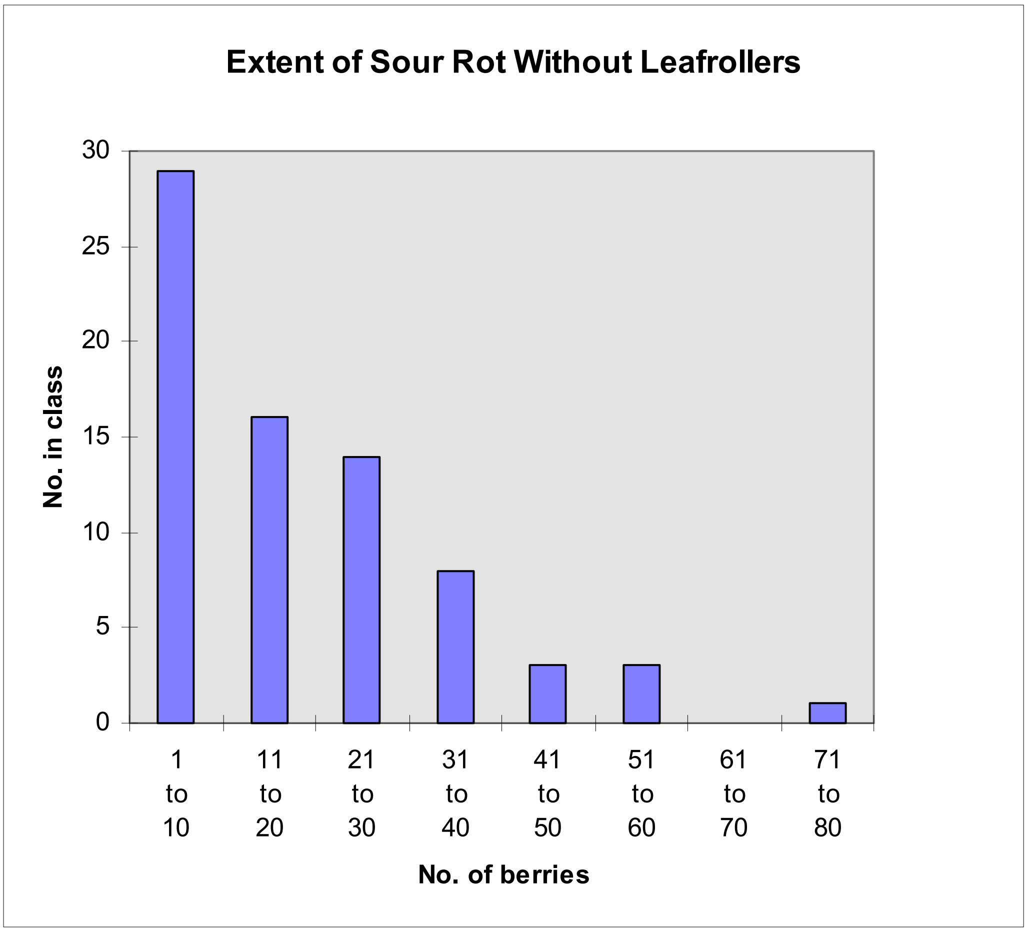

Fig. 7 Number Class distribution of rotted berries in Vineyard J Average number rotted was 16.6 berries

Conclusions

There is a large difference between observed activity and the collected caterpillars(fig. 1) in vineyard I, suggesting greater losses of caterpillars at this stage than observed previously (see Wairarapa and Gisborne reports). As wasp parasitoids are not present in large numbers, caterpillar eating birds may have been responsible. Some bird species (*Zosterops lateralis*, Waxeyes) are especially adept at removing leafrollers from their shelters. The only significant catches of caterpillars are found in March, after the nets would have gone up, protecting any remaining caterpillars from the attentions of the birds.

Most of the diseased bunches from vineyard I contain few (1-10) damaged berries if leafroller are absent(fig.4). The much larger number of diseased berries in bunches where live leafroller are present at harvest shows that the presence of a live leafroller at this time can be a potent source of disease. When we examine the results from vineyard J (fig. 7), we find bunches with numbers of diseased berries that exceed the numbers seen with leafroller……….non-leafroller causes of disease can be equally effective in knocking out berries.
A growers attention may well be drawn to the most heavily damaged bunches ….these are more likely to be the bunches with live leafroller. The much more numerous bunches with a few rotted berries may not receive the same attention and

the grower may then not observe that these more numerous but more lightly rotted bunches are free of leafroller.

The successful completion of leafroller development in the bunches in vineyard I may in part be due to the absence of *Goniozus jacintae* (table 1), the specialist wasp that prefers to hunt leafroller in the bunches.

I would like to suggest an hypothesis to explain the difference between the incidence and severity of rots in the two vineyards (not attributable to leafrollers) This difference may be due to the nature of the inter-rows (grass and gravel). More work is needed on this possibility. Both vineyards are in the same Hastings region and are separated by a very short distance. Blocks of the same variety (Sauvignon blanc)were compared. The only obvious difference between the two sites is the nature of the inter-row area, grassed in vineyard I and stony and devoid of grasses in Vineyard J…..this was reflected in the vineyards name. Vineyard J felt hotter than vineyard I while the samples were being collected, the higher temperature generated by the thermal properties of the gravels between the vines in vineyard J. The fruit in vineyard J also appeared to develop faster than in I. Cap-fall was complete on the 13th December in J, but had reached only 80% complete in I. Many split berries were observed in February in vineyard J, but not in vineyard I. The split berries allowed the appearance of the disease and the appearance of the splits was independent of the activities of the leafrollers.

I recommend that thought be given to investigating the effect of sward and soil on the incidence of disease in Hawkes bay vineyards to test this hypothesis.

Acknowledgments

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References

Cameron P.J. (1989) *Helicoverpa armigera* (Hubner), Tomato fruitworm (Lepidoptera: Noctuidae) in “A Review of Biological Control of Invertebrate Pests and Weeds in New Zealand 1874 to 1987” eds. P.J. Cameron, R. L. Hill, J. Bain, W. P. Thomas CAB International