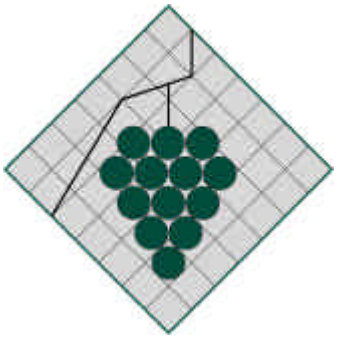
PDMS
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Biological control of Lightbrown Apple Moth (*Epiphyas potvitanna*) in the Adelaide Hills.

FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **RT 02/18-3**

Principal Investigator: **John Jeffs**

Research Organisation: **Pest & Disease Monitoring Services**

Date: 31st of August 2003

FINAL REPORT

RT 02/18-3
Biological control of Light Brown Apple Moth (Epiphyas potvitanna) in the Adelaide Hills
18 September 2003

1. Executive Summary.

The biological control of the Light Brown Apple Moth by larval parasitoid wasps was researched in five vineyards in the Adelaide Hills. Of the five vineyards, four were Chardonnay and one was Sauvignon Blanc. Fortnightly monitoring of 100 shoots per hectare (chosen at random) were monitored from shoot tip to cordon for the presence of LBAM larvae and egg masses. Larvae were then dissected under a microscope to determine if they had been parasitised or not. Dissections allow quick determination of LBAM larvae to see if they have been parasitised or not however, this method is terminal for both the LBAM larva and the parasitoid larva. This results in the parasitoid larvae not being able to be identified.

LBAM pressure was a great deal less in the Adelaide Hills in 2002/2003 compared to 2001/2002. Only one of the five vineyard warranted spraying to control LBAM although three of the five sprayed despite LBAM levels being of no real concern for the season. This unwarranted spraying probably resulted in less LBAM larvae and therefore a smaller sample size.

This research found that parasitism levels of LBAM larvae varied from 0% to 100% which shows exactly how much of an impact parasitoid wasps are having on LBAM larvae. As a result of this project, further research could also be done to determine what level of LBAM larval parasitism is required to have an impact on a particular LBAM generation and therefore potential damage. Another interesting topic which could be researched further is what percentage of LBAM larvae in bunches would be safe to leave untreated depending on the level of LBAM larval parasitism. This research has already been done in other crops such as Brassica's.

2. Background.

Epiphyas postvitanna (Walker) (Lepidoptera: Tortricidae) Light Brown Apple Moth (LBAM) is a native moth that has a wide host range including broad leaf weeds, native plants and horticultural crops such as wine grapes. It is considered to be a major pest in wine grapes with a particular preference for Chardonnay and Pinot varieties which are commonly grown in the Adelaide Hills.

LBAM can cause significant crop loss as it feeds on leaves, inflorescences and bunches. Chewing damage to flowers, young berries and bunches can significantly decrease yields and also increase the potential for latent Botrytis infection. This may result in further spraying and crop loss due to Botrytis. The caterpillars webbing also makes it very difficult to penetrate bunches with sprays.

Pest and disease monitoring is being widely adopted by the wine grape industry which is providing vineyard managers with a lot more information enabling them to make better spray decisions. Pheromone lures, traps, *Trichogramma* releases, biological and cultural controls are currently used by vignerons to control LBAM.

Chemical control is still mainly used to keep LBAM at tolerable levels which are quite costly and potentially damaging to the consumer, spray applicator, environment, and beneficial insects. Chemical control also risks Australia's clean green image should an MRL be exceeded. In order to protect Australia's clean green image, the Australian Wine Research Institute has restricted the use of most insecticides to 80% cap fall. This makes it very difficult to control LBAM between 80% cap fall and harvest which is when there is significant pressure from the summer generation of LBAM in the Adelaide Hills. *Bacillus thuringiensis* type sprays are commonly repeatedly used after 80% cap fall with various results as it is difficult to penetrate bunches with sprays and to detect young LBAM caterpillars and egg masses. This can be a costly exercise in both time and money. An option during this period is not to spray if monitoring determines

damage potential is low due to low pest numbers and/or high levels of control from natural enemies.
There are many natural enemies which help to keep LBAM in check such as lacewings, ladybirds, predatory shield bugs, spiders, the egg parasite *Trichogramma spp*. the larval parasite *Dolichogenidea tasmanica* and *Voriella uniseta* and the pupal parasite *Brachymeria phya* (Baker and Bailey, 1999). The combined effect of all these beneficial insects can have a significant impact on LBAM levels and should be conserved by monitoring and minimising the use of toxic chemicals in the vineyard.

Dolichogenidea tasmanica is a small black solitary parasitoid wasp of LBAM larvae and can significantly reduce their levels. In order to determine the level of LBAM parasitism by this wasp, I have dissected LBAM larvae under a microscope and searched for eggs/larvae of the wasp. LBAM larvae from two Eden Valley vineyards in 2001/2002 were dissected two and four weeks prior to harvest which deduced that forty to fifty percent of the larvae had been parasitised. White cocoons in bunches and leaves from parasitised LBAM larvae were continually found in both patches throughout the season. Often more cocoons were found than LBAM larvae hence prompting me to dissect the larvae. *D. tasmanica* has also shown to be one of the most common and useful wasp species for Leafroller control in winegrapes in Gisborne New Zealand. The combination of *D. tasmanica* and *Goniozus jacintae* have controlled 100% of leafrollers in a vineyard in Gisborne (Clearwater, 2000).

Pest and Disease Monitoring Services also dissects Diamondback Moth (DBM) larvae in brassicaceous crops thanks to the training from Mike Keller and the S.A.R.D.I. Entomology Department. Research is currently being performed on the effects of larval parasitism on DBM populations in brassicaceous crops at The University of Adelaide (Waite Campus) and several overseas countries in Asia. Knowing the percentage of parasitised LBAM larvae throughout the growing season is an area which would greatly benefit vineyard managers and the wine grape industry also. This information as not been available to vineyard managers before and would therefore help to decide if a control is warranted, and what impact it would have on *D. tasmanica* levels. Managers could therefore save time, money, beneficial insects, protect the environment and help maintain Australia's clean green image. Adelaide Hills growers are also under threat from the urban sprawl which is another reason why insecticides need to be decreased.

The results from this research can be easily applied to other grape growing regions which also suffer from crop loss due to LBAM and have shown signs of *D. tasmanica*. This would include areas such as Eden Valley, Barossa Valley, McLaren Vale and Langhorne Creek. I have seen significant levels of parasitised LBAM caterpillars i.e. more parasitised larvae than unparasitised larvae in these regions.

3. Objectives.
The objective of this project is to determine the level LBAM parasitism in five separate vineyards from around budburst to harvest in the Adelaide Hills.

4. Method.
Five vineyards were selected of which four were Chardonnay and the remainder was Sauvignon Blanc. Fortnightly monitoring of 100 shoots per hectare (chosen at random) were monitored from shoot tip to cordon for the presence of LBAM larvae and egg masses. Monitoring would begin around budburst and finish at harvest. When LBAM egg masses were found, they were circled with a pen and flagging tape was tied to the shoot. On the tape was written the colour of the egg mass and the date it was found. This made it a great deal easier to find during the next inspection, and to help determine egg mass development.

When a LBAM larvae were found, they were kept in a vial and then placed in a chilled esky to ensure their survival throughout the day. Larvae were then dissected under a 10X microscope to determine if they had been parasitised or not. Dissections allow quick determination if the LBAM larvae has been parasitised or not however, this method is terminal for both the LBAM larva and the parasitoid larvae therefore the parasitoid can' be identified.

5. Results/Discussion.

LBAM pressure was significantly lower in season 2002/2003 compared to the previous season. PDMS monitors around 700 hectares of wine grapes of which only 2 blocks of Chardonnay were recommended to spray for LBAM in 2002/2003. One block was in the Adelaide Hills and the other in Lyndoch Valley. This is a great deal less compared to the 2001/2002 season.

All five vineyards involved this research experienced varying levels of LBAM activity in the 2002/2003 growing season. LBAM levels increased in general as the season went on. Maximum LBAM levels ranged from 12% of bunches with a LBAM larva for Vineyard A to a 2% for Vineyard C and D see figure 1.

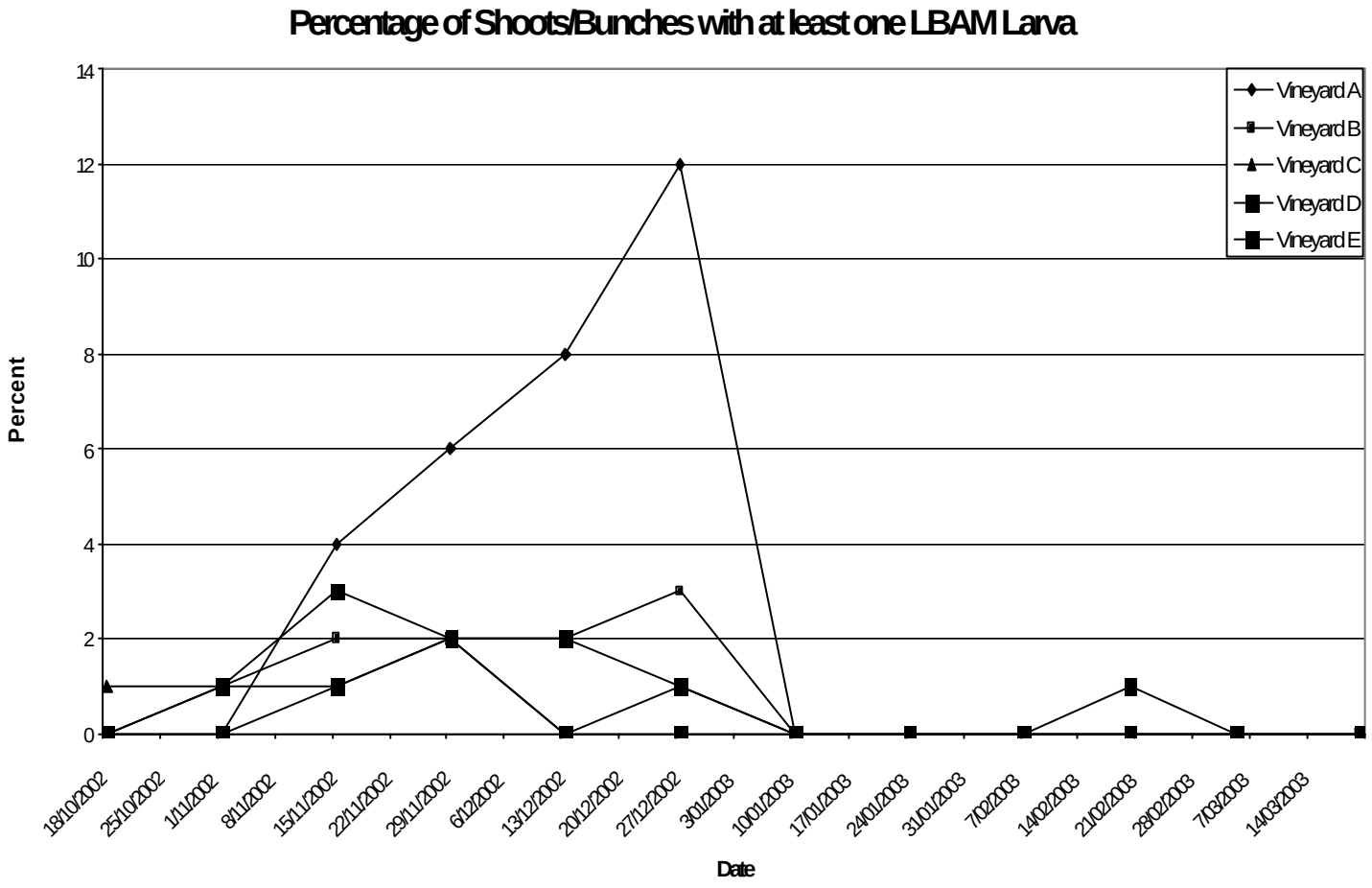


Figure 1. Percentage of shoots/bunches with at least one LBAM determined by fortnightly monitoring.

The only vineyard that warranted a control according to the monitoring by P.D.M.S. was Vineyard A. Avatar was applied in early January which resulted in effective control of LBAM and no more LBAM larvae were found (see figure 2).

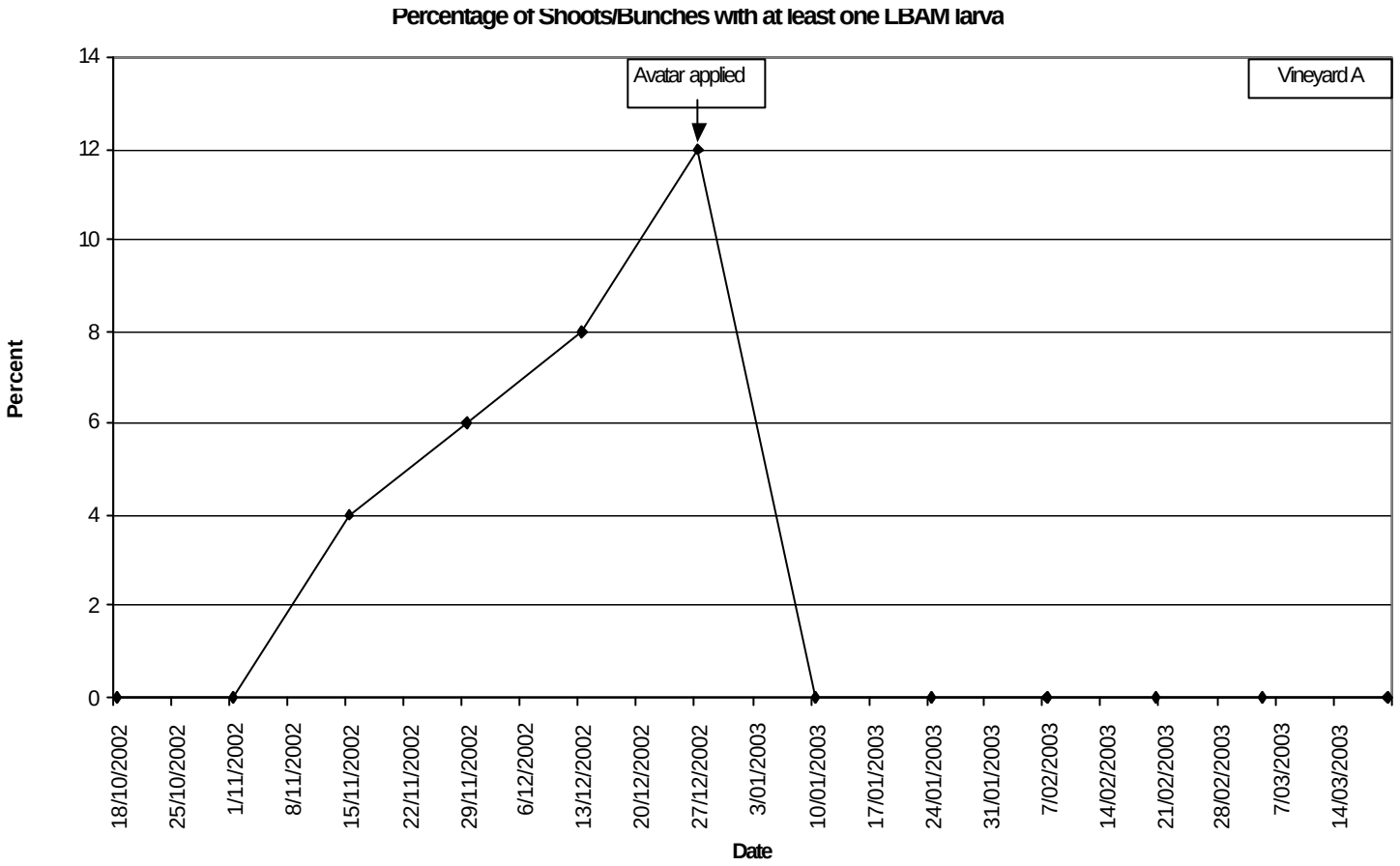


Figure 2. LBAM controls applied in Vineyard A.

LBAM levels remained low in the remaining four vineyards however, vineyards C, D, and E all applied controls for LBAM. Vineyard C sprayed with *Bacillus thuringiensis* fortnightly early in the season (see figure 3), Vineyard D sprayed with Mimic during flowering (see figure 4) and Vineyard E sprayed Avatar in mid December and again in early January (see figure 5).

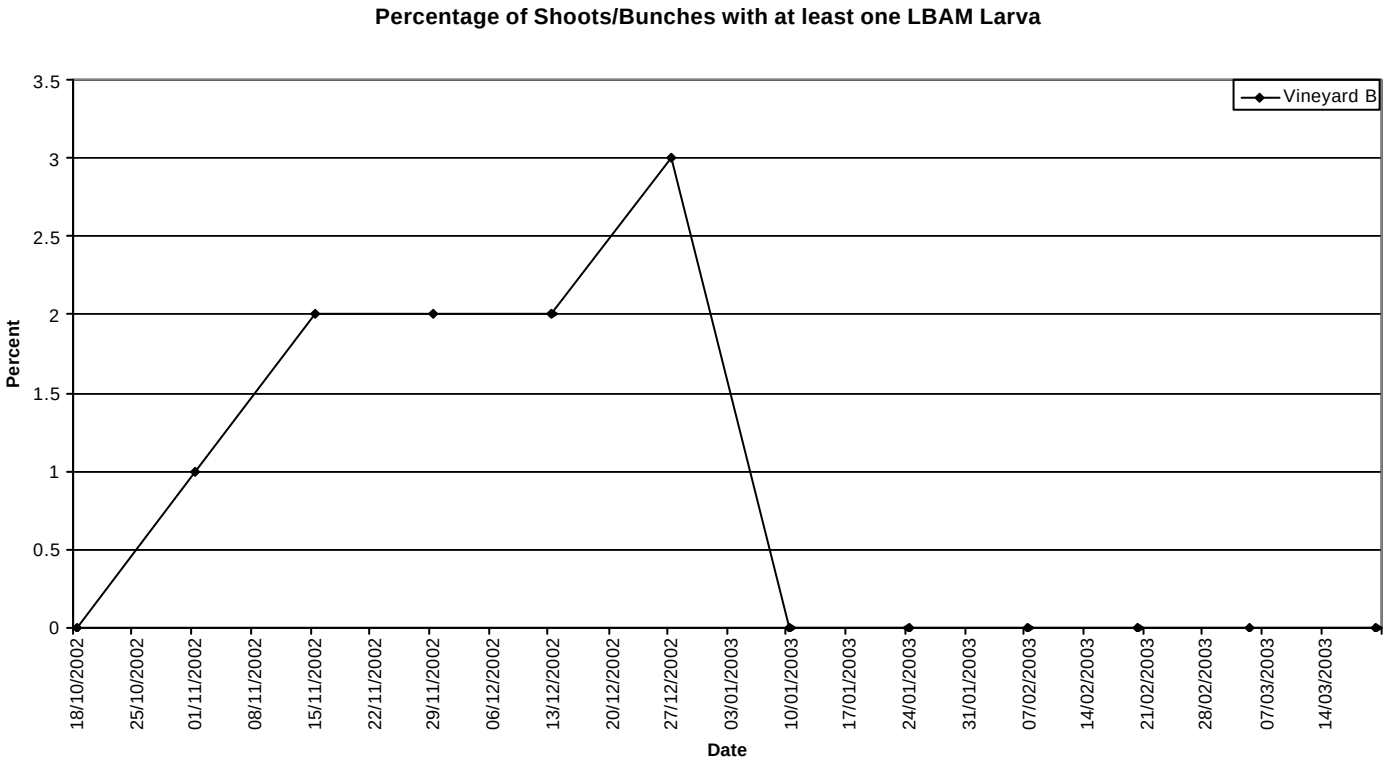


Figure 3. LBAM levels in vineyard B.

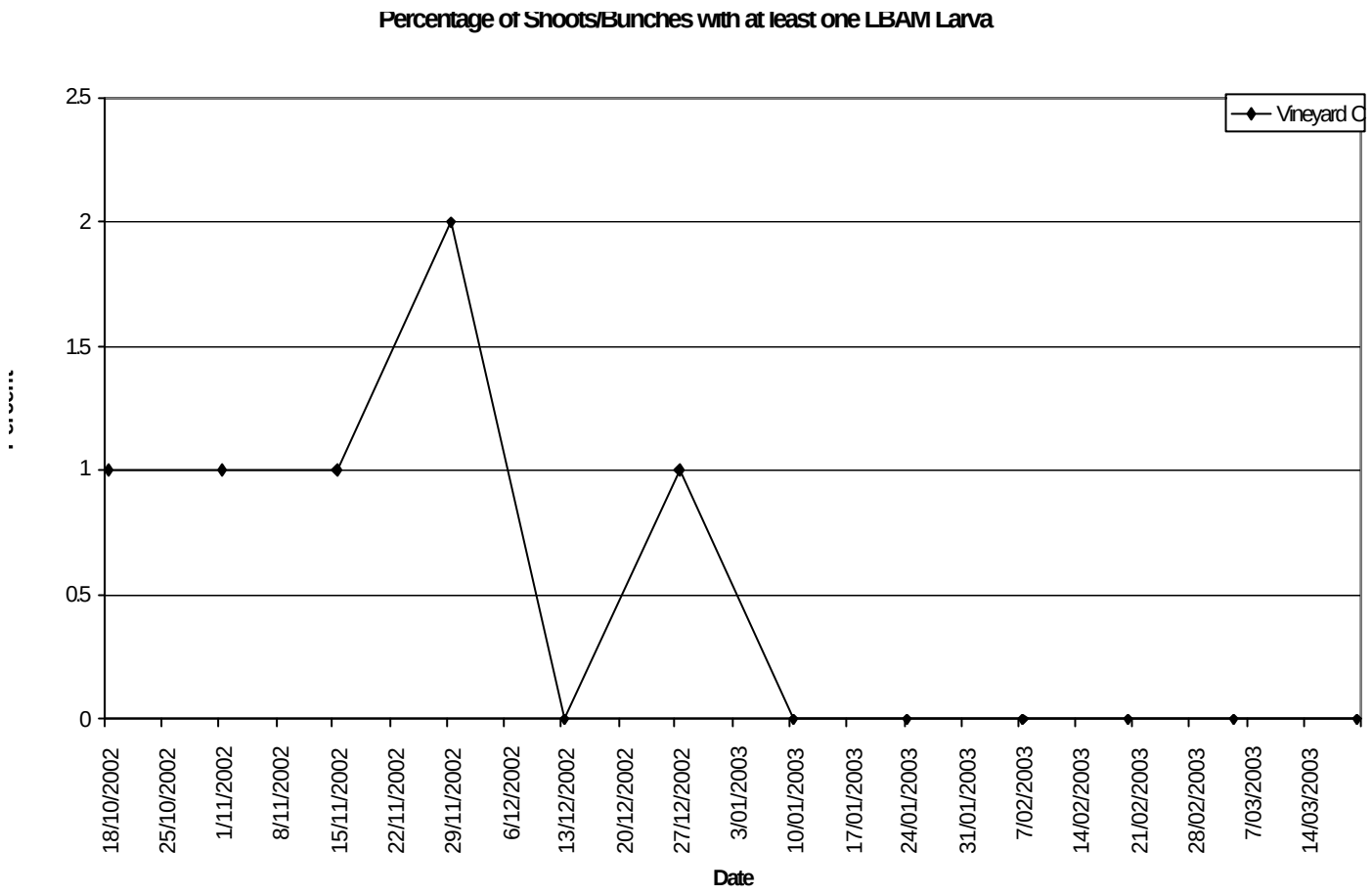


Figure 4. Controls applied for LBAM in vineyard C,

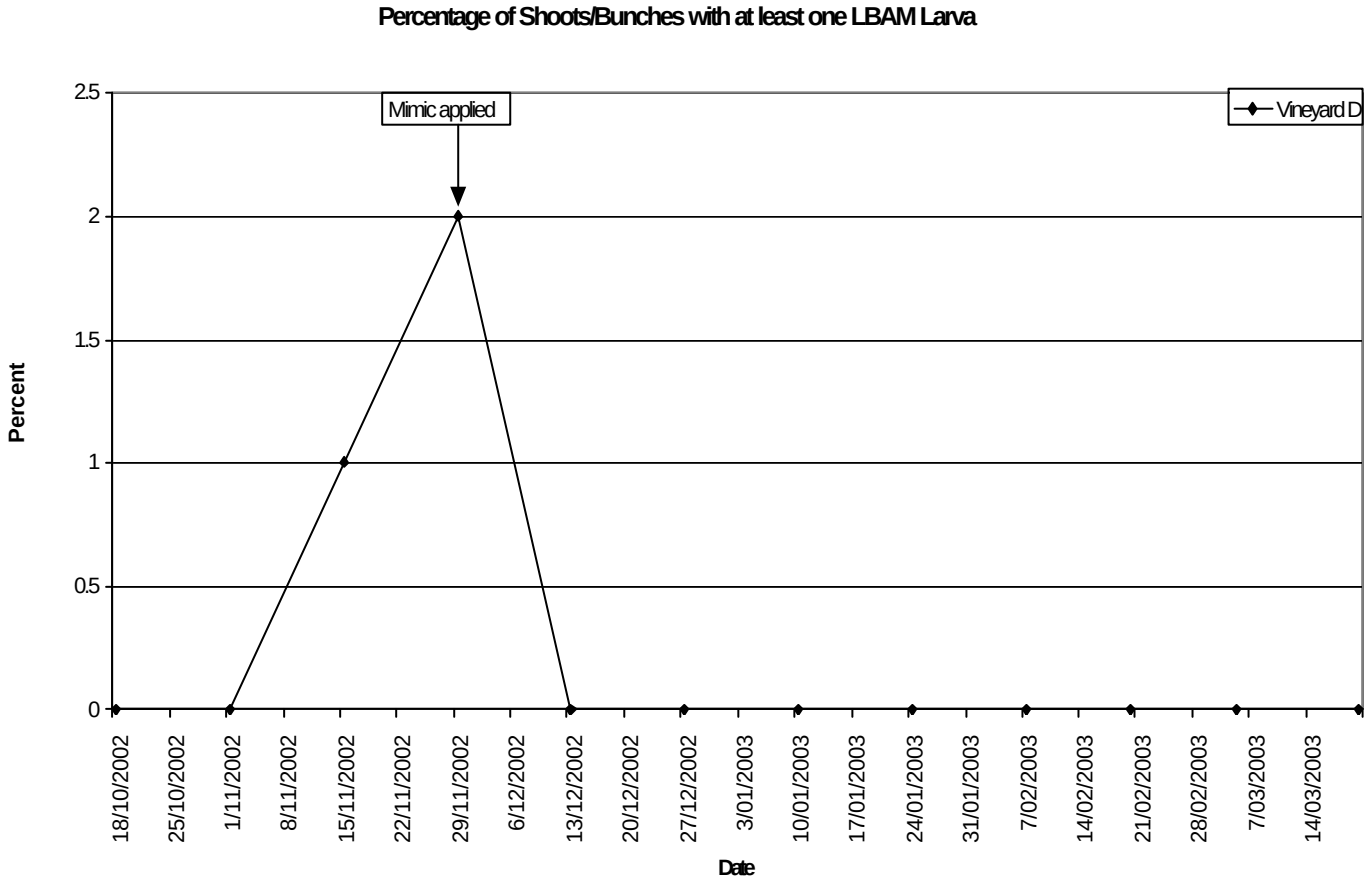


Figure 5. Controls applied for LBAM in vineyard D.

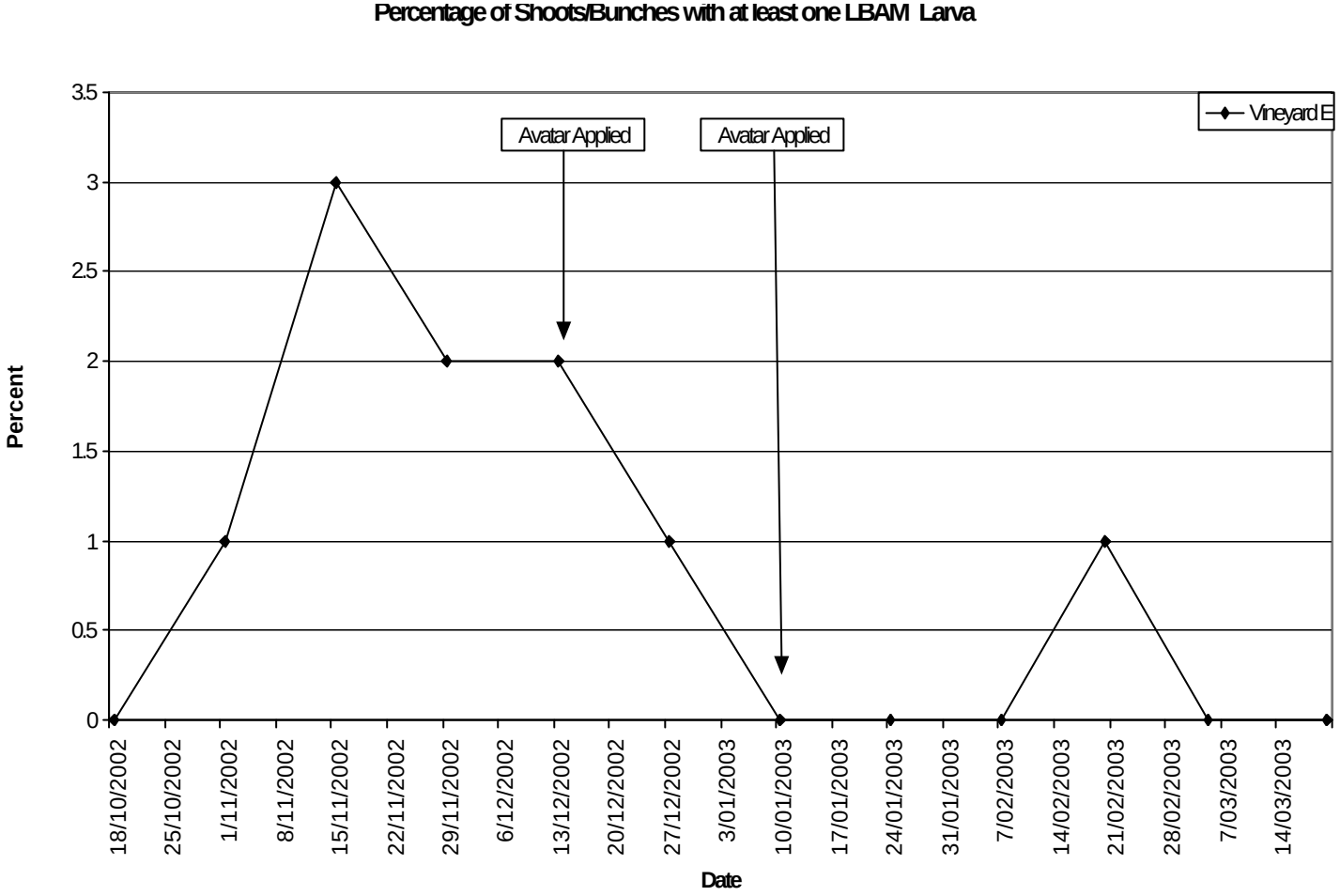


Figure 6. Controls applied for LBAM in vineyard E.

Many beneficial insects have an impact on LBAM throughout its lifecycle. The main predators would be Spiders, lacewings and the Predatory Shield Bug (*Oechlia schellenbergii*) while common parasites include the egg parasite *Trichogramma*, larval parasites *Dolichogenidea tasmanica* and *Voriella uniseta*, and the pupal parasite *Brachymeria phya* (Baker and Bailey 1999). As this project involved dissecting LBAM larvae under a microscope, the identification of the parasite larva was not possible.

LBAM larval parasitism varied from 0% in vineyard D up to 100% in vineyard E. These results can be misleading due to the small sample size.

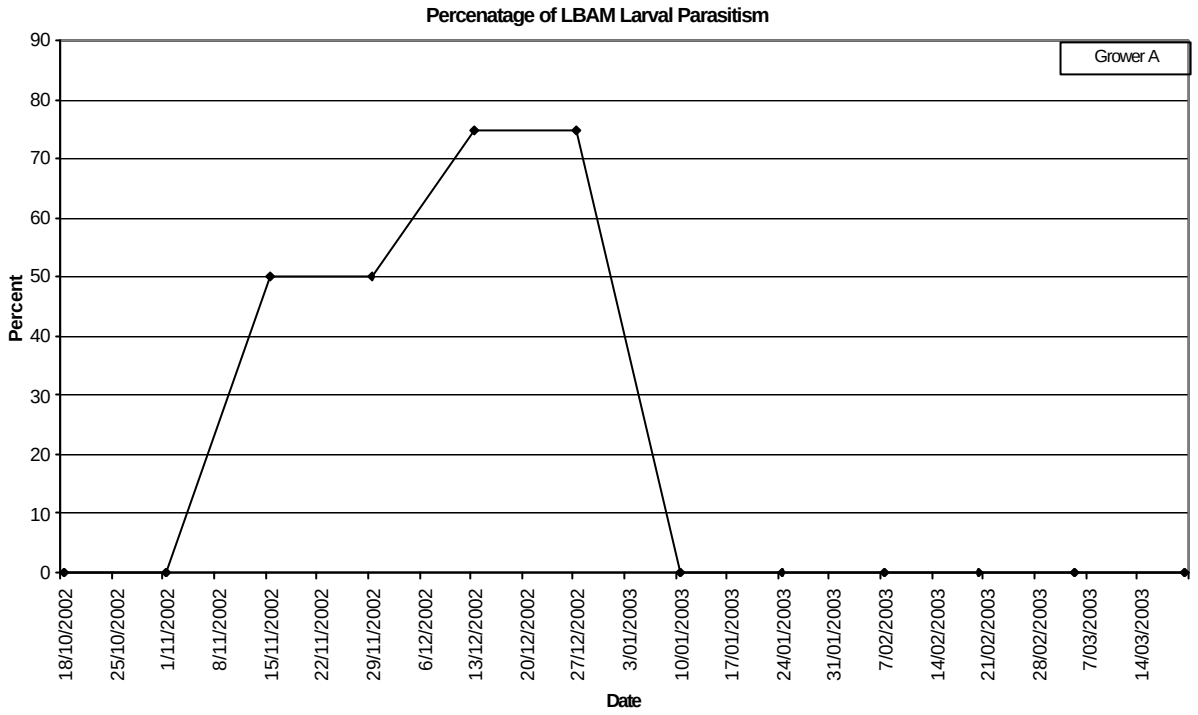


Figure 7. LBAM larval parasitism in vineyard A.

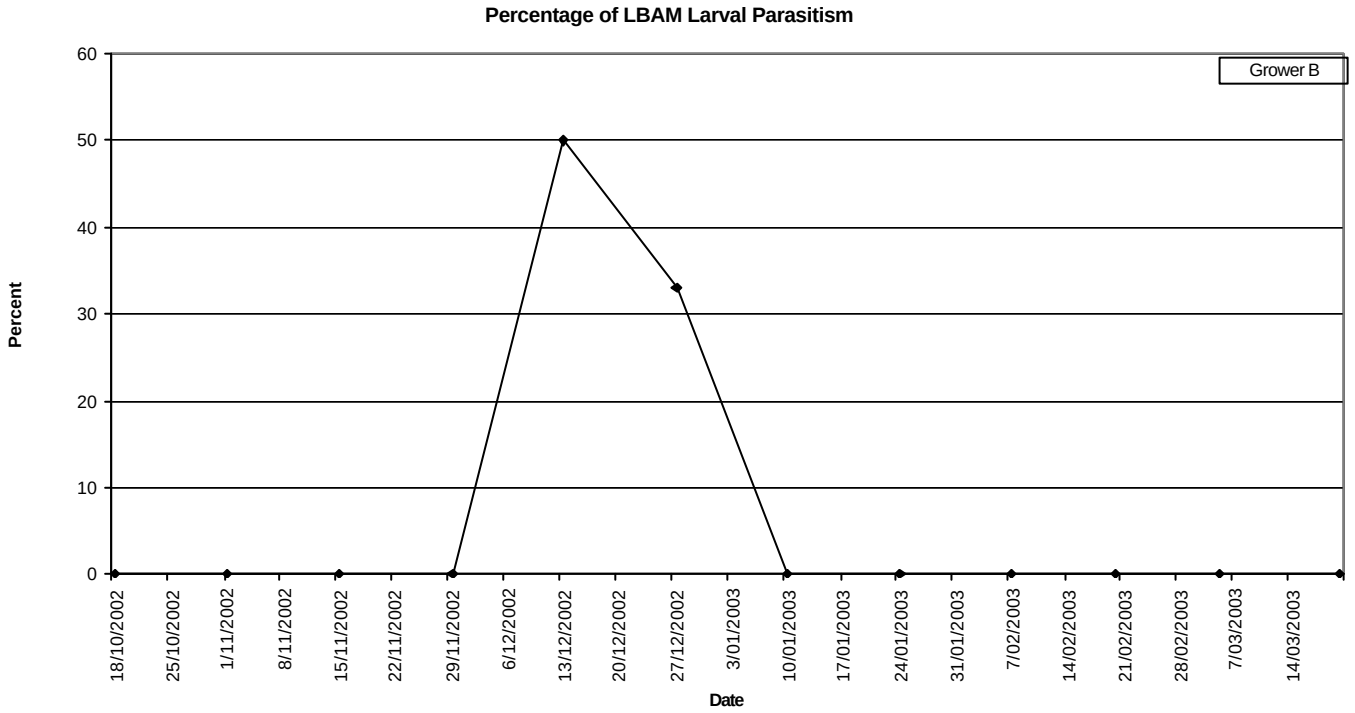


Figure 8. LBAM larval parasitism in vineyard B.

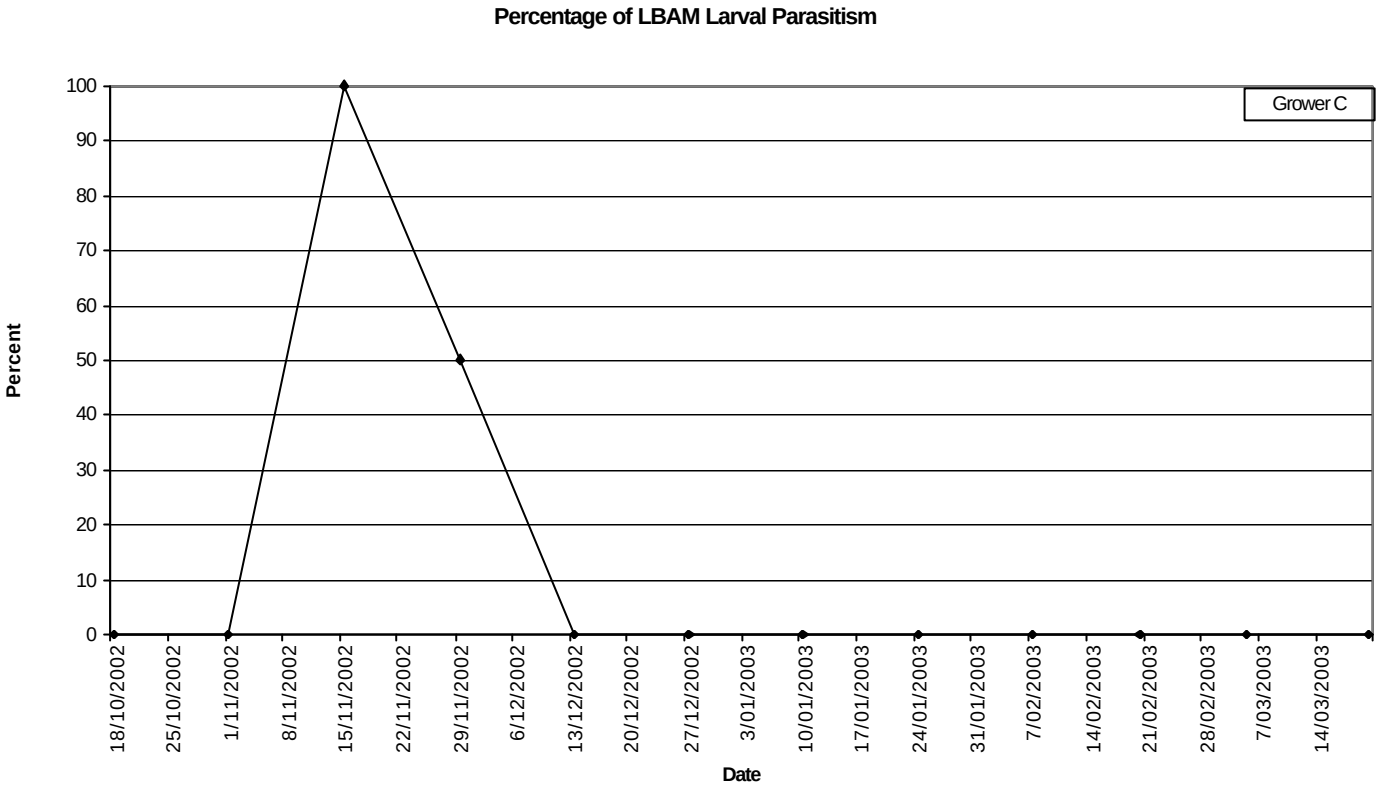


Figure 9. LBAM larval parasitism in vineyard C.

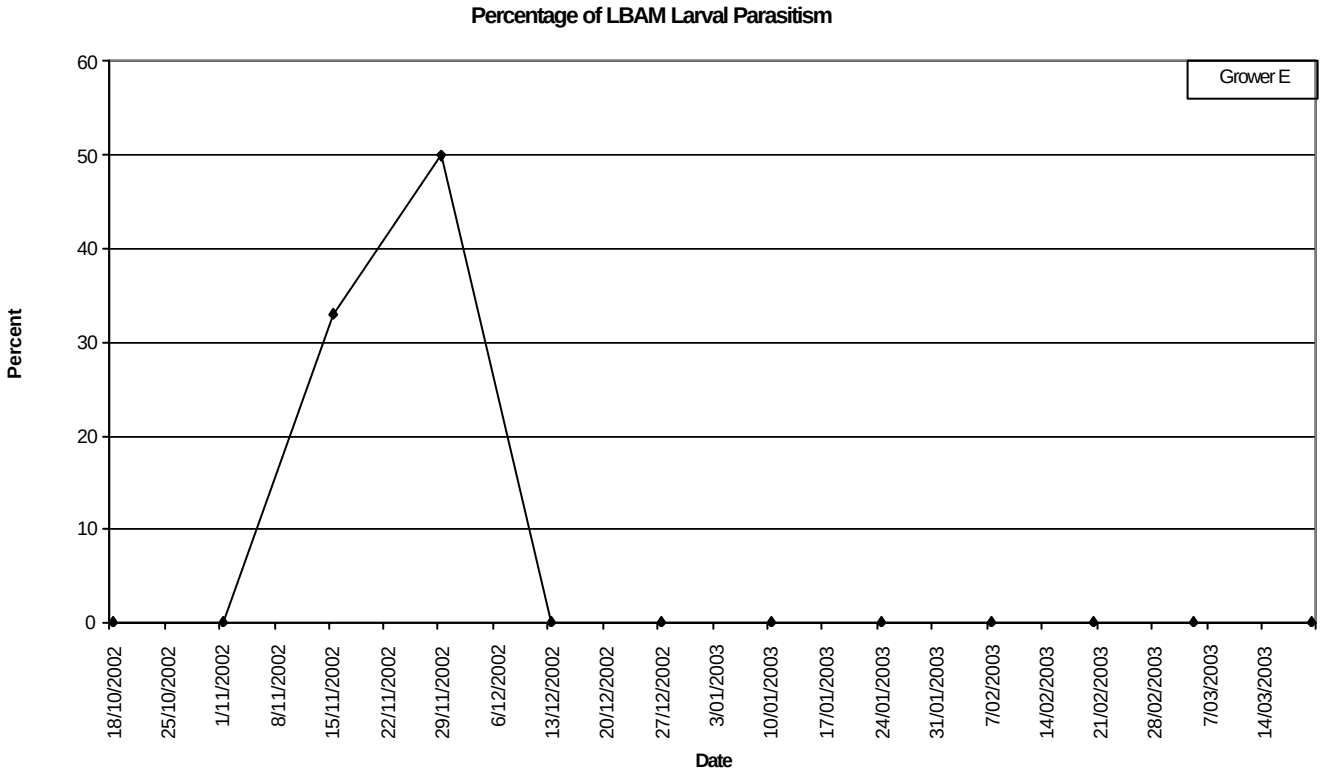


Figure 10. LBAM larval parasitism in vineyard E.

7. Outcomes/Conclusion

All vineyards involved in the research experienced LBAM pressure at different levels throughout the 2002/2003 season. Only one vineyard (vineyard A) had high enough numbers of LBAM larvae to warrant control according to PDMS monitoring and thresholds. Vineyards C, D and E still sprayed for LBAM regardless of their low numbers. These sprays would have resulted in less LBAM larvae to dissect and therefore a smaller sample size for these vineyards. It was interesting to note that the controls decreased LBAM larvae numbers but parasitism of the LBAM larvae still occurred. The persistence of the parasitoids may have been due to the use of 'softer' insecticides being used i.e. Mimic, Avatar and *Bacillus thuringiensis,* compared to more detrimental insecticides.

As you can see in figures 7 to 10, significant LBAM larval parasitism occurred in four of the five vineyards and ranged from 0 to 100%. This method of dissecting larvae has proven to give accurate fast results of the impact of larval parasitoids on LBAM. Vineyard A experienced a moderate level of LBAM larvae in bunches during late December but also had a high percentage of parasitised LBAM larvae. A control was still applied due to the uncertainty of potential feeding damage to bunches, and how long it takes for the larvae to stop feeding if at all when parasitised. These questions warrant further research.

Another outcome of this project was an insight into LBAM control by the five vignerons. Three of the five growers applied chemical controls for LBAM although there was no real concern. This may be due to winegrapes being a high value crop, new softer insecticides with shorter withholding periods and there was also much higher LBAM pressure in the Adelaide Hills and surrounding districts in the previous season.

One thing that could be changed in such a project is to rear out the parasitoid wasps from the LBAM larvae. This would result in the identification of the parasitoid which would help in determining the dominant species and any possible new species. Rearing the parasitoids has a downside as it takes much longer to receive results compared to dissecting the LBAM larvae which gives immediate results.

Further research could also be done to determine what level of LBAM larval parasitism is required to have an impact on a particular LBAM generation and therefore potential damage. Another interesting topic which could be researched further is what percentage of LBAM larvae in bunches would be safe to leave untreated depending on the level of LBAM larval parasitism. This research has already been done in other crops such as Brassica's.

All growers in the Adelaide Hills who are members of the Adelaide Hills Wine Region will receive a copy of this project via email or post. An article will also be published in the Australian and New Zealand Grapegrower and Winemaker magazine.

8. References

Baker, G and Bailey P. 1999. Lightbrown apple moth – our most damaging pest. Australian Viticulture.

Clearwater, J. 2000. Biological Control of Leafroller on Wine Grapes in Gisborne. Clearwater Research and Consulting.