Control of European wasps (*Vespula germanica*) in vineyards by baiting

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A report to the Vineyards Association of Tasmania

REPORT TO THE VINE YARDS ASSOCIATION OF TASMANIA

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Summary

European wasps *(Vespula germanica)* cause significant problems in some Tasmanian vineyards, with losses of up to 6 Tonnes recorded by an individual grower in 2001. Meat baits can be used to indicate the presence and activity of wasps during late February - March , when they are seeking protein to feed their larvae. This feeding activity can be exploited to achieve wasp control without the need to find and destroy nests.. In trial work in northern Tasmania the insecticide fipronil® (Aventis CropScience) at a concentration of 0.05% in fresh meat bait was found to reduce wasp numbers by over 99% within two days.

Further work is needed to investigate the use of alternative meat baits to increase attractiveness to wasps, the timing of control operations and to determine whether there is a threshold sugar content at which wasps are attracted to fruit.

Wasp population lifecycle

European wasps become apparent in spring when young queens emerge from hibernation and search for nesting sites. Most of these young queens die, particularly if the weather is wet and cold. Each surviving queen establishes a nest in a warm, dry area, usually in a bank which faces the sun, but also sometimes in a tree or building. The number of eggs laid by the queen in European wasp nests in England was reported by Spradbery, (1973) as increasing from 7 per day in early December, to 72 per day in early January. The number peaked at 225 in late January and declined to 120 by the end of March (dates adjusted for the change in season between England and Tasmania for ease of comparison.) The first workers emerge in November and the nest increases in number until about April. New queens are produced in February and March, with a maximum of 603 recorded in a single nest (Spradbery 1973). They leave the nest in April to hibernate over winter. The old queen usually dies around this time, followed by the death of the nest. In some cases the nest will survive and over - winter as an active nest. This results in a bigger nest the following year.

Adult wasps require a high energy diet, principally consisting of carbohydrates, including nectar, honey dew and ripe fruit juice. The larvae, however, need protein for development and are fed by the adult workers with premasticated meat and liquid collected in the field (Spradbery, 1973).

This differentiation in feed requirements allows for selective control of wasps by meat baiting, as worker wasps can carry toxic meat back to a nest.

Background

I started the Tasmanian research on wasps in 1999 with a small trial designed to replicate work published by a New Zealand scientist (Spurr, 1996). The technique uses meat bait which is carried back to the nest by worker wasps to feed larvae. Poison is therefore introduced directly to the nest. This initial trial using fish as bait resulted in a 92% reduction in wasp numbers but posed two problems. Firstly, Sulfuramid, the insecticide used, was not registered in Australia, and secondly, mammals, in this case quolls, ate the baits each night.

In 2000 I conducted further trials using different protein baits and attractants suggested from American literature (Jandolt, 1998). I also worked on developing a feeder which was acceptable to wasps but kept the baits inaccessible to mammals.

From a range of meat baits with or without attractants it was obvious that wallaby meat was the most attractive. For example at one site the standard fish bait had an average of 87 wasp visits / 10 minutes, while wallaby meat had 258.

Work in one vineyard indicated the potential for significant losses of production, particularly in late - picked fruit as this is the period when wasp numbers are peaking and demand for sugars is greatest.

An application was made by the Vineyards Association of Tasmania (VAT) to the Grape and Wine research and Development Corporation for funding to continue this work.

VAT Survey

In 2000 a survey form was included in a VAT newsletter to assess the perceived effect of wasp damage to fruit. Of the 14 replies, from throughout the state, all except 1 considered wasps to be a problem and the following estimates of yield loss were recorded (Table 1).

Table 1 Reported losses 2000

% loss	Not Reported	0	0 - 2 %	2 - 5 %	> 5 %	Total
Number of respondents	2	3	4	4	1	14

Perceived damage appeared to be spread over a number of varieties, without any one standing out as more preferred than others.

A similar survey in 2001 (Table 2) showed more reports of greater damage than the previous year, with losses of up to 60% (6 Tonnes of fruit) in one block of one vineyard, and an overall 50% loss in another vineyard.

Table 2 Reported losses 2001

% loss	Not reported	0	0 - 2%	2-5%	5-15%	> 15%	Total
Number of respondents in the first 2 weeks	2	5	6	1	6	9	29

The increase in perceived damage may be a consequence of the increased number of wasps present in the state in 2001, or an increased awareness of the problem, rather than a specific increase in numbers in vineyards. However, it demonstrates the potential for loss which can occur.

Of the respondents who reported damage, varieties most affected were Pinot Noir 15 reports, Chardonay 7, Pinot Gris 4, Savignon Blanc and Traminer 2, and Reisling, Schonenberger and Mullerthurgau 1 report each. Most growers listed more than one variety being damaged while 6 reported no difference in degree of attack from the previous year.

Current research

Sites

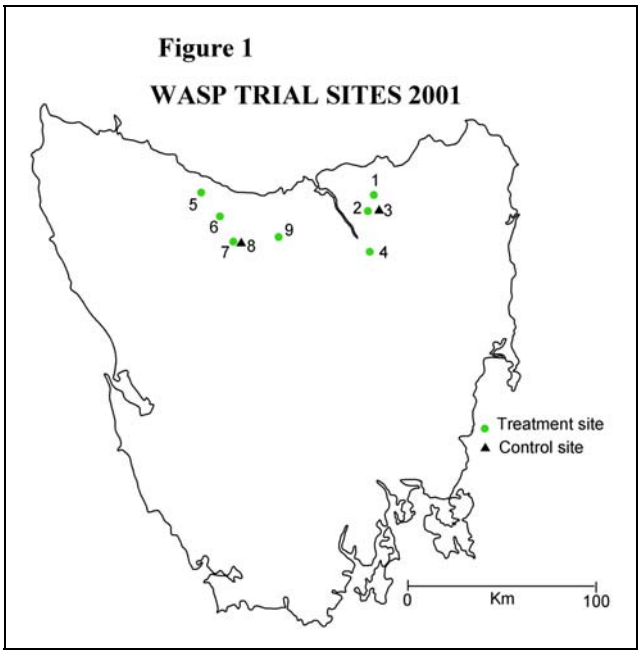
Based on previous work and losses reported in the 2000 survey, a number of sites across the north of the state were selected (Fig 1).
The sites were

1 A vineyard where wasps had been a problem, but several nests had been destroyed the previous season.
2 A vineyard where wasps were reported to be in large numbers early in the season.
3 A monitoring site where no control was applied.
4 A vineyard where damage in late grapes had occurred the previous season.
5 A developing vineyard with significant losses in the previous season.
6 An established vineyard with significant losses in the previous season.
7 A reserve area with a history of high wasp numbers where trial work had previously been conducted.
8 A monitoring site where no control was applied.
9 A vineyard with losses in the previous year but where several nests had been destroyed.

Methods

At each site, 4 mammal - proof feeders developed in the previous years trials were established at random. Starting in early February, fresh wallaby meat was placed in each feeder. Twenty four hours later the number of wasps entering each feeder in a 10 minute period was counted. The procedure was repeated at 14 day intervals, except for a count 2 days post - poison treatment. Poisoning was carried out by using

wallaby meat containing 0.1%, 0.05% or 0.025% (w/w) fipronil (Aventis CropScience) prior to grape picking.



Timing of control was selected to minimise reinvasion by wasps and the possible subsequent difficulty in attracting those wasps to baits due to the increase in alternative food available to the reduced population.

This technique does not estimate the total number of wasps present in an area, but rather the collection of protein for feeding larvae and therefor the breeding activity of nests in the area.

Results

The wasp numbers counted at each feeder were averaged and the results are shown in Table 3 while those with the highest wasp numbers (*) are summarised in Fig 2.

Individual sites

1 In this area there were few wasps recorded during the trial, and little damage reported. Destruction of nests in the previous season appeared to have removed the wasp population. No control was carried out.

2 This vineyard was reported as having "large numbers of wasps" by a worker in early February. The population attracted to feeders rose rapidly, but dropped to less than 1% following control with 0.05% fipronil. At picking there was still a low wasp population present.

3 A house and garden surrounded by paddocks where the owner was prepared to allow monitoring of the wasp population. The numbers counted show the typical pattern of wasp feeding activity through the breeding season.

Table 3 Mean number of wasps / 10 minutes ± standard error)

	SITE								
	1	2*	3*	4*	5	6	7*	8*	9*
	Vines	Vines	Control	Vines	Vines	Vines	Reserve	Control	Vines
6-Feb	0±0			9±3	0±0	0±0			0±0
20-Feb	0±0	57±35	5±2	7±1	0±0	0±0	9±2	56±21	0±0
7-Mar	3±2	137±62	98±30	46±29	2±2	1±1	50±6		16±3
12-Mar							93±50 Poison	107±10	
14-Mar							1±1		
18-Mar					12±6	10±4	2±1	120±43	76±66 Poison
19-Mar				35±7 Poison					
20-Mar	2±3	262±80 Poison	162±42						
22-Mar		2±2		10±4					
1-Apr					5±6	6±5	0±0	38±20	2±3
7-Apr	1±3	0±0	80±7	1±1					
29-Apr			30±5						

4 A vineyard where damage had been extensive in late picked grapes during the previous season. In mid March a wasp nest in the vicinity of the monitoring site was found and destroyed. This probably accounted for the decline in numbers prior to poison being used. A 70% reduction in remaining numbers was achieved with 0.025% fipronil. Wasp damage still occurred in grapes in a block distant from the area where control was applied.

5 A vineyard under development which had a 50% loss in the previous season. Wasp numbers remained low this year, despite the owner finding and destroying a number of nests around the area in late March. Fruit damage began when grapes split prior to ripening as a result of heavy rain.

6 A vineyard which had suffered significant damage in 2000. Wasp numbers at feeders remained low despite attack of fruit split following heavy rain. As the owner reported the presence of wasps in the vineyard during the trial period, it is possible that wasps in this area were not attracted to the bait used.

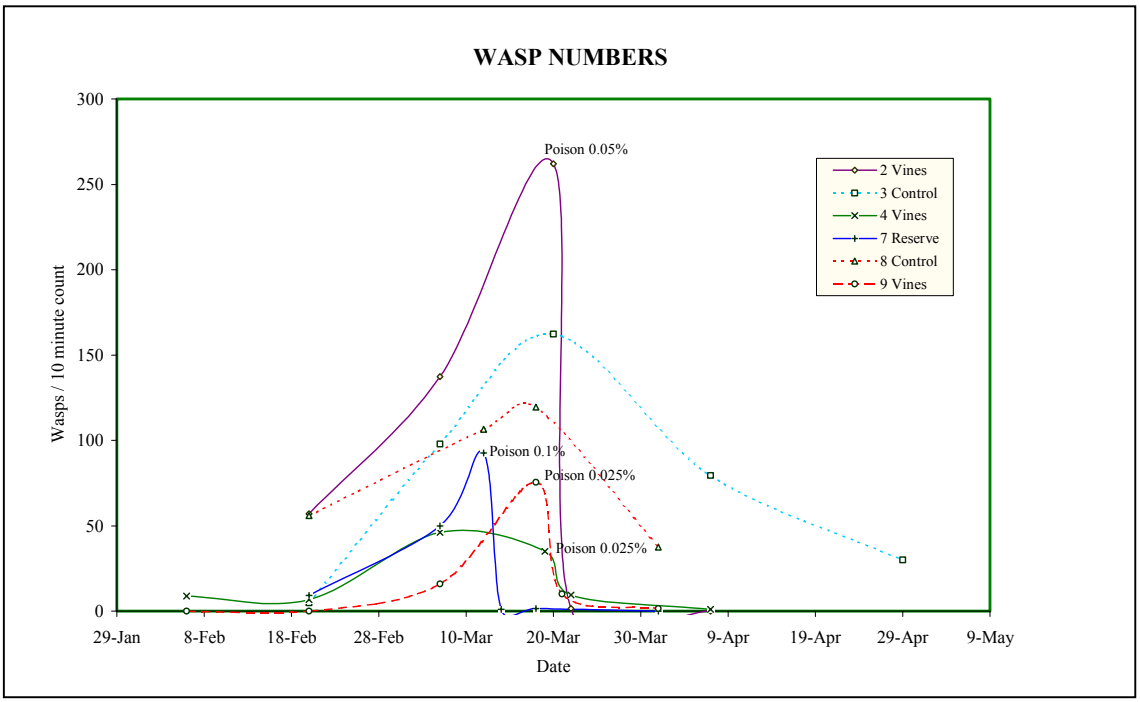
7 A reserve area where wasp control had been carried out in the two previous seasons. Following control wasp numbers dropped rapidly to less than 1% of the pre treatment population with use of 0.1% fipronil in the bait, and remained low.

8 A bush area where reserve rubbish is routinely dumped. Wasp numbers at feeders showed a similar pattern to that found at the other control area (3).

9 A vineyard where wasp numbers initially stayed low but increased in March. Rain prevented an immediate post control count, but two weeks post control

with 0.025% fipronil wasp numbers were reduced by 95% of those pre control. At similar times, the reduction at site 7 was only around 70%.

Figure 2



Discussion

For this research trial sites were selected initially from responses to a 2000 survey. The vineyards selected here had suffered significant damage in the previous year, or a number of nests had been found and destroyed. From other work it appeared that although wasp numbers fluctuated, they tended to be present in affected areas from year to year. In vineyards, however, this may not be the case as destruction of nests in 2000 appeared to affect numbers in 2001, with the result that a number of areas selected did not have a large wasp population.

In the areas where wasp populations did build up, the use of fipronil in meat baits resulted in a rapid and significant decline in numbers. This result is similar to earlier New Zealand research, where a 99.7% reduction in wasp colony activity occurred within 6 days of fipronil baiting (Harris and Etheridge, 2001).

The sensitivity of European wasps to fipronil was demonstrated in a bioassay technique by Harris and Etheridge (2001) as individual wasp larvae did not emerge from the pupal stage if they had been given a dose of 0.05 µg of fipronil. Individual colonies in fact needed only 0.2 g of fipronil to reduce activity by more than 90%.

It is apparent that fipronil baiting prior to grape ripening can be an effective method of wasp control in vineyards. The technique does however depend on monitoring wasp numbers to determine whether a wasp population is present in significant numbers. Prior to grape ripening wasps are interested in meat to feed to larvae as the nest population increases and show no interest in developing grapes. Ripening of grapes occurs at the time wasp numbers are at their maximum, but when egg laying and

therefore larval numbers are reducing rapidly. Foraging wasps are more interested in carbohydrates and sugar to feed themselves than protein for their young, so they will not take meat baits. A monitoring system in late February - early March during the wasp build - up phase (see Fig. 2) will identify potential problems, and allow time for control to be initiated. The discovery of a second, similar, species of introduced wasp, the English wasp (*Vespula vulgaris*) in the southern Tasmanian forests (Matthews et al. 2000) could result in increased wasp numbers in the state if this species spreads widely.

Future research

In 2002 research will concentrate on

1 The development and trialing of alternate meat baits to increase acceptability of these baits to wasps.
2 Timing of control operations to minimise the number of wasps present at grape picking
3 An investigation of the timing of wasp attraction to grapes in relation to variety and sugar content.

Extension of information

An article has been written for the Vineyard's Association newsletter, and a talk is planned for a technical field day later in the year. A radio interview was conducted in May for the ABC Rural Report and an article was published in Tasmanian Country following an interview by a journalist.

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Acknowledgments

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