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A FIELD STUDY ON THE CONTROL OF EUROPEAN WASP *VESPULA GERMANICA* (HYMENOPTERA: VESPIDAE) AND PAPER WASP *POLISTES* SP. (HYMENOPTERA: VESPIDAE) USING A NOVEL AQUEOUS POWDER FORMULATION

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Abstract European Wasp, *Vespula germanica* (F.), was first noted in Tasmania in 1959, and in Victoria in 1977. It is now widespread over the cooler and wetter areas of the southern part of Australia. The Australian winters are mild, and whole nests can overwinter leading to high wasp populations in some places. Early attempts at eradication have been abandoned, and nests are controlled when they cause a problem. The object of this study was to investigate the activity of Sorsec Wasp Nest Killer. This is a new formulation technology known as an APT or Aqueous Powder Technology. It is well suited to wasp control because it is free flowing, even in damp conditions, and has the potential for good nest penetration and quick knockdown. The trial on European wasps was carried out in Ararat, Victoria, Australia. Twelve nests were located, and a pre-treatment count of the number of wasps entering and leaving each nest in a period of one minute, was made. Five nests were treated with Sorsec Wasp Killer (A.I. 4.0g / Kg d-phenothrin), and five were treated with Coopex insecticidal dust (A.I.10g / Kg permethrin). Two nests acted as controls, and were not treated. Post treatment counts were made 1 hour and 24 hours after treatment. In addition, at 24 hours, the treated nests were excavated, and wasp activity noted. A similar study was carried out on Paper wasp, *Polistes* sp. in Sydney NSW, Australia. Both products gave greater than 98% reduction of both Paper and European wasp activity around the nest after 1 hour, and 100% after 24 h. Control nests remained active throughout the trial period. There were only moribund or dead adults in the European wasps nests, which were excavated, and the nests were effectively killed. Similarly for Paper wasp, there was no adult activity in the nest, and any emerging adults were moribund. The Sorsec Wasp Nest Killer gave excellent results for both European and Paper wasp, in terms of both stopping wasp activity and killing the wasp nest.
Key Words D-phenothrin, permethrin, dust, wasp control

INTRODUCTION

European wasp or German yellowjacket (*Vespula germanica*) is common in Europe and was first accidentally introduced into Tasmania in 1959 (Spradbery and Maywald 1992). The wasp was noted on the mainland of Australia in 1977 and it is now a pest in South Eastern Australia and in the south of Western Australia. It has also spread to New Zealand, South Africa and Chile (Akre 1986). In the cold European winters normally only the queen will survive over winter, however, in Australia workers will also survive and this can lead to large nests, which can contain up to 100,000 wasps the following season. They often form nests underground but will also nest in structures such as wall voids and ceiling spaces. As they can live in close proximity to dwellings they annoy people as they forage for food and water.

The European wasp is aggressive and can give multiple stings. Multiple stings from a large colony could be life threatening and there was one documented case in Australia of a child having severe envenomation from numerous stings (Levick and Braitburg, 1996). However, deaths from wasp sting in Australia have normally been due to an allergic reaction to a single sting. McGain et al. (2000) reported seven fatalities between 1979 and 1988, which were due to wasp stings but none of these were attributable to European wasp. Although one fatality was caused by *Polistes* sp which is also be subject of this study.

Paper wasps (*Polistes* sp) form exposed nests of macerated plant material mixed with oral fluids. Nests are usually in exposed positions on the buildings or vegetation and may contain up to 250 wasps. They are not particularly aggressive but will sting if disturbed and there has been one death, which can be definitely attributed to this wasp in Australia.

Control of both wasps necessitates treatment of the nest. This may involve the use of dusts, or aerosol sprays. (Hadlington and Gerozisis, 1985). In this study the effectiveness of a new control product, Sorsec Wasp Nest Killer was investigated and compared to a Coopex insecticidal dust, a product currently in use.

MATERIALS AND METHODS

Insecticide Formulations and Treatment Equipment

Sorsec Wasp Nest Killer is a novel formulation known as Aqueous Powder Technology (APT). It is a white free flowing powder and remains free flowing even under damp conditions. The active ingredient is 4.0g/kg d-phenothrin. European wasps were treated with between 101.0 – 107.0 grams of material per nest and Paper wasp was treated with between 5.0 – 20.0 grams per nest. The product was compared to Coopex Insecticidal Dust (active ingredient 10g/kg permethrin). European wasps were treated with between 125 and 129 grams of this material per nest and Paper wasp wasps were treated with between 4.2 and 15.1 grams per nest. Both insecticidal dusts were applied using a handheld duster supplied by Globe, Australia. This has a metal nozzle 15 cm long and a rubber bulb 8 cm in diameter.

European Wasp Treatment and Assessment

The European wasp study was carried out in a rural area near Ararat, Victoria during the Autumn (March) of 2004. European wasp first became a problem in Ararat in the later 1980's and wasp nests increased in the 1990's necessitating the formation of the Ararat Wasp Group to find and eradicate nests. In 1998, the group treated more than 1400 nests. This dropped to nine nests the following season, which could indicate the success of the earlier population suppression or changed climatic condition as numbers dropped in other areas in this year. After this there appears to have been a number of years with low numbers, followed by increased activity in 2004, when 230 nests were treated.

European wasp nests were located with the help of the Ararat Wasp Group, by tracking foraging workers back from their food or water to their nest. The only visible evidence of a typical European wasp nest is the entrance, which consists of a hole approximately 50 mm in diameter. The entrance usually extends approximately 200 mm to 300 mm vertically down to the nest itself. The nest consists of papery material, which houses the various chambers. Although European wasp nests can be vary large, most nests encountered at Ararat are approximately the size of a football (20 – 30 cm) in diameter. 12 nests were located and five of these were treated with Sorsec Wasp Nest Killer, five with Coopex Insecticidal Dust and two were left as untreated Controls.

Pre treatment counts were made of wasp activity at the nest by counting the total wasps entering and leaving the nest in 1 minute. The same method was used for post treatment activity counts, which were made 1 hour and 24 hours after treatment. The nests were treated by a professional operator protected by a bee suit. The nests were treated according to label directions using a handheld dust applicator and the amount of dust used was noted. The nests treated were all relatively small and so the lower end of the recommended treatment rate was used. Treatment was carried out in the morning when the majority of the wasps would be in the nest and the wasps are less active and less aggressive. The operator stood at approximately 2 metres from the nest and puffed a stream of dust at the nest entrance. The operator advanced towards the nest entrance as the wasps were calmed or knocked down and this enabled dust to be blown directly into the nest. The aggressiveness of the wasp during and immediately after treatment was observed. The knockdown of adult wasps around the nest entrance was also noted after treating the nest and approximately ten knocked down adult wasps were collected from each nest and examined at 24 hours post treatment for recovery. The nests were then examined for adult activity post treatment (i.e. workers leaving and returning to the nest) at 1 hour and 24 h after treatment. Conditions on all assessment periods of the study were fine and sunny with a light breeze. The temperature was between 15 – 17° C at pre-treatment, 16 – 18° C at 1 h post treatment and 19 – 21° C at 24 hours post treatment. At 24 h after treatment the treated nests were also excavated and wasp activity was recorded. The two untreated control nests were not disturbed during the 24–hour study period and only observations were made at 1 and 24 hours. These nests were not excavated because the untreated wasps are too aggressive.

Paper Wasp Treatment and Assessment

The *Polistes* sp. study was carried out in suburban Sydney, NSW in April, 2004. Paper wasp nests were located by searching gardens and house exteriors in the inner suburbs of Sydney. Paper wasp nests occur in exposed locations and are more easily located than European wasp nests. Typically a Paper wasp nest was found hanging under the eaves or window sills of houses and out buildings. They were sometimes located attached to tree trunks or under the branches of trees and bushes. A Paper wasp nest typically consists of a relatively small

(5 – 20 cm) hanging chamber and the nests in this study varied from 5 cm to 15 cm in size. Only easily accessible nests less than 3 metres off the ground were used.

The design for the Paper wasp study was similar to the European wasp study detailed above. Pre and Post treatment counts were made by counting the actual number of wasps resting or walking on the nest. Post treatment counts were made at 1 h and 24 h post treatment. Adult wasps cluster around the nest in the morning and evening but in the daytime wasps forage for food and water. Pre and Post treatment counts were made in the morning when the wasps were at the nests. The treatment method was similar to that used for the European wasps. The temperature was between 18.0 – 26° C at pre treatment, 22 – 27° C at 1 hour post treatment and 19.0 – 22° C at 24 hours post treatment.

Data Analysis

An analysis of variance was performed to establish if there were significant differences between locations assigned to each treatment that could influence the results for both European wasp and Paper wasp.

RESULTS AND DISCUSSION

Pre-treatment numbers

Results show highly insignificant difference between treatments in pre-treatment count; European wasp ($F_{2,5}$ = 0.176, p = 0.843), Paper wasp ($F_{2,5}$ = 0.319, p = 0.741) indicating that the differences in the number of tested insects are randomly distributed across the treatments and do not influence the results.

Control of European wasp

Sorsec Wasp Nest Killer (d-phenothrin dust) flowed very well and was a light, floating formulation which gave good penetration into the nest. The Coopex Insecticidal Dust (permethrin dust) flowed well but seemed slightly heavier and seemed to accumulate around the nest entrance of the European wasp more than the d-phenothrin dust, however, it did flow into the nest. The wasps did not exhibit any aggression during the treatment with either of the treatments. Very few wasps left the nest after treatment with d-phenothrin dust. The majority of the wasps, which left the nest flew away and did not attempt to attack the experimenter. Returning wasps returned into the nest without becoming aggressive, and usually entered the nest even though it had been treated. As very few wasps left the nest and were knocked down at the entrance it was not possible to collect many wasps. None of the seven knocked down wasps collected recovered after 24 hours.

With permethrin dust, a few more wasps were disturbed and left the nests after treatment and flew away. In the case of one nest, there was an exodus of 50-100 wasps and these were knocked down around the nest. None of these wasps were aggressive towards the experimenter. None of the 17 knocked down wasps collected recovered after 24 h. Returning wasps returned to the nest without becoming aggressive and did not seem to be repelled by the presence of insecticide.

Percentage control was calculated as a percentage reduction at any time period compared to the pre treatment count using the following formula:

$$\% \text{ Reduction} = \frac{\text{Numbers of Wasps at Pre Treatment} - \text{Number of Wasps at Post Treatment}}{\text{Number of Wasps at Pre Treatment}} \times 100$$

Pre- and post-treatment counts for European wasp are presented in Table 1 and for Paper wasp in Table 2. The percentage reductions are shown graphically in Figure 1. The control nests remained active throughout the trial. At 1 h, there was a 0.85% percentage reduction and there was an increase in activity at 24 h (-39.9%). d-phenothrin dust gave 98.3% reduction in activity of European wasp 1 hour after treatment and 100% reduction after 24 h. Permethrin dust gave 98.2% reduction in activity of European wasp 1 hour after treatment and 100% reduction after 24 h. Since there were no variations between treatment replicates in both insecticidal treatments at 24 h, analysis of variance could not be performed.

Table 1. The number of European wasps before and after treatment.

Treatment	Nest	Number of Wasps Leaving and Returning Nest in 1 Minute		
		Pre Treatment Count	**1 Hour Post Treatment Count**	**24 Hours Post Treatment Count**
Sorsec Wasp Nest Killer 4.0g/kg d-phenothrin	1.	79	0	0
	2.	67	0	0
	3.	54	0	0
	4.	66	0	0
	5.	87	6 *	0
Average		**70.6**	**1.2**	**0**
Coopex Insecticidal Dusting Powder 10g/kg permethrin	1.	47	0	0
	2.	64	5 *	0
	3.	81	0	0
	4.	75	1 *	0
	5.	68	0	0
Average		**67.0**	**1.2**	**0**
Control	1.	54	67	107
	2.	63	49	54
Average		**58.5**	**58**	**80.5**

* These wasps were only returning to the nest

After treatment either with d-phenothrin dust or permethrin dust, the excavated nests appeared moribund after 24 hours. There were no flying activity and wasps in the nest were either dead or knocked down. There was evidence of residual dust in the nests suggesting good penetration of both dusts into the nests.

Control of Paper wasp

The behavior of the wasps with d-phenothrin dust or permethrin dust was similar. When contacted with the dust the wasps mainly flew away, and did not attempt to attack the experimenter. Some dropped down around the nest but there were few of these, and so it was not possible to collect many wasps. 10 wasps were collected which had been treated with d-phenothrin dust, and 12, which had been treated with permethrin dust. None if these recovered at 24 hours. The untreated control nests remained active and stable throughout the trial. There was 7.4% reduction at 1 hour and -11.1% reduction at 24 h. d-phenothrin dust gave 98.4% reduction in activity 1 hour after treatment and 100% reduction after 24 hours. Permethrin dust gave 99.8% reduction in activity 1 hour after treatment and 100% reduction after 24 h.

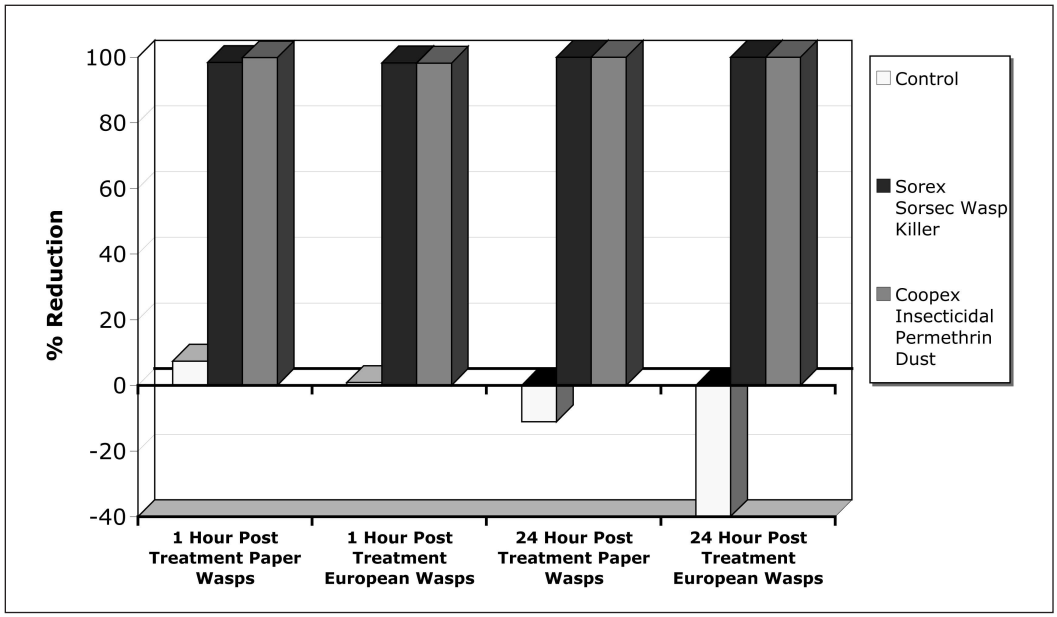

Figure 1. Percentage Reduction of European Wasp and Paper Wasp at 1 and 24 Hours after Treatment

Since there were no variations between treatment replicates in both insecticidal treatments at 24 h, analysis of variance could not be performed. After treatment with d-phenothrin dust or permethrin dust the nests appeared moribund after 24 hours. There was no flying activity and no wasps on the nest.

CONCLUSION

The new product Sorsec Wasp Nest Killer (d-phenothrin) dust gave excellent kill of both European Wasp and Paper Wasp and there was no activity in the nest after 24 hours. Wasps did not become aggressive during or after treatment.

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