Proceedings of the Sixth International Conference on Urban Pests
William H Robinson and Dániel Bajomi (editors), 2008
Printed by OOK-Press Kft., H-8200 Veszprém, Pápai út 37/a, Hungary

ELIMINATION OF A *TAPINOMA MELANOCEPHALUM* (HYMENOPTERA: FORMICIDAE) INFESTATION USING IMIDACLOPRID BAIT

[1]M.D. BROOKS, [2]G. NENTWIG, AND [2]V. GUTSMANN
[1]Kenniscentrum Dierplagen, Vadaring 81, Wageningen, NL
[2]Bayer CropScience AG, D-40789 Monheim,
e-mail: volker.gutsmann@bayercropscience.com

Abstract *Tapinoma melanocephalum* F. (Ghost Ant) infestations have increased in Western Europe. Generally, Ghost Ant infestations resemble those of *Monomorium pharaonis* (Pharaoh's Ant) with a focus to older, multi-unit apartment blocks which offer a multitude of nesting opportunities and easy migration of ants within the building. Control of these infestations is often regarded as difficult. Laboratory trials of a novel semi-liquid broad-spectrum ant bait product containing 0.03% imidacloprid against nest cells of Ghost ants demonstrated complete destruction of workers, queens and brood by week 6. The same ant bait product was tested in a field trial in Groningen, Netherlands. An apartment block containing 108 apartments had a seven year history of failing Ghost ant control. Using a conventional bait gun, one bait spot of 200 mg per m² treated area was applied. An area of 10 m² was treated; the average amount of product dispensed was 2 g per apartment. Several apartments were chosen as indicator sites and were closely followed. The remaining apartments were treated by a local pest control company using the same product with identical use pattern. Decline of ant numbers in the indicator flats was rapid (86 % reduction in 3 days) and total absence of ants was demonstrated from week eight after treatment. Similarly, all flats treated by the pest control company were shown to be free of ants at the last monitoring time point 5 months after initial treatment.
Key Words Ghost Ant, ant control, semi-liquid bait

INTRODUCTION

The Ghost ant, *Tapinoma melanocephalum*, is widely distributed in tropical and sub-tropical regions. In recent years, Ghost ants have been more and more found also in the temperate zones. Reasons for this dissemination can be found in the cultivation and trade with potted plants and increasing import of goods from the warmer regions and increasing mobility of human populations (Williams, 1994). Ghost ants are now considered urban pests in the U.S. (Klotz et al., 1995) and Europe where they have been detected in the recent years in almost every country (Espadaler, 2002; Dekoninck et.al., 2006; Boase, 2007).

In The Netherlands the Ghost ant is not as common as the Pharaoh's Ant, but the numbers of reported Ghost ant infestations has in recent years increased each year (Kenniscentrum Dierplagen (KAD), internal data). Due to the relatively cold climate in The Netherlands the nests of the Ghost ants are only found inside heated buildings. Worker ants are occasionally found foraging on windowsills and balconies outdoors during the summer months but in these cases the ant trails can be followed back to their nests indoors. The nest sites are generally in inaccessible warm and moist areas close to a food source. Typical nest locations can be found in plant pots, wall voids, behind tiling and cupboards in kitchens and bathrooms, meter cupboards and plug sockets (Pospischil, 2003). All in all, the behaviour and nesting habitats of *T. melanocephalum* resembles those of *M. pharaonis*, favouring older apartment blocks and being active mostly in kitchens and bathrooms.

Control of the Ghost ant is often very difficult due to the hidden location of the nest, the fact that a colony can contain multiple reproductive queens and that a colony may be divided into several satellite sub-colonies (Hedges, 1998). Similar to the Pharaoh's ant the colonies are capable of splitting and creating daughter colonies spreading the infestation potentially throughout the whole building (unsuitable control measures may even induce this behaviour and increase the problems within a structure). Spreading initially occurs in most of these cases in a vertical direction following for example the water, gas and electric cables and pipes. The best treatment method is the application of highly attractive bait products, preferably if the whole building block is treated. Only then, hidden nests and entire colonies including the queens can be

eliminated. The use of contact poisons should be avoided due to the above mentioned ability of Ghost ants to split and move colonies.

Due to the re-registration of active ingredients in the EU (Biocidal Products Directive) some active ingredients commonly used in baits to combat indoor ant infestations with tropical ant species have been removed from the portfolio of European professional Pest Control Operators (PCO). New bait products containing modern active ingredients are therefore needed to fill this gap.

Here we report on the efficacy of a novel semi-liquid bait product containing 0.03% Imidacloprid, a member of the neonicotinyl class of insecticides. This bait is marketed under the trade name Maxforce® Quantum by Bayer Environmental Science and herein referred to as Imidacloprid Ready-Bait 0.03 (Imidacloprid RB 0.03).

MATERIAL AND METHODS

Laboratory Trial

Ants. Colonies of the *T. melanocephalum* consisting of about 400-600 workers, approximately 5 queens and brood of all stages, nesting in an artificial nest cell made from wood measuring 2.5 x 5 cm x 2 mm high, covered with a transparent plane of glass plus a cover made from brass were allowed to acclimatize for one week in plastic containers (20 cm x 20 cm x 8 cm high) whose inner walls have been treated with Fluon GP1 to prevent the escape of the insects.

Evaluations. Competitive food was provided in small Petri dishes, a protein source consisted of dead cockroach larvae, the carbohydrate source was powdered cane sugar. Water was supplied via a cotton pad in a Petri dish. Illumination ran from 6.00 until 18.00. The temperature was about 25°C, relative humidity was uncontrolled. Test product was provided *ad libitum* in a Petri dish and the following parameters were determined visually by examination through binoculars: percentage of dead workers, percentage of living brood and percentage of dead queens. Monitoring intervals were as follows: immediately (0 week) and 1, 2, 3, 4 and 6 weeks after addition of toxicant bait. Dead insects were not removed. Each trial consisted of two replicates. Colonies without toxic bait were used as untreated controls.

Field Trial

Test site. The test site was a large apartment block in The Netherlands containing 108 small student apartments. The building consisted of two blocks overlapping each other 9 floors high. The levels could be reached by a staircase or via two lifts situated almost in the middle of the blocks by the overlapping. On each floor there were 12 apartments. Each apartment of approximately 50 m² consisted of a bedroom, a kitchen, a combined living/dining room, a combined shower/toilet room, a hall and a meter cupboard and a storage cupboard in the hall. The level of hygiene was very diverse ranging from good to very bad.

The apartment block had a very long history of Ghost ant infestations. For more than seven years inhabitants in various locations throughout the block had complained about large numbers of ants in their apartments. Residual sprays and baiting had been applied over the years by pest control operators from the local council and from pest control companies without really being able to provide a long term solution to the problem.

Before the trial, ants were collected and positively identified as *T. melanocephalum*. Ants were mainly seen in kitchens and bathrooms. The ants had probably generally spread through the building via openings around the water pipes between the kitchens of apartments above and/or below each other. In several apartments ants were also found in the meter cupboard by the front door. The openings around the cables provide the ants with an easy route to spread through the block. Due to the large size of the test site, an agreement was made to perform the test together with a local pest control company. Four selected apartments were treated and closely followed by the personnel of the KAD. These apartments are herein referred to as KAD flats and the remaining 104 apartments were treated and monitored by the pest control operator company (PCO flats).

The following protocols were devised by the KAD, and explained and demonstrated to the pest control officers to ensure consistent treatment and monitoring standards. **Monitoring.** Five locations were identified in each flat: the meter cupboard, the storage cupboard, the bathroom, the living room and the kitchen. In each of those locations ants were counted for a period of 1 min. The final value was the average of three individual counts.

Inspection intervals. The 4 KAD flats were inspected at the following time intervals: Day 0 (last pre-treatment monitoring and treatment), then at day 3, 7, 16, 22, 28, 56, 120 and 150 after treatment. The 104 PCO flats were inspected at: Day 0-14 (pre-treatment monitoring and treatment), followed by monitoring at day 28, 120 and 150. **Treatment**. Cartridges containing 30g of Imidacloprid RB 0.03 were supplied by Bayer Environmental Science, Monheim, Germany. Using the cartridges in conventional bait guns, 200 mg of product was dispensed per m² infested area. On average, 2 g of product was placed initially to treat 1 apartment as ants mainly occurred in kitchens and bathrooms totalling at 10 m². The bait droplets were deposited in areas of high ant activity but inaccessible to humans and non-target animals. When a bait point was found to be depleted at one of the later inspection intervals (3-28 days), or a new nest was located, an additional bait placement was made.

RESULTS

Laboratory Trial

Laboratory assessment of imidacloprid revealed a complete destruction of whole colonies of *T. melanocephalum* in artificial nest cells. Although ants started to feed on the bait product immediately, the effect on the whole colony was moderate within the first 2 weeks of the trial. However, from week 3 onwards, the colonies became irreversibly damaged (Figure 1). 6 weeks after treatment, the whole colonies including workers, queens and brood were eradicated. In untreated control colonies, the number of workers and quantity of brood remained unchanged, whereas the number of queens per colony increased.

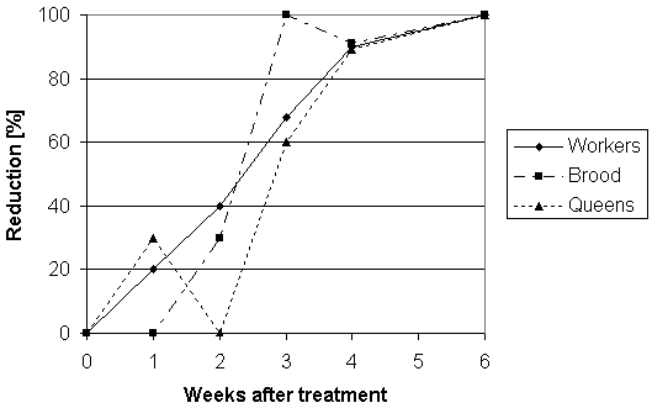

Figure 1. Reduction of *T. melanocephalum* colony activity after treatment with imidacloprid in the laboratory. Values are calculated based on two replicates and indicate reduction in ant activity/numbers to pre treatment values.

Field Trial

Results of the initial inspections were as follows: 107 of 108 apartments could be inspected. One apartment was inaccessible throughout the period of the trial and was excluded from the analysis. Of those 107 apartments, 53 were found to be infested with *T. melanocephalum*. Of those 53 flats, 4 flats were inspected, treated and monitored by the KAD (KAD flats), the remaining 49 infested and 54 not infested flats were inspected, treated and monitored by the pest control company (PCO flats).

The small number of 4 flats monitored by the KAD were observed frequently allowing accurate analysis of the speed of control. In contrast, the large number of PCO flats took 14 days to treat, and the first read-out time point was at 28 days after treatment (DAT). The dynamics of ant activity reduction after treatment with the imidacloprid bait is therefore better visible in the KAD flats and are presented separately from the PCO flats.

KAD flats. At the first monitoring at 3 DAT, the average reduction of ant activity across all flats was 86% and in 2 of 4 flats, reductions reached even 95 to 99% (Table 1). Flats were certified ant free at day 7 (apartment No 1) and day 16 (apartment No 4). Apartments No 2 and 3 were almost free of ants at 28 DAT with 4 and 1 ants still visible, respectively. Those 2 flats were then certified to be free of ants by 56 DAT. No further ants, neither alive nor moribund were seen during the following inspections up to the end of the monitoring period at 150 DAT. The monitoring results were further supported by interviews of the inhabitants who did not report sightings of ants after day 56.

To achieve this level of control, 8 additional treatment spots of 200 mg each had to be delivered, mostly because all bait points had been consumed due to high ant activity. These re-treatments took place within the first 7 days of the trial period. No further re-treatment was delivered. Additional observations on the speed of ant recruitment to the bait placement revealed that ants started to feed on the bait within minutes. This effect was also visible in those circumstances were bait had to be replenished indicating that no bait shyness had developed after feeding on the initial bait placement.

PCO flats. All 103 flats whether infested or not were treated by the pest control company company. This procedure took 14 days to be completed. Therefore the dynamics of reduction cannot be calculated accurately. At the first follow up intended to assess ant activity at 28 DAT, 13 of 49 infested apartments still showed ant activity, in other words, 74% of apartments were ant free. At 120 DAT, the next follow-up time point, 3 apartments still had ant activity (94% reduction). No ants were found in the entire building at 150 DAT. To achieve this level of control, additional treatment spots of 200 mg each were delivered in apartments during the inspections when a bait point had been consumed and ant activity was still observed. A total of 46 additional bait spots (9.2g) were applied.

DISCUSSION

Imidacloprid has proved to control successfully whole colonies of the Ghost ant *T. melanocephalum* in laboratory and field trials. In our laboratory trials (Figure 1), the bait had killed 100% of workers, brood and queens within 6 weeks after treatment in the presence of high quality competitive food. In our eyes, the most important success factor of a bait is the ability to completely destroy the colony to avoid rebound. The same bait, tested against whole colonies of *Monomorium pharaonis* (Rupes, personnel communication) in very similar experimental setup demonstrated 100% colony destruction within 1-2 weeks.

Imidacloprid was tested in a large building complex in The Netherlands comprising 108 individual apartments. This large structure provided a perfect opportunity to a) investigate the efficacy of the Imidacloprid bait in detail including ant behaviour and dynamics of control and b) test the performance of the bait when applied under realistic PCO working conditions.

Imidacloprid, applied in cracks and crevices alongside trails of Ghost ants at a use rate of 200 mg per m² treated area resulted in a rapid reduction of ant numbers after initial treatment (Table 1). Close inspection of the bait points revealed that in some flats, ants had consumed all of the bait in some areas. Those bait points were replenished once. Ants were seen approaching and commencing feeding on the bait during application. This is a clear indication of the attractivity of the bait matrix. It is proposed that the high consumption levels under field conditions were the cause of the rapid decline of the ant population.

Table 1. Ant counts and percentage reduction (RD AA) in 4 apartments (Ap) treated and monitored by the KAD within the trial period. Total ant counts is the sum of ants found in each apartment. Calculation of percentage reduction is based on pre-treatment values. Overall reduction of ant activity in all 4 apartments is shown in column Total RD.

Days after treatment	Apartments followed by the KAD								
	Ap1/ Ant Counts	Ap1/ Rd AA	Ap2 / Ant Counts	Ap2 / Rd AA	Ap3 / Ant Counts	Ap3 / Rd AA	Ap4 / Ant Counts	Ap4 / Rd AA	Total RD
0	99	0	300	0	70	0	28	0	0
3	1	99	15	95	7	90	11	61	86
7	0	100	20	93	9	87	16	43	81
16	0	100	19	94	14	80	0	100	93
22	0	100	6	98	5	93	0	100	98
28	0	100	4	99	1	99	0	100	99
56	0	100	0	100	0	100	0	100	100
120	0	100	0	100	0	100	0	100	100
150	0	100	0	100	0	100	0	100	100

Treatment of the remaining 103 apartments was performed by a local PCO company who was instructed to use the product at label rate. The treatment of this large number of apartments took around 14 days to complete, and the first monitoring time point was at 28 DAT. On this day, 74% of the previously infested apartments were free of ants. 94% of apartments were ant free at the next inspection at 120 DAT. No ants could be found in the whole building at the final inspection day. The eradication of the ant colonies in the PCO flats generally took longer than in the four apartments treated by the KAD. This was most likely due to the more frequent inspections by the KAD and therefore quicker re-applications of fresh bait when the bait points had been consumed. Due to this the ants had less chance to feed on other food sources in the apartment.

CONCLUSIONS

We conclude that treatment with Imidacloprid RB 0.03 will result in complete and reliable elimination of *T. melanocephalum* infestations for entire buildings. The amount of product dispensed to achieve this level of control is low averaging at 2 g per apartment (containing 0.6 mg imidacloprid). This low dose is sufficient to treat the vast majority of infestation levels. Should infestation be very high, re-treatment in those areas is recommended. Based on our results, a return visit by the PCO to the treated structure is best undertaken at 14 DAT when it is apparent whether a treatment has already resulted in complete eradication, or additional bait spots have to be delivered. In additional trials, imidacloprid has also been shown to efficiently control *M. pharaonis* L. infestations (Pospischil, 2008) and *Lasius niger* L. colonies in indoor and outdoor situations (Brooks, unpublished results).

REFERENCES CITED

Boase, C. 2007. The trouble with tramp ants. International Pest Control. Jul-Aug: 120-122

Dekoninck W., Wegnez P., Espadaler X. and Grootaert P. 2006. First record of infestation of the ghost ant *Tapinoma melanocephalum* (Fabricius, 1793) in Belgium (Hymenoptera, Formicidae) — A new indoor pest problem for the country? Bulletin SRBE/KBVE, 142: 25-28

Espadaler, X. 2002. *Tapinoma melanocephalum* (Fabricius, 1793), a new exotic ant in Spain (Hymenoptera, Formicidae). Orsis 17: 101-104.

Hedges, S.A. 1998. Field guide for the management of structure-infesting ants. Cleveland: G.I.E Inc.

Pospischil R. 2003. Die Schwarzkopfameise *Tapinoma melanocephalum*. Der prakt. Schädlingsbek. 55, 3: 4-5

Pospischil R. 2008. Neu: Maxforce Quantum, ein Flüssigköder gegen verschiedene Ameisenarten. Der prakt. Schädlingsbek. 60, 2: 20-21.

Williams D.F. 1994. (ed.) Exotic ants. Biology. impact and control of introduced species Westview Press. Boulder.