Asian honey bee Transition to Management Program

Destruction efficacy of Asian honey bees (*Apis cerana*) in Cairns, Australia

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Contents

Summary

A project under the Asian honey bee Transition to Management Plan was to validate the efficacy of detection and destruction methods and strategies as essential elements of controlling Asian honey bees in Australia. Here, destruction efficacy was determined by reviewing historical destruction data collected by the Biosecurity Queensland for Asian honey bee nests and swarms between May 2007 and October 2012. Products employed for destruction were examined and their application, operation and safety were reviewed. In addition, a survey for Asian honey bee Program staff and pest controllers was created to compare the practical uses of destruction methods.

Establishing efficacy of destruction methods relied greatly on the experiences of Asian honey bee Program staff and pest controllers who collectively have been involved in destroying over 800 AHB nests and swarms.

The majority (78.9%) of Asian honey bee nests and swarms were destroyed using flying insect spray (containing 2.4g/kg Bioallethrin and 0.46g/kg Bioresmethrin) and high-output liquid insect killer (containing 3.0g/kg Bioallethrin). Permethrin dust was used in 12.1% of destructions. In line with this, according to survey participants, flying insect spray was deemed the preferable product for destruction of both nests and swarms. Flying insect spray was considered easy to use, cost effective, provided a quick extermination, and is widely available for purchase. High-output liquid insect killer and permethrin dust (active constituent; 1g/kg permethrin 25:75) were considered the next best methods to use by survey respondents.

The review of destruction methods showed that special circumstances may require a particular product or method to be employed. High-output liquid insect killer and permethrin dust can be safely used around electrics while flying insect spray cannot. The impressive reach of high-output liquid insect killer's 'jet' stream (up to 4.5m) meant that this product was beneficial in situations where swarms were at heights which did not allow for successful capture within a plastic bag and also for use on external nests. Permethrin dust was useful where nests existed in large wall cavities and extra penetration of chemical was needed.

The results of a scientific report prepared previously as part of the Transition to Management Plan concluded that remote nest treatment was not an efficient and successful means to kill Asian honey bee nests. Analysis of the survey provided to staff and pest controllers showed that views of the practicalities associated with performing remote treatment as a destruction technique for Asian honey bee nests were mostly aligned with the findings of this report.

Limitations for effective use of destruction methods included wet and windy weather. It was also noted that the process of obtaining 'off-label use permits' may be lengthy as the Australian Pesticides and Veterinary Medicines Authority needs to be very particular and comprehensive in their decision to allow a chemical to be employed for use other that stated on the label.

Site-specific risk assessments were considered very important during nest and swarm destruction (so that an optimal destruction method could be decided upon), and unless a specialised permit had been obtained allowing otherwise, products had to be used in strict accordance with their label. Personal protective equipment was essential to prevent chemical exposure and bee stings.

Introduction

Since the first detection of the Asian honey bee (AHB), *Apis cerana* Java genotype, in Cairns (Queensland, Australia) in May 2007, there have been over 800 detections of AHB nests and swarms. Until April 2012, all detections were destroyed. After April 2012, some nests and swarms were kept for research, and post November 2012, all destruction within the Known Infested Area (KIA) ceased.

Various methods to detect and destroy nests and swarms were deployed between 2007 and 2012, including aerosols, permethrin dust and, for a short period, remote treatment using a broad-spectrum insecticide was trialled. However, efficacy of these methods was never formally validated.

Part of the AHB Transition to Management (T2M) Plan stipulates to "Validate the efficacy of detection and destruction methods and strategies as essential elements of deploying different control methods", which includes determining rates of effort and validation of all methods (AG2 Bi). "All methods" was taken as those methods mostly used during program operations as well as some of those that have been trialled or previously used for destroying nests and swarms.

Therefore, the goal of this report was to validate the efficacy for each of the identified destruction methods, where data was available.

Specifically, the report aimed to determine the efficacy of destruction methods by reviewing the appropriate use of each method as well as its advantages and disadvantages, and by conducting surveys and interviews with AHB staff and pest controllers.

Efficacy of detection methods are reviewed in a separate report: Detection efficacy of Asian honey bees (*Apis cerana*) in Cairns, Australia (Koetz, 2013).

Methods

Review of the destruction methods used in the AHB Program

AHB nest and swarm destruction data was sourced from BioSIRT (a computer database used by Biosecurity Queensland (BQ) for managing routine and emergency incidents for disease, pest or residues, in plants, animals or in the environment). Available data included date of detection, date of destruction, location information (GPS coordinates, suburb, land use) and method of destruction for each Infested Property (IP) or destruction event between May 2007 to October 2012. This data was summarised, categorised and tabulated in *Microsoft® Office Excel (2003)*.

Review of products, and program operations

Aerosols (flying insect spray and high-output liquid insect killer), permethrin dust and insecticide containing fipronil used in remote treatment trials were reviewed. Product labels, Material Safety Data Sheets (MSDS), and product brochures from manufacturers' websites were sourced, and information regarding methods of application and recommended safety standards were reviewed and summarised.

Survey

The most frequently used destruction methods (as determined by the analysis of BioSIRT data, i.e. aerosols, permethrin dust, and remote treatment) were included in a survey. This survey was distributed to past and current staff from the AHB Program, as well as to professional pest controllers who have had experience with AHB nest and swarm destruction. The professionals included an arborist pest controller contracted by BQ who had been involved in more than two hundred AHB destruction events.

The survey consisted of 17 open questions which asked participants to comment on the efficacy of each method for destroying nests and swarms in specific instances/situations (see Appendix 1).

For each question, individual responses were summarised, categorised (where possible) and compared.

Results

Review of destruction methods used by the AHB Program

Between 5th May 2007 and 31st of October 2012, 734 AHB nests and swarms were destroyed using various destruction methods as part of the AHB Program.

The majority of all destruction events (78.9%) were carried out using aerosol (74.8% of all nests and 87.4% of all swarms). Permethrin dust and remote treatment were used less frequently (12.8% and 2.2%, respectively) and seldom used to destroy swarms. In rare instances (1.6%), other techniques were used (e.g. insecticide bombs, bagging without chemical). For 4.5% of all destruction events a destruction method was not recorded (Table 1).

Table 1: Destruction methods used to exterminate Asian honey bee nests ad swarms during the Asian honey bee Program, April 2007 – October 2012.

Chemical/Method Used	Nest	Swarm**	Total
Aerosol*	371	208	579
Permethrin dust	82	12	94
Remote treatment	16	0	16
Other methods	5	7	12
No destruction method recorded	22	11	33
Total	**496**	**238**	**734**

***data entered into BioSIRT did not differentiate between the two different types of aerosols (flying insect spray and high-output liquid insect killer), so they were grouped as one entity.**

****Note: field officers usually captured swarms by enclosing a plastic bag around the bees. Chemical was then applied *inside* the bag in order to effectively kill the swarm.**

Review of products and program operations

The use of insecticides by the AHB Program is governed by the legal requirements of the Chemical Usage (Agriculture and Veterinary) Control Act 1988. This Act stipulates that chemical products must be used in strict accordance with the instructions on the product container's approved label. Approval from the Australian Pesticides and Veterinary Medicines Authority (APVMA) is required where products are to be used for purposes other than specified on the label. For copies of the fipronil permit used by the Department during AHB Program operations refer to Appendix 2.

Flying insect spray (aerosol)

Flying insect spray is an aerosol manufactured to kill a variety of insects. The AHB Program utilised a spray containing 2.4g/kg Bioallethrin and 0.46g/kg Bioresmethrin[1], both of which are synthetic derivatives of pyrethrum and registered as an insecticide for indoor/outdoor domestic use by the APVMA. For fast action, the manufacturer suggests directly spraying insects. As this product is essentially for household use, it was designed to be low allergenic with a low odour[2] so that it could be applied by people who suffer asthma and other common allergies. This type of product is readily available for purchase in many convenience, grocery, and hardware stores.

The MSDS[1] associated with this product recommends that the aerosol is protected from sunlight, high temperatures in excess of 50˚ Celsius and sources of ignition. It is highly toxic to aquatic organisms, and care should be taken to avoid contamination of waterways. Personal protective equipment (PPE) including suitable gloves, protective clothing, and safety glasses are recommended when handling bulk quantities[1].

High-output liquid insect killer (aerosol)

High-output liquid insect killer is a fast-acting insecticide spray that is intended to control a variety of flying and crawling insects. The active constituent in the product employed by the AHB Program is 3.0g/kg Bioallethrin[3].

This product is safe to use around electrical equipment, and is available for purchase in most shops that stock industrial supplies. The high-output spray pattern of this aerosol allows users to spray targets with an upward angle of 15 degrees to distances of 3-4.5 metres[4].

Following examination of the hazards and safety issues associated with this product it was found that the product's label and MSDS[3] contain conflicting information regarding flammability and PPE. Users may want to assess these inconsistencies when using this product, especially relating to personal safety. Stringent Workplace Health and Safety (WHS) regulations ensured that staff and contractors of the AHB Program always wore full PPE when applying any chemical product in the field.

Permethrin dust

Permethrin dusts can be used to control a variety of insects, including feral honey bees, and are suitable for use in wall cavities in both industrial and domestic areas[5]. The product employed by the AHB Program contained the active constituent 1g/kg permethrin 25:75[5].

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[1] *http://www.rb-msds.com.au/uploadedFiles/pdf/Mortein%20Ultra%20Low%20Allergenic%20FIK%20Aero-v6-30490.pdf
[2] *http://www.mortein.com.au/product_low_aller_fly.php
[3] *http://www.rainbowtech.net/products/docs/8f14e45f590ca3fe2e0/88500%20MSDS.pdf.pdf
[4] *http://www.rainbowtech.net/products/view.php?cn=4042
[5] *http://www.bayercropscience.com.au/resources/uploads/label/file7426.pdf
*Websites accessed 17.04.13

This product is designed to be hydrophobic - it does not absorb moisture from the environment, and will remain active for long periods of time without clotting. It is also fine and lightweight, which allows for increased penetration into inaccessible spaces including wall cracks, wall crevices, and wall voids[5]. This product is readily available for purchase in many hardware stores or professional pest control chemical suppliers.

Permethrin dust was one of the first destruction products utilised while the AHB Program was in 'eradication' mode.

Remote treatment

Feasibility of remote nest treatment for AHB management and control was experimentally investigated as part of the AHB T2M. Regent® 200 SC (active constituent: 200g/L fipronil) and Termidor® Residual Termiticide Insecticide (active constituent: 100g/L fipronil) were used during this investigation. While Regent® 200 SC is available for purchase by agricultural chemical suppliers, both of these products require authorisation by the APVMA in order to be used for the purpose of controlling unwanted bees (see Appendix 2 for a copy of the permit).

Detailed results of remote treatment trials can be found in: Asian honey bee (*Apis cerana*) remote nest treatment (Koetz and Hyatt, 2013).

Survey

The survey was distributed to a total of 13 participants (nine current staff members, two previous staff members and two pest controllers). Participants' experience with AHB nest and swarm destruction ranged from three kills to over 200 kills. All participants responded to every question.

Applying products/methods in the field – ease of use

Aerosols

As BioSIRT data failed to differentiate between the two types of aerosol used as part of AHB nest and swarm destruction, the survey was helpful in assessing the effectiveness of each product for different situations. Survey results showed that flying insect spray can be easily used to kill both nests and swarms, while high-output liquid insect killer is more suited for killing nests in areas exposed to electrical currents, or for swarms at great heights (i.e. where it was not possible to safely capture the bees and destroy the swarm with flying insect spray).

Seven staff reported using high-output liquid insect killer as a destruction method for swarms. Most survey respondents reported this method as easy to use. However, some disadvantages mentioned were: the spray occasionally comes out as a runny liquid, and the canister tends to spray out its contents rather quickly, requiring the need for extra cans of product on hand.

Permethrin dust

Four staff and one professional reported using permethrin dust to destroy nests of bees, all conveying this method as easy to use. One additional respondent noted that while they had not utilised it themselves, they had observed the use of permethrin dust on a bee nest and felt it was easy to apply.

Remote treatment using insecticide containing fipronil

The efficacy of remote treatment as a suitable means for nest destruction has already been scientifically assessed as part of another Transition to Management project (Koetz and Hyatt,

2013). This method of destruction was included within the survey only to gain an opinion of the practicalities associated with the technique.

Nine staff members reported taking part in remote treatment trials during the AHB Program. Only one of the respondents indicated this method as being easy to use while the remainder reported it a difficult technique. It was noted that this method was time consuming, complex, had restrictive regulations, and that the potential impact on non-target species was concerning.

Applying products/methods in the field – effectiveness and success in varying situations

How much product is required to guarantee complete destruction?

Less than one and up to five canisters (350g each) of flying insect spray was deemed to be sufficient to destroy a nest or swarm of AHB. Just over half of the respondents stated that one to two cans was adequate. However, it was mentioned by remaining respondents that size and accessibility of the comb can determine if more cans are needed to destroy a nest. One to two cans (340g each) of high-output liquid insect killer was regarded as being sufficient for most swarms. For permethrin dust, most users reported that between 30g and 100g was ample chemical to destroy a nest.

While survey participants did not specify precise quantities of chemical required, they all reported that only a very small amount was needed for a complete nest extermination using the remote treatment method. Some participants did point out, however, that nests may require more than one treatment.

How quickly and comprehensively are nests and swarms destroyed?

Persons experienced in destroying swarms and nests were confident that all of the destruction methods employed by the AHB Program (except for remote treatment) killed bees within 30 minutes.

Flying insect spray, when used to destroy nests, was believed to be effective within 20 minutes (84.6% of respondents stated this) with some respondents declaring that it only took minutes for a nest to be killed using this method. 92% of survey participants felt that this destruction method completely killed nests.

Only seven survey participants had used permethrin dust on bees. More than half (66.7%) of users indicated that permethrin dust killed nests within five minutes, while some felt it took much longer (up to 30 minutes). 71.4% of experienced users stated that this destruction method completely kills nests.

When questioned about using remote treatment to destroy nests all respondents that had participated in the efficacy investigation pointed out that nests may take up to a day or much longer to be exterminated. There was uncertainty regarding how thoroughly this method completely destroyed nests with many respondents unsure if it killed nests entirely. There were three survey participants that assumed remote treatment did destroy entire nests.

Survey respondents recommend that, ideally, nests should be destroyed after dusk or before dawn (when bee numbers within the nest were likely to be greater). But in saying this, a majority of the nest kills that the respondents participated in were carried out during day light hours (working hours). Remote treatment on nests could only be carried out while bees were foraging.

For swarms, using either flying insect spray or high-output liquid insect killer was thought to kill bees within five minutes. This was felt by 70% of respondents that used flying insect spray and 87.5% of respondents that used high-output liquid insect killer. Most experienced users of these methods for swarm destruction reported that they completely killed bees. There were some survey participants, however, that claimed swarms were killed only partially. Partial kills were attributed to problems with penetration of the liquid insecticide where bees on the exterior of a swarm may be quickly killed but bees in the interior remain alive.

Swarms can be destroyed at any time of the day according to survey participants, and many recommended that destruction occur as soon as possible after discovery to ensure that the swarm does not abscond.

Which method is ideal, and in what situations should it be applied?

Based on answers provided by participants in the survey, ideal uses of each destruction method can be summarised as follows:

Table 2: Suitability of destruction methods used by Biosecurity Queensland for AHB nests and swarms

	Aerosol: Flying insect spray	Aerosol: High-output liquid insect killer	Permethrin dust	Remote treatment
Suitable for Nests	✓	✓	✓	✓
Suitable for Swarms	✓	✓	✘	✘

Table 3: Destruction methods used to exterminate Asian honey bee nests ad swarms during the Asian honey bee Program, April 2007 – October 2012.

	Swarms and nest		Nest only	
	Flying Insect spray (aerosol)	**High-output liquid insect killer (aerosol)**	**Permethrin Dust**	**Remote Treatment**
Ideally used	If able to be captured inside a bag (swarms) Within cavities in domestic and natural areas (nests) For small to medium cavity sizes (nests) Where nest is easily accessible	If unable to be captured in a bag (swarms) For external nests Where nest/swarm is inaccessible but visible and within 4.5m reach. Within cavities with electrics	On nests Where nest is inaccessible but visible Where multiple exits exist but can be plugged In large cavities (but less than 2m diameter) Within wall cavities with electrics	Where nests are inaccessible When there are no time and resource constraints When nest location is known When there is an active nest with a high number of foragers
Avoid use	Near electrical wires and sources of ignition When ventilation is poor	On very Large swarms and nests Where nests are inaccessible/not visible Where a swarm/nest is further than 4.5m away	Extremely large wall cavities (greater than 2m wide) Where bee escape routes cannot be plugged	When time and resource are constrained Near any known European honey bee or native bee nests/hives

Other Considerations

High-output liquid insect killer

Some respondents noted that this method should be avoided in situations where the bees are directly overhead (to avoid product dripping on personnel during application), and when weather conditions are windy – personnel should be positioned upwind of a swarm/nest when spraying product.

Permethrin dust

A respondent mentioned the possibility of needing specialised equipment, e.g. puffer extensions, for additional saturation of chemical to larger wall cavities.

Weather

Wet and windy weather conditions were noted as limitations for all destruction methods. Opinions reflected that wet and windy weather during aerosol use may decrease the accuracy of the spray and strength of stream attempting to reach the target. The use of permethrin dust in windy weather raised concerns of potential chemical drift when used on nests within cavities on the exterior of buildings. Many were concerned about wet weather causing powder to clog during application.

Respondents stated unanimously that poor weather conditions severely restricted the use of remote treatment as a method of destruction. Foraging activity of bees on bait stations was likely to be affected and chemical may become diluted due to rain.

Personal safety

Generally, survey participants considered all of the destruction methods used to destroy AHB nests and swarms safe to apply providing that a) appropriate PPE was worn, b) site specific

risk assessments were undertaken, and c) adverse weather effects were taken into consideration (e.g. wind).

Environmental concerns were raised by some. Specifically the breakdown of chemicals in the environment as well as possible off-target impacts on animal species other than the AHB due to chemical residues, were mentioned as issues.

Personal protective equipment

Staff and contractors of the AHB Program identified the following list of PPE as absolutely essential when applying AHB swarm or nest destruction methods. Many of these items are also listed in product MSDS's, while some items (e.g. apiarist veil) are additional items necessary when managing bees (to prevent stings).

Table 4: List of essential personal protective equipment identified by survey respondents

Bee sting protection	Chemical protection
Bee suit / bee jacket Apiarist veil Elbow length gloves Covered shoes Disposable coveralls Long pants Long sleeved shirt	Respirator Goggles Facemask PVC gloves Washable coveralls

Who could potentially use these methods?

The survey asked participants whether they believed that the destruction methods employed by the AHB Program could be used effectively by other stakeholders (e.g. pest controllers, bee keepers, national park rangers, and the public).

General consensus amongst respondents was that because aerosols are readily available for purchase and a permit is not required to use them, they are appropriate for use by almost anyone. Some respondents felt that permethrin dust was able to be appropriately used by industries, while some did not, but reasons for this opinion were not provided.

Permit restrictions and off-target species impacts were mentioned as limitations for other stakeholders being able to apply remote treatment as a method to destroy nests of bees.

Discussion

This report aimed to review the efficacy of destruction methods used throughout the AHB Program.

Between May 2007 and October 2012, the majority of AHB nests and swarms were destroyed using flying insect spray. In line with this, according to survey participants, flying insect spray was deemed the preferable product for destruction of nests and swarms, which was described as being easy to use. In addition, it was deemed a cost-effective product that is widely available for purchase at all major grocery and hardware stores Australia-wide.

Survey respondents felt that high-output spray and permethrin dust were the next best methods to use depending upon the situation and accessibility of equipment and PPE. Both methods were considered easy to use. High-output liquid insect killer needs less equipment and is especially designed to be safely used around electrics. Permethrin dust, while easily accessible and also safe to use around electrics, requires more equipment (e.g. a puffer

applicator and extension tubes). Weather considerations regarded as being very important when applying either of these products

Application of products

While flying insect spray was regarded as being practical in most situations, and destroyed bees quickly (most nests were successfully destroyed by 20 minutes time and swarms in plastic bags were destroyed within 5 minutes) with minimal product, special circumstances necessitated the use of an alternative product.

AHB swarms and nests can be found at varied heights and in various types of natural and man-made cavities (Commerford and Koetz, 2013). Swarms are sometimes discovered at heights where it is it is impossible to destroy the swarm effectively by capturing it within a plastic bag and applying flying insect spray (even whilst using an extension ladder). In this type of situation using high-output liquid insect killer was found to be a better option - the product's 'jet' stream will spray targets with an upward angle of 15 degrees to distances of 3-4.5 metres (Rainbow Technology Corporation, 2008). Because partial kills have been noted while using this method, this method would be best applied only to smaller swarms (less than 20cm diameter). Partial kills of nests and swarms can result in the nest or swarm absconding before it is completely destroyed, allowing the colony to survive. For larger inaccessible swarms, contacting an arborist pest controller was necessary to eradicate the bees during the AHB Program.

High-output liquid insect killer was also beneficial for destroying nests that were not contained within a cavity and were at an inaccessible height i.e. external nests. Again, this method is likely to be more effective on smaller nests where partial kills can be mostly avoided. This product was best used on nests clear of obstructions (e.g. leaves and branches) so that extensive chemical coverage could be ensured and therefore a more successful extermination occurred. Where nests and swarms were present in close proximity to electrical apparatus, high-output liquid insect killer was the product of choice as it can be safely applied around electrics. Weather considerations are important when using this product as it was found that strong wind can jeopardise the effectiveness of this technique by altering the aim of chemical 'jetting' out from the canister.

Whilst applying either of the aerosols mentioned in this report to destroy AHB nests or swarms, it was important to ensure additional canisters of product were at hand in case they were required to complete extermination. In survey participants' experience, depending on the size and position of nests within a cavity, more chemical may be needed than initially estimated.

While aerosols can be used to effectively destroy both nests and swarms of AHB, permethrin dust was best applied to nests only. This destruction method was considered to be ideal to use on nests that are within larger wall cavities as the dust will disperse readily to all corners of the wall cavity. Only a small amount of chemical was required for a reasonably quick eradication and this product also allowed for chemical penetration into wall cracks and crevices. An extension tube can provide even greater access. Bees may also have assisted in spreading this product to nest components during exterminations due to chemical dispersing as bees walked or flew around the wall cavity. Care had to be taken when using this product in wet weather however, as on occasion dust became clogged inside the applicator, rendering the technique ineffective. An additional benefit of this product was that it could be safely applied around electrics. Recent correspondence between the AHB Program community engagement team and North Queensland pest controllers has indicated that permethrin dust is commonly used by the industry to destroy nests of European honey bees. The two pest controllers surveyed as part of this review did not state this.

Survey participants' views of the practicalities associated with performing remote treatment as a destruction technique for AHB nests were mostly aligned with the final results of a scientific report prepared previously as part of the AHB T2M work plan (Koetz and Hyatt, 2013). A number of field trials were carried out by the Program's science team (and field staff), and the efficacy of destroying nests by remote treatment was assessed within the report. Remote nest treatment was found not to be an efficient and successful means to kill exotic bees for several reasons: (1) treated nests did not always die; (2) treatments required extensive person-hours to conduct (average of 93 hours per treatment); (3), unacceptable risk to non-target species, and (4) the necessity to locate the nest in order to determine treatment success (Koetz and Hyatt, 2013).

Permits

Approval from the APVMA is required where chemical products are to be used for purposes other than specified on their label. It was necessary for the Department of Agriculture, Fisheries and Forestry (formally Department of Employment, Economic Development and Innovation) to obtain specialised permits in order to use a number of methods/products for the purpose of destroying Asian honey bees. Permits detail exactly when and how products may be used by the permit holder(s) (Appendix 2). Obtaining permits can be a lengthy and difficult process and this important pre-requisite will certainly place limitations on the use of remote nest treatment by other stakeholders – especially since research to date implies that off-target impacts are probable.

Safety

The safety review found that prior to each AHB nest or swarm destruction event, a thorough site specific risk assessment is essential. This ensures that the most suitable destruction method is used for individual situations. Appropriate PPE was also paramount, not only to avoid chemical exposure, but also to protect personnel from bee stings. Anaphylaxis can be severe, therefore precautions needed to be taken. Strict WHS regulations ensured that staff and contractors of the AHB Program always wore appropriate PPE when performing nest or swarm destruction activities. The label and MSDS associated with the chosen product employed needed to be read carefully to avoid misuse.

Occasionally, AHB nests and swarms were apparent in the close vicinity of electrical currents/equipment. The only products reviewed in this report that can be safely used around electrics were either high-output liquid insect killer or permethrin dust.

Weather can impact safety also. In particular, windy weather may result in chemical drift resulting in accidental exposure. It was important to apply aerosols and dusts when positioned up-wind of the nest or swarm.

The potential off-target effects of any chemical used to control AHB should also be considered when selecting appropriate chemicals.

Conclusion

The findings of this review show that aerosols were the most effective method for the destruction of both nests and swarms of AHB in most situations. Flying insect spray appeared to be the superior of all products considered, however, circumstances may arise where an alternative product is necessary (examples of special circumstances experienced

by AHB Program staff and contractors included: height, accessibility, size of cavity, size and position of a nest, electrical voltage, or wet or windy weather). Based on research to date, remote nest treatment was not considered an effective means of destroying AHB nests. All destruction methods required personnel to wear an assortment of PPE to prevent chemical exposure and bee stings. Site specific risk assessments were essential to ensure safety and to prevent misuse of product. The *Asian honey bee manual: Techniques for the identification, detection and destruction of Apis cerana* (Foley, 2013) provides further guidance on AHB destruction techniques.

Appendix 1 SURVEY

Survey – Destruction methods/techniques

This survey is part of the T2M Plan (Project AG2 B(i) Validate efficacy of detection and destruction methods and strategies as essential elements of deploying different control methods). Your input will form one part of the validation for different destruction methods and is very highly valued.

QUESTIONS	Flying insect killer NESTS	Flying insect killer SWARMS	Permethrin dust	High-output liquid insect killer	Remote treatment
1) Is it easy to use? If not, why not?					
2) How quickly does it kill (minutes/hours/ days)?					
3) How thoroughly does it kill (single bees/ part of nest/whole nest)?					
4) What situations is it good for? Why?					
5) What situations is it bad for? Why?					
6) Can it be used in all weather conditions?					
7) Do you think it's safe to use?					
8) What PPE do you think is required?					
9) What residual safety issues do you perceive to people or other animals?					
10) How much of the product (roughly) is used for a single kill?					
11) Do you think kills should be conducted early or late in the day?					
12) What time/s of the day are most kills conducted?					
13) Do bees ever exit out other exits whilst conducting a kill? How often have you seen this?					
14) Do you think this would be good for industries (beekeepers, pesties, rangers) to use?					
15) How many kills have you performed (or how many years have you been doing it for)?		16) What was/is your position when you did nest/swarm kills?		17) Do you feel uncomfortable or unsafe using any of these methods? Which one? Why?	
Other comments/ideas:					

Appendix 2 FIPRONIL PERMIT

Australian Government
Australian Pesticides and Veterinary Medicines Authority

PERMIT TO ALLOW EMERGENCY USE OF A REGISTERED AGVET CHEMICAL PRODUCT

PERMIT NUMBER - PER12948

This permit is issued to the Permit Holder in response to an application granted by the APVMA under section 112 of the Agvet Codes of the jurisdictions set out below. This permit allows a person, as stipulated below, to use the product in the manner specified in this permit in the designated jurisdictions. This permit also allows any person to claim that the product can be used in the manner specified in this permit.

THIS PERMIT IS IN FORCE FROM 9 NOVEMBER 2011 UNTIL 1 JULY 2015.

Permit Holder:
Biosecurity Queensland
Department of Employment, Economic Development & Innovation
GPO Box 46
Brisbane, QLD, 4001

Persons who can use the product under this permit:
Employees of the Department of Employment, Economic Development & Innovation or persons under their direction who are suitably trained and experienced in the use of agricultural chemicals.

CONDITIONS OF USE

Products to be used:

REGENT 200SC INSECTICIDE
Containing 200 g/L FIPRONIL as its only active constituent.

TERMIDOR RESIDUAL TERMITICIDE AND INSECTICIDE
Containing 100 g/L FIPRONIL as its only active constituent.

Directions for Use:

Situation	Pest	Rate
UNMANAGED COLONIES	EXOTIC HONEYBEES (including *Apis cerana*) AND EUROPEAN HONEYBEE (*Apis mellifera*)	Mix 0.5 to 1 mL of Regent or 1 to 2 mL of Termidor into 20 L of prepared syrup.

Critical Use Comments:

- Feeding stations with non-toxic syrup must be established and monitored to ensure the targeted species are using each station.
- Once a significant number ot targeted bees are feeding, replace the non toxic syrup with toxic syrup (bait).
- Offer the bait for up to 1 hour then remove to sealed plastic containers and replace with non toxic bait.
- Repeat this process daily with fresh bait until bees no longer return to the bait station.
- Toxic baiting must be constantly monitored for the presence of non-target organisms whilst on offer at bait stations. If non-targets are observed feeding at the bait stations, action must be taken to prevent bait consumption by non-target organisms.
- All remaining bait, fresh and used, must be disposed of by burial at least 30 cm below ground.

Jurisdiction:
QLD only

Additional Conditions:

1. THIS PERMIT provides for the use of a product in a manner other than specified on the approved label of the product. Unless otherwise stated in this permit, the use of the product must be in accordance with instructions on its label.

2. PERSONS who wish to prepare for use and/or use products for the purposes specified in this permit must read, or have read to them, the details and conditions of this permit.

3. Where baiting is conducted using stations that do not exclude European bees:
   a. All commercial apiarists with hives located within 5km radius of areas to be baited must be notified of the intent to carry out the baiting in sufficient time to allow their hives to be relocated.
   b. The Permit holder must undertake every two months sampling of commercial hives located within a 5km radius of areas baited for 6 months to ensure any fipronil residue do not exceed the current MRL for fipronil in honey.

Issued by

Delegated Officer
Note: Permit amended to include half concentration rate. Critical Use Comments amended to allow option to withdraw bait prior to one hour exposure. (Permit version 2 issued 27 February 2012).

References

Foley, B.M., 2013. Asian honey bee manual: Techniques for the identification, detection and destruction of *Apis cerana*. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF) (Ed.). Department of Agriculture, Fisheries and Forestry (DAFF), Queensland.

Koetz, A.H., 2013. Detection efficacy of Asian honey bees (*Apis cerana*) in Cairns, Australia. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF) (Ed.). Department of Agriculture, Fisheries and Forestry (DAFF), Queensland.

Koetz, A.H. and S. Hyatt, 2013. Asian honey bee (*Apis cerana*) remote nest treatment. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF) (Ed.). Department of Agriculture, Fisheries and Forestry (DAFF), Queensland.

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