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Foreword

This publication, Honeybee Research Report 2006, provides details of honeybee research from July 2005 until June 2006 and lists projects commencing in the 2006/2007 financial year. It follows the Honeybee Research and Development Council Research Report 1980-1995 and the RIRDC Reports 1995-1997, 1998-2004, which were a collection of final report and progress summaries of levy funded honeybee research until June 2004. All of these research summaries plus many of the full research reports have been included on the Honeybee Research Reports CD (Version 3).

This report provides information to help apiarists and others access research recommendations and research in progress, together with researcher contact details, in a simple, easy to read format.

This report, a new addition to RIRDC's diverse range of over 1500 research publications, forms part of our Honeybee R&D program, which aims to improve the productivity and profitability of the Australian beekeeping industry

Most of our publications are available for viewing, downloading or purchasing online through our website:

- downloads at www.rirdc.gov.au/fullreports/Index.htm
- purchases at www.rirdc.gov.au/eshop

Peter O'Brien
Managing Director
Rural Industries Research and Development Corporation

Contents

Foreword ……..……. iii

PRODUCTION – Bee husbandry and management

Continuing projects

DAN-205A Drone honey bees - semen production ……. 1

PRODUCTION – Diseases and pests

Continuing projects

ANU-58A Biological control of chalkbrood by anti-fungal bacterial symbionts of bees …… 2
DAN-216A Insecticidal control of small hive beetle …… 3
DAN-228A Literature review and survey of *Nosema apis* in Australia …… 4
DAV-223A Bacteriophage control of European foulbrood ……... 5
DAN-245A Development of treatment options for European foulbrood …….. 6

Final report summary

CSE-87A Clarification of aspects of Varroa reproduction - first stage of a possible new control method …… 7

PRODUCTION – Nutrition

Continuing projects

DAW-100A An Australian survey of pollens for their fatty acid composition ……. 9
DAW-105A The effect of high and low fat pollens on honey bee longevity ……. 10

Final report summary

DAN-214A Nutrition field trial to maximise colony population …….. 12

PRODUCTION – Genetic improvement

Continuing project

US-123A Development of two genetic markers for hygienic behaviour of honeybees …… 13

RESOURCES

Continuing projects

SFN-2A The effect of logging on nectar production in NSW forests ……. 14
UA-66A Securing long-term floral resources for the honeybee industry …… 15
DAN-244A Forest plantations and honeybees …….. 16
UD-3A Long-term flowering patterns of south-east Australian melliferous flora …… 18

OFF-FARM ISSUES

Continuing projects

US-128A An investigation into the therapeutic properties of honey ……. 19

NEW PROJECTS – 2006/2007 20
NON-RIRDC PUBLICATIONS AND VIDEOS 21
RIRDC PUBLICATIONS 23

PRODUCTION - Bee Husbandry & Management

Project Title	Drone honey bees- semen production
RIRDC Project No.:	DAN-205A
Start Date:	01/07/02
Finish Date:	31/07/07
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Objectives	• To provide data on the effects of drone age, season (time of year), and differences between unrelated drone breeding lines on the production and quality of drone semen. • To determine if semen quantity and sperm numbers produced are selectable traits.
Current Progress	• Work has been completed on the proportion of drones/sample producing semen, volume of semen/drone, number of sperm/drone, viability of sperm/drone, motility of sperm/drone, and initial data has been collected on changes in amino acids and fatty acids of semen with changes in drone age and season. Collection and analysis of semen for amino and fatty acids is continuing to increase the amount of data on this subject. • At the end of the 2003-4 season, two breeding line were identified as a High Line and a Low Line for the proportion of drones/sample producing semen, semen volume/drone and sperm numbers/drone. A 4-way crossing experiment was planned for the 2005-6 season to determine whether these three characteristics were selectable traits. Queen bees from the High Line were superseded in 2005. Two attempts were made, spring/summer 2005/6 to re-establish the High Line queens without success. This part of the project has ceased.

PRODUCTION - Diseases & Pests

Project Title	**A study of Gluconobacter – gluconic acid producing bacteria, symbionts of bees: development of biological control for chalkbrood**
RIRDC Project No.:	ANU-58A
Start Date:	01/01/02
Finish Date:	30/05/07
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Objectives	• To isolate and characterise bacteria from varied Australian bee hives that produce antifungal agents effective against the chalk brood disease. The results of this strategic basic research will provide specific information to carry out applied research in the future to develop a biological control of chalk brood disease.
Current Progress	This project is studying the symbiotic association of bacteria with Australian honeybees for the first time. A large number of gram positive and negative bacteria have been isolated, characterised and stored from bees from Apiaries around Australia, that inhibit the chalkbrood fungus. There is a strong correlation between number and diversity of bacteria found in the bee gut and whether there is chalkbrood disease in the hive. Therefore it may be possible to use bacterial numbers present in the bee gut as an indicator for the onset of diseases such as chalkbrood in the future. Two types of feeding are being used in experiments to control chalkbrood. Initial experiments with pure anti-fungal compounds added to sugar solution has suggested a trend that chalkbrood disease can be significantly reduced. We are planning to test probiotic mixtures of bacteria (which strongly inhibit chalkbrood) to see if we can improve bee health. In all these cases if an effective control method is found then the bee keeper will not have to worry about any untoward residues in the honey from such treatments. Furthermore this approach has the potential to treat a number of diseases of bees other than chalkboard.

PRODUCTION - Diseases & Pests

Project Title	Insecticidal control of small hive beetle
RIRDC Project No.:	DAN-216A
Start Date:	01/04/03
Finish Date:	30/06/07
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Objectives	• Part 1. To identify the most appropriate insecticides and insecticide application methods to control small hive beetle in hives. • Part 2. To refine the insecticidal harbourage developed in Part 1 into a ready-to-use product for use by beekeepers.
Current Progress	We have demonstrated the effectiveness in controlling Small Hive Beetle adults, of a prototype harbourage that comprised insecticide treated corrugated cardboard sandwiched between layers of aluminium foil. In field trials, when placed on the bottom board of infested hives, beetle numbers were reduced by 86-93% compared to untreated hives. The prototype harbourages were insufficiently robust to exclude bees completely, and some hives were killed. A strong, two-piece plastic housing for the insecticide treated cardboard was designed and moulds are currently under manufacture by Pro-Plas Pty. Ltd. in Melbourne. When assembled the harbourage will be a tamper-proof, ready-to-use product for bee keepers. One thousand units have been ordered. Prior to commercial release an insecticide residue trial of the end-use-product must be undertaken in accordance with **APVMA *Guideline 21 Residues in Honey***. This will be done using NSW DPI research hives. Insecticide analyses will be outsourced to AgriSolutions Pty. Ltd. in Brisbane, a company with specialist experience with insecticide residue analysis of honey. We will apply to Australian Pesticides and Veterinary Medicines Authority (APVMA) to conduct further field trials with the end-use-product under Pesticide Permit. We hope to interest a commercial manufacturer at this point.

PRODUCTION - Diseases & Pests

Project Title	Literature review and survey of *Nosema apis* in Australia
RIRDC Project No.:	DAN–228A
Start Date:	01/07/04
Finish Date:	01/03/06
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Objectives	• To provide a literature review and survey of *Nosema apis* (a protozoan disease of honeybees).
Current Progress	A literature review that provides information on the effects of nosema disease, current control methods and the laboratory diagnosis of the infection has been produced. It also provides beekeepers with the methodology to monitor nosema levels in their hives. In 2004 a survey of 800 hives (involved in the pollination of almond trees, belonging to 20 beekeepers) for *Nosema apis* was carried out. In 2005 a second survey was carried on the same hives. There was a broad range of infection levels in both surveys. In the first survey the spore count ranged from 10,000 to 12,236,000 spores per bee and in the second the range was from 11,250 to 6,190,000. Analysis of the questionnaires that were completed by the beekeepers who took part in the survey provided a number of insights into factors which may influence nosema levels: Factors associated with low nosema levels were: (i) packing of hives down tight for the winter, (ii) no manipulation of hives during the winter, (iii) no shifting of bees during the winter, (iv) hives going to almonds mostly ¾ to full of honey. Factors associated with high nosema levels were: (i) working spotted gum during the winter (ii) manipulation of hives (iii) shifting hives during winter A number of factors did not seem to have a significant bearing on nosema levels: (i) comb replacement programs (ii) age of queens (iii) honey yields A further survey is planned for 2006. The data from this survey will be collated with the data from 2004 and 2005 to provide a more robust analysis of nosema infections than would have been possible with the analysis of the results for a single survey.

PRODUCTION - Diseases & Pests

Project Title	Bacteriophage control of European foulbrood
RIRDC Project No.:	DAV-223A
Start Date:	01/04/05
Finish Date:	31/03/07
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Objectives	• Isolate and culture bacteriophages capable of lysing (killing) *M. pluton* bacteria. • Assess the ability of bacteriophage therapy to control European Foulbrood (EFB) disease in-vitro, in larval rearing assays and in hive based disease situations.
Current Progress	European Foulbrood infected hives were used as source material for bacteriophage isolation. *M. pluton* was isolated from infected hive material taken from the Lake Bolac region. Sections of infected comb were washed in EFB growth media to extract bacteriophage. Particulate matter, bacteria and fungi were removed by filtration, leaving bacteriophage and other viruses. Solid and liquid phase bacteriophage isolation experiments were performed on comb washes from all sourced material. Comb washes were incubated with active *M. pluton* cultures and either spread on petri dish media, or diluted across the wells of a microtitre plate. Following anaerobic incubation the plates were examined for the presence of bacteriophage. The presence of parasitic bacteriophage (prophage) in *M. pluton* was examined, by culturing the bacteria under stress (heat and ultraviolet light exposure), and looking for the emergence of bacteriophage. To date we have not been able to demonstrate bacteriophage activity against *M. pluton*, nor have we been able to isolate bacteriophage with activity against *M. pluton*. Ongoing activities: We are continuing to perform bacteriophage isolation experiments from the hive material already obtained, and are examining ways of obtaining more comb samples. Experiments to isolate bacteriophage to other hive borne bacterial species using the same methodology are also under way, to validate the current methods.

PRODUCTION - Diseases & Pests

Project Title	Development of treatment options for European foulbrood
RIRDC Project No.:	DAN-245A
Start Date:	01/01/06
Finish Date:	31/12/07
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Objectives	• To determine the minimum infectious dose of *Melissococcus pluton* required to initiate European foulbrood (EFB) in artificially raised honey bee larvae. • To determine whether eight fatty acids (previously demonstrated to inhibit the growth of *M. pluton*) can protect honey bee larvae from infection with *M. pluton*. • To determine the minimum inhibitory concentration of oxytetracycline to *M. pluton* in artificially raised honey bee larvae.
Current Progress	This project was due to start on 1 January 2006 but commencement has been delayed until 1 August 2006.

PRODUCTION - Diseases & Pests

Project Title:	**Clarification of aspects of Varroa reproduction - first stage of a possible new control method**

RIRDC Project No.:	CSE-87A
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Objectives

- To determine the hormone profiles in the blood of pre and post-pupal stages of *Apis mellifera* and *Apis cerana* drone brood in Java, Indonesia, and in the blood of Varroa mites infesting those stages. This information will form a basis for developing a possible new method for controlling Varroa destructor on *Apis mellifera*.

Background

Varroa mites present a serious threat to the Australian beekeeping industry, are listed in the Ausvet Plan and are covered by Animal Heath Australia's (AHA) Emergency Animal Disease Response Agreement (EADRA). Research conducted by CSIRO in the late 1990's showed that the mite long referred to as "*Varroa jacobsoni*" was a species-complex. The complex consists of at least 30 genotypes each belonging to one of at least 2, but possibly 5, different species. Only 2 of these genotypes (a Korea and Japan genotype of *Varroa destructor*) can reproduce on the European honeybee, *Apis mellifera*. The other genotypes are harmless to *A. mellifera* as they lack the ability to produce on that bees' susceptible brood. Acquisition of information on the *Varroa* mite reproduction system would provide a better understanding as to why females of most genotypes cannot reproduce on *A. mellifera*. This, in turn, could lead to the development of novels ways of controlling the 2 damaging genotypes on *A. mellifera*. The first step along this pathway, and the focus of the current study, is to develop a method for differentiating the internal body tissues of female mites.

Research

Field stations were established in Java and Irian Jaya in Indonesia. Colonies of *A. mellifera* were placed at the Java field station, while both *A. mellifera* and *A. cerana* colonies were placed side-by-side at the Irian Jaya station. The Java colonies served as a source for reproducing female Korean genotypes of *V. destructor*, while the *A. cerana* and *A. mellifera* colonies in Irian Jaya served as a source for reproducing and non-reproducing female Java genotypes of *V. jacobsoni* respectively. Mites sourced from the colonies were transported under permit to the laboratory in Canberra where their identity was confirmed by DNA fingerprinting. Research was then carried out to develop a light microscopy-based method by which the internal body tissues of the female mites could be easily differentiated.

Outcomes

A technique that allows for the various internal tissues of reproducing and non-reproducing female *Varroa* mites to be differentiated by light microscopy. The technique involves embedding female mites in wax blocks, obtaining ultra-thin sections from them, staining those sections with specific stains and examining the sections with a light microscope.

Implications

The newly developed light microscopy technique will now allow for the construction of 3D models of female *Varroa* mites that show the layout and organization of their internal body parts (presently underway). The technique will also be useful in future studies to develop a conceptual model of the *Varroa* mite reproduction system. When

developed, this model will be capable of pinpointing the time when mite reproduction is first initiated. This, in turn, will allow for a search for chemical signals responsible for triggering mite reproduction.

PRODUCTION - Nutrition

Project Title	An Australian survey of pollens for their fatty acid composition
RIRDC Project No.:	DAW-100A
Start Date:	01/05/01
Finish Date:	30/06/06
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Objectives	• To analyse the fatty acid composition of pollen from at least 120 of Australia's major honey and pollen producing species by 2004 (20 species from each State).
Current Progress	Fatty acid analysis was carried out on 577 pollen samples where 73 different fatty acids were identified. Forty two (57.5%) of the fatty acids do not have a systematic name and were regarded as 'unknown'. Of the 73 fatty acids only 5 (6.9%) were common to all pollens sampled. The five common fatty acids were palmitic, stearic, oleic, linoleic and linolenic. Both linoleic and linolenic acids were the highest in concentration of the five fatty acids and had the greatest variability in concentration in pollen. Some further statistical analyses have yet to be completed.

PRODUCTION - Nutrition

Project Title	The effect of high and low fat pollens on honey bee longevity
RIRDC Project No.:	DAW-105A
Start Date:	01/07/03
Finish Date:	30/06/06
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Objectives	• To ascertain the effect of oleic and linoleic acids on honey bee longevity and their effect on body fat composition.
Current Progress	All experiments have been completed and statistical analyses about 90% complete. Eucalypt pollens contain low concentrations of lipid when compared to species that European honey bees have evolved with. Enhancing pollen diets with fatty acids was hypothesized to improve honey bee longevity. Different concentrations of linoleic and oleic acid added to eucalypt pollen was trialed in small cages containing ca. 1400 bees each. Honey bees (*Apis mellifera* L.) fed diets of redgum (*Corymbia calophylla* (Lindl.) Hill & Johnson) pollen (formerly *Eucalyptus calophylla*) had the lowest mortality of twenty-two diets tested for six weeks and had a life-span greater than 42 days. The lowest life-span (50% mortality) of 14 days was from bees fed invert sugar. A diet of cane sugar enabled 50% of the population to survive 17 days. Linoleic acid mixed with a redgum diet in concentrations of greater than 6%, limited life-span to 24-25 days, whereas bees were more sensitive to oleic acid where life-spans decreased to 15-21 days when diets had concentrations >2%. Of the flours, the lowest fat soyflour (0.6% lipid) gave bees a greater life-span of 26 days whereas bees fed a defatted and full-fat soyflour had life-spans of 19 and 20 days respectively. Bees fed on lupin flour had a slightly better life-span (23 days). Adding pollen to lupin flour caused an increase in mortality but for the other flours, an addition of pollen to soy flour was beneficial in increasing life span. Overall, the results showed deleterious effect of oleic acid was greater on honey bees when in high concentration in diets whereas the bees were more tolerant of linoleic acid in high concentrations in diets. In terms of longevity and life-span, pollen that had been crushed and irradiated and several years old was as good as fresh pollen in tests conducted. Accidental fungal contamination of sugar diets in one experiment caused high mortality and is discussed in context of the possible impact that yeasts and fungi have on bees in apiaries. Fatty acid enhanced pollen diets containing up to 2% oleic acid increased head weight greater than diets containing 6, 10 or 16% oleic acid, whilst the head weight response to added linoleic acid was extended from diets with concentrations up 6%. Bees fed these same diets were the only colonies able to feed larvae hatched from eggs the queen laid in comb indicating head weight response to diets can be developed as a measure of hypopharyngeal activity. Concentrations of fatty acids in

excess of these percentages for both lipids reduced head weight. None of the fatty acids added to pollen caused head weights to exceed those bees fed the pure pollen diets and therefore there is no advantage in respect of oleic and linoleic acid by way of enhancement of the diet in improving the nutritional value of redgum pollen.

Diets based on flours of soybean and lupin when compared to pollen diets corresponded to lower head weights. Soyabean flour diets whether, low, medium or high fat did show differences in head weight at day 7 and in growth rate over the 6 week experiment. In terms of head weight growth rate, defatted soyabean flour was the only flour significantly different to the protein soy concentrate Promine™ which while a low fat flour had an overlapping similarity matrix for growth rate and diet with a full-fat soyabean flour diet. For diet alone, the similarity matrix showed a significant difference between full-fat and defatted soybean flour on head weight.

However, the effect of diet on head weight and on the growth rate of the head weight was found to be dependent on *season* and *experiment within season* which means that a diet that may have a certain effect over summer for example may have a different effect during a different season making comparisons between diets a complex matter.

In Western Australia, emerged bees raised in winter (June-August) for experiments had the highest mean head weight with bees born in summer (December-February) having the next highest weight, followed by bees born in spring and statistically need to be taken into account in any analysis of head weight-diet relationships.

PRODUCTION - Nutrition

Project Title	Nutrition field trial to maximise colony population
RIRDC Project No.:	DAN-214A
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Objectives	• To provide evidence of the effectiveness of supplementary feeding honeybee colonies to achieve population increase.
Background	Periodically honey bee colonies suffer nutritional shortfalls in the field, either in the form of a lack of pollen or nectar, or both. Various strategies have been enacted by beekeepers to overcome these deficiencies but with mixed success. The purpose of this research was to test various strategies to overcome field deficiencies of nectar and pollen.
Research	Four commercial apiaries were fed various supplements and the response was measured gains in brood area, frames of bees, total weight gain, Nosema levels and body protein content. These experiments were conducted over the winter of 2003 & 2004. The 2003 experiments included sugar syrup and pollen supplement treatments whereas the 2004 experiment involved only pollen supplement treatments.
Outcomes	Providing supplements, particularly sugar syrup during winter increased the Nosema disease levels of the colonies. The dismantling of colonies during winter to provide pollen supplements also appeared to have a negative impact on the colonies involved in the trial. The provision of dry pollen supplement in the second year did not add significantly to Nosema levels in the colonies. A number of the parameters measured did improve in colonies provided with pollen supplement, particularly straight pollen, but this was not uniform across all measurements and apiaries in the trial. Thus there was no conclusive evidence to suggest any definitive course of action for commercial beekeepers who wish to provide nutritional supplement over the winter period.
Implications	The two year trial demonstrated the need to prepare bee colonies in the autumn for late winter and early spring pollination contracts or honey gathering duties. The various methods trialled were ineffective in conclusively building or maintaining bee populations. Future field trials should incorporate cage trials in parallel with the field trials and increase the numbers of hives in each treatment.

PRODUCTION - Genetic Improvement

Project Title	**Development of two genetic markers for hygienic behaviour of honeybees**
RIRDC Project No.:	US-123A
Start Date:	01/06/03
Finish Date:	31/03/07
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Objectives	• To identify two genes related to hygienic behaviour at the level of their sequence • To produce a diagnostic test so that individuals carrying the allele that confers hygienic behaviour can be identified without field testing • To develop general procedures for the identification of economically important behavioural genes of the honeybee and protocols for their exploitation by industry
Current Progress	We have identified two genetic markers, which are strongly linked to hygienic behaviour, using colonies classified as hygienic and non-hygienic from field studies. By sequencing the surrounding regions of one of the markers, we have developed a single-nucleotide polymorphic (SNP) marker, which would allow for the diagnosis of potential hygienic stock without the need of field testing. However, results from initial tests have shown that the SNP marker was unreliable for identifying hygienic stock – the marker correctly identifies all hygienic colonies, but also classifies 50% of non-hygienic colonies as being hygienic. From the sequencing of the original genetic marker, we have also pinpointed the location of the marker in the honeybee genome. Based on the marker's position in the genome as well as protein homology, we have generated a list of 70 candidate genes for hygienic behaviour. A new field study is currently being prepared to enable a more refined selection of candidate genes, through the use of larger sample sizes, greater extremes of hygienic behaviour, and a more comprehensive range of genetic markers. Identified genes will allow for the design of more definitive tests for hygienic behaviour. We are also continuing in the development of diagnostic markers for hygienic behaviour.

RESOURCES

Project Title	The effect of logging on nectar production in NSW forests
RIRDC Project No.:	SFN-2A
Start Date:	30/08/02
Finish Date:	30/06/06
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Objectives	• To quantify the impact of logging on nectar production in two eucalypt species (Spotted Gum and Grey Ironbark) by measuring nectar production in different tree sizes in forest under different stages of regeneration from logging. • A better understanding of nectar production in logged forests, when widely communicated, will allow an integration of apiculture with forest management and thus promote sustainability and accessibility.
Current Progress	Spotted Gum that was well budded since 2003 burst into flower in 2005. Over the course of winter we measured nectar at 3 replicate sites from each of 3 logging histories. At each site 8 trees were measured – 4 large and 4 small. Nectar was measured in flowers bagged over-night to determine nectar production and on unbagged flowers in the late afternoon and early morning to determine nectar availability at each of these times of day. This will provide us with excellent data to address the project's objectives, including comparisons in nectar production between a poor flowering year (2003) and a prolific one (2005). Nectar measurements from over 2,000 flowers have been data-based and are currently being analysed statistically. Grey Ironbark also flowered moderately well in spring. We completed one trip to measure nectar in unbagged and bagged flowers from 3 sites, each with a different logging history. This gives us data for this species from 2004, 2005 and we have proposed 2006 as well. We also collected data on honey production from beekeepers with site permits surrounding our study areas. Survey forms were designed and distributed to 38 beekeepers – so far we have received 5 replies with data on honey production from 13 sites.

RESOURCES

Project Title	Securing long-term floral resources for the honeybee industry
RIRDC Project No.:	UA-66A
Start Date:	01/07/04
Finish Date:	31/07/07
Researcher:	Dr David Paton
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Objectives	• The broad aims of this project are to better document the use and importance of native plants (particularly woodland eucalypts) in different landscapes (natural bushland, paddock and revegetation) to commercial beekeepers, identifying deficiencies in the resource base where they exist. This information will then be used to assist in maintaining the health and productivity of current trees from a beekeeper perspective while growing the floral resource base through appropriate revegetation and restoration programs.
Current Progress	Levels of flowering (percentage of plants flowering, # flowers per tree) for most of the key eucalypts were much lower in 2005 than 2004 at our study sites and sufficiently poor to not be used by beekeepers. Remnant trees, scattered paddock trees and revegetated trees all showed similar patterns. Poor flowering for *Eucalyptus leucoxylon*, *E. cosmophylla* and *E. diversifolia* in 2005 was reflected across the Mt Lofty Ranges region (SA) and adjacent regions (e.g. Kangaroo Island). For each of these plants flowering will be substantial in 2006. For *E. camaldulensis* however there were sub-regional differences: a sub-region that flowered extensively in 2004-05 flowered poorly in 2005-06, and vice versa. Two additional study sites have been established to measure changes in pasture weeds (*Echium*, *Hypochoeris*) as a consequence of weed management to facilitate re-establishment of native vegetation. To date nectar production has been measured for 8 species of eucalypts. Remnant, paddock and revegetated *E. leucoxylon* trees produced similar quantities of nectar per flower per day. Similar patterns were found for *E. odorata* in remnant versus revegetation. These data suggest re-vegetation programs can lift the resource base for the beekeeping industry. Key pollen sources are also being identified so that these can be planted too.

RESOURCES

Project Title	Forest plantations and honeybees
RIRDC Project No.:	DAN-244A
Start Date:	01/08/05
Finish Date:	30/07/07
Researcher:	Dr Doug Somerville
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Objectives

- To evaluate the species of commercial value in the plantation industry to the Australian honeybee industry and estimate the economic contribution of plantations to the honeybee industry.

Current Progress

Two papers were presented to two separate international conferences during 2005.

"Can plantation forestry replace declining floral resources for apiculture in Australia?" delivered by Mike Moncur at Apimondia in Ireland and "Plantation forestry – What value to honey bees in Australia?", delivered by Doug Somerville at the International Beekeeping Congress in India.

At both conferences it was evident that the beekeeping expertise in various countries around the world has a significant lack of knowledge of the specific eucalypt species grown in their various countries. In many cases the literature and verbal communication refer to the genus only, i.e. *Eucalyptus*.

It was noted that in many countries eucalypts are listed or regarded as major floral species of significance. In some cases the bark type or even species could be identified. The 'gum' bark type eucalypts were frequently mentioned by international beekeeping experts, yet this group of eucalypts is not always considered by Australian beekeepers as of high value. The evidence that the relative importance of eucalypts to beekeepers in many countries does not necessarily parallel Australia for the following reasons:

a. Rainfall in many countries is more regular and plentiful then the indigenous environment.
b. Soil fertility in many countries is superior to that of Australia.
c. Pest pressure on eucalypts particularly from insects is virtually non existent outside Australia.
d. The annual honey yields per hive in many countries are substantially below what is expected in Australia. Average annual honey yields are in excess of 100kg/hive in Australia compared to 20 to 50kg/hive in many countries.
e. A floral species that is considered a 'good' source of nectar in another country where an apiary many consist of 10 or less hives which are not substantially migrated, may be considered a 'poor' source of nectar in Australia where apiaries range from 80 to in excess of 120 hives on the one location and are regularly transported to major flowering events 4 to 6 times per annum.
f. Bud initiation for many eucalypts within Australia is on average every 2 to 4 years or greater, whereas bud initiation is frequently observed to be annual in many countries were eucalypts are propagated.
g. The stage of growth at which budding commences was also observed to be earlier in many countries which could be due to points mentioned in a, b and c.
h. Forestry plantations are propagated for many reasons. As plantation species

mature the regularity and reliability of flowering events will improve.

The next stage of the project will involve communication with the various forest plantation agencies and companies within Australia, to gather data on the management issues that may impact on beekeepers usage of this floral resource.

RESOURCES

Project Title	Long-term flowering patterns of south-east Australian melliferous flora
RIRDC Project No.:	UD-3A
Start Date:	01/07/05
Finish Date:	30/11/06
Researcher:	Dr Maria Gibson
Organisation:	Deakin University
Phone:	(03) 9251 7466
Fax:	(03) 9251 7473
Email:	maryg@deakin.edu.au
Objectives	• Determine long-term flowering patterns of south-east Australian melliferous flora (including Eucalyptus, Banksia and Eucryphia species) • Investigate pollen-related bee nutrition • Investigate occurrence of 'toxic' nectar in Victorian eucalypts • Compile a written, accessible record of anecdotal information sourced from highly experienced apiarists • Investigate Bogong moth visitation, logging and their effects on nectar production.
Current Progress	The project was primarily designed to access the knowledge of long-term flowering patterns of native honey flora held by apiarists with at least thirty years experience. The information has wide-reaching implications for apiculture, ecological management and Australia's cultural heritage so it is particularly vital to have an accessible written record of the information. The project is made more urgent as younger generations are resisting tradition by moving away from apiculture, thereby risking the permanent loss of this largely unrecorded knowledge. Face to face interviews with apiarists have yielded a large volume of long-term data relating principally to melliferous *Eucalyptus*, *Banksia*, and *Eucryphia* species. Data related to other topics identified as important to the industry also have been collected, such as the effects of timber harvesting and *Agrotis infusa* (Bogong Moth) visitation on honey production. Investigation of nectar fermentation is continuing after interviews indicated this could cause high honeybee mortality and a drastic decline in honey production. The interviews identified the melliferous species most likely to illicit such a dramatic response and the possible factors triggering the response. Experiments are being conducted to determine the yeast and alcohol content of nectar of selected species over their flowering period.

OFF-FARM ISSUES

Project Title	An investigation into the therapeutic properties of honey
RIRDC Project No.:	US-128A
Start Date:	31/07/04
Finish Date:	30/09/08
Researcher:	Dr Dee Carter
Organisation:	The University of Sydney School of Molecular and Microbial Biosciences Building G08 UNIVERSITY OF SYDNEY NSW 2006
Phone:	(02) 9351 5383
Fax:	(02) 9351 4571
Email:	d.carter@mmb.usyd.edu.au
Objectives	• To increase the use and acceptance of honey as a therapeutic agent in conventional medicine.
Current Progress	A survey of Australian honeys for antimicrobial activity is being undertaken. Technical problems with the assay caused significant delays in its optimisation; however these issues have now been rectified. Honey samples sent from beekeepers around Australia have been entered into a comprehensive database developed specifically for this project. Approximately 60 honey samples have been tested for antibacterial activity so far, with results ranging from undetectable to exceptionally high levels (above 30% phenol equivalence). While most of the samples had hydrogen-peroxide type activity some also possessed non-peroxide type activity. Further samples have been requested from beekeepers in all states. Collection of samples and testing will continue until 2008. The effect of honey on biofilm formation in *Staphylococcus aureus* is under investigation. Preliminary results show that biofilm formation in two strains of this organism is significantly reduced at honey concentrations as low as 1% (w/v). Also, both strains were found to be significantly more susceptible to honey than to an artificial honey (sugar syrup) control. The effect of honey on biofilm formation in *Pseudomonas aeruginosa* and *Candida albicans* is also being investigated. The antibacterial activity of honey against emerging wound pathogens has been examined. Fifty clinical isolates of Gram-negative antibiotic-resistant wound pathogens were tested using Jarrah honey and artificial honey. The minimum inhibitory concentration (MIC) of Jarrah honey ranged from 9.8 to 12.2% (w/v) and was significantly lower than the MIC for artificial honey in all cases. The following articles were published in the last year: Irish, J; Carter, DA; Shokohi, T; Blair SE. Honey has an antifungal effect on *Candida* species. *Medical Mycology*, 2006 (in press). Blair, SE; Carter, DA. The potential for honey in the management of wounds and infection. *Australian Infection Control* 10:1:24-31, March 2005. Blair, SE. Therapeutic honey… nature's own clever antimicrobial agent. *National Healthcare Journal* pp. 54-58, August 2005. Blair, SE and Irish, J. Honey vs Superbugs. *The Australasian Beekeeper* pp. 79-83, August 2005. Blair, SE and Irish, J. The medicinal properties of honey. *Honeybee News* pp. 24-25, September/October 2005.

New Projects –2006/2007

New projects being funded or under consideration in the 2006/2007 financial year are as follows:

Title	Researcher	Phone
The lessons for Australian beekeepers - the New Zealand experience with pests and diseases	Dr Doug Somerville	(02) 4828 6619
Development of a pollen substitute meeting the nutritional needs of honeybees*	Dr John Black	(02) 4753 6231
Testing pollen substitutes that meets the nutritional needs of honeybees	Mr Rob Manning	(08) 9368 3567
Small hive beetle biology providing control options*	Mr Nick Annand	(02) 6330 1210

Note: An asterisk (*) indicates that the Corporation is still to finalise amendments to the project in terms of, for example, a lower budget or project design.

Non-RIRDC Publications and Videos

The following publications and videos have been jointly funded by RIRDC but are not available from RIRDC. Ordering details as indicated.

Beekeeping in the NSW State Forest Districts

by NSW Agriculture, $5 each, phone (02) 4823 0616 to order

A series of reports which include information on beekeeping activities and honey and pollen flora of importance to beekeeping within each state forest district of New South Wales. Each report is approximately 20-26 pages.

Current reports in the series are:

- Queanbeyan/Badja State Forest Management Area – Apiary Management Potential (1995)
- Central Murray Valley Forestry Area – Apiary Management Survey (1995)
- Forbes Forestry District – Apiary Management Survey Results (1996)
- Beekeeping in the Bulahdelah State Forests (1997)
- Beekeeping in the Kempsey State Forests (1997)
- Beekeeping in the Narrandera State Forests (1997)
- Beekeeping in the Taree State Forests (1997)
- Beekeeping in the Tumut-Tumbarumba State Forests (1997)
- Beekeeping in the Wauchope State Forests (1997)
- Beekeeping in the Glen Innes State Forests (1997)
- Beekeeping in the Mildura Forestry Management Area (1997)
- Beekeeping in the Inverell State Forests (1997)
- Eden-Bombala Forestry District - Study of Beekeeping Usage and Importance (1997)
- Beekeeping in the Dubbo State Forests (1998)
- Beekeeping in the Urbenville State Forests (1998)
- Beekeeping in the Morisset State Forests (1998)
- Beekeeping in the Bathurst/Oberon State Forests (1998)
- Beekeeping in the Grafton State Forests (1998)
- Beekeeping in the Urunga State Forests (1998)
- Beekeeping in the Casino State Forests (1998)
- Beekeeping in the Gloucester/Walcha State Forests (1998)
- Beekeeping in the Dorrigo State Forests (1998)

Chalkbrood Disease of Bees

by NSW Agriculture, $25 (includes postage), phone (02) 6391 3433 or 1800 028 374 to order

Enables beekeepers to identify the symptoms of Chalkbrood, outlines measures to take to reduce the impact of this disease and outlines the epidemiology of this disease and how to correctly examine hives to detect Chalkbrood. 10 minutes

Bee Parasites Exotic to Australia

by NSW Agriculture, $30 (incudes postage), phone 02) 6391 3433 or 1800 028 374 to order

Enables beekeepers to identify external exotic parasites (varroa, trachael mites and tropilaelaps) and exotic bees (Asian, giant and dwarf honeybees) and be able to contact the right authorities should they see them in Australia. Includes biology of the parasites, how to inspect hives, how they spread and control measures should they enter Australia. Also covers how to legally import honeybees with approval from AQIS. 20 minutes

Endemic Bee Diseases (VDO5) 1992

by NSW Agriculture, $30 (includes postage), phone (02) 6391 3433 or 1800 028 374 to order

Enables beekeepers to identify endemic bee diseases (American Foulbrood, European Foulbrood, Sac Brood, Wax Moths, Braula Coeca (Tasmania only)) and other brood disorders. Enables beekeepers to identify the symptoms of the disease and pests, outlines measures to take to reduce the impact of this disease and outlines the epidemiology of the diseases and pests. How to correctly examine hives to detect problems. 49 minutes

Package Bee Production in Australia

by NSW Agriculture, $30 (includes postage), phone (02) 6391 3433 or 1800 028 374 to order

Enables beekeepers to follow a step-by-step guide on how to produce, handle and care for package bees, how to prepare package bees for shipment to overseas destinations. Inspection and certification requirements to overseas countries who buy package bees and Queen bees from Australia. 27 minutes

RIRDC PUBLICATIONS

Nosema Disease-Literature Review & Survey of Beekeepers	05/055 (2005, 26 pgs)	$21
Honeybee Research Reports (Version 3)	CD05/001	$26
Fat Bees Skinny Bees-A Manual on Honey Bee Nutrition for Beekeepers	05/054 (2005, 150 pgs)	$30
Honeybee Research Report 2005	05/053 (2005, 33 pgs)	Free
Antioxidants in Australian Floral Honeys – Identification of health-enhancing nutrient components	05/040 (2005, 94 pgs)	$21
A Preliminary Assessment of the Glycemic Index of Honey	05/027 (2005, 33 pgs)	$16
Oxytetracycline Sensitivity of Paenibacillus Larvae.SUBSP. Larvae Isolates	05/021 (2005, 12 pgs)	$16
Improving Queen Bee Production	04/153 (2004, 23 pgs)	$16
Disappearing Disorder	04/152 (2004,18 pgs)	$16
Evaluating Alternative antibiotics for Control of EFB	04/095 (2004, 54pgs)	$16
A beekeeper's guide to understanding control measures for European Foulbrood	04/091 (2004, 43pgs)	$21
Floral Resources used by the South Australian Apiary industry	04/089 (2004, 74pgs)	$21
Honeybee Research Report 2004	04/078 (2004, 33 pgs)	Free
Valuing Honeybee Pollination	03/077 (2003, 47pgs)	$16
Small Hive Beetle in the USA	03/050 (2003, 69 pgs)	$21
Introduction & Early Performance of Queen Bees	03/049 (2003, 45pgs)	$16
Honey Industry Survey	03/039 (2003, 39pgs)	$21
Commercial Beekeeping in Australia	03/037 (2003, 86 pgs)	$21
Fatty Acids – an alternative control strategy for honeybee disease	03/028 (2003, 19 pgs)	$16
R&D Plan for the Honeybee Program 2002-2007	02/081 (2002, 21 pgs)	Free
Breeding hygienic disease resistant bees	02/048 (2002, 35pgs)	$16
Techniques for the detection of adulterated honey	02/047 (2002,16pgs)	$16
The Use of Honeybees as a Transfer Vector for Control of Core Rot in Apples	02/046 (2002,54pgs)	$16
Literature Review of Chalkbrood-a Fungal Disease	01/150 (2001, 20pgs)	$16
Pollen Analysis of Eucalypts in Western Australia	01/053 (2001, 63pgs)	$16
Honeybee Disease Barrier Management Systems	01/052 (2001, 23pgs)	$16
Hot Wax Dipping of Beehive Components	01/051 (2001, 28pgs)	$16
Beekeepers Use of Honey & Pollen Flora Resources in Victoria	01/050 (2001, 104pgs)	$21
Quality Survey of Australian Honeys	01/049 (2001, 42 pgs)	$16
Controlling American Foulbrood	01/048 (2001,14pgs)	$16
Nutritional Value of Bee Collected Pollens	01/047 (2001, 166pgs)	$21
Nosema Disease in Honeybees-Genetic Variation & Control	01/046 (2001, 36pgs)	$16
Honeybee Research Reports (Version 2)	C01/001	$26
Pollination Manual 2001	C00/001	$26
Floral Resource Database for the NSW Apiary industry	99/174 (1999, 154pgs)	$21
Australian Liquid Honey	99/145 (1999, 83pgs)	$21
Natural Resource Database for the QLD Apiary industry	99/043 (1999, 68pgs)	$16
European Foulbrood	99/020 (1999, 23pgs)	$16
Impact of Commercial Honeybees on Flora & Fauna	99/015 (1999, 31pgs)	$16
Treating American Foulbrood	98/144 (1998, 12pgs)	$16
Strategic Planning & Action Meeting for Honeybee Nutrition	98/128 (1998, 22pgs)	$16
Beekeeping & Secure Access to Public Land	97/026 (1997, 52pgs)	$16

SHORT REPORTS (FREE)

Management of small hive beetle (SHB) in Australia (May 2006, 2 pgs)	
Update on control of Small Hive Beetle (May 2005)	S05/139
Control of European Foulbrood with OTC & Apiary Management	S03/135
Successful introduction & Performance of Queen Bees in a Commercial Apiary	S03/126
Bulk Honey Containers	S97/010