Honeybee Research Report 2007

Research completed and in progress for the Honeybee R & D Program

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Foreword

This publication, Honeybee Research Report 2007, provides details of honeybee research from July 2006 until June 2007 and lists projects commencing in the 2007/2008 financial year. It follows the Honeybee Research and Development Council Research Report 1980-1995 and the RIRDC Reports 1995-1997, 1998-2005, which were a collection of final report and progress summaries of levy funded honeybee research until June 2005.

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 1600 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

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COMMUNICATION AND EXTENSION

PRODUCTION - Bee Husbandry & Management

Project Title	Drone honeybees- semen production
RIRDC Project No.:	DAN-205A
Start Date:	01/07/02
Finish Date:	31/07/07
Researcher:	Mr John Rhodes
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Objectives	(i) To provide data on the effects of drone age, season and breeding lines on the production and quality of drone semen (ii) To determine if semen volume per drone and sperm numbers per drone are selectable traits (iii) To determine changes in fatty acid and amino acid content of semen with drone age and season (iv) To determine the efficiency of manual eversion of drones for presenting available semen for collection
Current Progress	Objective (i) – these projects have been completed Objective (ii) – this project was not able to be carried out due to the loss of breeding lines and inability to regain the breeding lines required Objective (iii) – 2005 data completed, 2006 samples being analysed Objective (iv) – data collection completed 2007, data being analysed Final report in preparation for release in July 2007.

PRODUCTION - Bee Husbandry & Management (completed)

Project Title	Para dichlorobenzene (PDB) Strategy
RIRDC Project No.:	AHC-3A
Start Date:	06-Mar-2007
Finish Date:	20-Mar-2007
Researcher:	Dr Ben McKee
Organisation:	Australian Honey Bee Industry Council Inc
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Email:	b.mckee@capilano.com.au
Objectives	• To establish a change to the Food Standards Code 1.4.2 to include Para dichlorobenzene (PDB) with a sunset clause.
Current Progress	PDB has been used in the honeybee industry as a fumigant insecticide control for the destructive pest of stored honey bee combs, wax moth (*Galleria mellonella*). PDB is no longer registered for use, but has been widely used in the past by beekeepers domestically and internationally. As a result of residues stemming from historical use, this project aimed to prepare and present an application to Food Standards Australia and New Zealand (FSANZ) for the establishment of an Extraneous Residue Limit (ERL) for PDB in honey, achieved by an amendment to Food Standards Code 1.4.2. The success of this application will deem product that may contain very low levels of PDB as saleable, considering no food safety concerns have been identified. A full application has been completed and presented to FSANZ by the Australian Honey Bee Industry Council.

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

The design of the Small Hive Beetle harbourage was finalised in July 2006. It is a robust, black, two-piece rigid plastic device that is tamperproof after assembly. It contains precisely sized openings that allow beetles in, but exclude bees. The plastic shell is protective of the fipronil-treated cardboard insert. A trial of the harbourage was conducted in accordance with APVMA **Guideline 28** ***Residues in honey***.

Results indicated that the mean total fipronil content in post-treatment samples was less than 1 ppb. On the basis of this result APVMA issued Permit PER9732 in February 2007 allowing field trials to begin. During March and April field trials were completed with three western Sydney bee keepers. A single harbourage was placed in each 'trial hive'. At each site at least one hive acted as a 'control'. Post-treatment beetle counts were conducted after four and six weeks. During the trial interval mean live beetle numbers declined significantly at each apiary. When allowance was made for the increased numbers of live beetles found in the control hives, the mean percentage reductions in beetle numbers in the three apiaries were 98, 92 and 99% respectively after 4 weeks and 90, 97 and 99% after 6 weeks.

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).
Background	Nosema apis is an important parasite of adult honeybees. It causes significant production losses as a result of its effects on adult bee longevity, queen bees, brood rearing, bee biochemistry, pollen collection and other bee behaviour. Despite these effects there are no classic signs of infection and hence most infections are unrecognised. Little is known of the prevalence of nosema disease in Australia. In 2004 a survey of 800 hives owned by 20 beekeepers in Robinvale, Victoria was carried out for Nosema apis spores. In conjunction with the survey a literature review was also carried out on the subject. The results of the first survey and the literature review were published by RIRDC in 2005 (RIRDC publication No 05/055). Specific management practices which had an impact on Nosema apis levels were identified. The high prevalence of Nosema apis in bees in Australia coupled with associations with management techniques as well as a need to better establish the links between management practices and Nosema counts prompted the follow up surveys in 2005 and 2006.
Research	Approximately 800 hives owned by 20 beekeepers were examined each year for Nosema apis spores in the Augusts of 2004, 2005 and 2006. These beekeepers were based in Victoria, New South Wales and South Australia. Following the collection and laboratory examination of the bee samples each beekeeper was asked to complete a questionnaire. The Nosema counts and their collation with the questionnaire data and an updated literature review provide the basis for this report.
Outcomes	Nosema apis was detected in all apiaries examined over the three years of the survey indicating that this infection is widespread in bees in Australia. In 2004 the spore count per bee, per apiary ranged from 12,236,000 to 10,000, in 2005, 6,190,000 to 26,500 and in 2006, 3,836,500 to 55,500 spores per bee were detected. The number of infected hives in the apiaries ranged from 40 (100%) to 1 (2.5%). This broad range of infection levels indicates there are management practices and environmental conditions which influence the development of nosema disease. Analysis of the beekeepers' questionnaires indicated the following links between management practices and flora, and Nosema counts: (i) Hive manipulation such as taking honey off, checking brood and shifting bees were key factors in promoting high Nosema counts. (ii) Supplementary feeding was also linked to higher counts although manipulation and feeding supplements had a lesser effect on increased Nosema counts than manipulation alone. (iii) The highest Nosema counts were associated with a reduction in hive bee strength or stagnant bee strength during the almond pollination period indicating reduced pollination efficiency of

hives with heavily infected bees.

(iv) High Nosema counts were associated with Spotted Gum; however, there was no other clear link between Nosema counts and other floral species.

(v) Hives packed down tightly and full, or nearly full of honey were linked to low Nosema counts.

(vi) The influence of age of queens and comb replacement on Nosema counts could not be determined as most beekeepers in this study had comb replacement programs and used queen bees less than one year old.

Implications

This study indicates that Nosema apis is commonly found in bees in Australia and that bees heavily infected with Nosema do not provide as good a pollination service compared to those with little or no infection. Beekeepers can monitor the development of nosema disease by examining adult bees under the microscope and influence the progress of nosema disease by management decisions regarding hive manipulation, supplementary feeding and their choice of working particular flora. In this survey no severe losses of bees or hives were reported. However, had conditions been otherwise such as unfavourable weather at a critical time eg mid-March, severe losses of bees and honey production could have occurred especially in those apiaries where nosema counts were high.

PRODUCTION - Diseases & Pests

Project Title	Sustainable control of small hive beetle through targeting in-ground stages
RIRDC Project No.:	UWS-22A
Start Date:	01-Aug-2006
Finish Date:	30-Nov-2007
Researcher:	Prof Robert Spooner-Hart
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Objectives	• Conduct laboratory bioassays, using commercial strains of the entomopathogenic nematodes *Steinernema spp*. and *Heterorhabditis spp*, and the entomopathogenic fungus *Metarhizium anisopliae* to assess their efficacy against larvae and pupae of small hive beetle (*A. tumida*). • Evaluate efficacy of these above treatments in simulated field-soil conditions. • Generate preliminary data for use of drenches of entomopathogens in field apiary sites.
Current Progress	• A synchronous laboratory culture of *A. tumida* has been established, which allows selection of uniform age cohorts for bioassay testing. • Formulations (granular) of two commercially available *M. anisopliae* cultures are being tested in Petri dish laboratory bioassays for efficacy against pre-pupae ("wandering larvae) of *A. tumida*. We are also using a positive control of a non-commercial strain of *M. anisopliae* known to have high efficacy against a number of insect species, for comparison. Results have been variable, with some efficacy shown at moderate spore application rates. This work will be repeated in simulated soil conditions. • Detailed laboratory bioassays have been conducted to screen commercially available entomopathogenic nematodes *Heterorhabditis bacteriophora, H. zealandica* and *Steinernema feltiae*. *H. bacteriophora* and *H. zealandica* have demonstrated high efficacy against *A. tumida* pre-pupal stages in simulated soil conditions, with the former species superior, at rates similar to those recommended for field application against other pests. The length of protection afforded by a single nematode application to soil is currently under investigation in laboratory trials, and preliminary results look promising. • The highly successful results by *H. bacteriophora* in laboratory investigations indicate it should be evaluated under field conditions.

PRODUCTION - Diseases & Pests

Project Title	Small hive beetle biology providing control options

RIRDC Project No.:	DAN-250A
Start Date:	01-Jul-2006
Finish Date:	30-Dec-2008
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Objectives

- To determine temperature, humidity and air movement thresholds to prevent any small hive beetle (SHB) damage to stored honey supers (fulls and stickies) and what techniques/appliances could be used practically in the sheds of beekeepers.
- To determine if weak hives and queen-less hives are more attractive and more susceptible to SHB damage than strong healthy hives.
- To identify the usual daily movements of SHB in and out of managed beehives during each season of the year.
- To find the number of SHB in the immediate vicinity (ground surrounding and under the hive) of a bee hive compared to the SHB inside the hive for each season of the year.
- To identify ways of cleaning combs that have been 'slimed' as a result of SHB larval damage causing honey fermentation.

Current Progress

Addressing each point as listed above.

- Difficulties have been experienced in tracking down a suitable environmental chamber with both accurate temperature and humidity control settings, however a chamber is likely to located shortly.
- Currently developing the methodology to use for assessing the thresholds for SHB egg laying and egg survival.
- Hives have been split to increase numbers for the trial. Conditions for bees at Bathurst are currently very poor. Will be relocating hives to better conditions to build their strength ready for starting the trial next summer. Sister queens (used to reduce genetic variation having an affect on the trial) are ordered for mid October.
- A closed circuit television surveillance kit has been purchased. It comprises of 4 infrared day/night vision cameras and a digital video recorder. This allows for continuous 24 hour plus recording. The next step is to set up hives and surveillance equipment and start monitoring.
- Two enclosures that can be hammered into the soil entrapping all within have been made. Different types of lures to attract released SHB in the enclosures have been trialled. Best results from comb containing pollen, honey and brood. The lure is placed in a container (trap) made to allow SHB to enter but not leave. I have been getting recapture rates of released SHB greater than 95% run over three to four days.

PRODUCTION - Diseases & Pests

Project Title	The lessons for Australian beekeepers - the New Zealand experience with pests and diseases
RIRDC Project No.:	DAN-251A
Start Date:	01-Jul-2006
Finish Date:	31-Aug-2007
Researcher:	Dr Doug Somerville
Organisation:	NSW Department of Primary Industries
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Objectives	• To provide to the Australian beekeeping industry the opportunity to learn from the New Zealand beekeeping industry - primarily focused on the introduction of the exotic bee mite Varroa, but also including pollination management systems, the industry managed American Foulbrood (AFB) program and any aspect of value to the Australian beekeeper.
Background	The New Zealand beekeeping industry first discovered varroa mites in 2000 in the North island. Since then the industry has progressed through various phases in their endeavour to manage this pest of bee hives. This experience provides an excellent opportunity for the Australian beekeeping industry to study the issues surrounding this potential threat to the Australian beekeeping industry. The New Zealand beekeepers are also known to be innovative and progressive in many other areas and as such a study of their practices should provide Australian beekeepers with many insights.
Research	A small group of Australian beekeepers and researchers visited and discussed beekeeping issues with 28 plus NZ beekeepers and researchers in 17 locations within 11 days in March 2007. The study group consisted of Doug Somerville (NSW), Rob Manning (WA), Des Cannon (NSW), Peter Barnes (Qld.), Col Wilson (NSW), Peter McDonald (Vic.), Julian Wolfhagen (Tas.), Ian Zadow (SA) and Colin Fleay (WA). Notes where taken by all participants with the following subheadings as guide lines;- varroa management and costs, AFB – government versus industry driven, marketing honey, pollination – management and income, extracting facilities – QA and contracting, flora, beekeeping association role and other observations eg. harvesting of propolis.
Outcomes	All participants gained a great deal of knowledge from the study and there was a strong 'take-home' message that varroa was manageable after an initial settling down period of a few years while feral bee colonies remained a source of mites to reinfest managed bees. There were also worthwhile lessons to be learnt from the New Zealanders on a range of other subjects including AFB management, marketing honey, providing pollination services, contracting extraction, propolis as a by-product and the value of promoting a single honey source such as Manuka.
Implications	Varroa mites, although quite a nuisance to beekeepers, particularly when they first establish are not seen as a current threat to the future of the NZ beekeeping industry. The income stream from Manuka honey and pollination services is enough to make any Australian beekeeper very envious. It became apparent during the study that if a beekeeping business has a good cash flow then any problem that comes along can be managed. Tighten this cash flow and parasites such as varroa mites could very likely tip the balance in relation to conducting a profitable beekeeping enterprise.
Publications	Somerville D (2007) New Zealand Beekeeping Study. Honeybee News 8(2) 12-13.

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 chalkbrood 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 Research

This project is studying the important symbiotic association of bacteria with Australian honeybees (in the gut). A major Australia-wide ecological study of intestinal flora of bees has shown that healthy hives have high bacterial counts and a significant number of bacterial species inhibit chalkbrood. While chalkbrood diseased hives have much lower bacteria counts and virtually no bacterial strains in the bee gut that can inhibit chalkbrood. Bacteria have been isolated from almost all regions of Australia and characterized. We have stored about 120 different bacterial isolates from bee guts, which can strongly inhibit the chalkbrood fungus. There seems to be a propensity of different gram negative bacterial species such as *Pseudomonas, Klebsiella* and *Gluconobacter*. *Bacillus* gram positive bacterial species have also been isolated that can inhibit chalkbrood. We are currently studying the mechanisms by which these bacteria are able to inhibit chalkbrood. One mechanism we have identified is the production of the anti-fungal agent gluconic acid. We are currently testing the feasibility of a number of these bacterial isolates and the pure gluconic acid to be used as a probiotic by feeding, in protecting against the chalkbrood disease in Apiaries.

PRODUCTION - Diseases & Pests (completed)

Project Title	Development of treatment options for European foulbrood

RIRDC Project No.:	DAN-245A
Start Date:	01/01/06
Finish Date:	31/12/07
Researcher:	Dr Michael Hornitzky
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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

European foulbrood (EFB), caused by *Melissococcus plutonius*, is a disease of honey bee larvae which causes significant economic losses to the beekeeping industry in Australia. Hive experiments to test the effectiveness of chemicals to treat EFB and other studies have been hampered by the fact that bees detect and eject diseased larvae in experimental hives. By conducting experiments in laboratory raised larvae the ejection of the test larvae will be prevented, providing an effective means of determining the effectiveness of candidate treatments and other studies of EFB.

Considerable progress has been made in developing the larval assay:

(i) Larvae have been grafted into plastic microtitre plates and successfully raised to the pupal stage by feeding a basic larval diet (BLD).

(ii) Initial work to determine whether fatty acids are toxic to larvae has shown that even a very high concentration of (2000 ug/ml) of lauric acid (one of the eight candidate fatty acids) has little effect on larval survival.

(iii) EFB has developed in larvae fed suspensions of larvae with EFB.

(iv) EFB has also developed in larvae fed low passage *Melissococcus plutonius* cultures.

These developments provide the basis for fulfilling the aims of the project as outlined.

PRODUCTION - Diseases & Pests (completed)

Project Title	Transmission of American foulbrood (AFB) disease of honeybees through replacement of queen bees
RIRDC Project No.:	DAQ-293A
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Objectives	• To better understand of the role queen bees play in transmitting AFB to managed honeybee colonies.
Background	Queen bees are a main expense for commercial and amateur apiarists, and are usually replaced annually. American Foulbrood (AFB) is a major disease of honeybees. Some studies suggested queen bees are capable of playing a role in spreading AFB disease; other studies have suggested queens may be a low risk in the spread of AFB. However, no field trials have been conducted to prove or disprove these theories.
Research	Queen bees taken from infected hives were used to requeen disease-free hives. Two treatment protocols were used: The first treatment involved requeening using queens only; the second treatment involved requeening using queens and escorts.
Outcomes	This study demonstrated that queen bees, taken from hives with AFB disease and used to requeen disease-free colonies, are unlikely to cause clinical AFB.
Implications	This has positive implications for the honeybee industry, giving apiarists' confidence that disease is unlikely to be spread through the purchase of queen bees.

PRODUCTION – Nutrition

Project Title	Development of a pollen substitute meeting the nutritional needs of honeybees
RIRDC Project No.:	JLB-4A
Start Date:	01-Jul-2006
Finish Date:	30-Nov-2009
Researcher:	Dr John Black
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Objectives	• Develop specifications for an effective pollen substitute that is attractive, meets the requirements of honeybee colonies and is as economically viable as possible.
Current Research	Literature relating to factors determining the attractiveness of pollen or artificial pollen substitutes by foraging honeybees has been further reviewed and a range of substances selected in consultation with Rob Manning for preference testing with honeybees. The oil extracts initially selected for testing include avocado, lavender, olive, sesame, almond, blended vegetable, linseed, orange, apricot, canola, fish, rose, macadamia, peanut and evening primrose. The attractiveness of these materials has been determined by Rob Manning by measuring consumption of material containing a constant proportion of the oils and number of bees attracted to each 'feed pellet' at specific time intervals. The results are currently being analysed to identify the substances most attractive to honeybees. A mineral and vitamin mix meeting the specifications required for honeybees as determined in project JLB-2A has been manufactured. Fifteen protein sources (most pure proteins) from eggs, milk, blood, lupins, soybeans, canola and micro-algae are being procured for developing prospective pollen substitutes that meet the nutrient specifications defined previously for honeybees. These pollen substitutes will be evaluated for their suitability for growth and brood rearing commencing later in 2007.

PRODUCTION – Nutrition

Project Title	Testing pollen substitutes that meet the nutritional needs of honeybees
RIRDC Project No.:	DAW-121A
Start Date:	01-Nov-2006
Finish Date:	30-Nov-2008
Researcher:	Dr Robert Manning
Organisation:	Department of Agriculture and Food (WA)
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Objectives	• To test ingredients and feedstuffs developed by John Black Consulting (RIRDC Project JLB-4A) for preference and palatability. • To test the final substitute feeds in cage experiments for their effect on honeybee longevity.
Current Progress	First experiment testing oils mixed with cellulose was abandoned after three weeks of tests in bee hives. It was determined that poor consumption of the diets and high water content of the mix would cause problems in the statistical analyses. Instead of looking at the attractiveness (as above) of the oils to bees, it was decided to test the oils by mixing them at the same rate to crushed and irradiated redgum pollen to determine palatability. The various oil's attractiveness could be ranked from most attractive (higher consumption) to least attractive (poor consumption). Fifteen different oils in two five week experiments have been mixed with redgum pollen and measurements of consumption and numbers of bees attracted to the diets recorded. The data is currently being assessed by statisticians to determine the best of these to mix with protein mixes, minerals and vitamins for the next stage of the experimentation. A vitamin and mineral mixture has arrived from JLB consulting ahead of the next series of experiments.

PRODUCTION – Nutrition (completed)

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).

Background

Outside of Australia, there are few research papers that report the fatty acid composition of pollens. The earliest paper from Battaglini and Bosi (1968) examined 15 species from Italy and more recent, Serra Bonvehi and Escola Jorda (1997) analysed 20 pollen samples (no species named) from Spain. Others include Shawer *et al*. (1987) and Farag *et al.* (1978) who examined honey bee collected pollen in Egypt; Loper *et al.* (1980) analysed almond pollen in California, USA and Evans *et al.* (1987) examined the fatty acid profile of rapeseed *(Brassica* spp.*)* pollen. The only Australian publication, by Manning and Harvey (2002), reported the fatty acid composition of six eucalypts.

This research catalogues the largest group of honey bee-collected pollens analysed for fatty acids to date for both endemic and exotic plant species.

Research

The objective, to conduct a national survey of pollen for fatty acids was important because it would document for the first time a basic dataset that would be important in determining the main fatty acid components and concentration from a diverse range of pollens. The benefit in further understanding and improving the lipid component that is mixed in artificial feedstuffs, and used in the beekeeping industry to enhance bee populations, is critical for increased honey production and improved pollination services.

Pollen trapped from honeybees was collected from a number of beekeepers in Queensland, New South Wales, Victoria, Tasmania, South Australia and Western Australia. Because of quarantine restrictions, pollen from the eastern seaboard of Australia was allowed into Western Australia under a special pre-arranged permit issued from the Western Australian Department of Agriculture and Food.

Outcomes

The number of pollen samples analysed for fatty acids amounted to 577 which was 72.3% of the total number processed (798), being sorted from pollen trap samples sent in by beekeepers.

Thirty one known fatty acids from C8 to C24:1+22:6 were found to be present in pollens with another 42 fatty acids being identified (labelled as ‘unknown’) from their specific elution times, which were ‘peppered’ between the elution times of the known fatty acids.

Of the 73 fatty acids, the most dominant was linolenic acid followed by linoleic acid, palmitic acid, oleic acid and stearic acid in all pollen samples (N=577).

Fatty acids prevalent in more than 50% of pollen samples were C20, found in 574 pollen samples; C14 in 564 samples; C17 in 447 samples; C20:1 in 395 samples; C22 in 385 samples; C16:1 in 382 samples; C12 and Unk30 in 365 samples; Unk19 in 335 samples; C15 in 314 samples and Unk15 in 312 samples.

Only five fatty acids were common to all 577 pollens analysed and in that regard are the most important: palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2) and linolenic (C18:3) acids. The most uncommon fatty acids in pollens were three unknowns: 13, 14 and 42 respectively.

There was a wide range of concentrations of each of the five common fatty acids: palmitic, stearic, oleic, linoleic and linolenic acids.

Of the 577 pollen samples, 19.1% remain unidentified after microscopically examining the acetylosed pollen samples. There were 23 plant groups which had more than three representative pollen samples that could be identified as either being a named species or genus. The 23 groups covered 69.8% of the pollen samples analysed.

Implications

The study has determined the level of fatty acids in pollen and the data will be important in formulating artificial feedstuffs.

Publications

The research is the subject of a PhD, Murdoch University which will be published in electronic format in due course.

PRODUCTION – Nutrition (completed)

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
Researcher:	Mr Rob Manning
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Objectives	• To ascertain the value of primary lipids: oleic and linoleic acid to honey bee longevity and their effect on body concentration of fats. • To ascertain the order of high and low fat soyabean flour products and lupin flour on honey bee longevity and nutrition.
Background	Australia's major honey producing species are eucalypts. By European standards, the pollen of these plants are low in lipid and therefore it may affect the longevity of European honeybees. If pollen intake into beehives is poor, beekeepers feed artificial sources of protein such as soyabean flour to enable the queen bee to keep laying eggs, which when hatched and fully develop into bees, increasing colony population.
Research	Additions of two common fatty acids found in pollen as identified in RIRDC project DAW-100A, found that longevity was significantly affected by fatty acid concentration when added to low-lipid pollen such as that from *Corymbia calophylla*. The addition of fatty acids did not improve longevity, but new to knowledge of fatty acids and honeybees, was that honeybees were more tolerant of linoleic acid than oleic acid in pollen diets. In similar experiments, the most common of all substitute feedstuffs, soyabean flour did not improve longevity, nor did hypopharyngeal gland development respond to this source of protein. However, bees did respond positively to the low fat, high protein soyabean protein concentrate rather than the plain soyabean flours whether used as defatted or full fat product. A further study of the nutrition of bees during the period when they were fed diets revealed that from soyabean flour diets, little linoleic acid was accumulated in the body of bees. Bees fed sugar diets increased in lipid levels and with only linoleic acid not accumulated. Manganese was another element not accumulated like other minerals when fed flour diets.
Outcomes	Enhancing eucalypt pollen with fatty acids did not increase honey bee longevity. Nutritionally, a diet of soyabean flour failed to impart two key elements into the bees' body. Another source of protein without using the traditional source such as from soyabean flour needs to be identified. Any new diet will need to be tested against natural pollen where head weight can determine any physiological benefit and analysis of body nutrients will determine if all major elements, particularly linoleic acid and manganese are accumulated.

Implications	Lupin flour is not recommended to be a replacement source of protein to the imported soyabean flour. In order to maximise the efficiency of bees, populations have to be strong to collect nectar which bees turn into honey. Fruit and nut industries such as the almond industry which directly benefit from honey bee pollination can achieve major improvements in yield, if bees are placed into crops at their maximum population. Thus the findings from this project are very important to beekeepers and to research professionals who are involved in developing artificial feedstuffs for honeybees in order for bees to breed into populous colonies. The addition of oils to protein substitute feeds needs to still be researched as many of the additives currently used, contain high levels of oleic acid.
Publications	Three papers are written and either have been or are being prepared for publication.

PRODUCTION – Nutrition (completed)

Project Title:	Predicting the productivity of honeybees from the nutritional value of pollen
RIRDC Project No.:	ANU-57A
Researcher:	Ian Wallis
Organisation:	School of Botany and Zoology Australian National University Canberra ACT 0200.
Phone:	02 6125 2058
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Email:	Ian.wallis@anu.edu.au
Objectives	• To use near infrared reflectance spectroscopy (NIRS) to predict how various attributes of bees (size, protein content, longevity, etc) change depending on the pollen that they eat.
Background	We know that the concentrations of nutrients in pollen vary widely between species. For instance, the protein content ranges from 6 to 41%. Although important, this is only part of the story. Apart from composition, we need to know how a pollen affects a bee that eats it. This is essential knowledge because it could identify nutritional perturbations and enable apiarists to take remedial action, such as feeding supplementary nutrients – a practice common to many animal industries. The drawback is that measuring the responses of bees to different pollens entails hundreds of feeding studies and chemical analyses, all of which are beyond the scope of a small industry. One way to circumvent this problem is to use NIRS, a rapid method of analysis, to predict how bees will respond to eating particular pollen.
Research	The first step was to test whether we could analyse the chemical composition of pollen and bees using NIRS. We did not anticipate problems analysing bees but we thought that NIRS might have trouble coping with the chemical complexity of pollen samples. Not only do they vary many fold in chemical composition but pollen grains also show an incredible diversity of physical forms. In addition, we studied samples from single species and from mixtures. We then fed pollen samples with honey and water of varying protein content to cages of 100-150 bees housed in incubators set at 31ºC and 70% relative humidity. By measuring the chemical composition of the pollen, how much the bees ate, their body composition and how many eggs they raised, we could identify factors in pollen that are important to bees. The final step was to relate these attributes of bees to the NIR spectra of pollen so that we could predict the responses of bees rather than having to measure them.
Outcomes	NIRS proved a fast and inexpensive method with which to analyse pollen for protein, amino acids and fat. The method works equally well with pollen from a single species or a mixture of many species. Likewise, it is an extremely fast and cheap method for analysing the protein content of bees and thus can quickly resolve whether the protein content varies as widely as the literature suggests or whether some of the published values are erroneous. Finally, it is possible to predict attributes of bees from the NIR spectrum of pollen.
Implications	This project shows that NIRS is a useful tool for apiculture. It can quickly analyse the nutrient content of pollen and the body composition of bees and show that the two are related. Any future research should attempt to relate these factors to honey production. With rising fuel prices and dwindling resources, apiarists might

	consider more supplementary feeding. By using NIRS to monitor the quality of the pollen entering hives and the body composition of emerging and young nurse bees, it should be possible to determine whether or not a hive requires supplementary feeding and exactly what it requires.
Publications	We are preparing publications. These will follow the publication of this report.

RESOURCES (completed)

Project Title	Floral resource database for Tasmania
RIRDC Project No.:	DAT-42A
Researcher:	Dr Simon Pigot
Organisation:	Department of Primary Industries, Water and Environment (Tas)
Phone:	(03) 6233 8357
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Email:	simon.pigot@dpiwe.tas.gov.au
Objectives	• Survey and document the floral resources on which the Tasmanian Beekeeping Industry depends. Relate the value of sites and floral resources (in beekeeping terms) to tenure, vegetation type and bioregions in order to help estimate the social, environmental and economic value of the Tasmanian Beekeeping Industry.
Objectives Background	
Research Outcomes	Discussions currently being held with DPI to determine whether this project will be completed.
Implications	
Publications	

RESOURCES (completed)

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
Researcher:	Dr Brad Law
Organisation:	Forest Science Centre, Science and Research, DPI PO Box 100 BEECROFT NSW 2119
Phone:	(02) 9872 0162
Fax:	(02) 9871 6941
Email:	bradl@sf.nsw.gov.au
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.
Background	State Forests provide the major honey resource for the apiary industry in NSW. However, recent surveys of beekeepers using State Forests have highlighted their concern about the effects of logging on nectar production. State Forest research has partly investigated this concern with a 10 year study on flowering patterns of forest trees and the effects of climate and logging (Law et al. 2000). However, this research did not measure nectar production, which can be highly variable in eucalypts.
Research	Nectar production per flower in Spotted Gum was not affected by logging history nor tree size. When scaled up to the forest stand, mature forest with large trees and many more flowers produced almost 10 times as much sugar per ha as recently logged forest, with regrowth being intermediate. However, at the compartment scale, the difference between mature forest and recently logged forest was reduced to a factor of two times when the extent of areas left unlogged under current logging practices was considered. More importantly, nectar was not a limiting resource in 2005 as extensive flowering was recorded across the south coast. At this time, beekeepers reported honey yields (54 – 83 kg/hive over seven months of flowering) above the typical range for the south coast of NSW. Also, honey productivity was comparable across the three different logging histories. This is contrary to the views expressed by some beekeepers that small trees in recently logged forest do not produce much nectar. Flowers measured in 2003 provided a strong contrast with few trees in flower and virtually unmeasurable quantities of nectar after 0930 h. Beekeepers reported that bees were not producing honey under these conditions. Finalised analysis of data on Grey Ironbark is currently being completed.
Outcomes	Through contact with regional forestry offices this project has led to a greater recognition of eucalypt nectar as a valuable forest resource. Understanding logging impacts provides a scientific basis for assessing the effectiveness of current management prescriptions. The project has generated widespread interest from beekeepers, foresters and the public. An article appeared in the Sydney Morning Herald about the research on 28/06/2006.
Implications	This project has shown that current logging practices in NSW halve the nectar resource, but that in years of good flowering there is little nectar depletion and honey production was similar under different logging histories. However, there is justification for the existing additional prescriptions that retain mature trees of

locally important flowering species, as in years of poor flowering nectar is rapidly consumed in the mornings and is thus a limiting resource at those times.

Publications

Law, B.S. and Chidel, M.C. (in prep.) Quantifying the canopy nectar resource and the impact of logging and climate in spotted gum *Corymbia maculata* forests.

RESOURCES (completed)

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
Organisation:	The University of Adelaide School of Earth & Environmental Sciences Benham Building DP 312 ADELAIDE SA 5005
Phone:	(08) 8303 4742
Fax:	(08) 8303 4364
Email:	david.paton@adelaide.edu.au
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	A key nectar source in the Mt Lofty Ranges, *Eucalyptus leucoxylon*, flowered extensively in 2004 and 2006 but flowered poorly in 2005. *Eucalyptus leucoxylon*, however, produced similar quantities of nectar in each year (8-13 mg sugar/flower/day in 2004; 14mg /flower/day in 2005; 7-15mg/fl/d in 2006) whether in native vegetation, as paddock trees or in re-vegetation plantings. In 2006, significant quantities of nectar remained unexploited in flowers, dripping from flowers at most sites even within 100m of commercial apiaries. Commercial loads of honeybees, therefore, were unable to reduce standing crops of nectar to levels below which other fauna like birds would be disadvantaged. Under these conditions there is no reason to exclude beekeepers from such resources. 'Surpluses' of nectar were due to a lack of birds, particularly for paddock trees, and not an increase in nectar secretion by flowers. The inability of commercial loads of bees to crop nectar resources fully may be due to inadequate pollen sources. Similar data on flowering levels, nectar production and use of flowers by honeybees and native fauna have been collected for other eucalypts (e.g. *E.fasciculosa*, *E.cosmophylla*, *E.diversifolia*), understorey shrubs (*Banksia ornata*, *Styphelia exarrhena*) and agricultural weeds (e.g. *Echium plantagineum*) during the last year.

RESOURCES (completed)

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
Organisation:	NSW Department of Primary Industries PO Box 389 GOULBURN NSW 2580
Phone:	(02) 4828 6619
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Email:	doug.somerville@dpi.nsw.gov.au
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.
Background	The diminishing floral resources available to the beekeeping industry have been identified as one of the major, medium to long term impediments to the future viability of the Australian commercial beekeeping industry. The concept that the major expansion in the national forest plantation estate will provide opportunities for beekeepers has been suggested. Anti-dotal evidence from the beekeeping industry suggests that this is not the case but some opportunities may exist.
Research	The study involved discussions with commercial beekeepers in all states on the value of forest plantations as a floral resource for beekeeping. This also included dialogue with various land managers and foresters. A number of publications were reviewed including the following:- Plantations of Australia 2001, Natural Heritage Trust; Plantations of Australia – wood availability 2001-2044, Natural Heritage Trust; Hardwood Plantations – quantifying conservation and environmental service benefits, Natural Heritage Trust; Australian forest plantations – a review of plantations for Australia: the 2020 vision, The Senate committee – Rural and regional affairs and transport 2004; Biodiversity benefits of commercial environmental forestry - the plantation biodiversity score, CSIRO 2005. A review of the current value of forest plantation species for honey and pollen values is also provided.
Outcomes	With the dominance of plantation species selected for high growth rates and reasonably short harvest rotations many of the current species do not reach maturity or any semblance of a regular flowering frequency. The study does not support Australian forest plantations providing any major contribution to the commercial beekeeping industry in the form of nectar and pollen. If, in the event that plantation species selection changes from the current dominance of E. globulus or the species selected are grown for longer time periods, then opportunities for beekeepers may arise when species of known nectar producing capabilities are planted.
Implications	At this stage trees selected for pulp wood production do not present a great deal of opportunity for beekeepers, hybrids and trees grown under different circumstances may. Hybrids may reach maturity quicker and be more resilient to pests and diseases. Although these trees will be harvested for end products that may not equate to them being old enough to begin a regular flowering pattern. The trade in carbon credits may provide significant opportunities for beekeepers with species being selected for multiple use rather than just timber.
Publications	Somerville D, Moncur M (2005), Can plantation forestry replace declining floral resources for apiculture in Australia? Apimondia, Ireland. Somerville D (2005), Plantation forestry – What value to honeybees in Australia? International beekeeping Congress, Bangalore, India.

RESOURCES (completed)

Project Title	Long-term flowering patterns of south-east Australian melliferous flora
RIRDC Project No.:	UD-3A
Start Date:	01/07/05
Finish Date:	30/5/07
Researcher:	Dr Maria Gibson
Organisation:	Deakin University
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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 primarily was designed to access the knowledge of long-term flowering patterns of native honey flora held by apiarists with at least thirty years experience. Face to face interviews yielded much data relating principally to melliferous *Eucalyptus*, *Banksia*, and *Eucryphia* species.

Interviews suggested that nectar fermentation occurred and could cause high honeybee mortality and a drastic decline in honey production. Interviews identified melliferous species most likely to illicit such a dramatic response and the possible factors triggering the response. Experiments currently are being conducted to determine the yeast and alcohol content of nectar of selected species over their flowering period. Alcohol has been found in the nectar of *Eucalyptus wandoo* in 2006 and three yeasts were identified: *Candida pulcherrima*, *Candida sake* and *Rhodotorula glutinis*.

Data related to the effects of timber harvesting and *Agrotis infusa* (Bogong Moth) visitation on honey production have also been collected.

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.

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
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Email:	d.carter@mmb.usyd.edu.au

Objectives

- The objectives of this study are to conduct an ongoing screen of Australian honeys for therapeutic properties, and to build on our previous work on the antimicrobial and wound healing properties of honey. This will lead to an increase in the use and acceptance of honey as a therapeutic agent in conventional medicine.

Current Progress

Sample collection for our survey of Australian honeys for antimicrobial activity is being concluded. We have collected 485 honeys, which have been supplied by beekeepers around Australia (NSW-281, QLD-54, VIC-21, SA-15, WA-67, TAS-47). Details of all of the samples have been entered into a comprehensive database developed specifically for this project. To date 424 honey samples have been tested for antibacterial activity against *Staphylococcus aureus* (which is expressed as a % equivalent to the antibacterial activity of phenol). The number of honeys tested with low to undetectable activity is 164 (38% of honeys tested). Six (1%) honeys have activity equivalent to between 5%-10% phenol. Clinically relevant activity, equivalent to between 10%-20% phenol, was detected in 177 honeys (40%), and 97 (21%) samples were highly active with phenol equivalences above 20%. Interestingly, we have also tested 25 honeys from native Australian bees and found them to have significant non-peroxide activity. We intend to test the effects of heat and long-term storage on the antibacterial activity of *Apis* honey.

We previously reported on the effect of honey on biofilm formation by the Gram-positive pathogen, *Staphylococcus aureus*. Now we are investigating the ability of honey to interfere with biofilm formation in the Gram-negative pathogen, *Pseudomonas aeruginosa*.

We are also continuing to examine the antibacterial activity of honey against emerging wound pathogens. We have obtained various anaerobic clinical isolates from patients with wound or bone infections (including *Peptostreptococcus*, *Propionibacterium* and *Bacteroides* species) and are currently optimising methods to determine the minimum inhibitory concentration of various honeys against these organisms.

OFF-FARM ISSUES (Completed)

Project Title	High-Power Ultrasound for Control of Honey Crystallisation

RIRDC Project No.: UQ-101A
Researcher: Bruce D'Arcy
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Objectives

- To reduce the amount of expensive heating and loss in quality during liquefaction of candied honey by developing an alternate, cost-effective ultrasound based method for the partial or complete liquefaction of candied honey by 2006, with a view to ultrasound having direct application for beekeeper control of honey crystallisation, or for liquefying candied honey prior to decanting in a honey packing plant.
- To better control the texture of creamed honey spread by developing an ultrasound based method that enhances the nucleation rate and produces uniform crystal growth in a creamed honey system by 2006, with a view to it being used by beekeepers and honey processors for producing consistent and high quality creamed honey

Background

There is a problem in the honey industry with crystallisation or candying of some floral types of honey between harvest and packaging. Presently, heating in a hot room is used by beekeepers and honey packers to liquefy candied honey. The potential for overheating or 'cooking' the honey, with a consequent reduction in honey quality, particularly flavour quality, is ever present. Therefore, an alternate means, such as ultrasound treatment, for liquefying candied honey is required.

Research

The optimum conditions for liquefying candied Salvation Jane honey using a laboratory scale ultrasound processor were identified, and the effects of ultrasound treatment on the quality parameters of HMF concentration, and the diastase and invertase enzyme activities, were determined. In addition, the specific input energy (kWh) to liquefy 1 kg of candied honey was calculated from the collected data. Finally, consultation with an ultrasound manufacturer was undertaken to identify a protocol for a future industrial scale trial within the honey industry.

Further, the Dyce method for production of creamed honey was evaluated using two honey blends (canola/red gum honeys and alfalfa/blue gum honeys at ratios of 70:30 for each blend) to see if ultrasound treatment could improve the quality and consistency of creamed honey through a reduction in the size of D-glucose monohydrate crystals. This included examination of the conditioning process used at the end of the creamed honey production process.

Outcomes

Use of an ultrasound input energy of 70000 J from a 40 mm sonotrode operated at an amplitude of 12 µm is sufficient to liquefy ~250 g of candied Salvation Jane honey without compromising honey quality. For example, this ultrasound treatment produces a lower concentration of HMF which is formed from honey sugars , and no decrease in diastase and invertase activities, relative to that produced by a heating regime (55 °C for 16 h and 72 °C for 2 min) similar to that used by industry. The specific energy input needed to completely liquefy candied Salvation Jane honey is 0.126 kWh/kg. Therefore, 10 kg of candied honey will require 1.26 kWh, while 300 kg will require 37.9 kWh. Ultrasound treatment may delay D-glucose monohydrate crystallisation more than does a heat treatment. This effect occurs at both the microscopic level (in a drop of honey) and in bulk samples. In addition, there is a difference in the crystal formation process at the microscopic level in ultrasound-treated honey relative to that in heat-treated honey. The reason for this difference is

not clear, and requires further study. Thus, ultrasound treatment will not only liquefy candied honey without long exposure of the honey to high temperatures, but may make the liquefied honey more stable to subsequent crystallisation on storage.

The untreated canola/red gum creamed honeys (47.1 g/100 g honey) had similar crystal contents to the ultrasound-treated canola/red gum creamed honeys (44.5 g/100 g to 47.1 g/100 g), while the untreated alfalfa/blue gum creamed honeys (33.1 g/100 g honey) had similar crystal contents to the ultrasound-treated alfalfa/blue gum creamed honeys (32.2 g/100 g to 33.1 g/100 g honey). In addition, the conditioning process dissolves some of the D glucose monohydrate crystals leading to an increase in the amount of liquid honey, and an overall softening of the creamed honey, with a consequent improvement in spreadability. While ultrasound treatment did not produce a product that was different to untreated creamed honey, the importance of conditioning the final product before sale is highlighted as critical in producing a consistent product from one production run to another.

Interest in the project is high with many requests for information from beekeepers and honey packers.

Implications

This project has produced data that need to be used by beekeepers and honey packing companies to develop a pilot-scale ultrasound processing system, in conjunction with an ultrasound equipment manufacturer. Initially, this will involve ultrasound treatment of, for example, 10 kg of honey in plastic containers with removable lids, followed by 300 kg candied honey in large plastic containers with removable lids. Where problems will arise will be in the treatment of honey in 200 L galvabond drums with their two small hole outlets. Insertion of an ultrasound sonotrode will be difficult with such a drum design, and an alternate sonotrode design to the cylinder type sonotrode will be required. The implications for the honey industry, when this ultrasound technology is applied on an industrial scale, will be the production of more stable and better quality honey (less effect on flavour, HMF etc.), and removal of the need for hot rooms (and thus reduce energy costs) in honey packing plants.

Publications

None

COMMUNICATION AND EXTENSION (completed)

Project Title	Commercial Beekeeping in Australia (Second Edition)
RIRDC Project No.: Researcher: Organisation: Phone: Fax: Email:	FSB-2A Frederick S Benecke F S Benecke (02) 9487 2828 fbenecke@bigpond.com
Objectives	• To revise the RIRDC report *Commercial Beekeeping in Australia* (2003) to better describe the physical and cultural environment in which beekeeping is undertaken and to describe production methods commonly employed by Australian beekeepers. As well as being reference for those contemplating a career in beekeeping and for students of Australian primary production, the revised edition will be aimed at a wider, international audience.
Background	The 2003 version of *Commercial Beekeeping in Australia* collated data from an earlier series of RIRDC reports on commercial beekeeping produced between March 1990 and March 1996. One report was prepared for each State in the Commonwealth. The original six State reports never achieved the circulation and attention that they deserved and failed to fulfil their intended role. The 2003 edition of *Commercial Beekeeping in Australia* proved a popular publication and sold well.
Research	Updated information was sought from industry leaders throughout Australia, Government officials and private industry. All references to the original state reports were deleted and the 2003 edition was completely re-written and reduced in size.
Outcomes	The 70 page manuscript is intended to be published in 2007, in time for the International Beekeeping Congress to be held in Melbourne in September 2007.
Implications	An easy-to-read, factual account of commercial beekeeping in Australia at the beginning of the third millennium will be available to readers in Australia and overseas. The ingenuity and inventiveness of Australian beekeepers in devising methods of production and patterns of management that permits successful commercial beekeeping under Australia's unique conditions of climate and flora is documented.
Publications	

Project Title	RIRDC honeybee research compendium
RIRDC Project No.:	AGL-7A
Start Date:	15 March 2007
Finish Date:	30 June 2007
Researcher:	Michael Clarke and George Reeves
Organisation:	AgEconPlus Pty Ltd
Phone:	(02) 9817 5888
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Email:	Clarke@AgEconPlus.com.au
Objectives	Preparation of a plain-English research compendium of recent research
Current Progress (200 words maximum)	The project will be complete by 30 June 2007 and will provide approximately 25 articles in compendium format. Articles will summarise completed and current R&D projects supported by the RIRDC Honeybee R&D Program. Each article will be between two and three A4 pages and will include photography and boxed diagrams. The compendium will include introductory comments from the Parliamentary Secretary, the Chair of the RIRDC Board, the RIRDC Honeybee R&D Chair and the AHBIC President. The Compendium will provide an extension tool for beekeepers.

New Projects –2007/2008

New projects being funded or under consideration in the 2007/2008 financial year are as follows:

Title	Researcher	Phone
Research that supports importance of pollination	To be commissioned	
Feasibility study into in-hive fungal bio-control of small hive beetle	Dr Diana Leemon	07 3362 9575
Investigation of prebiotic components of Australian honeys	Dr Patricia Conway University of NSW	02 9385 1593
ABARE/ NSWDPI Industry Survey and Benchmarking Study	Mr Colin Mues	02 62 72 2027

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

Honeybee Industry Linkages Workshop	07/067 (2007, 10pgs)	Free
Commercial Beekeeping in Australia (Second Edition)	07/059 (2007, 46pgs)	$21
Honeybee Five year Plan 2007-2012	07/056 (2007, 39pgs)	Free
Honeybee Five year Plan 2007-2012	07/056 (2007, 39pgs)	Free
Honeybee Nutrition – Review of research and practices	06/052 (2006, 79pgs)	$16
Honeybee Research in Progress Report 2006	06/051 (2006)	Free
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
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