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Commercial Beekeeping in Australia

RIRDC Shaping the future

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Foreword

This report is a snapshot of the Australian beekeeping industry. It describes the physical and cultural environment in which beekeeping is undertaken and describes production methods commonly employed by beekeepers.

Beekeeping in Australia has developed to meet our unique climate and flora. Australian beekeepers have shown great ingenuity in devising methods of production and patterns of management that have led to a successful national beekeeping industry. RIRDC believes these achievements are worth recording: as an historical document; as a reference for those contemplating a career in beekeeping: and for those wishing to understand this unique segment of Australian primary production.

Beekeepers have been assisted in their endeavours, particularly in recent years, by world standard research. RIRDC, through its Honeybee Research and Development Committee, is pleased to be a vital part of the national apicultural research effort.

This project was funded from industry revenue which is matched by funds provided by the Federal Government.

This report is an addition to RIRDC's diverse range of over 1600 research publications.Most of our publications are available for viewing, downloading or purchasing online through our website:

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

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

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Executive Summary

What the report is about

This report describes the physical and cultural environment in which beekeeping is undertaken and describes production methods commonly employed by Australian beekeepers.

Who is the report targeted at?

This report is written for all those interested in Australia's beekeeping industry. It is intended for a wider readership than the first edition, which was projected mainly at Australian beekeepers and those considering entering the industry.

Background

This publication has been updated due to overwhelming interest generating from the publishing of the first edition in 2003. It provides key statistics and information on the honeybee industry and describes the key industry opportunities and threats.

Commercial Beekeeping in Australia comprises over 9000 registered beekeepers that manage over 600,000 hives. With over 25 per cent of honey exported each year, the price received by commercial beekeepers is dependant on both domestic and international demand for honey based products. There is also a growing market for pollination services and queen bees.

Aims and 0bjectives

This report revises the RIRDC report *Commercial Beekeeping in Australia* (2003) to better describe the physical and cultural environment in which beekeeping is undertaken and describes 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.

Methods used

Updated information was sought from industry leaders throughout Australia, Government officials and private industry. The 2003 edition was completely re-written and reduced in size.

Results/key findings

Australia's commercial beekeeping industry comprises a relatively small number of professional beekeepers deriving most of their livelihood from beekeeping and a larger number of people who keep bees for profit but who do not depend solely on beekeeping for their livelihood.

Recommendations

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 of flora is documented.

1. Industry Overview

The commercial beekeeping industry in Australia comprises a relatively small number of professional beekeepers deriving most of their livelihood from beekeeping and a larger number of people who keep bees for profit but who do not depend solely on beekeeping for their livelihood.

There are about 600,000 hives in Australia which produce around 30,000 tonnes of honey each year. Usually 25-30% of annual production is exported.

The principal honey producing area of Australia is the huge swath of temperate land stretching from southern Queensland to central Victoria. The area includes the Australian Capital Territory.

South Australia and Western Australia are both significant honey states, whilst Tasmania is the smallest producer. Regardless of location, beekeeping, like agriculture generally, is dependant on the weather.

A strong queen breeding industry exists to supply local and export markets; and packaged bee exports are expanding.

Paid pollination is becoming relatively more important to the industry and is a valuable source of income to some sectors.

Most of the world's serious bee diseases exist in Australia although the nation is so far free of varroa. The Small Hive Beetle is proving a more serious pest than was first imagined.

The resource base on which the industry depends is shrinking. More of the nation's remaining melliferous flora is being incorporated into conserved areas. Ensuring continued access to these areas has taxed the energies of State and federal beekeeper bodies.

Whilst the packing and sale of honey remains well ordered, with most of each year's crop being committed to a handful of major packers, a degree of instability has appeared in recent years. Prices have fluctuated widely due to drought-induced shortages and for the first time significant quantities of honey have been imported.

Industry associations exist in all states and as well they each have representatives on the Federal Council of Australian Apiarists' Associations (FCAAA). The peak industry body, the Australian Honey Bee Industry Council (AHBIC), represents all sectors of the industry.

Six States and two Territories constitute the Australian Commonwealth, and it is they that administer most of the laws and regulations to which the beekeeper is subject in his or her beekeeping activities. The Commonwealth is responsible for quarantine and other nation-wide aspects of the industry.

Number of Hives

State registration systems provide the only information available about the number of beekeepers and of the number of hives they keep. Registration is compulsory in five of the six states, but not in the territories, where the number of beekeepers is insignificant. In states with registration a fee is levied, based on the number of hives kept. Basing the registration fee on the number of hives kept may provide an incentive to register fewer hives than are actually kept. And it is not unknown for even commercial beekeepers to fail to register at all. So the numbers may be suspect to some degree, but they are the only ones available.

Apiary registration is no longer required in Tasmania. Beekeepers there are, however, obliged to participate in the Apiary Disease Control Program, which was established under the Animal Health Act 1995.

Table 1.1 shows the number of beekeepers and the number of hives kept, as provided by the Australian states and territories as at the time of writing.

Table 1.1 Numbers of beekeepers and number of hives, by States and Territories.

State	Number of Beekeepers	% of Total Beekeepers	Number of Hives	% of Total Hives
NSW	3,195	31.9	265,474	43.8
QLD	3,084	30.8.	119,418	19.7
SA	740	7.4	66,013	10.9
TAS	179	1.8	17,904	3.0
VIC	1,927	19.2	96,455	16.0
WA	880	8.8	39,000	6.4
ACT	na		na	--
NT	4		1,500	
	10,009	**99.9**	**605,764**	**99.8**

Numbers by Categories

An insight into the distribution of hive number may be gained from an analysis of New South Wales apiary registrations.

Table 1.2 New South Wales beekeeping registrations at January 2007

	Beekeepers	Hives
Amateur (1 to 40 hives)	2,475	20,210
Part Time (41 to 200 hives)	401	41,364
Commercial (more than 201 hives)	319	203,900
Total	**3,195**	**265,474**

Amateur beekeepers account for 77% of registrations and experience shows that most amateurs own less than 11 hives. (It is an interesting thought, nevertheless, that a beekeeper owning 30 hives, and perhaps moving them a couple of times a year in a trailer, may well harvest 50kg of honey per hive. A total crop of 1.5 tonnes of honey supposes a surplus for sale.)

Table 1.3 New South Wales commercial beekeepers by hive numbers.

	Beekeepers	Hives	Average
201 to 500 hives	171	60,055	351
501 to 1000 hives	113	83,877	742
Greater than 1000 hives	35	59,968	1,713
Total	**319**	**203,900**	

The 148 beekeepers owning over 500 hives may be termed professional beekeepers. They constitute only 4.6% of total apiary registrations in New South Wales yet account for 54% of all hives registered in the State.

Comparable figures for Queensland are even more striking, where less than 2% of registered beekeepers own 42% of the registered hives.

It is probable that this kind of distribution occurs throughout Australia. That is, relatively few enterprises owning a substantial portion of total hives, but with a significant number of commercial, though not necessarily full-time beekeepers each owning several hundred hives.

This trend to larger commercial enterprises is common to all States and has accelerated since the end of WWII, and indeed has continued since the first edition of this Report in 2003.

Honey Production

There is no exact measure of Australia's total honey production. The Australian Bureau of Statistics (ABS) periodically reports on beekeeping, but because it only collects data from beekeepers owning more than 50 hives, and for other reasons, its estimates of production may be on the low side.

Table 1.5 shows the per cent of total recorded production attributable to each State and the average production per beehive, for the period ending 30 June 2000.

Table 1.5 Per ent honey production and average production per hive, by States.

State	% of national honey production	Average production per productive hive (kg)
NSW	41.0	77.9
QLD	9.7	56.6
SA	14.0	83.7
TAS	4.4	80.3
VIC	23.0	91.6
WA	7.5	99.6

Source: ABS

In their *Honeybee Industry Survey*, 2003, Rodriguez et al[1], estimated total honey production from Australian commercial beekeepers in 2000–01 was approximately 27,800 tonnes; and that this crop was worth approximately $53 million.

The Centre for International Economics' report *Future directions for the Australian honeybee industry*, September 2005, estimates Australia's annual production of honey to range from 20,000 to 30,000 tonnes "…depending on weather conditions." (The Centre also suggests that Rodriguez's estimate of the value of the industry is on the low side.)

Thus the annual production figure mentioned in the introduction to this chapter – about 30,000 tonnes – is probably close to the mark.

A detailed stocktake of the Australian honeybee industry setting out a number of key future directions for the industry. The study, undertaken by George Reeves and Henry Cutler, involved extensive consultations with the industry and was funded through the Industry Partnerships Program of the Australian Government Department of Agriculture, Fisheries and Forestry.

Key challenges for the industry are to maintain and enhance measures to keep Australia free from the exotic varroa mite pest, and to arrest and reverse the declining trend in the industry's access to the native floral resources on public lands, particularly conservation reserves. Another key challenge is to expand export markets for retail pack honey products and further develop honey products with medicinal properties. A recommendation for the industry to implement an industry driven environmental management system (EMS) is being acted on, with a major industry/government workshop on EMS held recently in Canberra.

[1] *Rodriguez, V.B., C. Riley, W. Shafron, and R.Lindsay, 2003, Honeybee industry survey, Rural Industries Research and Development Corporation, Pub No: 03/039*

South-eastern Australia

Australia's beekeeping heartland is the *huge swath of temperate land stretching from southern Queensland to central Victoria* mentioned in the introduction to this chapter is here called **South-eastern Australia.** Beekeepers migrate extensively within this area, regardless of State borders.

South-eastern Australia contains about 80% of the nation's hives and 80% of its beekeepers. The area produces about 70% of Australia's honey, most of its queen bees for sale and virtually all of its packaged bees.

South-eastern Australia is composed of three principal climatic regions, all running from north to south: a generally narrow coastal plain; a relatively low (1,000 metres) tableland with occasional high peaks; and a wider area sloping westward from the mountains and merging into an extensive plain. Rainfall is highest in the east, diminishing as one moves west.

Other States

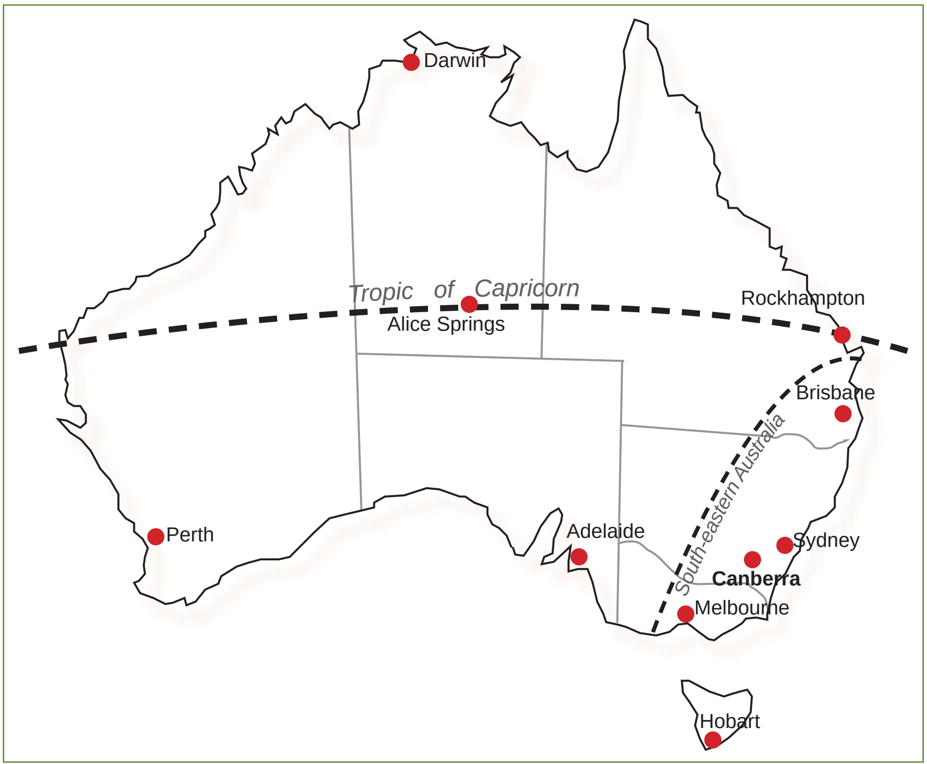
South Australia, the nation's driest state, is a significant producer but lacks both the diversity and the area of melliferous flora enjoyed in South-eastern Australia. Like South Australia, the relatively small proportion of Western Australia suitable for beekeeping restricts production in that state. A significant portion of the Western Australia crop is exported. Tasmania is by far the smallest honey producing state, but has the advantage that its main crop is dependable and fetches a premium price. A small industry became established in the Northern Territory, but is now in decline.

Apiary Products Other Than Bulk Honey

There are a few specialist producers of **section honey**, but its overall value is insignificant.

Beeswax is mostly a by-product of honey production and is therefore proportional between states. Beeswax production is usually reckoned at 1kg of wax for every 60kg of honey.

The coastal strip from Sydney to southern Queensland supports many, or most, of Australia's **commercial queen breeding** enterprises. The prevalence of queen breeders in Queensland may help to explain the apparent discrepancy between hive numbers and honey production, since queen breeders may own a relatively large number of hives, which are not kept primarily for honey production. No estimate of the value of sales of queen bee or of packaged bees is available. The export market, for both queen bees and for packages that contain a queen bee, is significant.



Australia's beekeeping heartland is the huge swath of temperate land stretching from southern Queensland to central Victoria.

The export of **packaged bees** is a relatively new aspect of the industry. Only the exporters know its financial worth. New South Wales is the principal source of bees for packages with some coming from Victoria and southern Queensland. Sydney, the capital of New South Wales, is the usual place of shipment.

Commercial **pollen production** is an important diversification for many Western Australian beekeepers. Production has increased in recent years with some beekeepers able to trap three to four tonnes per year. Most of the pollen is sold either overseas or interstate. It is used in the health food industry and for supplementary feeding.

Honey from some species of Jelly Bush is marketed through pharmacies under the trade name of **Medihoney®.** The product is said to be particularly efficacious in treating skin ulcers. Its development was supported by RIRDC funding.

Pollination

Renting hives of bees to the growers of plants benefiting from pollination by honeybees is an important source of income to some sections of the industry. Paid pollination is undertaken in most states. The practice is most important in the almond orchards of Victoria and South Australia, and draws hives from a wide area.

Marketing

The number of smaller packers and independent exporters throughout Australia appears to be increasing. They have always existed, often selling to independent stores in their immediate locality. Lately, unusually low prices for bulk honey has encouraged more beekeepers to enter the retail trade, either through farm-gate sales, producer markets or through regular retail markets. Others have also entered the export trade. Nevertheless, it is the handful of large packers whose brands appear most often on the supermarket shelf; who pack most of the generic lines; and who are responsible for the bulk of Australia's exports.

Capilano Honey Limited (CHL), of Brisbane, Queensland is the biggest of the packers. Its main brand is "Capilano". It has packing plants in Brisbane and Maryborough, Victoria. Many of its suppliers are also shareholders who enter a contractual obligation to deliver all of their honey to the company. CHL also buys honey from non-shareholders. Over the years it has been the biggest exporter of Australian honey.

The other large packers are Adelaide based Leabrook Farms, the Corowa based Beechworth Honey and the Perth based Wescobee. Wescobee is a co-operative society and dominates the market in Western Australia. Although many suppliers are also shareholders, non-shareholders receive the same prices, terms and conditions. Wescobee was established in April 1992 when it took over the assets of the former West Australian Honey Pool. The Honey Pool was restricted to trading in honey only, whereas its successor, Wescobee, can trade in any product.

Legislation

Legislation is in place in all states and territories aimed at limiting the spread of endemic bee diseases, and at containing or eradicating exotic bee diseases, should they appear in Australia. As well as legislation concerned directly with diseases of bees, the beekeeping industry is subject to wider legislative control in all states and territories.

The several Apiaries Acts have as their chief purpose, the control of bee diseases and typically require apiaries to be registered, impose a registration fee and prescribe procedures to be adopted in the event of certain diseases occurring. They may also include matters not concerned with bee diseases, such as dealing with bees causing a nuisance.

Other legislation effecting where and how bees may be kept range from environment provisions of local government acts to State and federal legislation relating to pure foods, conserved areas, bio-diversity, quarantine, research and development and so on.

Producer Organisations

Each State has an association of commercial beekeepers, composed of regional branches and a central management committee. There are also associations representing amateur beekeepers.

There is a national body representing the State associations, the Federal Council of Australian Apiarists' Associations (FCAAA) and a national body representing the whole industry, the Australian Honey Bee Industry Council (AHBIC).

It is the State associations that bear the brunt of the load of protecting the interests of their members and of the industry as a whole. They are under-funded and under-staffed and are generally struggling to make ends meet. Their revenue derives form subscriptions and to a varying extent, from commissions, sale of product at agricultural shows and so on. Most can only afford part-time paid staff and all depend extensively on their elected office bearers giving generously of their (unpaid) time.

The State associations are the New South Wales Apiarists' Association Inc.; Queensland Beekeepers Association; South Australian Apiarists Association (Inc.); Tasmanian Beekeepers' Association; Victorian Apiarists Association (Inc.); Western Australian Farmers' Federation (Inc.) Beekeepers Section. There is also a Northern Territory Beekeepers' Association.

Queen breeders are represented by the Australian Queen Bee Breeders Association (AQBBA) and the several State pollination associations by the National Council of Pollination Associations (NCPA).

Peak Industry Body

The Australian Honey Bee Industry Council (AHBIC) is the peak industry body and was launched on 1 March 1998. AHBIC typically concerns itself with federal matters such as quarantine, residue levels, genetically modified organisms and international trade. It is comprised of representatives of the following bodies. Their voting entitlement is shown below.

Federal Council of Australian Apiarists' Associations	7 votes*
Honey Packers and Marketers Association of Australia Inc	3 votes
Australian Queen Bee Breeders' Association	2 votes
National Council of Pollination Associations	2 votes
* New South Wales 2 votes and other states 1 vote each.	

AHBIC is financed by voluntary contributions of two cents for each kilogram of honey sold. The contribution is collected by participating packers.

AHBIC employs a small full-time staff. A list of participating packers, queen breeders and pollinators appears in the AHBIC monthly newsletter, which may be accessed on its web site www.honeybee.org.au.

Bee Diseases

Australia is so far free from varroa mite and Tropilaelaps; however most of the world's other serious bee diseases exist in Australia, as well as the common pests of beekeeping and a few less common ones. The diseases discussed all limit production at some time or another. Nutritional deficiencies can also significantly limit production and exacerbate disease problems.

Commercial beekeeping in Australia is dependant on successfully containing infectious diseases and on avoiding nutritionally induced ones.

Varroa mite

2. Resource Base

Allocasuarina meulleriana and honeybee

Eucalyptus leucoxylon

European honeybees were introduced into Australia in 1822 and thrived mightily in their new home.

Commercial beekeeping in Australia has been successful because of extensive areas of native vegetation, particularly eucalypts and their close relatives. Native vegetation has been supplemented by a range of exotic weeds, and, to a much lesser extent, by agricultural crops.

Unfortunately for the beekeeping industry, past and continuing land clearing has removed much of the nation's most valuable melliferous native flora. What remains is increasingly being locked up in conserved areas, many of which are not accessible to beekeepers. These are the two most critical factors affecting Australia's beekeeping resource base.

Advances in agricultural technology have reduced the area and range of exotic weeds as well as increasing herbicide and pesticide usage in traditional beekeeping areas.

All is not doom and gloom, however, as Australian commercial beekeepers still achieve commendable yields of honey.

Native Flora

Australia's dominant flora, the eucalypts and their close relatives, are pollinated by insects, birds, possums and fruit bats. To attract these relatively large animals, the native flora often produce nectar and pollen in quantities unknown in the Mediterranean climate in which honeybees evolved. Honeybees found the living easy in this country and soon colonised those areas suitable to them.

The downside of having no evolutionary link with European honeybees is that pollen from some Australian native flora is of no value to the imported bees. Beekeepers soon realised that bees often do best when there are some European plants, usually weeds, in the vicinity of flowering eucalypts.

Public and Private Land

Nectar and pollen producing plants are found on both private and public lands, and the relative importance of each varies enormously from State to state.

An analysis of major honey deliveries from suppliers living in New South Wales to Capilano Honey Limited (then known as the Honey Corporation of Australia), for the four years 1991 to 1994, showed that 40% of the honey received came from agricultural land and 38% from forest land.[2] The analysis does not distinguish between forest on private land and forest on public lands.

In its publication Facts and Figures for 2005–2006, Forests NSW points out that:

There are 164 million hectares of forests in Australia covering 21% of the continent. Australia has one of the highest per capita areas of forest in the world, with 8.2 hectares of forest per person.

There are about 27 million hectares of forests in NSW, covering 34% of the state. About 9% of forests in NSW are managed as multiple use forest such as State forests, with more than 16% managed in nature conservation reserves such as national parks. The remaining forest is on leasehold and private lands.

Of the approximately 2 million hectares of native forest managed by Forests NSW, less than 2.3% was harvested this year.

And

Other Forest products;…Apiculture (sites), 3,371

Australia has, according to another Forests NSW source, 1.7 million hectares of planted forest. (New South Wales has 341,000 hectares, of which 74% is radiata pine.)

West Australian beekeepers depend almost entirely on native flora growing on public lands managed by the Department of Conservation and Land Management (CALM).

Tasmanian beekeepers are also dependant on public lands as their principal source of honey; Leatherwood grows in forest areas as an understorey plant to eucalypts. It is found almost exclusively on public lands: 60% of which are controlled by the Department of Parks, Wildlife and Heritage, and the other 40% by Forestry Tasmania (FT).

Beekeepers in Queensland, New South Wales, Victoria and South Australia, depend on a combination of both public and private land. Conserved areas often have a special significance. For instance although a large proportion of South Australian honey is produced from both native and exotic plants growing on freehold land, many of the sites on public lands are critical for over-wintering bees; and although only 3% of the State of Queensland is State Forest, this area represents an estimated 40% of the currently used beekeeping resource.

Land clearance

Forest areas and timber continue to be cleared throughout the nation. This is despite legal requirements in some states to preserve timber and despite Government programs concerned with land care, sustainable agriculture, trees on farms, catchment protection and environmental protection generally.

[2] *Somerville DC and Moncur MW (1997). The importance of Eucalyptus species for honey production in New South Western Australiales, Australia. Paper for the XXXVth International Congress, Antwerp, Belgium, Sept 1997.*

The Australian Bureau of Statistics is quoted as saying:[3]

Land Clearance. In 1999, about 470,000 hectares of native vegetation were cleared, an annual rate 40% higher than 1991.

Even with substantial tree planting programs, Landcare Australia says that in Australia more trees are being removed each year than are being planted. Legislation controlling land clearance is a State issue, and varies accordingly. In Queensland, for instance, where protection for trees is limited, it was reported in 2001 that land clearing was occurring at a rate of 400,000 hectares a year.[4]

In its report *NSW Woody Vegetation Change 2004 to 2006*, the NSW Department of Natural Resources says:

Total reduction in the area of native vegetation in NSW over the period 2004 to 2006 was 31,394 hectares per annum or 0.04% of the area of NSW.

The report discusses the nature of the reduction by category.

Dieback of Eucalypts

Dieback of a number of species of eucalypts in several states is continuing and is a concern to beekeepers. Although research has helped to understand the problem there is no indication that it has been overcome. In South-eastern Australia dieback is caused largely by insects, (scarabs in particular), defoliating trees. Scattered trees in agricultural areas are particularly vulnerable. In these areas then, dieback is essentially a problem of land use.

The problems of dieback in the Karri and Jarrah forests of Western Australia are caused by soil-born fungi, notably a species of phytophthora, *phytophthora cinnamomi* (PC). PC is also present in Victoria and South Australia, including Kangaroo Island, and is still spreading. Karri forests are still quarantined for dieback disease but beekeepers are allowed access to some areas of State Forest under permit.

Dieback is a serious problem in South Australia, and has become known as "Mundulla Yellows" (MY). Despite considerable research, the cause or causes remain unknown.

Trees Drowned

Large areas of the valuable honey tree River Red Gum have been critically damaged by flooding the Red Gum forests at the wrong time of the year. The flooding is caused by water releases from dams intended to maintain flows in the river system. Prior to the Murray system being regulated, the Red Gum forests on the New South Wales/Victoria border were flooded in the winter/spring and dry in the summer/autumn. They were flooded for an average of eight months in eight out of ten years. Since the river has been regulated they are flooded for an average of four months in four out of ten years and are more likely to be flooded in the summer/autumn.[5]

Salinity

Salinity and rising water tables are serious problems in many parts of South-eastern Australia and in South Australia and have caused the death of thousands of trees as well as wreaking damage on agriculture generally.

Tree Plantations

In response to the introduction of trading in carbon credits as a means of slowing global warming, Australian hardwood plantations have expanded markedly in recent years, helped by taxation concessions to investors and the rapid growth of Managed Investment Schemes (MIS). They are dominated by *Eucalyptus* species, supplemented by a small proportion of tropical rainforest and other hardwood species. Of the total hardwood species Tasmanian Blue Gum comprises over 60 per cent of plantings but may be of little use to beekeepers as it is harvested at a relatively young age.

The combined standing plantation resource in Australia of 1.7 million hectares composed of two-thirds softwood and one-third hardwood species. The greatest proportions of the plantation State are more or less evenly distributed across the three states of New South Wales, Western Australia and Victoria. The most extensive hardwood plantation areas occur in Western Australia, Tasmania, and Victoria while the most extensive areas of softwood plantations are in New South Wales, Victoria and Queensland.

Western Australian forest

Weed Control

Many of Australia's principal honey producing areas are in, or adjacent to, agricultural and grazing country. In these areas weeds of pastures, roadside weeds and weeds of cultivation commonly enhance spring build-up and every now and then provide a valuable windfall crop in late summer. One weed, Paterson's Curse, (also known as Salvation Jane), is a major source of honey over wide areas of South-eastern Australia and in the State of South Australia.

Improved weed control and minimum tillage farming methods have already reduced the population and range of exotic weeds and the expansion of cultivation of crops has further reduced their incidence.

[3] Gratton, Michelle and Clennell, Andrew, "Labor vows to put an end to land clearing" October 16, 2001 Sydney Morning Herald.
[4] Stevenson, Andrew, "Bean counters get to the heart of the matter" April 5. 2002 Sydney Morning Herald.
[5] Mike Thompson, Regional Manager, Deniliquin, State Forests of NSW. 2002 State Conference, NSW Apiarists' Association, Griffith.

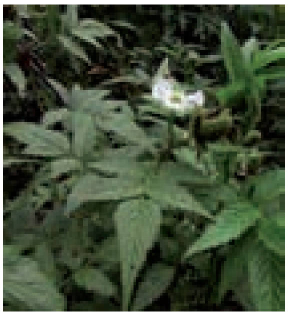
Biological Control of Weeds

Paterson's Curse

In 1972 Australia's national research body, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) launched a program aimed at the biological control of Paterson's Curse. Experimental release of a leaf-mining moth commenced in June 1980 in southern New South Wales. The beekeeping industry strongly opposed the program and briefly had the program suspended. In the end however, the beekeepers failed to prevent the program continuing.

Since the first release nearly thirty years ago a wide range of insect predators have been tested and released, and despite obvious progress with the biological control program, it has not yet had any real impact on the usefulness of Paterson's Curse to the beekeeping industry.

Blackberry



Blackberry is useful to Tasmanian beekeepers and attempts at biological control using fungi that cause leaf rust has met with some success.

The position in Tasmania in 2003 was described thus by Harold Ayton:
While some varieties of blackberries may have been almost eradicated, others are still doing reasonably well but at times, not quite as vigorous as in their hey day. As with all new such agents, the first couple of years or so they seem to have some dramatic effect but then the effect seems to flatten out. This has happened here.

Beneficial Changes

Not all changes to the resource base are negative. The emergence of Canola, a type of oilseed rape, as an important crop in South-eastern Australia and the south of Western Australia has provided beekeepers with both build-up conditions in the early spring and a useful source of honey. South-western New South Wales is popular with beekeepers from Victoria as well as from New South Wales for Canola production. Swarming can be a problem in some years and Canola honey candies very rapidly.

According to Capilano Honey Limited, New South Wales is the main producing State for Canola honey in eastern Australia and the crop represents an important source of honey, though not without its marketing problems.

Access to the Resource Base

Conserved Areas

Increasing regulation of land use as a result of changing community perceptions and expectations have resulted in significant portions of the traditional resource base being located in conserved areas and no longer accessible to beekeepers. Unfettered access to valuable native flora is a thing of the past in most of Australia. Because land conservation is a State matter, regulations governing keeping bees on conserved areas varies from State to state.

In broad terms, traditional access to State forests remains, but access to national parks and wilderness areas is much more restricted. This situation has been compounded by an enormous expansion in the area of national parks and wilderness areas, accompanied by a corresponding reduction in the area of State forests.

One of the effects of the reduction in the area of State forests and the increase in the area of conserved land is the gradual disappearance of access roads on both types of tenure. In State forests land available for timber harvesting has been greatly reduced and fewer access roads are being made or maintained. In most national parks, and in nearly all wilderness areas, former logging roads are not maintained and in some instances are deliberately made impassable to vehicular traffic.

The onus of protecting access to conserved areas became a prime responsibility of State beekeeper associations. There was little that individual beekeepers could do, and as conserved areas were almost entirely State matters, there was little that the federal beekeeper organisations could do either.

An apiary in Banksia ornata heathland

B. ornata

One small win for the industry was the result of a research project to determine the impact of commercially managed honeybees in the Ngarkat Conservation Park in South Australia. The Ngarkat Conservation Park contains bee sites with access to *Banksia ornata,* a species valuable for over-wintering bees and utilised by a large proportion of the commercially-managed hives in South Australia. Access to the area was threatened and the Honeybee Research & Development Council and other organisations supported the research. The research report[6] said, in part:

Although the presence of honeybees reduced the quantities of nectar available at Banksia inflorescences, particularly near apiaries, there were still considerable quantities of nectar remaining at the end of the day when honeybee foraging had ceased. The quantities left over often exceeded 0.5g of sugar/inflorescence even within 100m of an apiary. These quantities were more than adequate to satisfy the energy requirements of native fauna.

The results of the research carried out in Ngarkat was welcome news to South Australian beekeepers and the number of bee sites on government managed lands available to the industry in that State remained unchanged.

Regional Forest Agreements (RFA)

During the 1990s a further serious matter arose that threatened the access of beekeepers to conserved areas. Commonwealth and State Governments combined to deliver the environmental, economic and social values required of sustainable forest management, as defined by the Montreal Process. The history of the Montreal Process follows on from the UN Conference on Environment and Development (UNCED), held in Rio de Janeiro in June 1992 and began when Canada convened an International Seminar of Experts on Sustainable Development of Boreal and Temperate Forests. The seminar, held in Montreal, Canada, in September 1993 focussed specifically on the development of criteria and indicators for the sustainable management of temperate and boreal forests and provided the conceptual basis for subsequent regional and international work on criteria and indicators.

In Australia a program of studies known as comprehensive regional assessments (CRA) collected data about the forests and woodlands in a number of regions in which commercial timber production is a major forest use. Following completion of these assessments the Commonwealth and relevant State Governments entered into Regional Forest Agreements (RFAs) that met the obligations of both governments and provide certainty about land use and forest management.

The upshot of this process was an enormous amount of work by State and federal beekeeper bodies that resulted in a study of the socio/economic affects of the CRA program on the beekeeping industry. The Federal council of Australian Apiarists' commissioned a study *Economic Value and Environmental Impact of the Australian Beekeeping Industry,* by Diana Gibbs and Ian Muirhead which was released in 1998 and in September of the same, year the New South Wales Apiarists' Association published *Keeping Bees on Forested Lands, a Code of Practice*.

Fortunately, in most states at least, beekeepers are now able to meet with relevant State agencies through consultative committees and thanks to closer industry/Government liaison than ever before, a number of good outcomes have been achieved.

Present Position

New South Wales

In New South Wales, existing sites on the National Parks and Wildlife Service estate may be transferred when the beekeeping business is passed on to another family member (intra or inter - generational transfer). As well, sites may be transferred to the purchaser when a beekeeping business is sold. In the event of a bee site becoming vacant, the New South Wales Apiarists' Association advertises the vacant site and if there is more than one application the Association conducts a ballot. No new beekeeping sites have been granted by the NPWS estate. Access to existing sites is becoming more difficult in many areas.

State Forests in New South Wales established seven Forest Management Zones (FMZ) under the RFA process. Zones 1 and 2 cover the most sensitive areas and for these Zones conditions apply to keeping bees that are similar to those applying to NPWS. Limited transferability of existing sites and no new sites will be established. In the other five zones bee sites are leased on the first in first served principal. Bee sites allocated by State Forests are 1.5 km square in area. There is no statutory limit to the number of forest bee sites held by individual beekeepers.

Travelling Stock Routes and Travelling Stock Reserves throughout New South Wales, controlled by Rural Lands Protection Boards (RLPBs), are

[6] *Paton D C (1995) Impact of honeybees on the flora and fauna of Banksia heath in Ngarkat Conservation Park. SASTA Journal 95:3–11.*

available to beekeepers for rent as bee sites. Each Board sets its own permit fees. These Stock Routes and Reserves provide a large number of valuable apiary sites to the beekeeping industry.

The annual rental for bee sites for Forests, National Parks and RLPBs averages around $80 a year each.

A Beekeeping Industry Consultative Committee (BICC) was established in the early 1990s and comprises representatives of all sections of the beekeeping industry and of government departments and agencies that are associated with the industry. The Committee has proved useful in maintaining effective communications between the several sections of the industry and government agencies.

Northern Territory

Bees are banned from national parks, creating something of a unique problem since many of the permanent watercourses have been declared national parks.

Queensland

The following statement is based on information kindly provided by Mr Rex Carruthers, President of the Queensland Beekeepers' Association (Inc).

Queensland beekeepers face an enormous problem in retaining access to conserved areas. Their State Government is implementing a policy of converting the State Forest Estate to the Parks and Wildlife Service for the creation of national parks; and, the government has announced that there will be no apiary sites in any national park in Queensland by December 2024.

For the time being beekeepers have retained their traditional access to remaining State forests and have maintained apiary sites in newly formed national parks. This was achieved in two ways; one, mainly by a legislative change to allow honeybees within the new National Parks and secondly by gazetting resource reserves within one National Park. The reserves are the actual, formerly existing apiary sites. This stratagem gets around the prohibition of keeping bees in national parks for the short term, as beekeeping is a permitted use on Resource Reserves. The legislation now permits beekeeping on the national park estate with an exit date of 30 December 2024.

So far only the State forests located in South-east Queensland have been dealt with. The far larger area of State forests west of the Great Dividing Range, over one million hectares, is also to be converted to national parks, with a loss of approximately 4000 apiary sites to the industry. It is possible that the vast Napunyah resource in the channel country of far western Queensland could also be lost to the industry.

The Queensland beekeeping industry is continuing negotiations with Government and is maintaining its involvement with the beekeeping Consultative Committee. The Committee is composed of representatives of the beekeeping industry, managers of public lands and other relevant government agencies.

South Australia

Through the Apiary Industry Consultative Committee (AICC), the industry consults with the Department of Environment and Heritage on matters concerning bee sites in parks and reserves. The AICC can deal with any matters covered by the Environment Minister's portfolio.

Most beekeeping sites on public land are located in a small number of parks and other conserved areas and are considered vital for over-wintering.

The public land used by apiarists falls into four categories: – Forest Reserve, Water Catchment Areas, National Parks and Heritage Agreement Areas.

All sites (other than burnt sites) attract a holding fee and a further fee is payable if a site is transferred to another beekeeper. If a site is burnt out, no fee is required until the site has recovered and is again ready for use, when the normal fees will apply.

Tasmania

World Heritage Areas and National Parks contain 40% or more of Tasmania's principal honey crop, Leatherwood. Thus access to these areas is of the utmost importance to the industry. Most of the remaining Leatherwood is found in State Forests.

World Heritage Areas and National Parks are under the control of the Department of Primary Industries, Water and Environment. Forestry Tasmania is a statutory authority under the control of the Department of Infrastructure, Energy and Resources.

The management strategy plan adopted in relation to beekeeping in World Heritage Areas and National Parks is as follows:

(a) The existing licensed apiary sites will be permitted to continue operating.

(b) Licensed sites may be transferred to another fit and proper commercial beekeeper.

(c) Consideration will be given to the conditions necessary to provide for new apiary sites during the management planning process. Until this process is completed licences for additional sites will not be granted.

Beekeepers are able to retain sites in these areas and they can be transferred to other beekeepers. Since few, if any, new roads are allowed to be constructed in World Heritage Areas and National Parks, the possibility of new sites being granted is remote.

The Tasmanian Beekeepers' Association and Forestry Tasmania consult on a regular basis and have agreed to a *Community Forest Agreement* governing the keeping of bees in State forests. The two parties have also agreed to a code of practice named *Guidelines for Beekeeping on State Forests.* Clear felling in State forests in southern Tasmania is creating serious problems for beekeepers in that area.

Victoria

The *Victorian Environmental Assessment Council Act 2001* established the Victorian Environmental Assessment Council (VEAC), whose function is to provide the State Government with independent advice on protection and management of the environment and natural resources of public land.

Although VEAC advises Government on land use, this advice, so far as bee sites are concerned, is usually general in nature and rarely gets down to the level of the individual bee site.

The administration of public land bee sites in Victoria is the responsibility of the Department of Sustainability and Environment (DSE).

Bee sites are established on all but the highest order conservation reserves (e.g. Reference Areas, Wilderness and some Nature Conservation Reserves). Beekeeping is allowed, subject to licences or permits, on other public land categories such as State forest, national and State parks and many Crown Reserves. Depending on the legislative provisions under which the particular category of public land is managed, bee sites may be 'permanent' and/or 'temporary.'

Permanent sites are subject to an annual licence. These sites consist of 0.4 hectare of land for the bee farm and a surrounding circular bee range or forage area of 1.6km radius (from the centre of the bee farm). Annual rental is based on a fee $23 for the bee farm plus a fee of 11 cents per hectare for all the forested public land within the bee range or forage area. Rentals vary from $59.00 to $112.00 per year.

Temporary sites are subject to three or six month licences or permits. These sites were traditionally provided to enable highly mobile or nomadic beekeepers to take advantage of particular and usually semi-regular or sporadic flowering events. These sites consist of a circular area with a radius of 0.8 km. Bees are generally located close to the centre of the circular bee forage area. While there is provision for 3 month licences, the minimum rental unit is $40 plus GST per six months. Six months is effectively the minimum tenure period.

There is a great deal of competition for bee sites, and many "Temporary Bee Sites" are, in reality, held continually.

Bee sites in National Parks are allowed on a "temporary" basis as outlined above. The allocation of bee sites in National Parks is based on the following criteria: if an area of public land has a history of usage by apiarists before becoming a National Park, bee sites are allowed, providing that the placement of bee sites is not in conflict with the management of the Park. This means that usually there are some changes as to where apiarists can have sites but, generally, the industry continues to have access to National Parks.

Western Australia[7]

The bulk of the honey (about 80–90%) produced in Western Australia is from native flora growing on the conservation estate and State forest lands managed by the Department of Environment and Conservation (DEC) (formerly the Department of Conservation and Land Management (CALM)) and on unallocated Crown land, unvested lands; pastoral leases, and also reserves vested in other government agencies or local government authorities. DEC regulates the access and use of apiary sites on all Crown land in Western Australia.

A Beekeepers Consultative Committee (BCC) includes representatives from the Western Australian Farmers Federation, Water Corporation, Pollination Association of Western Australia, Department for Planning and Infrastructure – Pastoral Lands Board, Wescobee Pty Ltd, Western Australian Beekeepers Association, Western Australian Apiarist's Society (Amateurs), Pastoralists and Graziers' Association and the Department of Agriculture. The objectives of the committee are to ensure effective communication between DEC, the beekeeping industry and other government agencies and to provide advice to the Minister for Environment when required.

Apiary sites are set 3km apart to reduce the risk of spread of bee disease and the current cost is $60 per year per site (soon to be increased to $84 during 2007 as the result of a rent review) in the south west zone and $12 per year per site (soon to be increased to $42 during 2007 as the result of a rent review) in the remote zone. Beekeepers are also charged an application fee of $100 for between 1–5 sites applied for at any one time within the South west region and a $50 application fee for between 1–5 sites within the Remote zone. There is no restriction on the number of permits held by a beekeeper.

Bee sites are transferable with the sale of a beekeeping business but not for monetary gain. However the Minister for the Environment is currently preparing proposed legislation amendments to the Forest Management Regulation 1993 so that in future beekeepers will be able to trade their sites. This proposal arose as a result of recommendations arising from the National Competition Review of the CALM Act. The fee for transferring apiary sites is $8.50 per site.

As of the 1 February 2007, the Department has made available 3,506 current apiary sites for use – 2,203 in the South West Zone and 1,303 in the Remote Zone. Of these, 462 apiary sites are located within Water Catchments, 370 are within Pastoral Leases, 859 on State Forest, 409 on national parks, 249 on Nature Reserves and 1109 on unallocated Crown land. The remainder are located on Shire Reserves, Timber Reserves, Freehold land held by the State.

[7] *Information provided by WA Department of Environment and Conservation.*

3. Nutrition and Hive Management

Commercial beekeeping in Australia is conducted in an unpredictable environment – often harsh and unfriendly but at times generously abundant. The weather is paramount.

To succeed, beekeepers must understand the flowering habits and distribution of a wide range of flora and be aware of its nutritional value.

Experience with supplementary feeding, particularly of protein supplements, is progressing.

The importance of providing water to bees located in arid areas is well understood and methods of providing water have been devised.

Virtually all commercial honey production in Australia is from hives that are moved (migrated) from one source of pollens and nectars to another. In some states regular patterns of migration are possible, but in most of South-eastern Australia migration patterns are more variable, requiring beekeepers to retain a large number of apiary sites spread over a wide area.

Swarming is managed by a variety of methods and is not generally regarded as a serious problem.

Nutrition

Beekeepers have long suspected that many native Australian pollens lack something that bees need. They appreciate that European honeybees evolved in a Mediterranean climate in the presence of Mediterranean plants. On the other hand Australia's dominant flora, the eucalypts, often produce abundant quantities of nectar and pollen and are pollinated by insects, birds, possums and fruit bats.[8] The eucalypts have no evolutionary link with European honeybees. Beekeepers soon realised that bees often did best when there were some European plants, usually weeds, in the vicinity of flowering eucalypts. But what nobody knew what was wrong with eucalypt pollen.

Potentially, the biggest breakthrough in improving bee nutrition has come with a better understanding of the quality of pollen available from different plant species. The results of research by a number of people have shown a wide variation in the crude protein level of native pollens.

More recent research is highlighting some amino acid deficiencies in Australian pollens. As well, investigations into the role of fatty acids in pollen are in train. Thus beekeeper's understanding of the nutritional role of pollen is better than it has ever been, and seems likely to improve even further in the short to mid term.

On the basis of his research results, Doug Somerville, of the New South Wales Department of Primary Industries (NSW DPI) has categorised many of the pollens found in southern NSW according to their crude protein levels, with a consideration for significant amino acid deficiencies.[9] The four categories used; the plant species in each category; and, the crude protein percentages shown in Table 4.1.

The author points out that Paterson's Curse pollen is of a very high quality with consistent levels of crude protein above 30%. Combine this with the ample quantity of pollen available and it is strongly arguable that this is the single most important pollen source in southern New South Wales.

It is of interest that although plants of European origin appear in each of four categories, three of the five species with the highest level of crude protein are of European origin.

The most definitive work on honeybee nutrition in Australia is Somerville's "Fat Bees/Skinny Bees" published in 2005 by the Rural Industries Research and Development Corporation. The book also relates beekeepers' first hand experience in supplementary feeding.

Supplementary Feeding

Supplementary feeding is a management tool with many applications. Feeding carbohydrate or protein supplements, or both, to bees is a way of kick-starting colony build up in the spring; avoiding starvation; stimulating brood rearing on pollen-deficient honey flows and as an integral part of queen rearing.

Carbohydrate

White cane sugar is the commonly used carbohydrate in Australia. It is fed dry or as a syrup. Syrup is fed in all manner of contrivances, but usually in specially built trays, in pepper pot feeders, frame feeders or in plastic bags. Occasionally syrup is fed from open drums.

Plastic honey buckets modified to act as a pepper pot feeder are popular and effective but of must be covered with an empty super – a real disadvantage when feeding large numbers of hives.

Equipment for preparing syrup ranges from hand mixing to mechanical mixing and pumping from a truck or trailer mounted tank. Ready mixed heavy syrup is also available from sugar refiners.

Supplementary feeding, particularly of sugar syrup, is the norm for hives involved in producing queen cells, although the practice is much less common in commercial honey production.

For Tasmanian beekeepers, however, supplementary feeding is a regular management tool and from 1 to 1¼ tonnes of sugar per 100 hives may be fed in five litre capacity top feeders. Sugar concentration varies from 50% to as concentrated as possible. The heavier syrup reduces the possibility of fermentation, reduces the frequency of feeding and maintains breeding.

[8] *House, S.M. (1997) Reproductive biology of the eucalypts. Pp 30–55 in Williams, J.E & Woinarski, J.C.Z (Eds) Eucalypt ecology (Cambridge University Press: Cambridge).*

[9] *(4) Somerville D C (2000) Crude protein, amino acid and fat levels of pollens collected by honeybees primarily in southern NSW. Final report: DAN 134A for the Rural Industries Research and Development Corporation. NSW Agriculture, Goulburn NSW.*

Table 4.1 Pollen categories found in southern New South Wales

POOR QUALITY POLLENS					
SPECIES	CP %	SPECIES	CP %	SPECIES	CP %
Buckwheat	11	Weeping willow*	15	Saffron thistle	18
Fireweed*	12	Nodding thistle	15	Silky hakea*	18
Black sheoak*	13	Flatweed*	16	Citrus	19
Sunflower	13	Black thistle*	17	Lavender*	20
Blueberry	14	Capeweed*	17	Eggs & bacon*	20
Maize	15				
AVERAGE QUALITY POLLENS					
Red ironbark	20	White box*	23	Apple box*	24
Yellow burr	21	Onion weed*	23	Canola	24
White mallee*	21	Swamp mahogany	23	Vetch	24
Sweet scented wattle	22	Turnip weed	23	River red gum*	24
Pussy willow	22	Skeleton weed*	23	Faba bean	24
Rough barked apple	22	Alpine ash	23	Sydney golden wattle	25
Hedge mustard	22	Grey box*	24	Red stringybark*	25
Red box*	22	Manna gum	24	Currawong wattle*	25
				Woollybutt*	25
ABOVE AVERAGE QUALITY POLLEN					
Almond	25	Christmas mallee*	27	Blakely's red gum*	29
Balansa clover	25	Bloodwood	27	Spotted gum*	29
White clover	26	Grey gum*	27	White stringybark*	29
Pear	26	Sydney blue gum*	28	Heath-leaved banksia*	29
Brittle gum*	26	Gorse	28		

LENT QUALITY POLLENS			
SPECIES	CP %	SPECIES	CP %
Scribbly gum	30	Lupin	34
Paterson's curse	33	Vipers bugloss	35
Saw banksia*	33		

* Deficient in one or more essential amino acids.

Protein supplements

Feeding protein supplements is still not a common practice among commercial beekeepers. Those who do feed a protein supplement have the choice of using commercially produced protein patties or of mixing the supplement themselves.

Home-mixed supplements contain various proportions of irradiated pollen, brewers or torula yeast, soy flour and either sugar of some kind or honey (often irradiated) to bind the mix and increase its palatability.

Beekeepers report varied results with feeding pollen supplements.

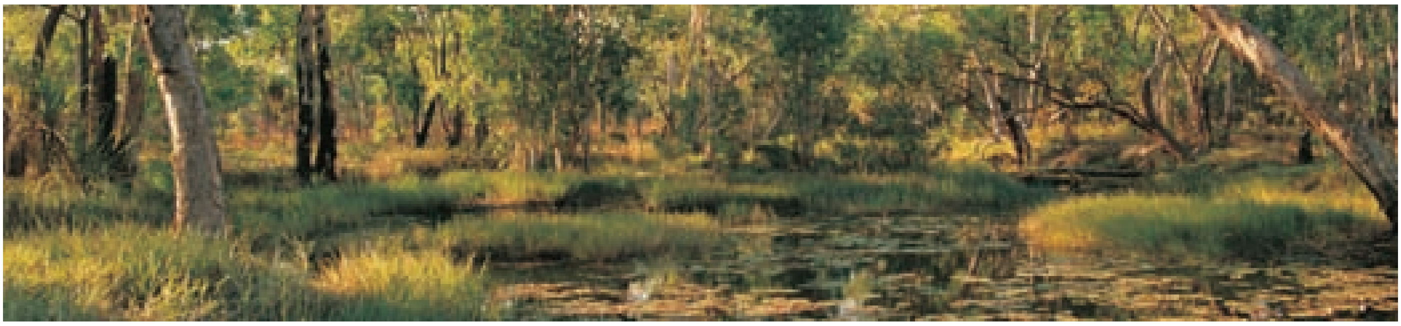
Perhaps new knowledge of the role of fatty acids in pollen will result in substitutes that are both more attractive and more beneficial to bees.

Watering Bees

Mostly bees can find a source of water to meet their needs but in arid areas this may not be so and beekeepers take special precautions, particularly in warm weather. The most obvious strategy is to locate apiaries within easy reach of a natural water supply. This may mean locating the hives further from the nectar source than one may wish, but it is better that the bees fly further for nectar than for water in hot dry weather. Because the peak demand for water is in the hottest part of the day, bees forced to fly then are quickly exhausted.

If no natural source of water is available, and the beekeeper still wants to keep bees in the area, then water must be provided. Providing water for bees in relatively remote areas is time consuming and hence expensive. It can be more laborious if the need only arises occasionally and the beekeeper does not have the right equipment for the job. Those watering bees on a regular basis have effective equipment for doing this.

In some areas it is compulsory to provide water for bees. This is because surface water in these areas is scarce and bees watering at the same troughs as livestock may create problems.



Hive Management

The Weather

Rainfall is all-important and dictates management practices. Drought is an ever present threat and affects all aspects of the growth and flowering of native flora and of the flowering of exotic weeds, so important for providing nutritious pollen. This even holds true for the tropical north of Australia, where below average rainfall in the wet season results in poor honey crops in the following dry season.

Rainfall at the wrong time can also be a problem, particularly if it falls on autumn flowering trees such as Belbowrie Tea-tree or Grey Gum, whose thin nectar is difficult to ripen in cool humid weather.

Migratory Beekeeping

It is difficult to put it better than Alan Clemson, [10] who said:

Virtually all commercial honey production in Australia is from hives that are moved (migrated) from one source of pollens and nectars to another. This is economically necessary in Australia because extremely variable rainfall and other weather conditions affect not only the budding and flowering patterns of the flora but also the pollen and nectar yields. It is quite common for an area that has provided a heavy honey crop one season to be totally unproductive the next, and a period of non-productivity may last for months or even several years. Australia's high honey production yields per hive have only been achieved through beekeepers migrating their hives throughout the year from one favourable area to another.

With a few notable exceptions honey flows are notoriously unreliable. Even a good flowering of a usually productive plant does not always result in a honey crop.

Understanding the options available for honey production in any given season requires astute observation, experience, and, a great deal of driving to examine prospects first hand. Often there is little from which to choose, but sometimes there is more than one option available – and they will not necessarily be the same options as last year. Thus it is that in South-eastern Australia at least, commercial beekeepers need to keep permanently booked between eight and 12 sites for each load of bees. These sites will be spread over a large area and will cost, on average, about $80 each.

Most State Departments of Agriculture or equivalent have at some time published information about honey and pollen flora. Probably the most comprehensive publication is Alan Clemson's "Honey and Pollen Flora" produced in 1985 by Inkata Press, Melbourne, for the New South Wales Department of Agriculture. Unfortunately the work is out of print, but occasionally a second-hand copy turns up.

Migration Patterns

Despite the big rigs and mechanical aids described in the chapter on Equipment, most beekeepers only move their apiaries as often and as far as necessary. They know their own locality well and prefer to work within it. Besides, moving hives, and servicing them at long distance, is expensive and time consuming. Generally, beekeepers are prepared to travel long distances if the potential rewards, either economic or managerial, are greater than those nearer to base. Typical long hauls are to Almond pollination; to the Channel Country for Napunyah; and in the case of drought to wherever it has rained.

Migration patterns vary throughout Australia. The main differences are described below.

South-eastern Australian

As mentioned previously, South-eastern Australia is composed of three principal climatic regions: coast, tablelands and the western slopes.

Coastal region

There is a great diversity of flora down the South-east coast of Australia. However, with a few notable exceptions, the coast is not counted as a major honey producing area.

Because of its temperate climate and its range of pollens, coastal areas are popular for over-wintering and for spring build up. Banksia, melaleuca and heath are popular sites for over-wintering.

On the northern and central parts of the coast Spotted Gum provides an excellent pollen source every three or four years. Flowering time varies from late summer through to winter. It also provides heavy honey flows every four to ten years, with moderate flows more frequently. Narrow-leaved Ironbark is another useful source of nectar.

In the northern section of the coast Pea bush, supported by the Wallum Banksia, provides pollen for spring build-up. In agricultural and grazing areas White Clover, and associated weed flora and eucalypts that flower early in the season encourage continued breeding during spring, sometimes with an extractable surplus of honey. Forest Red Gum grows mostly on the coastal flats and hills, and depending on the season, can be a useful tree.

[10] *Clemson A A. Honey and Pollen Flora. (NSW Department of Agriculture, 1985) p 6.*

The region's major honey production is mostly from summer flowering trees on the coastal ranges. In the northern areas this means Grey Ironbark and Brush Box. Pollen is often provided by various support species, including: Blackbutt, Sydney Blue Gum, Mahogany, Messmate, Stringybark and Bangalay. Angophora Apple species, sometimes contribute. These species are useful for queen rearing.

In late summer and early autumn Bloodwood, and in the north Mangrove, support colonies prior to the Broad-leaved Tea-tree flowering. The Tea-tree has a long flowering period, produces abundant pollen, and, in a dry autumn, a fair honey crop.

Tablelands region

Spring is late on the mountains, so most build up takes place elsewhere. Summer provides a range of melliferous flora, including smoothed-bark eucalypts such as Ribbon Gum, half-bark eucalypts including Mountain Ash, Yellow Box and Fuzzy Box. When weather conditions are suitable the large areas of White Clover on the northern tablelands may provide an extractable surplus of honey in mid-summer. Paterson's Curse and Vipers Bugloss extend onto the tablelands and, weather permitting, provide both good breeding conditions and a major source of honey.

The tablelands and higher slopes are the home of a range of valuable autumn flowering rough-barked eucalypts, particularly the Stringybarks. Messmate and Peppermint add to the late summer/autumn opportunities.

On the tablelands, bees tend to cease breeding during winter, but since the colonies are often in good condition after the autumn flowerings, with good stores of honey and pollen, many beekeepers choose to leave apiaries to over-winter in a semi-dormant condition in the high country.

Western slopes

There is a great diversity of melliferous flora available from the higher slopes all the way to the western plains. It is not possible to describe all of the opportunities available to beekeepers, but as mentioned elsewhere (time and again) it all depends of rainfall.

In an average season, if there is such a thing, one may expect conditions suitable for building bees during late winter and early spring on pollen from plants such as Turnip Weed, Canola and Cape Weed, Paterson's Curse and early flowering eucalypts. It is not unusual for bees over-wintered on the tablelands to be moved westward in the springtime to take advantage of warmer weather and early pollen producing plants. As well, hives that have worked winter-flowering eucalypts on the slopes are also moved west for building conditions.

Ground flora is a mainstay in parts of South-eastern Australia. Paterson's Curse in particular is an important source of honey in many areas in late spring and early summer. Rainfall at the right time is critical.

Other species of ground flora sometimes produce a crop of honey. St. Barnaby's Thistle is often used for late summer queen production. Various other thistles, Horehound Mint Weed, Caltrop and Carpet Weed are all useful from time to time, as well as some legume crops.

On the higher slopes various Box trees, or half-bark eucalypts, flower and yield honey from time to time. The common names for these trees usually involve a colour – Brown Box, Grey Box, Red Box, Yellow Box and White Box. Other Box trees, that grow further west on the lower slopes and out onto the plains, include Bimble Box, Pilliga Box, Black Box and the box-like Coolibah.

A number of Ironbarks, which are full-barked eucalypts, also grow the length of the slopes and plains. Narrow-leaved Ironbark, Broad-leaved Ironbark and Mugga Ironbark are very widespread species; others have a more restricted habitat. Caley's Ironbark is found at the northern end of the region, as is Silver-leaved Ironbark, which grows well beyond the region into central Queensland.

The smooth-barked eucalypts, the Gums, are found throughout the region. River Red Gum is the most widely distributed of all the eucalypts, but is at its best as a honey tree along the Murray River and the lower Darling River.

Plantation of E. camaldulensis *– Murray Red Gum (Source: Trees for Saline Landscapes. RIRDC Pub. No. 03/108 by N Marcar and D Crawford. Photograph Nico Marcar)*

Several of the eucalypt honey species do not provide adequate pollen. Yellow Box, Brown or Inland Grey Box and Pilliga or Mallee Box, Mugga Ironbark and Caley's Ironbark all require supporting pollens at the honey sites or specific pollen management to correct protein inadequacies.

In years of adequate rainfall, when a range of pollen producing plants are available, winter flowering ironbark forests in northern New South Wales and southern Queensland provide winter breeding and profitable honey production.

Far western/Channel country

Beyond the north-western edge of South-eastern Australia is a large area of rich soil that is periodically inundated by water flowing south-west from high rainfall areas of central Queensland via a series of creeks and mostly dry river-beds – known as the Channel Country. When so watered, impressive winter and spring honey flows may be provided by a range of eucalypts, notably the Napunyah, which grows on the banks of watercourses. Napunyah grows in association with Coolibah, Black Box, Bimble Box and River Red Gum.

Important pollen plants in the channel country include Ellangowan, Boobialla, Lignum, Gidgee and Bloodwood.

Apiarists from a wide area of South-eastern Australia concentrate on the channel country when conditions are favourable. Generally, beekeepers who work Napunyah attempt to avoid pollen deficient late summer and autumn species such as Mugga and Caley's Ironbark and Brown/Inland Grey Box and Pilliga/Mallee Box which could deplete colony populations prior to migration to the autumn/winter Channel Country flows.

South Australia

South Australia differs from South-east Australia in that it has a true Mediterranean climate (dry hot summers and cool wet winters) and is the nation's driest state. It is a significant honey producer but lacks both the diversity and the area of melliferous flora enjoyed in South-eastern Australia.

In South Australia good colony nutrition during winter can be promoted by Banksia and various heath plants, or by Coastal Mallee and ground flora in the warmer, drier areas. These plants are the major food sources for colony build prior to Almond pollination.

Access to the winter build-up species is essential for active early spring colonies because bees tend to run down during autumn. Colonies left on Lucerne decline and can become broodless after the main flowering. This decrease is more severe in areas without sufficient supporting pollens during Lucerne flowering. Broodless colonies require one brood cycle before winter if they are to take full advantage of winter build-up species. Both Dryland Tea-tree and Brown Stringybark promote autumn breeding.

Lucerne crop

Once, nutrition from Almonds maintained brood rearing. Now however, more intensive cultivation and higher stocking rates of hives/ha may in fact reduce the colonies stores of honey, thus adding an additional cost to providing a pollination service.

Salvation Jane (Paterson's Curse) provides spring build-up. In some areas it provides primarily pollen and in others gives both pollen and honey.

When bees that have worked White Mallee and require pollen, canola is used to commence colony refurbishment.

While most apiarists work their bees during winter, a few locate their bees at the spring locations and allow the hives to close down. Unless an early flow is available, these apiarists do not encourage early build-up. This acts as a means of swarm reduction. This procedure cannot be followed by the late winter/early spring pollinators.

Common honey species requiring specific management include: Blue Gum, Grey Box, Hill/Pink Gum, Sugar Gum, Coastal Mallee (in cool, wet areas), White Mallee, Red Mallee and Lucerne.

Pink gum woodland

Tasmania

Tasmania, the island State, is the most southerly part of Australia and probably the State with a climate most like Western Europe.

Pollen is not considered a limiting factor in most areas, although an occasional deficiency may necessitate relocation to another site. The major nutritional factor in management is carbohydrate, both during the build period and after leatherwood. (See Supplementary Feeding.)

Although Tasmanian beekeeping revolves around the Leatherwood flow, Blackberry is also an important resource for beekeepers as it has been a more reliable nectar source than Clover. Unfortunately, Blackberry is suffering from several varieties of rust, which is making the crop less reliable than before. The benefit of Blackberry is reduced if the early spring is wet and as a consequence rust appears prior to flowering.

Western Australia

Beekeeping in Western Australia is pretty well restricted to the South-western corner of the vast State.

There is generally an abundance of good quality pollen in the traditional beekeeping areas. Pollen can be in such abundance that the bees may choke out the brood nest with pollen thereby preventing the queen from laying. Many beekeepers trap pollen.

The goldfields and mallee areas are areas of low rainfall and are only worked, on average, one year in five, when above average rainfall promotes heavy budding and flowering. Beekeepers rely on these areas when traditional honey flows closer to Perth fail to produce.

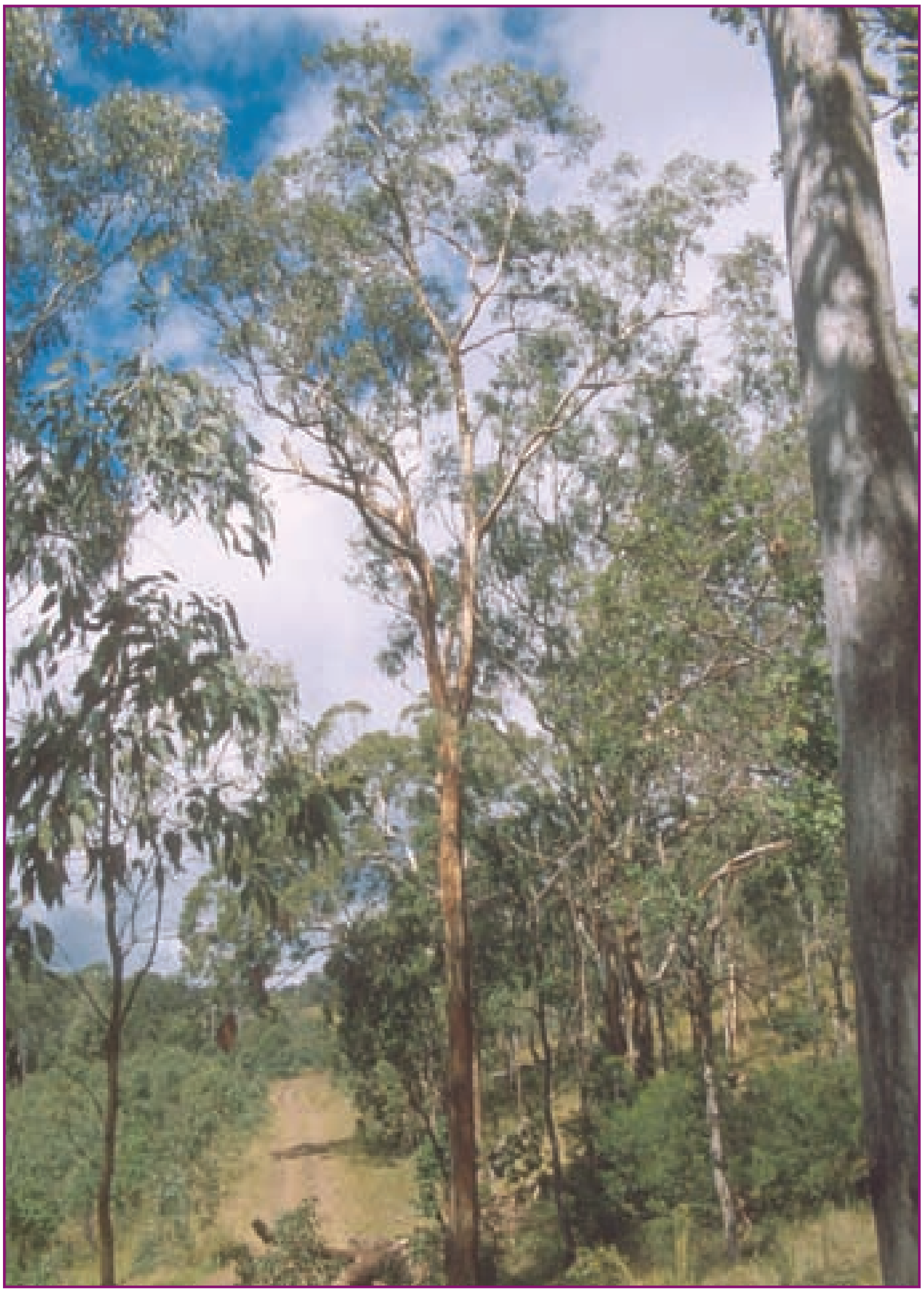
Most beekeepers in Western Australia do not feed sugar as a routine part of their hive management, except in drought years when some may use it if honey stores in the hives are low.

The Tropical North

Over 30% of Australia lies north of the Tropic of Capricorn, and is influenced by monsoonal weather patterns – dry winters and wet summers. This imposes severe restrictions on honey production. The wet extends from October to May, with the highest rainfall in January, February and March. Honey production is linked to rainfall and is likely to be best after good monsoonal rain in the wet and worst following low rainfall in the wet season. Beekeepers report that April and May are the worst two months for honey production. Beekeeping in the tropics is difficult and of only minor importance in the overall scheme of things.

On the eastern side of the tropics, on the Atherton Tablelands, west of Cairns, honey production is low, but profitable. Most of the honey produced there is sold in tourist gift shops in Cairns.

On the Atherton Tableland Forest Red Gum (known locally as Blue Gum), White Mahogany, Carbeen, Narrow-leaved Ironbark, Bloodwood, Red Mahogany, Turnip, Glycine, Blue Billy Goat Weed and Sarsaparilla are major pollen sources.



Forest Red Gum. (Source: Trees for Saline Landscapes. RIRDC Pub. No. 03/108 by N Marcar and D Crawford. (Photograph Maurice McDonald)

The small beekeeping industry in the Northern Territory is concentrated around Katherine and Darwin. Adequate supplies of pollen are usually available and beekeepers report that there is brood in the hive all year round. A range of eucalypts and other native plants provide honey.

Pollination of cucurbits in the tropical north of Queensland, the Northern Territory and Western Australia is important but generally on a relatively small scale. See Chapter 5 on Pollination

Swarming

Swarming is most likely to be a problem during the build up period in late spring/early summer. Most beekeepers do not consider swarming to be a serious impediment to honey production.

Methods of controlling swarming include taking healthy brood and bees from strong colonies and using them to make up nucleus colonies or new colonies or to strengthen weak colonies; placing foundation in strong hives; moving frames of brood from the brood box to supers above the excluder; and moving colonies from good breeding conditions to a likely honey crop.

Swarming is less of a problem when the colony is headed by a young queen.

4. Equipment

The equipment used by commercial beekeepers throughout Australia is fairly uniform. Full depth Langstroth hive bodies, either 8 frame or 10 frame, are most popular, with 10 frame outnumbering 8 frame.

Most hives are moved on diesel trucks and the longer the distances regularly travelled, the bigger the truck and the more likely that the truck will tow a trailer. Almost all hives are loaded mechanically.

Most hives are fitted with a queen excluder and are robbed with the aid of a bee blower or an escape board.

Honey is most commonly extracted in a central location in highly mechanised stainless steel extracting equipment.

Bulk honey is marketed in 1,000 litre intermediate bulk containers (IBCs) by the larger producers and in 200 litre closed head drums by smaller producers.

Packers encourage suppliers to enter into quality assurance schemes, as does the federal industry organisation, the Australian Honey Bee Industry Council (AHBIC).

Hive Materials

As beekeeping enterprises grow the need for uniformity of hive material becomes more important. There are advantages in having combs and boxes that are interchangeable, partly for easier hive manipulation but also to achieve standardised loading patterns on trucks and trailers and standardised extracting procedures.

For a commercial beekeeper the resale value of the enterprise is also an important consideration. Thus there is pressure to match the sizes and designs of one's material with those commonly used by other commercial beekeepers.

There is no standard hive size and configuration in Australia. Perhaps the most common is an all 10 frame full depth size, with a metal-bound wire excluder over the bottom box, a 50mm deep migratory lid and a bottom board with 22mm risers. Most beekeepers use nine frames in a ten frame box.

Make or Buy?

Traditionally beekeepers whiled away the winter months making and repairing hive material. However, due to big increases in enterprise size there is no longer the down-time in winter that there once was, hence beekeepers buy more material these days, even though modern wood working equipment makes the job easier.

Most woodware now comes from New Zealand, with its abundant supply of high-grade, kiln dried *Pinus radiata* (even when most woodware sold in Australia was made in Australia, the timber from which it was made often came from New Zealand).

Some beekeepers still make their own boxes. Tasmania is cited as an ideal location for do-it-yourself box making because of the availability of suitable quality timber and the beekeeping annual cycle allows sufficient time to manufacture equipment with existing labour.

Plastic or Timber?

Plastic frames and boxes have so far failed to displace wooden hives and hive parts. In the Northern Territory plastic cleats are sometimes used on bottom boards to help protect against termites. Plastic comb foundation is making a more serious challenge to beeswax foundation. Many commercial beekeepers, particularly those using different depth supers to bottom box, use both types of foundation. Beeswax is sometimes favoured in the brood nest because the bees more readily accept it and plastic is used in the supers. Some beekeepers paint molten beeswax onto plastic foundation to make it more acceptable to the bees. A paint roller is handy for this job.

The Australian designed plastic queen cell cup has been an outstanding success and is widely used throughout the country.

Preservatives

The majority of boxes, lids and bottoms are routinely treated with the wood preservative copper naphthenate prior to painting. Dipping boxes in hot paraffin wax is an alternative method of preserving boxes, though it is relatively uncommon.

Boxes

Using ⅞ inch thick timber, Australian ten frame hive bodies measure 20 inches by 16 inches; and eight frame hive bodies 20 inches by 13⅞ inches. (Exact conversion of these dimensions

from imperial to metric produces awkward figures and are usually rounded off to whole numbers: using 20mm thick timber; 10 frame = 505mm x 405mm; 8 frame = 505mm x 350mm; full depth = 240mm.)

Full depth is the most popular depth for both brood nest and honey supers. Even when honey supers of another depth are used, the brood nest is nearly always a full depth.

Hives comprising a full depth bottom box, either 10 frame or 8 frame, and smaller size honey supers are common. The smaller size honey supers are usually WSP or Ideals. A few beekeepers use WSP size honey supers filled with Manley frames. Manley frames have wider end bars than standard frames, thus making eight Manley frames a snug fit in an Australian 10 frame box, resulting in plump, easily un-capped combs.

The all full depth 8 frame hive is popular and is used extensively in Victoria, and to a lesser extent, in New South Wales and Western Australia. The all Ideal size 8 frame hive is popular in Tasmania. All WSP or all Manley size hives are used, but are not common. A few beekeepers use an all 12 frame full depth hive.

Lids and Bottoms

Many commercial beekeepers make their own lids and bottom boards.

Migratory lids with a 50mm rim, either ventilated or not, are probably the most popular. They usually consist of a wooden rim and a hardboard or marine ply top, depending on whether or not they are covered with galvanised or Colorbond metal. It is common to paint lids white to reduce heat. Flat wooden lids cleated at the ends are common, and less commonly, flat covers with end cleats that extend downwards for 30mm or so over the ends of the top box. Telescopic lids are far less popular than formerly, but are still used in Tasmania.

Most beekeepers use an inner mat of some kind to discourage bees from building burr comb in the lid.

Common materials include heavy gauge plastic sheeting, hardboard and vinyl floor covering. Some beekeepers build an inner cover into the migratory lid, leaving a 10mm space between the inner cover and the top bars of the frames.

Bottom boards usually consist of a wooden riser of anything from 10mm to 50mm, with 22mm perhaps the most common. The bottom itself is made generally of either galvanised metal, timber or marine ply. Some beekeepers that move their hives on pallets build the risers directly onto the pallet. Whilst many bottom boards are still fitted with an entrance closer, the practice appears to be diminishing. Both fixed and loose bottom boards are used.

Queen Excluders

Queen excluders are used on the great majority of hives. They are less common in Tasmania where beekeepers using Ideal size boxes depend on the principal honey flow to push the queen out of the honey supers. The most popular excluder by far is the metal bound wire model.

Moving Hives

Trucks

Commonly, trucks are two-axle with 7 to 9 tonnes carrying capacity and tray lengths of 6 to 7.5 metres. Beekeepers that consistently operate close to home are more likely to have smaller trucks of 4 to 6 tonnes.

Local working conditions also influence the size and type of truck used. For example, some beekeepers working in large areas of sandy soil as found in South Australia favour four-wheel drive trucks.

Nearly all commercial beekeepers have a small vehicle for running around – either a utility (often with a limited-slip differential and long range fuel tanks) or a small diesel truck or a four-wheel drive of some kind.

The largest outfits use powerful trucks with a sleeper-cab; bogie drive and long range fuel tanks. Such a vehicle, when towing a tri-axle pig trailer can carry, say, 360 hives of bees on pallets, around 1,150 empty 10 frame full-depth supers or over 700 supers of honey. Its total length is likely to be 19 metres and its range around 1,400 km. It would carry a fork-lift of some kind.

Loaders

Almost all commercial beekeepers use a mechanical loader of some kind; mostly a forklift when hives are on pallets or a boom loader when hives are not on pallets. A few beekeepers wheel hives onto a powered tailgate, then wheel and lift them into position on the truck.

Skid-steer forklifts of the Bobcat type are popular, as are non-skid forklifts of one kind or another. Small tractors or four wheel drive vehicles converted, usually by the beekeeper, to forklifts are still in use, and commercially made non-skid forklifts are also available. The non-skid types are preferred by some beekeepers working in sandy country and by other beekeepers who consider them to be more environmentally friendly. Forklifts are either carried on the truck or towed on a purpose built trailer.

The range of types and brands of boom loaders has something of a regional bias. Regular loaders mounted immediately behind the cab are popular in New South Wales. Centre or rear mounted split booms are popular in New South Wales, Queensland, South Australia and Victoria. Powered tailgates are used by some beekeepers in Victoria and Tasmania. Western Australian beekeepers traditionally used gantry loaders, although boom loaders are also used. A few beekeepers have adopted hydraulic lifters.

Boom loaders are often employed when under-supering, prior to robbing.

Hive fasteners of some kind are widely used. The Emlock type, with stainless steel strapping, is probably the most popular.

Open Entrance

Hives are generally moved open entrance. When travelling during daylight the load is usually covered with a bee-proof plastic net.

On long hauls, beekeepers sometimes opt to not use a net but to stop shortly after dawn and let the bees fly off the load during daylight hours and resume the journey at dusk. To exercise this option it is important that the day-long stop be reasonably close to water and reasonably far from people.

It is probable however, that in the majority of moves the hives are loaded at dusk, the move is completed during the night and the hives unloaded at dawn.

Harvesting Honey

Robbing the Hives

From their beginning in early 1992 the packer Leabrook Farms would not accept honey that had been removed from hives by the use of chemical repellents. A few months later the Honey Corporation of Australia followed suit. Thus in a period of only a few months most commercial beekeepers abandoned all chemical methods of harvesting honey and adopted physical ones.

The most common method by far is the use of escape boards or clearer boards, as they are also known. Most beekeepers under-super with sticky combs, place the escape board above the stickies and return in twenty-four hours and remove the supers of honey. If escape boards are left in place too long robbing may occur.

Conditions permitting, many beekeepers place the removed super of honey on top of the hive (or on the previous hive, to make it easier) to allow any remaining bees to return to the hive.

Bee blowers are also commonly used to remove any bees still remaining in the supers. Some beekeepers prefer to make only one trip to the apiary to harvest honey, and use a bee blower only.

A few beekeepers rob by shaking bees off individual combs. These are more likely to be those using mobile extracting plants, though not exclusively.

For beekeepers extracting in central premises (most beekeepers), an additional expense is ensuring that the supers of honey stacked on the truck, or truck and trailer, are both bee-proof and dust-proof. Most beekeepers have purpose-built trays on which to stack supers and either spare lids or purpose-built covers.

Extracting Honey

Most of Australia's honey crop is extracted in central extracting premises, though mobile plants, many of them very efficient, are still in use. In South Australia for instance, a number of mobile plants have Quality Assurance accreditation. But, the trend for the past 50 years has been to central extracting. Bear in mind though, that some beekeepers always extracted in a central plant.

Honey extraction is a highly mechanised process; and since commercial extracting machinery is now made overwhelmingly of stainless steel, it is also a hygienic one.

Uncapping machines are in universal service, whether extracting in a central or a mobile plant. There are a handful of popular brands, all reliable and all effective. It is usual to have a conveyer to take the uncapped combs from the uncapping machine to the extractor or extractors.

Whilst there are still semi-radial extractors in use, radial extractors are more commonly used. Radial extractors, with a vertical shaft, were made in 42 and 72 and 100 frame sizes.

Vertical shaft extractors, whilst popular and effective, have the inherent disadvantage of requiring loading and unloading to be done by hand. Nevertheless, the capital cost is lower than for setting up a horizontal shaft extractor and its ancillary equipment.

To automate the extracting process more thoroughly, a horizontal shaft extractor and pneumatic loading/unloading equipment is necessary, as well as pumping, straining/settling and cappings treatment equipment. In a large plant it is necessary to use a heat exchange and a centrifuge to handle the volume of honey/cappings mix. In cooler areas hot rooms are used for pre-warming supers of combs.

In all a large capital investment is required, but great savings are achieved on variable costs, most importantly, labour.

Some extracting equipment is imported, usually from the USA and New Zealand, but most is made in Australia.

The production of custom made stainless steel honey house equipment was pioneered by one small Western Australian firm "Bee Engineering" owned and operated by Mr Peter Cash. He had a significant influence on the lay-out and design of central extracting plants built over the past 15 years. Now there are more manufacturers ready to design, custom build, assemble and install complete extracting plants in any configuration to suit the requirements of individual beekeepers.

Shipping Honey

The industry changed from packing honey in four gallon (18 litre) tins to 44 gallon (200 litre) drums in the late 1950s in West Australia and in the early 1960s in South-eastern Australia. By the 1990s many in the industry were concerned about the possibility of zinc contamination as many of the drums in use aged, and a search was begun for a replacement. It wasn't until the early part of this century that 1,000 litre intermediate bulk containers (IBMs) were chosen as the preferred shipping container. The decision entailed additional capital expense by both producers and packers. Producers had to have premises with a strong floor as well as having a suitable fork-lift.

Beeswax Production

Production of beeswax is often regarded as an incidental sideline to honey production. Many beekeepers refine as much beeswax as possible from wax cappings with minimum effort, and discard the residue.

Most beeswax is produced from cappings as the beekeepers extract their honey. The central plant operators either melt down and clean their wax ready for market as their honey extracting is being carried out or stockpile cappings for a couple of days and then refine them. Some beekeepers refine the beeswax in the extracting room, others move the cappings to a separate wax room. Stainless steel refining vats are heated with steam, hot water or gas fire.

Whilst some beekeepers simply burn old and reject combs, others go to great pains to maximise wax production from them. In between is an increasingly common compromise of cutting old combs out of the frames, bagging the comb and sending it to a specialist wax refiner. The old frames are burnt.

Pollen Production

Commercial pollen production is an important diversification for some Western Australian beekeepers, whilst others trap pollen to feed back to their bees over winter or when their colonies need it. Commercial producers often have pollen traps permanently fitted to a percentage of their beehives.

The traps are constructed so that beekeepers can activate them to either trap pollen or allow the bees to bypass the trap. This allows the operator to selectively trap pollen in times of abundance.

Some beekeepers have modified their pollen traps by slightly enlarging two or three of the holes in the punch plate through which the bees can pass to detach their pollen loads. This permits the access of some bees without loss of their pollen loads and ensures adequate supply of pollen for the hive's own use during the trapping period. The enlarged holes also allow virgin queens produced as a result of supersedure, to exit for mating. This practice substantially reduces the number of queenless colonies when trapping pollen.

Pollen traps are continually being modified. Currently, besides the traps that are placed under the hives, there are a range of smaller metal traps that clip onto the front of beehives.

Quality Assurance (QA)

The major packers have adopted quality control measures in one form or another.

Eddy Planken of Wescobee said in a personal communication in 2002:

Wescobee has adopted Quality Assurance under the SQF 2000 code. We were the first fully HACCP certified packer in Australia and have had our system in place and certified for 4 years. Leabrook was certified before us for QA but it was not the full HACCP QA.

Leabrook Farms has adopted a QA scheme as has Capilano Honey Limited (CHL). Capilano has a sophisticated quality assurance scheme in place for its suppliers. The Capilano scheme is voluntary and an increasing number of beekeepers have embraced the complete scheme, by upgrading their honey extracting facilities. More are anxious to do so.

As well, the Australian Honey Bee Industry Council (AHBIC) is well down the track to establishing a nation-wide quality assurance scheme (B-Qual) that it believes will meet the needs of industry without costing individual beekeepers as much as the more complete CHL scheme.

B-Qual

B-Qual Australia Pty Limited has been established by the Australian Honey Bee Industry Council (AHBIC) as an independently developed and audited food safety program. Its purpose is to accredit and have adopted a quality assurance program for greater than 90% of the production of the Australian honeybee industry. The project will develop accreditation and train industry participants in QA standards, organic standards and biosecurity as well as providing an ongoing third party audit system.

B-Qual Australia Pty Ltd (www.bqual.com.au) is owned by AHBIC and the program is administered by AUS-QUAL Pty Ltd (www.ausqual.com.au).

5. Pollination

The invaluable service provided by European honeybees in pollinating plants is widely acknowledged. Less widely understood is the contribution that pollination provides to the beekeeping industry.

Beekeepers have long believed that one day our agricultural and horticultural industries would become more dependent on paid pollination – generally they haven't. Almonds are the exception; otherwise paid pollination is increasing only slowly.

Whilst some beekeepers derive a significant portion of their income from providing a pollination service, the overall contribution to the industry remains small. For many of the larger honey producers, pollination is a risky diversion from their core business.

Many individuals have worked hard to bring organisation to the pollination industry. There are now agreed guidelines and codes of practice for beekeepers and growers alike, and every indication that beekeepers and growers are nearer to understanding each other's problems.

For beekeepers, the greatest technical problem involved with paid pollination is achieving the necessary colony strength at the right time.

Can Pollination be Valued?

Putting a dollar value on the benefits to the nation of European honeybees as pollinators is attempting to consider one factor of production whilst ignoring all the others.

Several attempts have been made to assign a value to the total pollination effort. The total effort includes pollination provided by feral bees, the incidental pollination provided by commercially managed bees and the pollination from hives rented for the purpose. For example Rod Gill[11] of the University of New England valued the pollination benefits for Australia as $1.2 billion; Gibbs and Muirhead[12] made their own thorough assessment of the total benefit of pollination to the nation and arrived at much the same figure. Jenny Gordon[13] of the Centre for International Economics, Canberra took a fresh approach to valuing the benefit of bees as pollinators and assigned a value of $1.8 billion to honeybee pollination.

Of more direct interest to beekeepers is what they earn from pollination. It is estimated that for Almonds alone, participating beekeepers received $3.5 million in pollination fees in 2006; equivalent to perhaps 5 or 6% of the value of the national honey crop, and the figure is expected to increase rapidly.

Pollination in Australia

Largely because of changes in agricultural practice and in land management (see Resources), fewer feral bees are available to provide pollination. As well, large-scale monoculture, typically such crops as almonds and rockmelons, means that adequate pollination is beyond the capacity of feral bees, even if they exist in the area. As well, some forms of large-scale monoculture, although attractive as a source of nectar or pollen to commercially managed hives, fail to attract managed hives in sufficient numbers to provide effective unpaid, incidental pollination, for to do so would overstock the site for honey production. Thus the demand for rented hives is gradually increasing in a general sense and increasing more rapidly in specific areas. Meeting a rapidly increasing demand may present problems to beekeepers and growers alike.

On the other hand crops benefiting honeybees, either as a source of nectar or pollen or both, and which in turn benefit from pollination by honeybees, are sought after. Thus, although canola or lucerne may appear in the lists of crops benefiting to some degree from pollination by honeybees, beekeepers are more likely to pay growers for the privilege of placing their hives in the crop than to be paid by them. (This example does not extend to specialist seed production.) As well, beekeepers sometimes provide bees for pollination simply to hold sites, or to service small contracts in their locality.

Renting hives to provide pollination is relatively common for pome and stone fruit, particularly since pesticides have long since destroyed feral colonies near growing areas. It is also common to rent hives for ensuring adequate pollination of seed crops. The biggest demand for paid pollination in South-eastern Australia is for the pollination of almonds. Other, smaller, markets for paid pollination exist in the tropical north. The main regional differences in pollination practices are described below.

South-eastern Australia

Almonds is by far the most important pollination crop for beekeepers in South-eastern Australia and South Australia, and is discussed separately.

Pollination of pome fruit in the main growing areas is common, but not

[11] *Gill, Roderick (1996) The Benefits to the Beekeeping Industry and Society from Secure Access to Public Lands and their Melliferous Resources. RIRDC report. Canberra.*

[12] *Gibbs, Diana M H and Muirhead, Ian F, (1998) The Economic Value and Environmental Impact of the Australian Beekeeping Industry. A report prepared for the Australian beekeeping industry.*

[13] *Gordon, J. and Davis, L, 2003, Valuing honeybee pollination, RIRDC report No 03/077. Canberra.*

without risk. Whilst the grower on whose property the bees are placed may abide by an agreement to advise of intention to spray, the grower's neighbours may not. In areas of intensive horticultural production, orchards tend to be small and located near to each other, thereby increasing the risk of pesticide damage to colonies.

It is in the southern end of South-eastern Australia that beekeepers are most active in pollination work. The Goulburn Valley is an important area for cherries and pome fruit, including nashi; and in the outer Melbourne area pome fruit, cherries and berries are grown. Pollination of seed crops, clover, lucerne, carrot and canola is undertaken in southwest Victoria.

More and more orchardists are using hail mesh, which requires specific practices for effective pollination. Bees must not be located under the mesh until the trees are flowering so as to avoid bees orientating themselves outside the hail mesh covered area.

Pollination of broad acre crops such as cotton has not occurred in the manner that was once hoped for. Growers are reluctant to pay for pollination services and beekeepers are reluctant to place apiaries in areas of high pesticide usage.

Tropical North

Cucurbits of several kinds are grown in the tropics to supply southern markets out of season. The main growing areas are Burdekin in Queensland, Katherine in the Northern Territory and the Ord River Irrigation Area in Western Australia. Since there are few, if any, feral colonies in the tropical north, production is dependant on managed colonies that are either owned by the growers or by beekeepers and rented for pollination.

With fewer managed hives than formerly in the Northern Territory, it is expected that bees will have to be trucked in from Queensland to meet the need for pollination.

Maintaining European honeybees in the tropics is not without its problems, and a Western Australian innovation for providing low-cost pollination is the Bee Tube. The Tube is made of cardboard and is protected from the elements by a plastic cover. The tubes do not contain frames or comb, but are simply loaded with about a kilogram of bees together with a laying queen. The tubes are not used much at present, but the Beekeepers' Act was changed to permit the use of frameless colonies for pollination, and the tubes remain a clever idea, as they are light to transport and easily disposable when pollination is complete.

Pesticides are sometimes a problem for pollinators as insect pests breed well in the tropics.

Tasmania

Paid pollination is of minor importance to the beekeeping industry in Tasmania. Relatively few hives are involved, and those that are, are often owned by non-professional beekeepers.

The majority of hives are used for pollinating apples, cabbage, cauliflower, raspberries, and carrot and onion crops. The most frequent crop pollinated is apples.

Almond Pollination

Until a few years ago about half of Australia's area of almonds was grown in South Australia and most of the balance in Victoria. However there has been a huge increase in plantings (see below), over 80% of which has been in Victoria[14] – along the Murray River in the far west of the state. Other recent plantings have been made in New South Wales, but so far on a much smaller scale than Victoria.

In a personal communication, Chris Bennett, Industry Development Manager, Australian Almond Industry reported:

2006 grower survey figures *(now much better methodology) show:*

Bearing trees (4 yrs and over) 21,012 ha (est about 5.2 million trees)

- *Non-bearing 25,658 ha (est 6.5 million trees)*
- *6,740 ha planted in 2005 and 13,095 ha in 2006.*
- *2007 should be similar, but after that impossible to predict. Key unknowns, such as water availability and the changes to the tax implications of MIS (Managed Investment Scheme) investments etc make predictions difficult.*

Current mature plantings require an estimated 150,000 hives, with a further 180,000 needed for the non-bearing trees over the next five years as they mature.

There is unlikely to be 150,000 hives on almond pollination for a little while yet. Bennett is calculating hive numbers on the generally accepted stocking rate of six hives/ha of mature trees, and is allowing for trees reaching maturity in 2007.

In practice, growers do not stock trees at six hives/ha until the trees have reached their peak, at about six to eight years. Less productive trees, both the young and the old, are stocked at lighter rates.

For the next year or two it is estimated[15] that around 100,000 hives will be required for almond pollination. All other things being equal, this figure will rise to over 300,000 by 2012 and to 370,000 by 2015. Changes to taxation laws, removal of older plantations and market forces could all influence the future size of the industry.

Probably the greatest technical problem facing beekeepers involved with paid pollination is achieving the necessary colony strength at the right time. This generally means having hives up to strength by late winter, so that when the first blossoms open the bees are ready to start work. This is a vital part of almond pollination and beekeepers depend on good conditions in the autumn/early winter.

The greatest problem facing growers is likely to be finding sufficient hives.

[14] *Media Release October 2006, Almond Board of Australia.*
[15] *Trevor Monson, 2007, pers com.*

6. Queen Bees and Packages

Australian beekeepers probably rear more queens than they buy, but most professional beekeepers both buy queens and queen cells from commercial queen breeders and rear queens themselves.

Commercial queen breeders are located in widely scattered locations, although the greatest concentration is on the northern coastal area of South-eastern Australia – from the mid coast of New South Wales to south-eastern Queensland.

The beekeepers that rear most of their own replacement queens frequently buy their breeders from commercial queen breeders.

Queen breeders, in turn, buy most of their breeders from a relatively small number of reliable sources; import stock; and, select from within their own gene pool. Several genetic improvement programs have been attempted in the past and another is underway now.

All beekeepers, whether honey producers or professional queen breeders, recognise the importance of nutrition in queen rearing.

A strong export market exists for both queens and for packaged bees.

Importations

Australia has traditionally imported most of its breeding stock. However with stricter and more expensive quarantine protocols, importations have waned and more of the industry's breeding stock is being sourced locally.

Nevertheless queens are still being imported, driven by the desire of Australian queen exporters to meet the demands of their customers. Australian breeders import preferred stock from the country they are supplying, reproduce it in large numbers and export the progeny back to the country of origin.

Quarantine

Queen bees could be imported relatively freely from Europe until 1964 and from USA until 1983. Since the opening of a national quarantine facility in 1983 the imported queens are kept in nucleus colonies located in bee-proof flight cages. The escorts are destroyed and examined for the presence of parasites and the queens allowed to lay. The brood is tested for the presence of disease, and if the queen and her brood are free from disease, larvae from the quarantined queen are released to the importer. The imported queen is never released from quarantine and is killed when the importer is finished with her. The importer of course pays for the queen to remain in quarantine.

Full details on all quarantine matters are available from the Australian Quarantine and Inspection Service. See Appendix II.

Genetic Improvement Programs

Influential sections of the beekeeping industry want a national genetic improvement program implemented, but recognise that the task is too daunting and too expensive to be undertaken by an individual queen breeder.

In 1980 a national research levy was introduced and some of the funds generated by the levy helped finance two breeding programs, one in Western Australia in conjunction with the Western Australian Department of Agriculture and the other in New South Wales in conjunction with the University of Western Sydney, Hawkesbury. Both involved Italians.

These programs ran their course, but never achieved financial viability. When the money ran out the programs ran out.

As well, a private genetic improvement program was established in New South Wales from imported Carniolan and Italian stock. This involved one family's dedication to stock improvement using isolated mating. For many years it provided foundation stock to queen breeders.

A new attempt at a genetic improvement program is currently underway, this time driven by the peak industry body, the Australian Honey Bee Industry Council (AHBIC). The new program is called the Australian Queen Bee Breeding Group (AQBBG). It is intended that the program should become self-funding and provide a long-term source of high quality breeding stock for all of Australia except the State of Western Australia, which, because of its freedom from European Foulbrood, does not permit the introduction of bees. The program got underway in the autumn of 2006 and its first generation of queens will be evaluated by selected commercial beekeepers in 2007.

Queen Breeding Practices in Australia

Italian is overwhelmingly the most popular race, with much less interest in the grey races, Caucasian and Carniolan.

The Cloake system of producing queen cells, whilst not universal, is the most common, particularly among commercial queen breeders. The Cloake system is outlined in the Proceedings of the XXVIth International Congress of Apiculture, Adelaide 1977, pp 204-206 and in an article by Bruce White and Bill Winner in the December 1990 issue of the Australasian Beekeeper.

Honey producers mostly use nucleus colonies compatible with their regular hives, usually regular hive bodies divided into several compartments each of which houses a nucleus colony. Demaree boards, which in effect create a nucleus colony on top of a regular hive, are common in all states, as are freestanding three or four frame nucleus hives. Queen breeders are much more likely than honey producers to use mini-nucs of one design or another.

Introduction by mailing cage and by the gauze Miller cage is practiced all over Australia and so is papering on for uniting colonies.

Many commercial beekeepers prefer to let a nucleus colony or a Demaree grow into a productive hive rather than to introduce a caged queen into a failing colony.

The methods of rearing and handling queen bees adopted by commercial queen breeders and by honey producers rearing queens for their own use depend on the same basic principals but may differ from one part of the country to another.

Commercial Queen Breeding

A relatively small number of large scale queen breeding enterprises produce most of the queen bees with much smaller enterprises producing the rest – not unlike the old 20/80 theory, where 20% produce 80% of the product and vice versa.

The export market is essential for the continued prosperity of the sector.

Commercial queen breeders are located in widely scattered locations, although the greatest concentration is on the northern coastal area of South-eastern Australia – from the mid coast of New South Wales to south-eastern Queensland.

The Cloake system is the most common cell starting method. Grafts vary from one bar of 30 to two bars of 25 cells. The Cloake system is generally used to start and finish the cells. Finished queen cells are usually held in an incubator for the last one to three days prior to emergence.

Mating colonies include mini-nuclei, three-five frame single-nuclei and two-three nuclei in a standard hive body. The standard hive body containing multi-nuclei is popular because it can quickly be converted to a honey production unit when not required for queen mating purposes. Mini or baby nucs require far fewer bees to stock them nucs containing full-depth frames, even though more care is required to maintain mini nuclei in warm climates. A compromise size is also used – half length full-depth combs.

Mating nucleus apiaries are stocked according to forage availability and hold from 40 to 150 nuclei. The number of drone colonies in, or preferably out of but adjacent to mating yards, varies between four and 12 per 150 nuclei, depending on the number of cells introduced at the same time. Drone combs are introduced during July for September grafting in areas experiencing low winter temperatures.

If conditions are good, queen cells are transferred to mating nuclei as the mated queens are caged. In less favourable conditions nuclei are left queenless for a day or two.

Queen caging time commonly varies from 14 to 21 days after cell introduction. The longer period is used if extra brood is required, later in autumn when mating is slower, and for Carniolans because they take longer to mate. Surplus brood is used to boost cell feeders.

However, Australian research published in 2001 examined the number of introduced queen bees still alive 14 days after introduction (Introduction Success), and the number surviving 15 weeks after introduction (Short Term Survival)[16]. The results were:

Table 6.1 Introduction Success

Age of queens when caught In days	% of queens alive 14 days after introduction
7	15.0
14	47.5
21	85.0
28	85.0

Table 6.2 Short Term Survival

Age of queens when caught In days	% of queens alive 15 weeks after introduction
7	10.0
14	17.5
21	62.5
28	60.0
35	72.5

These results confirmed what many people had long suspected and may lead to caging times being extended to allow the young queen more time in the mating colony. Even before the research results were published, one Queensland queen breeder was advertising "All Queens are held in nucs for 28 days before catching" and another now advertises "Queens are caged on a 21 day cycle in line with current research results."

Supplementary feeding is widely used by queen producers. Carbohydrate is supplied both as granular sugar during winter to maintain colonies and as a syrup for warm weather stimulation. Queen cell starters and feeders may also be fed protein supplements, either home mixed or commercial patties.

Protection from disease is important. Commercial queen breeders are

[16] *Rhodes J and Somerville D (2001) Introduction and Early Performance Success of Queen Bees. Honeybee News 2(1):13-14*

permitted to feed fumagillin to control Nosema disease. Both commercial queen breeders and honey producers rearing their own queens commonly feed oxytetracycline hydrochloride (OTC) to prevent European Foulbrood. Since commercial queen breeders are constantly working their hives the possibility of an infection of American Foulbrood going undetected is quite remote.

Queen banks are sometimes used to hold queen bees during the collection periods prior to despatch. Queen bees are generally banked for less than a week and one month is considered the maximum period. The short term banking colonies are made up in singles using brood and bees from several lines. It is important to ensure that queen bees are transferred to the bank within 20–30 minutes of being caged.

Queen bees are shipped in both wooden and plastic mailing cages. The cages are taped into small groups, packed into ventilated foam boxes, overnight express bags or into Riteway queen shippers (a mini bank for queen despatch). Queen cells are packed in sawdust in foam coolers. Queen bees are despatched by post, overnight coach or express courier.

Seasonal Production

The domestic demand is spread from a peak in the spring through summer and into autumn, depending on the season.

Export markets, both for queens and for queens in packages, tend to be the reverse of Australian seasons. Thus autumn here corresponds to spring in the northern hemisphere. The export of both queens and packages extends from December through to as late in the autumn as bees can be produced, say April or even early May, depending somewhat on markets.

Breeder Queen Bees

Queen producers carry a range of breeder stock from both AI and natural mating programs. As noted above, genetic improvement programs have attempted to maximise the productivity of Australian honeybees. Commonly, new breeder queen bees are selected from daughter queens of existing breeders, based on personal observation and on the favourable reports from client. Artificial insemination is used by some breeders. As noted above, breeder queens continue to be imported.

Honey Producer Queen Breeding

It is probable that over half of the beekeepers in Australia rear most or all of their queens. Of the remaining beekeepers, most rear some and buy some, and it is only a minority who buy all of their queens. However, the number of queens reared by commercial apiarists for their own use, verses the number purchased from commercial queen breeders obviously varies, depending on seasonal conditions, the price of honey and demands on the beekeepers time. Spring and autumn are the most popular times for queen rearing. Probably 95% of queens are Italian.

Whilst some breeder queen bees are purchased, mass selection from within the production apiaries is popular. Beekeepers are usually on the lookout for a good line of bees that they think may do well in their situation.

There is no universal method of starting cells nor is there a standard mating nucleus. The Cloake method is popular while the supersedure method, where brood is moved above the queen excluder and grafting is carried out 2 - 3 days later, is also common, as is starting cells in a queenless colony and finishing them above a queen excluder.

Although many types and sizes of mating nuclei are found, the standard hive body containing multi-nuclei is preferred because it can quickly be converted to a honey production unit when not required for queen mating purposes. Demaree boards (or splits, as they are also called) are also popular.

Single nuclei are sometimes carried with each load of bees and used to paper both queen and bees onto weak colonies. Both Miller cages and mailing cages are used to introduce queen bees into stronger colonies. Several apiarists prefer to bank purchased queen bees a minimum of overnight to provide access to free flight worker bees before introduction.

State Differences

The few commercial beekeepers in the Northern Territory purchase queens from Queensland queen breeders, mainly because seasonal conditions and birds, Rainbow Bee Eaters, make queen rearing in the Northern Territory hazardous. Some queens are reared locally.

South Australia beekeepers rely more heavily on mated queen bees from queen breeders than do their

Painted queen bee

counterparts in other states. Shipments arrive in spring and early summer and commonly some of the queens are introduced directly into hives (sometimes via queen banks) whilst others are first introduced into nucleus colonies. The nucs are for later use, even to be over-wintered to provide young colonies for almond pollination.

Tasmanian beekeepers have a strong preference for locally produced queens, but climatic and other considerations dictate a significant use of mainland queen bees. It is said that the major problem with mainland queen bees is their tendency to breed late in the season and consume stores. Local strains tend to cease breeding soon after the leatherwood flow. This minimises stress during the winter, decreases the risk of starvation and reduces the quantity of spring feeding required.

The importation of queen bees into Western Australia was prohibited in November 1977. This has confined the industry to the genetic pool of bees available in the State at that time. These were predominantly Italian bees with some Carniolan and Caucasian stock, also traces of North European Black bees occur mainly in feral colonies on the south coast. There are few commercial queen breeders. In the past a significant number of honey producers relied to some degree on supersedure and self-raised queens. A feature of Western Australian beekeeping is the almost continuous supply of pollen of many varieties which enables honey producers to raise their own queens at times which fit in with honey production.

Packaged Bees

The packaged bee industry in Australia began in 1963 with a shipment to England from Queensland. Previously there had been a modest trade in nucleus colonies. Packaged bee exports remained steady until the late 1980s and early 1990s, when markets opened up in Korea. The Korean market was met by New South Wales exporters. Korea no longer accepts bees from Australia because of the presence here of Small Hive Beetle.

The export of packages continues and New South Wales remains the main producing state. It is estimated that the NSW Department of Primary Industries staff inspected apiaries (on behalf of AQIS) for the export of 25,000 packages during 2006. The United States of America and Canada were the principal markets. Australia's strengths as a source of queen bees and packaged bees are its ability to deliver bees early in the northern hemisphere spring and its current freedom from varroa mites. Its weakness is the finite limit on cargo space aboard international flights. As well, it may be necessary to feed hives shaken late in summer to prepare them for winter.

It is a requirement of importing countries that the apiaries from which the bees are shaken must be inspected by government officials, within a specified time prior to shipping, and certified free of prescribed pests and diseases. In New South Wales, inspection costs are borne by the beekeeper.

At the time of writing there are three principal Australian package exporters, all based in New South Wales and all good at their job. They use the old imperial measure for packaged bees because exports to North America are sold by the pound – typically 4lb packages.

Packaged bee production in Australia is basically the same as anywhere else, except that the shipping distance is far greater and the shipping costs consequently higher. Shipments leave Sydney airport in mid-summer through to autumn; pass through the tropics; and, arrive at their destination in mid-winter through to early spring. As a consequence of these factors export is expensive and prone to occasional serious loss.

7. Diseases and Pests

In Australia the serious diseases of bees are American foulbrood (AFB), European foulbrood (EFB), Chalkbrood, Nosema and Sacbrood; and the important pests are Wax Moth and the Small Hive Beetle. Other pests include ants, Cane Toads, the Bee Louse and the Rainbow Bee Eater.

The diseases and pests mentioned above are dealt with separately in this chapter. With a few notable exceptions they are common to all regions of Australia.

Legislation relating to bee diseases, both endemic and exotic, exists in all Australian states and territories.

Any of the common bee diseases may limit production. The worst of them, AFB, can be cripplingly expensive to control. The loss of hives destroyed because of AFB is a minor cost compared to the cost of the additional effort required to minimise the risk of AFB spreading within the apiaries. Preventing the spread of AFB reduces, or even nullifies, some of the economies of scale achieved by modern large-scale beekeeping.

The development of EFB, Chalkbrood and Nosema is strongly influenced by temperature and nutrition. The causal organisms for these diseases are present in the colony for most of the time and symptoms appear when conditions suit the development of the causal organism.

None of the diseases of bees found in Australia are transmissible to humans – they present no threat to public health.

With the possible exception of the Small Hive Beetle, the pests mentioned, although serious to individual beekeepers on occasion, are generally regarded as nuisances that have to be dealt with as necessary.

The most important pests not in Australia are the mites – Varroa, Acarine and Tropilaelaps. Africanised Bees are not generally considered a serious threat. These exotic diseases are discussed separately in this chapter.

Legislation

Endemic Diseases

Legislation is in place in all states and territories aimed at limiting the spread of endemic bee diseases; and at containing or eradicating exotic bee diseases, should they appear in Australia. The Acts of State or Territory Government have different names – Apiaries Act, Stock Diseases Act, Animal Health Act and so on, but are similar in most respects.

Legislation was first applied to the beekeeping industry early last century in response to the spread of American foulbrood (AFB), *Paenibacillus larvae.*

Other important diseases and pests of bees have appeared in Australia since legislation was first applied to beekeeping and they have been incorporated into existing legislation.

However, there is a clear trend by legislators to move responsibility for controlling bee diseases, particularly AFB, from the State to the industry.

Commonly, legislation regulating the keeping of bees has provisions for the registration of apiaries; identification of hives; disposal of infected hives; the use of removable frame hives; abandoned or neglected hives; exposed honey; disease control; and, the declaration of notifiable disease.

With regard to endemic diseases, most legislation lists several diseases as notifiable even though in practice most attention is paid AFB and its control.

Government agencies see advantage in declaring certain diseases notifiable for the sake of maintaining an avenue for legislative control and so that international trade requirements may be met. Some unusual anomalies exist between states, though as mentioned, the regulations are generally similar.

Exotic Diseases

All of the important exotic diseases are also notifiable. Exotic diseases, wherever found, are the concern of all of the states and the Commonwealth. Attempting to contain or eradicate an exotic disease that occurs in Australia is a national effort coordinated by the Agriculture and Resource Management Council of Australia and New Zealand's Australian Veterinary Emergency Plan, known as AUSVETPLAN.

AUSVETPLAN is a series of technical response plans that describe the proposed Australian approach to an exotic animal disease incursion. The documents provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency-management plans.

A working group of industry specialists has prepared a set of strategies for dealing with an incursion of exotic bee diseases or pests. The strategy may be viewed on the AUSVETPLAN web site.

Under certain circumstances the industry is obliged to share in the cost of controlling, or attempting to control, an incursion of pests or disease. To finance this obligation an Emergency Animal Disease (EAD) Response Cost Sharing Deed of Agreement has been ratified by industry and a levy has been imposed to create a fund to be used in the event of an exotic incursion. The fund is capped at an amount of AU$1 million.

Brood Diseases

American foulbrood (AFB)

AFB is contagious and is commonly spread throughout the apiary by the interchange of infected hive material. If untreated, infected colonies die and if neglected, all the hives in an apiary may be expected to perish.

AFB is endemic throughout most of Australia. It is generally regarded as the nation's most serious disease of bees. At various times industry organisations have considered national campaigns to reduce the level of AFB infection, so far without adoption. Coordinated control programs exist in some states.

In some states beekeepers may be compensated for material destroyed in treating AFB. Most states have some kind of inspection service available to help enforce the provisions of their respective Acts and most states have a laboratory testing service available for the positive diagnosis of AFB.

It is salutary to note that legislation intended to control AFB has been in place throughout most of Australia for 90 years. In that time a fortune has been spent on inspectors' salaries, registration fees and compensation schemes, yet nowhere has AFB been eradicated, or even adequately controlled. If anything, changes in beekeeping practices may have exacerbated the problem.

The use of antibiotics to control AFB is banned in all mainland states and territories and only in the island State of Tasmania are antibiotics permitted. In fact Tasmania's approach to AFB control is worth looking at in some detail.[17]

Registration of beekeepers in Tasmania is not compulsory. The Tasmanian apiary industry has established an Apiary Industry Disease Control Program (AIDCP) under the conditions set out in section 46 of the Animal Health Act 1995. A committee comprising representatives from all stakeholder groups from within the industry has formed to manage the program.

Each year beekeepers register with the AIDCP. They receive free honey tests for AFB. The number of free tests depends on the number of hives registered. They are also given the option of paying for more tests at a reduced rate at the time of registration. The reduced rate is able to be offered due to economies in scale. If the honey is tested with a positive spore count the beekeeper is notified and receives free inspection and advisory service from officers of the Department of Primary Industry & Water. The honey testing also enables the Department to discover and target any disease "hot spots" on a seasonal basis.

Unlike in the past when all registration fees collected were retained as consolidated revenue and lost to the industry, beekeepers register with the AIDCP which makes provision for the fees collected to be retained in a bank account managed by the committee and to be used by the committee to benefit the industry. Funds are only spent on extension and management of bee diseases, both endemic and exotic, including bee incursions and mites. For example some of the funds have been used to reprint bee disease field guides, pay for visiting experts to address beekeepers at field days and have been important in purchasing pheromone lures and materials for the establishment of a bait-hive program for Tasmanian ports.

Most Tasmanian beekeepers are very aware of AFB and are diligent in searching for it. In the spring a very careful inspection of the brood nest is made. In the early spring, hives are usually low on stores and are being fed. There is very little honey on the hives. This is when AFB is most likely to be found. Infected colonies usually have a few infected cells at the time of the spring inspection and are therefore easily treated with oxytetracycline hydrochloride (OTC).

In a major breakthrough Dr Michael Hornitzky[18] of the New South Wales Department of Primary Industry found that although the spores of the causal organism of AFB, the bacterium *Paenibacillus larvae* subsp. *larvae,* are very resistant to heat, chemical disinfectants and desiccation, they are quite sensitive to gamma radiation from cobalt 60.

In states other than Tasmania regulations exist for the disposal or sterilisation of AFB infected material. Treatments include destruction by burning, irradiation with Cobalt 60, and, dipping in hot wax. Irradiation of infected hive material has largely replaced burning of infected hive material as a control mechanism.

Hornitzky also developed an extremely sensitive test that can detect AFB in commercial honey samples, even at sub-clinical levels. Commercial honey samples are cultured and linked to a trace-back system to the hives of origin. Several states provide a bulk honey testing service.

The barrier system of minimising the spread of AFB that was pioneered in Western Australia has been widely adopted, in one form or another, by beekeepers in most states. A full barrier system is one where honey supers and combs removed from hives for extraction are returned to the hives of origin. A variant, a partial system, ensures that hive materials are maintained in particular pallets of particular loads or at least within the same load. In South-eastern Australia loads of supers are commonly rotated as honey is harvested. When a barrier system is introduced sufficient additional supers must be provided to maintain the integrity of each apiary – a significant additional capital cost. Some beekeepers have had their extracting equipment tailor-made to suit the barrier system, by ensuring that the extractors hold discrete box loads of combs and that combs are returned to the correct box after extraction.

At least one beekeeper keeps track of hive material by labelling each box with a bar code and using a hand held bar code reader on each visit to each apiary, thus enabling him to trace individual boxes from hive to hive using a custom designed computer program.

Since OTC is available for the control of European Foulbrood (EFB) in all states except Western Australia, where EFB does not occur, the possibility that it may be deliberately used for the control of symptoms of AFB cannot be discounted. In areas where OTC is

[17] *David White, Tasmanian Department of Primary Industries, Water and Environment, Pers com.*

[18] *Hornitzky, MAZ; Wills, PA(1983) Gamma radiation inactivation of* Bacillus larvae *to control American foulbrood. Journal of Apicultural Research 22:196-199.*

routinely "blanket fed" to control EFB, the possibility exists that symptoms of AFB are being unintentionally suppressed. In either case bulk honey testing, if available, should show AFB spores even if the symptoms of the disease are not evident.

The infection rate of AFB in most areas is probably less than 1% of registered hives. In recent years the reported incidence of AFB in New South Wales has fallen, and from March 2005 to March 2006 only 45 beekeepers (out of 3,195 registered beekeepers) reported AFB in their apiaries. No one knows how many infected apiaries went unreported.

European foulbrood (EFB)

EFB is usually noticed in early spring when colonies are building up and to a lesser extent in autumn. Low larval mortality may occur in light infections or when the colonies are on good nectar and pollen flow conditions. High mortality of larvae, pupae and young adult bees occurs during a heavy infection or when colonies are on poor nutritional conditions.

Sub-optimal brood rearing temperatures in the spring and frequent interruption of nectar flows and pollen production places hives under stress that stimulates the development of not only EFB but also of Chalkbrood and Nosema. With all three diseases the symptoms and severity of the infection may be reduced by "good beekeeping practice". That is, by having young queens, maintaining relatively new combs in the hive, particularly in the brood chamber; regulating the size of the hive to suit the strength of the colony; rearing bees on good conditions; and, taking care when moving hives.

European foulbrood is caused by the bacterium *Melissococcus pluton* and has been endemic throughout eastern Australia since the mid 1970s. In old larval remains the bacterium, *Bacillus alvei*, is commonly present as a secondary invader.

EFB is controlled with the antibiotic oxytetracycline hydrochloride (OTC). Procedures and protocols for treating EFB with antibiotics are similar in all states where the disease occurs. OTC is the only antibiotic recommended for the treatment of EFB.

To obtain OTC, most states require a prescription from a veterinarian or an order to supply from a Government apiary officer, although South Australia is more rigorous in trying to prevent antibiotic treatment of EFB from accidentally or deliberately treating American foulbrood (AFB) and requires evidence that AFB is not present in the apiary and has not been present for the previous six months.

Great care is taken to minimise the risk of OTC residues occurring in honey.

Western Australia and the Northern Territory are the only areas in Australia known to be free from EFB. To help maintain this EFB-free status, bees, honey, used hives, hive products, or used beekeeping equipment cannot be imported into Western Australia unless accompanied by the prescribed certificate.

Chalkbrood

Although Chalkbrood is not usually fatal to honeybee colonies it can cause substantial production losses.

Chalkbrood varies greatly in its severity. At its worst it causes major loss of colony strength with a consequent loss of production. This commonly occurs in spring and autumn. At other times its presence in the hive is barely noticeable. Chalkbrood seems to become a problem when colonies are stressed for some reason, but not all such colonies develop Chalkbrood.

Chalkbrood is caused by the fungus *Ascosphaera apis*. It occurs widely in the temperate regions of the Northern Hemisphere and in Hawaii, New Zealand and Western Samoa and was first diagnosed in Australia in 1993. It is now endemic in most areas of Australia.

There is no cure for Chalkbrood, but it is believed that its symptoms may be reduced by "good beekeeping practice".

It is accepted that some colonies clean out Chalkbrood infected dead brood much faster and more thoroughly than others, but more research is necessary to understand why.

Hornitzky says[19]:

A. apis *grows best in slightly chilled larvae as its optimal temperature for growth and formation of fruiting bodies is about 30°C (Maurizio, 1934). Experiments have shown that brood is most susceptible when chilled immediately after it has been capped (Bailey, 1967). The chilling need be only a slight reduction of temperature, from the normal 35°C, for a few hours; and it can easily occur, even in warm climates, in colonies that temporarily have insufficient adult bees to incubate their brood adequately. Larvae are most likely to be chilled in early summer when colonies are growing, and drone larvae often suffer most as they are generally on the periphery of brood nests. The smallest colonies are at the greatest risk of becoming chilled because they have the lowest capacity for heat and relatively large surface areas. Heath (1982a, b), in extensive reviews, quotes several observations that chalkbrood is aggravated when colonies are rapidly expanding in spring, i.e. when the ratio of brood to adult bees is high, or when it is increased experimentally; and that very small colonies used for mating virgin queens or in observation hives are very susceptible. Koenig* et al. *(1987) also noted that decreasing the ratio of adult bees to brood aggravated chalkbrood; and Pederson (1976) showed that artificially heating hives in spring diminished the incidence of the disease. Other non-lethal factors, such as slight infections by viruses or bacteria, or poisoning, or inadequate food from disease nurse bees may well cause the same effect as chilling by slowing the rate of development of larvae (Bailey and Ball, 1991).*

The effects described above go a long way to explain the often severe outbreaks experienced in Tasmania in the spring, when colonies are weak but being fed to encourage expansion of the brood nest.

Sacbrood

Sacbrood is the most common of a group of viral diseases infecting honeybees in Australia. Hornitzky reported in 1987[20] that five viruses were detected in samples of honeybees submitted to the New South Wales Department of Agriculture Regional Veterinary Laboratory, Glenfield, from 1980 to 1983. They were Sacbrood virus (SBV), black queen-cell virus (BQCV), chronic bee-paralysis virus (CBPV), Kashmir bee virus (KBV) and cloudy-wing virus (CWV).

It seems likely that bees carry the virus at all times but only show symptoms when they are stressed in some way. Thus bees may not so much "catch" a viral disease but for some reason fail to suppress a virus they are already carrying.

Many beekeepers have long believed that inadequate nutrition may be responsible for outbreaks of Sacbrood. Certainly Darling Pea has a strong relationship with Sacbrood in north-western New South Wales. However since Darling Pea contains a poison principal that produces a condition of "pea struck" or "loco" disease in livestock, it is possible that the Sacbrood symptoms exhibited by bees working Darling Pea are caused by poisoning.

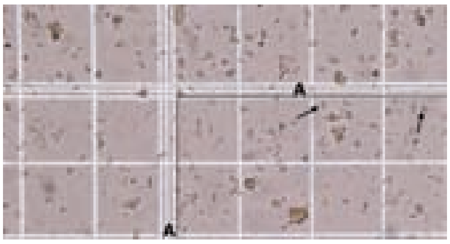
Sacbrood is generally of little importance, but in severe outbreaks, such as on Darling Pea, the quantity of dead larvae overwhelms the colony. As mentioned above, the mortality may be due to poisoning and not to Sacbrood virus.

Observations in South Australia suggested the efficacy of feeding sugar syrup to treat Sacbrood.[21] The report said:

In an apiary heavily infected with Sacbrood. 40 hives treated with sucrose syrup showed a reduction in Sacbrood. Brood mortality of 50% reduced to 3% in three weeks. Another 40 'check' hives were left untreated, and these showed an increase in brood mortality due to Sacbrood during the same period. We have observed similar results on smaller numbers of hives in several other apiaries.

Other Diseases and Pests

Nosema



Nosema disease, caused by the protozoon, *Nosema apis* Zander, is a parasite of the honeybee that can seriously limit production in some years, both by the direct effect of short-lived bees and by infecting the queen, often resulting in early supersedure. Nosema is rated as a serious disease of bees in most states.

The honeybee colony can tolerate a low to medium incidence of nosema. It is only when a large proportion of the bees within a colony become infected with the parasite that the colony is adversely affected. Gross contamination of the host occurs under conditions favourable to the parasite.

N. apis develops most rapidly at about 30°C. Development is retarded once the temperature drops into the low 10s (about clustering temperature) or rises into the mid to high 30s (typical summer temperatures in much of Australia).

The temperature most suited to nosema development is most likely to be experienced by colonies in autumn or spring. These are times of suboptimal brood rearing temperature. Colonies having difficulty in maintaining optimum brood rearing temperature commonly suffer from nosema. These are the conditions that also suit the development of Chalkbrood. Thus one of the drawbacks of working winter honeyflows and of manipulating hives in cold weather is that the disadvantages of suboptimal brood rearing temperatures with poor nutrition are often combined.

The antibiotic, fumagillin is useful in controlling nosema disease, but because of the persistence of fumagillin residues, its use is restricted. Short of feeding fumagillin, there is no real control for nosema. Beekeepers working areas where nosema is likely to be a problem pay particular attention to nutrition, both pre and post winter honey flows.

Small Hive Beetle

The Small Hive Beetle (SHB) *Aethina tumida* Murray, thrives in sub-tropical and tropical climates. It was identified in colonies near Sydney late in 2002 and was probably present for a year or so before that. It has since spread widely in South-eastern Australia. In the circumstances, eradication of the exotic pest was not an option.

At first the SHB did not cause any serious damage. This fact alone probably explains why it took so long to recognise the pest. Beekeepers occasionally saw an apparently harmless beetle or two in their hives. They saw a few more after rain, when the humidity was high, but otherwise sightings were sporadic.

Over time, however, damage became evident. Although it is more likely to find SHBs in weak, diseased or queenless colonies that in normal healthy ones, they have become a pest of colonies over a wide area of the east coast of Australia, from south of Sydney to Cairns in Queensland. As mentioned in the chapter on pollination, it is expected that bees will have to be trucked into the Northern Territory from Queensland to meet the need for pollination, and SHB will almost certainly be carried with them.

The beetle also damages supers of honey and stored combs in extracting premises well away from the high

[20] *Hornitzky M (1987) Prevalence of Virus Infections on Honeybees in Eastern Australia. Journal of Apicultural Research 26(3):181-185.*

[21] *Pinnock D E and Mew P H (1980) Sucrose Therapy for Sacbrood Disease of Bee Larvae. Waite Agricultural Institute. ABK 82(5):107*

humidity of the coast. The micro-climate of extracting premises provides sufficient warmth and humidity for the beetle to reproduce.

SHB has been found in feral colonies and has been observed to be reproducing, pupation occurring in composted material on the floor of the nest site. Beetles apparently take advantage of the area of the nest site inaccessible to bees. It is therefore possible that SHB may cause more damage to feral colonies than to managed ones.

At present, protecting stored combs by refrigeration, as for wax moth, appears to be effective – but experience is limited. The recommended application of Phostoxin for the control of wax moth (see below) reportedly kills SHB larvae.

The Honey Bee Research and Development Committee is funding research by the NSW Department of Primary Industries to develop an effective in-hive bait for SHB control. A bee-proof bait station has been successfully tested but use of the preferred chemical component has not yet been approved. In the meantime SHB populations continue to grow and to spread.

Wax Moth

The wax moth is a pest of stored combs. Occupied hives, unless very weak, have no problem with wax moth. Italian bees are particularly aggressive towards moths. Both the greater wax moth *Galleria mellonella* and lesser wax moth *Achroia grisella* are present in Australia but *G. mellonella* is the most common and most destructive.

Although wax moth can cause extensive damage throughout most of Australia, the generally warm conditions for much of the year in the tropical north and the northern end of South-eastern Australia are ideal for wax moth breeding whereas the relatively cool climate in Tasmania means that wax moth is less important in that state.

Beekeeping practices also influence the severity of the wax moth problem. It is not so serious in Western Australia because boxes and frames are usually used on a regular basis, leaving little time for wax moth to take hold. In the principal beekeeping areas of the South-eastern Australia however, honey flows are less regular and in some seasons supers are not rotated regularly enough to minimise wax moth infestation. Thus it is probable that from time to time beekeepers will have a large number of combs in storage during the warmer months, posing a challenge to control methods.

The older and darker the comb the more prone it is to deprivation of wax moth, sorting combs to establish priority for treatment is, in theory, an advantage. In practice it may be too time consuming.

Phostoxin is registered at an application dose rate of 1.5 tablets/m^3 under the brand names of SANPHOS, NUFARM/PESTCON and trade names FUMIGATION TABLETS and FUMITOXIN respectively in New South Wales, Queensland, Victoria, South Australia, Tasmania, Western Australia and the Australian Capital Territory and the Northern Territory, "for the control of the Larger Wax Moth and the Lesser Wax Moth in Beehives and Equipment". The major problem with this chemical is that airtight conditions are required if all stages of wax moth are to be killed. These cannot always be easily achieved and therefore reduces the effectiveness of Phostoxin in the industry.

The preferred option is to build cold rooms to provide a form of control that does not depend on toxic chemicals. Maintaining cold rooms below 4°C will protect combs from wax moth damage indefinitely, but the moth will become active again when combs are removed from the cold room. Drop the temperature to minus 7°C for 4.5 hours and all stages of the wax moth life cycle will be killed. The same result will be achieved at minus 12°C for 3 hours or minus 15° for 2 hours.

Some beekeepers have purpose-built cold rooms capable of holding several thousand boxes whereas others use shipping containers fitted with a refrigeration unit.

Heat will also kill all stages of the wax moth, however the high temperatures required; 46°C for 1.3 hours or 50°C for 40 minutes, present a generally unacceptable risk.

Chemical-free control may also be attempted with one of the insect-attracting light devices. One type electrocutes the adult moths attracted to the ultra-violet light and is generally known as a "Zapper". Another type attracts the moths into the device where they drown in a tray of water and is sold under the name of "Bug Eater".

Ants

The ubiquitous ant is a common pest of bees in many areas, particularly the drier regions.

In the past ants have largely been controlled by poison or pesticides, a practice that is no longer environmentally acceptable. As well, in many of the areas where ants cause the most problems, some landholders are producing certified "organic" product and will not tolerate pesticides or poisons being used.

In the meantime, beekeepers choose sites as far from ants as possible – or at least sites with few nests.

The significant losses that ants may cause have stimulated the development of a variety of stands to make the bees in hives inaccessible to ants. One of the most successful ideas is the use of beehive stands where the legs are placed in pots of oil. This prevents the ants from crawling up the legs. Unfortunately it is impractical for most commercial beekeepers.

Cane toads

The cane toad, *Bufo marinus* is a major problem for beekeepers along the coast of Queensland and a lesser problem on the far north coast of NSW. The cane toad is becoming a pest in the Northern Territory around Katherine and is reportedly spreading.

The toads have voracious appetites and have developed a liking for bees in their diet. Apiarists consider that the safest way to protect bees from this pest is to place the hives on stands.

These stands are made of timber or steel pipe and usually carry two hives. The legs of the toad stands fold under the frame for travelling, while the legs of the timber stands are usually dismantled from the frame. The legs splay out so that the stands are stable. The hives usually have to be up to 500mm off the ground for the bees to be safe from the toads.

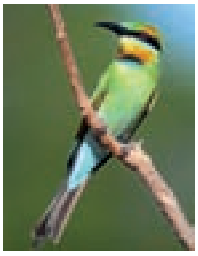
Bee Louse

The so called Bee Louse, *Braula coeca* (it is actually a wingless fly) occurs in Tasmania, but not on the Australian mainland.

These insects may occasionally be found on worker bees and drones, but they mainly infest queen bees. As a rule the adult louse does little damage, although it may eventually cause the death of the queen. It is not a true parasite, but feeds on the nectar or honey which it extracts from the mouth parts of its host. The greatest damage is caused by the larvae burrowing in the cappings of honeycombs.

In Tasmania the louse is widespread and commonly encountered. *B. caeca* is considered harmless by most beekeepers. Beekeepers consider that the louse may aggravate the queen and despoil comb when developing to the adult form.

Rainbow Bee Eater



The Rainbow Bee Eater, *Merops ornatus,* is a serious pest of bees in the tropical north of Australia. The bird is often a nuisance in other regions, particularly to queen rearing operations.

The birds migrate north in the winter, which coincides with the dry season in the tropical north. Bellis reports[22]:

The birds migrate from southern Australia to northern Australia and some go beyond to PNG and eastern Indonesia and return to southern Australia in August/September to breed. Huge numbers travel through the Torres Strait during these migrations.

In the tropical north the presence of large numbers of the birds can force bees to remain in their hives for most of the day. Hundreds of birds can be present in or near apiaries.

During summer months the birds can be found in many parts of Australia and are often blamed for eating young queens that are on their nuptial flight.

Exotic Diseases and Pests

Varroa

The greatest threat to beekeeping in Australia is probably the species of Varroa mite known as *Varroa destructor* (known henceforth in this item simply as Varroa). Australia is one of the few countries free from Varroa. It was found in the north island of New Zealand in early 2000 and has since spread to the South Island, so it is close.

Although the Varroa mite is a native parasite of the Asian honeybee *Apis cerana*, *V. destructor* can infest the European honeybee. While the Asian honeybee can tolerate the mite, the European honeybee cannot.

Overseas experience suggests that should Varroa become established in Australia it would spread rapidly and would, within two or three years, kill most colonies not being treated with an appropriate acaricide. Treatment is expensive both for the purchase of the acaricide and for the additional labour involved. Exports of queen bees and packaged bees could be affected.

Australia has plans in place to attempt to contain an outbreak should one occur. As well as strict quarantine requirements, Australia maintains a network of sentinel hives close to possible places of entry – ports and airports – that are monitored for the presence of mites.

Other Mites

Tropilaelaps

The mite *Tropilaelaps clareae* may be more of a problem than even Varroa, if it ever reaches our shores. It is about half the size of *Varroa destructor* and even more deadly. Its native host is the Giant Honey Bee *Apis dorsata* but it is able to transfer to *Apis mellifera*. The treatment for Tropilaelaps is similar to that for Varroa.

Tracheal Mite

The tracheal mite *Acarapis woodi,* is the cause of what was previously known as Acarine Disease, or Isle of Wright Disease. The mite infests the trachea of the bee and slowly weakens the host, eventually killing it, or at least causing its premature death. Colonies may die when the infestation is acute. The disease is not as dramatic in its effect as the mites mentioned above. European honeybees have considerable tolerance to the mite, which is reportedly more of a problem in cooler climates.

[22] *Glen Bellis, (2002), personal communication.*

8. Appendices

Appendix I: Plant Names[23]

All scientific names of species shown in this list without nomenclatural authorities follow the nomenclature used in Harden (1990, 1992, 2002) *Flora of New South Wales*, Volumes 1, 3 and 2 (revised edition). Non-New South Wales species have the nomenclatural authorities shown.

Common Names First

Apple	*Angophora* species
Almonds	*Prunus amygdalus* Batsch
Bangalay	*Eucalyptus botryoides*
Belbowrie	*Melaleuca quinquenervia*
Bimble Box	*Eucalyptus populnea*
Blackberry	*Rubus fruticosus*,
Blackbutt	*Eucalyptus pilularis*
Blue Billy Goat Weed	*Ageratum conyzoides*
Blue Gum	*Eucalyptus leucoxylon*
Boobialla	*Myoporum montanum*
Broad-leaved Ironbark	*Eucalyptus fibrosa*
Broad-leaved Tea-tree	*Melaleuca quinquenervia*
Brown Box	*Eucalyptus microcarpa*
Brown Stringybark	*Eucalyptus obliqua*
Brush Box	*Lophostemon confertus*
Caley's Ironbark	*Eucalyptus caleyi*
Caltrop	*Tribulus terrestris*
Canola	*Brassica* species
Cape Weed	*Arctotheca calendula*
Carbeen	*Corymbia tessellaris*
Carpet Weed	*Phyla nodiflora*
Coastal Mallee	*Eucalyptus diversifolia* Bonpl.
Coolibah	*Eucalyptus Coolabah*
Darling Pea	*Swainsona* species
Dryland Tea-tree	*Melaleuca lanceolata*
Ellangowan	*Eremophila deserti*
Forest Red Gum	*Eucalyptus tereticornis*
Fuzzy Box	*Eucalyptus conica*
Gidgee	*Acacia cambagei*
Glycine	*Glycine tomentella*
Grey Box	*Eucalyptus microcarpa*
Grey Gum	*Eucalyptus punctata*
Grey Ironbark	*Eucalyptus paniculata*
Horehound	*Marrubium vulgare*
Inland Bloodwood	*Corymbia tumescens*
Inland Grey Box	*Eucalyptus microcarpa*
Jarrah	*Eucalyptus marginate* Donn ex Smith
Jelly Bush	*Leptospermum* species
Karri	*Eucalyptus diversicolor* F.Muell.
Leatherwood	*Eucryphia lucida* (Labill.) Baill.
Leatherwood	*Eucryphia milliganii.* Hook.F.
Lignum,	*Eremophila* species
Lucerne	*Medicago sativa*
Mallee Box	*Eucalyptus pilligaensis*,
Mangrove	*Aegiceras* species
Mangrove	*Avicennia* species
Messmate	*Eucalyptus obliqua*
Mint Weed	*Salvia reflexa*
Mountain Ash	*Eucalyptus oreads*
Mugga Ironbark	*Eucalyptus sideroxylon*
Napunyah	*Eucalyptus ochrophloia*
Narrow-leaved Ironbark	*Eucalyptus crebra*
Paterson's Curse	*Echium plantagineum*
Pea bush	*Pultenaea villosa*
Pilliga Box	*Eucalyptus pilligaensis*,
Pink Bloodwood	*Corymbia intermedia*
Pink Gum	*Eucalyptus fasciculosa* F.Muell.
Red Box	*Eucalyptus polyanthemos*
Red Mahogany	*Eucalyptus resinifera*
Red Mallee	*Eucalyptus oleosa*
Red Stringybark	*Eucalyptus macrorhyncha*
Ribbon Gum	*Eucalyptus viminalis*
River Red Gum	*Eucalyptus camaldulensis*
Salvation Jane	*Echium plantagineum*
Sarsaparilla	*Alphitonia petriei*
Silver-leaved Ironbark	*Eucalyptus melanophloia*,
Spotted gum	*Corymbia maculata*
St. Barnaby's Thistle	*Centaurea solstitialis*
Sugar Gum	*Eucalyptus cladocalyx* F.Muell.
Sydney Blue Gum	*Eucalyptus saligna*
Tasmanian Blue Gum	*Eucalyptus globulus* Labill.
Turnip Weed	*Rapistrum rugosum*
Vipers Bugloss	*Echium vulgare*
White Box	*Eucalyptus albens*
White clover	*Trifolium repens*
White Mahogany	*Eucalyptus acmenoides*
White Mallee	*Eucalyptus gracilis*
White Stringybark	*Eucalyptus globoidea*
Wild Turnip	*Brassica tournefortii*
Yellow Box	*Eucalyptus melliodora*
Yellow Stringybark	*Eucalyptus muelleriana*

[23] *Thanks to botanist Dr Peter Myerscough for his help with plant names.*

Botanical Name First

Angophora species	Apple
Acacia cambagei	Gidgee
Aegiceras species	Mangrove
Ageratum conyzoides	Blue Billy Goat Weed
Alphitonia petriei	Sarsaparilla
Arctotheca calendula	Cape Weed
Avicennia species	Mangrove
Brassica species	Canola
Brassica tournefortii	Wild Turnip
Centaurea solstitalis	St. Barnaby's Thistle
Corymbia intermedia	Pink Bloodwood
Corymbia maculata	Spotted Gum
Corymbia tumescens	Inland Bloodwood
Corymbia tessellaris	Carbeen
Echium plantagineum	Paterson's Curse
Echium plantagineum	Salvation Jane
Echium vulgare	Viper' s Bugloss
Eremophila species	Lignum,
Eremophila deserti	Ellangowan
Eucalyptus acmenoides	White Mahogany
Eucalyptus albens	White Box
Eucalyptus botryoides	Bangalay
Eucalyptus caleyi	Caley's Ironbark
Eucalyptus camaldulensis	River Red Gum
Eucalyptus cladocalyx F.Muell.	Sugar Gum
Eucalyptus conica	Fuzzy Box
Eucalyptus crebra	Narrow-leaved Ironbark
Eucalyptus diversicolor F.Muel.	Karri
Eucalyptus diversifolia Bonpl.	Coastal Mallee
Eucalyptus fasciculosa F.Muell	Pink Gum
Eucalyptus fibrosa	Broad-leaved Ironbark
Eucalyptus globoidea	White Stringybark
Eucalyptus globulus Labill.	Tasmanian Blue Gum
Eucalyptus gracilis	White Mallee
Eucalyptus leucoxylon	Blue Gum
Eucalyptus macrocarpa Hook.	Grey Box
Eucalyptus macrocarpa Hook.	Inland Grey Box
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus marginata	Jarrah
Eucalyptus melanophloia Donn ex Sm.	Silver-leaved Ironbark,
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Brown Box
Eucalyptus coolabah	Coolibah
Eucalyptus muelleriana	Yellow Stringybark
Eucalyptus obliqua	Brown Stringybark
Eucalyptus obliqua	Messmate
Eucalyptus ochrophloia	Napunyah
Eucalyptus oleosa	Red Mallee
Eucalyptus oreades	Mountain Ash
Eucalyptus paniculata	Grey Ironbark
Eucalyptus pilligaensis	Mallee Box
Eucalyptus pilligaensis	Pilliga Box
Eucalyptus pilularis	Blackbutt
Eucalyptus polyanthemos	Red Box
Eucalyptus populnea	Bimble Box
Eucalyptus punctata	Grey Gum
Eucalyptus resinifera	Red Mahogany
Eucalyptus saligna	Sydney Blue Gum
Eucalyptus sideroxylon	Mugga Ironbark
Eucalyptus tereticornis	Blue Gum
Eucalyptus tereticornis	Forest Red Gum
Eucalyptus viminalis	Ribbon Gum
Eucryphia lucida (Labill.) Baill.	Leatherwood.
Eucryphia milliganii Hook.F.	Leatherwood
Glycine tomentella	Glycine
Leptospermum species	Jelly Bush
Lophostemon confertus	Brush Box
Marrubium vulgare	Horehound
Medicago sativa	Lucerne
Melaleuca lanceolata	Dryland Tea-tree
Melaleuca quinquenervia	Belbowrie
Melaleuca quinquenervia	Broad-leaved Tea-tree
Myoporum montanum	Boobialla
Phyla nodiflora	Carpet Weed
Prunus amygdalus Batsch.	Almonds
Pultenaea villosa	Pea bush
Rapistrum rugosum	Turnip Weed
Rubus fruticosus	Blackberry
Salvia reflexa	Mint Weed
Swainsona species	Darling Pea
Tribulus terrestris	Caltrop
Trifolium repens	White clover

Appendix II: Government Agencies

Commonwealth Agencies

Agriculture and Resource Management Council of Australia and New Zealand's Australian Veterinary Emergency Plan (AUSVETPLAN)
Website: www.aahc.com.au\ausvetplan

Australian Quarantine Inspection Service, GPO Box 858 Canberra ACT 2601.
Phone: 02 6272 3933. Email: aqis.contact@aqis.gov.au
Website: www.aqis.gov.au

Rural Industries Research & Development Corporation (RIRDC), PO Box 4776 Kingston ACT 2604.
Phone: 02 6272 4539. Email: rirdc@rirdc.gov.au
Website: www.rirdc.gov.au

State and Territory Agencies – Contact Details

Australian Capital Territory

Environment ACT, PO Box 144 Lyneham ACT 2602.
Phone: 02 6207 9777. Email: environmentACT@act.gov.au
Website: www.environment.act.gov.au

New South Wales

Doug Somerville, Apiary Officer, Department of Primary Industries (DPI) PO Box 389 Goulburn NSW 2580.
Phone: 02 4828 6619. Email: doug.somerville@agric.nsw.gov.au

Michael Hornitzky, Principal Research Scientist, DPI, Elizabeth Macarthur Agricultural Institute, PMB 8, Camden NSW 2570. Phone: 02 4640 6311. Email: michael.hornitzky@agric.nsw.gov.au

Mick Rankmore, Regulatory Specialist, Apiaries, DPI, PO Box 546, Gunnedah NSW 2380
Phone: 02 6742 9274. Email michael.rankmore@agric.nsw.gov.au

Northern Territory

Vicki Simlesa, Technical Officer Crocodiles & Apiary Officer Berrimah Farm, GPO Box 3000, Darwin NT 0801 Australia Tel 08 8999 2036. Email vicki.simlesa@nt.gov.au

Queensland

Peter Warhurst, Senior Apiary Officer, Queensland Department of Primary Industries (QDPI) PO Box 231 Warwick QLD 4370. Phone: 07 4661 1733. Email: warhurp@dpi.qld.gov.au

Hamish Lamb, Apiary Experimentalist, QDPI, PO Box 5165 SCMC Nambour QLD 4560
Phone: 07 5444 9613. Email: hamish.lamb@dpi.qld.gov.au

South Australia

Michael Stedman, Primary Industries and Resources, South Australia, Apicultural Adviser, 33 Flemington Street Glenside SA 5065. Phone 08 8207 7975. Email: stedman.michael@saugov.sa.gov.au

Tasmania

Rick Campbell, Veterinary Officer Department of Primary Industries, Water and Environment (DPIWE), PO Box 303 Davenport TAS 7310. Phone: 03 6421 7644. Email: rick.camplell@dpiwe.tas.gov.au

Graeme Raphael, Stock Officer, DPIWE, PO Box 96 Oatlands 7120.
Ph: 03 62545012. Email: Graeme.Raphael@dpiw.tas.gov.au

Victoria

Russell Goodman, Apicultural Scientist, Institute for Horticultural Development, Private Bag 15, Ferntree Gully Delivery Centre Vic. 3156. Phone: 03 9210 9222. Email: russell.goodman@nre.vic.gov.au

Peter Kaczynski, Senior Apiary Inspector, Department of Primary Industries, Shire Hall, Barkly Street, Ararat VIC 3377. Phone: 03 5355 0527. Email: peter.kaczynski@dpi.vic.gov.au

Western Australia

Rob Manning, Project Manager, Agriculture Western Australia, Baron-Hay Court, South Perth WA 6151
Phone: (08) 9368 3567. Email: rmanning@agric.wa.gov.au

Bill Trend, Senior Apiculturist, Agriculture Western Australia, Baron-Hay Court, South Perth WA 6151
Phone: 08 9368 3535. Email: btrend@agric.wa.gov.au

Appendix III: Beekeeper Organisations

National Beekeeper Organisations

Australian Honey Bee Industry Council (AHBIC), PO Box R838 Royal Exchange NSW 1225.
Phone: 02 9247 1180. Email: ahbic@honeybee.org.au Web site: www.honeybee.org.au

Federal Council of Australian Apiarists' Associations, RSD 7440 Northern Highway, Strathallan VIC 3622.
Phone: 03 5484 9231. Email: amberhunidue@bigpond.com

Australian Queen Bee Breeders' Association, MS 825, Middle Road Peak Crossing QLD 4306.
Phone: 07 5467 2135. Email: queenbee@gil.com.au

National Association of Crop Pollination Associations, 17 Goya Road Newnham TAS 7248.
Phone: 03 6326 6892. Email tashives@bigpond.net.au

State and Territory Producer Associations

New South Wales Apiarists' Association Inc, PO Box 3018 Toongabbie East NSW 2146.
Phone: 02 9631 3934. Email: nswaa@bigpond.net.au

Northern Territory Beekeepers' Association, c/o Vicki Simlesa, GPO Box 3000, Darwin NT 0801 Australia Tel 08 89992036. Email vicki.simlesa@nt.gov.au

Queensland Beekeepers' Association Inc, PO Box 49 Mapleton QLD 4560.
Phone: 07 5445 7512. Email: qbainc@bigpond.com

South Australian Apiarists' Association, PO Box 293 Tintinara SA 5266.
Phone: 08 8757 2001. E-mail: secretary@saaa.org.au

Tasmanian Beekeepers' Association, 78 Hill Street, West Launceston TAS 7254
Phone: 03 6334 2027. E-mail: sconway@utas.edu.au

Victorian Apiarists' Association, PO Box 40 California Gully, VIC 3556.
Phone: 03 5446 1455. E-mail: vaainc@bordernet.com.au

Western Australian Farmers' Federation (Inc.) Beekeepers Section, PO Box 6291 East Perth WA 6892.
Phone: 08 9486 2100. E-mail: lorenbebich@waff.org.au

Appendix IV: Journals

Honeybee News, PO Box 352 Leichhardt NSW 2040.
Phone: 02 9798 6240. E-mail: honeybee@accsoft.com.au

The Australasian Beekeeper, 34 Racecourse Road Rutherford NSW 2320.
Phone: 02 4932 7244. E-mail: pendersmaitland@bigpond.com

The Australian Bee Journal c/o Bookish, 6 High Street, Eaglehawk, VIC 3556
Phone: 03 5446 8211. E-mail: abjeditors@yahoo.com

Commercial Beekeeping in Australia

A report for the Rural Industries Research and Development Corporation

by Frederick S Benecke

RIRDC Publication No 07/059. RIRDC Project No FSB1A

This report, which is a snapshot of the Australian beekeeping industry describes the physical and cultural environment in which beekeeping is undertaken and the production methods commonly employed by beekeepers.

Beekeepers have been assisted in their endeavours, particularly in recent years, by world standard research and RIRDC's Honeybee R&D Program aims to to improve the productivity and profitability of the Australian beekeeping industry.

Australian honey is regarded on the world market as a premium quality product. It is produced over a large area from a wide variety of flowering plants which, because of fluctuating rainfall patterns and the extended budding cycles of much of the honey producing flora, tend to flower spasmodically.

Average Australian honey production ranges between 20–30,000 tonnes per year. The gross value of production is estimated to average around $65 million and the average production per hive was 118 kilograms per hive in 2005.

There are around 9,600 apiarists in Australia operating around 500,000 hives. Over 70% of hives are operated by commercial beekeepers managing more than 200 hives. Most commercial honeybee keepers are regionally based. Domestic honey consumption is likely to remain relatively elastic with other spreads representing a close substitute as retail prices increase. There is currently a strong demand in the horticultural industry for hive pollination services.

Future growth of the honeybee industry is dependent on international demand and supply conditions, access to public flora resources and the industry's ability to cope with pests and diseases.

The Rural Industries Research and Development Corporation (RIRDC) manages and funds priority research and translates results into practical outcomes for industry.

Our business is about new products and services and better ways of producing them.

Most of the information we produce can be downloaded for free from our website: www.rirdc.gov.au.

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www.rirdc.gov.au/eshop

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