Foreword

Propolis is a resinous mixture that honey bees produce from saliva, beeswax and the exude of flora which is used as both a sterilising agent and a sealant for unwanted open spaces in the hive. Its medicinal properties have been known to humans since ancient times. Modern research has shown that propolis is an effective antimicrobial that may also be useful in the treatment of skin cancers.

New Zealand has developed a propolis industry that provides opportunities for profitable participation by beekeepers. The purpose of this study was to investigate whether there were similar opportunities in propolis harvest for Australian beekeepers.

The study has shown that the absence of consistent buyers and local processors has held back the development of an Australian propolis industry. However, this situation is starting to change. There is now a single commercial propolis processor supplying a consumer product manufacturer and other parties are considering commercial investment in propolis processing. Niche processors, who are also beekeepers, produce simple propolis tinctures. Participation in these emerging value chains will provide modestly profitable opportunities for Australian beekeepers, especially those operating at a smaller-scale.

Australian beekeepers should consider the analysis contained within this report and prepare their own propolis production budgets before committing to the industry. They should also make contact with propolis buyers prior to industry entry to ensure there is clear agreement on quality expectations.

This report is an addition to AgriFutures Australia’s diverse range of over 2000 research publications and it forms part of our Honey Bee and Pollination RD&E Program, which aims to support research, development and extension that will secure a productive, sustainable and more profitable Australian beekeeping industry and ensure the pollination of Australia’s horticultural and agricultural crops.

Most of AgriFutures Australia’s publications are available for viewing, free downloading or purchasing online at: www.agrifutures.com.au. Purchases can also be made by phoning 1300 634 313.

John Harvey
Managing Director
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About the Author

Michael Clarke is a degree qualified agricultural economist with more than 30 years professional experience. Michael has post-graduate training in accounting, marketing, policy analysis and business administration. Michael’s project work includes economic evaluation, policy analysis, strategic planning and research in agriculture and natural resource management. Michael’s projects for the Australian honey bee industry include an analysis of policy options to facilitate live honey bee exports; an economic impact assessment of a regional pollination deficit, Varroa RD&E planning workshops, a review of AHBIC Varroa management policy and a review of NSW Government American foulbrood policy. Michael has worked for Plant Health Australia preparing the business case and regulatory impact statement for an increase in honey biosecurity levies and ACIAR reviewing the beekeeping industries in PNG, Solomon Islands and Fiji. Additional information on Michael is available at www.AgEconPlus.com.au.

Acknowledgments

The author of this report, Michael Clarke would like to thank:

Danny Le Feuvre, Australian Bee Services – project design, industry information and review of the draft report.

Dr Doug Somerville, Technical Specialist, Honey Bees, NSW DPI – review of the draft report.

A complete list of those assisting with the study is included as Appendix 1.

Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>ABARES</td>
<td>Australian Bureau of Agricultural and Resource Economics and Sciences</td>
</tr>
<tr>
<td>ACIAR</td>
<td>Australian Centre for International Agricultural Research</td>
</tr>
<tr>
<td>ACT</td>
<td>Australian Capital Territory</td>
</tr>
<tr>
<td>AFB</td>
<td>American foulbrood</td>
</tr>
<tr>
<td>AHBIC</td>
<td>Australian Honey Bee Industry Council</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>DAWR</td>
<td>Australian Government Department of Agriculture and Water Resources</td>
</tr>
<tr>
<td>DPI</td>
<td>Department of Primary Industries</td>
</tr>
<tr>
<td>HACCP</td>
<td>Hazard Analysis and Critical Control Points</td>
</tr>
<tr>
<td>KILH</td>
<td>Kangaroo Island Living Honey</td>
</tr>
<tr>
<td>MCoR</td>
<td>DAWR Manual of Importing Country Requirements</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>NZ</td>
<td>New Zealand</td>
</tr>
<tr>
<td>PNG</td>
<td>Papua New Guinea</td>
</tr>
<tr>
<td>QLD</td>
<td>Queensland</td>
</tr>
<tr>
<td>RD&amp;E</td>
<td>Research, Development and Extension</td>
</tr>
<tr>
<td>RMB</td>
<td>Renminbi (Chinese currency unit)</td>
</tr>
<tr>
<td>SARDI</td>
<td>South Australian Research and Development Institute</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
</tr>
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Executive Summary

What the report is about

This report investigates the status of propolis production in New Zealand and Australia, the market for Australian produced propolis and whether there is opportunity for additional profitable supply. The project was designed and delivered in consultation with commercial beekeepers.

Who is the report targeted at?

The report is targeted at Australian beekeepers with an interest in producing additional apiary products. The report is relevant to all beekeepers but may be particularly pertinent to smaller operations where the beekeeper is more likely to have uncommitted time and where additional income may make a difference to overall enterprise viability.

Where are the relevant industries located in Australia

Relevant beekeepers are located Australia wide. However, there appears to be regional differences in per hive propolis production that are attributable to flora and enterprise specific factors including the genetic makeup of the honey bees and the population of bees in the hive. In general terms, the harvesting of propolis for sale is more likely to be profitable in cooler and coastal areas.

Background

Propolis is a resinous mixture that honey bees produce from saliva, beeswax and the exude of tree buds, sap flows and other botanical sources. It is used by honey bees as both a sterilising agent and a sealant for unwanted open spaces in the hive. Humans make use of the antimicrobial properties of propolis for wound treatment, cold sores, mouth ulcers and the suppressing of immune responses. Propolis has also been used in the manufacturing of musical strings and varnish, chewing gum, car polish and various other industrial applications.

New Zealand has a propolis industry and prior to the project it was understood that beekeepers on Kangaroo Island harvest Australian propolis. Propolis has enjoyed increased exposure on the back of demand for natural therapies and beekeepers receive regular enquiry regarding its supply. This study was to provide a factual basis for beekeepers considering propolis harvest as a commercial opportunity.

Objectives

The objectives of this study were to:

1. Understand the status of propolis production in New Zealand and Australia.
2. Investigate the market for Australian produced propolis.
3. Determine the potential for additional profitable Australian propolis production.
4. Ensure commercial beekeepers are engaged in the project, assist with its design and are aware of project results.

Methods used

A small number of commercial beekeepers with an interest in propolis harvest were surveyed to determine their information needs. A survey was also completed with commercial beekeepers that currently harvest propolis or had past experience with propolis supply. Where possible, interviews were carried out with researchers investigating the chemical composition and medicinal qualities of propolis. A literature review was completed to better understand propolis uses, composition, production processes and world supply. An understanding of the status of propolis production in New Zealand was developed
through interviews with Ministry of Agriculture New Zealand apiculture specialists, beekeepers and propolis processors. A preliminary analysis of the financial return to Australian beekeepers from propolis harvesting and processing into simple products (tinctures) was completed. Conclusions were drawn on the impact of low cost Chinese imports, the competitive advantages of Australian propolis, and the profitability of propolis supply by Australian beekeepers in different forms. Results were presented to two state-based beekeeper conferences.

**Key findings**

*Status of propolis production in New Zealand*

New Zealand has a profitable and expanding propolis industry with most propolis sourced from poplar, willow and birch. The country has two well-resourced and professional propolis processors with others looking to expand their industry footprint. There is competition between processors for raw propolis supply and a filled mat pickup and extraction service is offered to beekeepers. Beekeepers making use of this service do not incur labour costs associated with cracking and scraping propolis mats. Raw propolis supply can be profitable for New Zealand beekeepers including those with small apiaries. On average, New Zealand hives produce 220 grams of raw propolis per annum and beekeepers receive between NZ$54 and NZ$197/kg for this product. New Zealand produces approximately 30 tonne/year of raw propolis, the equivalent of 12 tonnes of pure propolis. New Zealand imports many times this volume of processed propolis. Imports are required for lower cost consumer products but are also a recognition of New Zealand’s limited ability to increase domestic supply.

*Status of propolis production in Australia*

Some propolis is produced in all Australian honey bee hives but few beekeepers harvest it at the current time. Actual propolis yield in Australia is variable and dependent on location and hive specifics. A number of Australian regions have per hive production levels approaching that of cold countries such as New Zealand. Few studies are available on the chemistry of propolis produced by honey bees in Australia. Those studies that are available, point to additional unique and potentially useful chemistries. The quality of Australian propolis is understood to be acceptable to processors and their final customers. Propolis harvest by Australian beekeepers has been held back by the absence of consistent buyers. This is starting to change with other businesses looking to join the current processor who produces pure propolis for the consumer products sector. Propolis processing requires capital equipment, technical knowhow, scale and access to markets. Small-scale processing of propolis into tinctures is currently practiced by beekeepers for both personal use and for sale.

*Market for Australian produced propolis*

The market for propolis products in Australia, which includes re-export of consumer products to Asia, has grown rapidly and is forecast to grow at an average 10% per annum through to 2022. Australia imports an estimated 60 to 80 tonne per annum of pure propolis and propolis harvested by Australian beekeepers could at least partially offset some of this imported material. Companies with a potential future interest in raw Australian propolis include a honey packer, an established processor looking for additional supply, a New Zealand processor exploring opportunities to set up in Australia and a buyer of imported pure propolis. There is a market and willingness to pay for Australian sourced propolis. There is both lower and higher quality Chinese propolis available in Australia. Pure Australian propolis will need to achieve price premiums of between 200% and 300% to be profitable. If Australian product is well marketed, price premiums of this magnitude are possible. Australian propolis competitive advantages which might be used to establish price premiums include trust in the integrity of Australian origin products, a raw product that should be naturally low in chemical residues and unique chemistries in propolis sourced from native flora.

*Potential for additional profitable propolis production in Australia*

Using “best estimate” assumptions, harvest of raw propolis is modestly profitable. Propolis harvesting appears to be a useful addition to total income for all beekeepers, especially smaller operations where the beekeeper is more likely to have uncommitted time and additional income may provide a boost to overall enterprise viability. For example, raw propolis production in a 100 hive enterprise has the
potential to add $900/year to net revenue if paid labour is used and $1,400/year if the owner’s labour is employed and has no opportunity cost. The economics of raw propolis production is enhanced for all beekeepers if the processor provides a New Zealand style mat pickup and extraction service. Mat pickup and extraction is thought to require access to at least five tonne of raw propolis and substantial capital for processing equipment if a sustainable enterprise is to be created. Production of value added propolis tincture is relatively straightforward and is profitable for beekeepers for the “best estimate” assumptions used.

Implications for relevant stakeholders

There would appear to be a profitable opportunity to harvest propolis in Australia. Beekeepers should consider the analysis contained within this report and prepare their own propolis production budgets before committing to the industry. They should also make contact with propolis buyers prior to industry entry to ensure there is clear agreement on quality expectations.

Recommendations

The study recommends that AgriFutures Australia and other funding bodies give consideration to future research arising from this study including the development of standards/specifications for raw Australian propolis, assessment of which flora produce the most useful propolis and investigation of whether propolis is recoverable from existing honey processing operations. In time, it is possible that the Australian propolis harvesting industry might reach a size comparable to the New Zealand propolis industry, create opportunities in the value chain and deliver new, more effective medical treatments.
Introduction

This project was completed as part of the AgriFutures Australia, Honey Bee and Pollination Program. The aim of the program is to support research, development and extension (RD&E) that will secure a productive, sustainable and more profitable Australian beekeeping industry and ensure the pollination of Australia’s horticultural and agricultural crops.

Objective 2 of the Honey Bee and Pollination Program 5-Year RD&E Plan 2015-19 is to ‘Facilitate the development of at least one new Australian apiary product’. Consistent with the RD&E Plan the objectives of this project were to:

1. Understand the status of propolis production in New Zealand and Australia.
2. Investigate the market for Australian produced propolis.
3. Determine the potential for additional profitable Australian propolis production.
4. Ensure commercial beekeepers are engaged in the project, assist with its design and are aware of project results.

Consequently, the purpose of this study was to better understand the production and market potential of Australian propolis.

Project background

Propolis is a resinous mixture that honey bees produce from saliva, beeswax and the exude of tree buds, sap flows and other botanical sources. It is used by honey bees as a sealant for unwanted open spaces in the hive. Humans make use of the antimicrobial properties of propolis for wound treatment, cold sores, mouth ulcers and the suppressing of immune responses. Propolis has also been used in the manufacturing of musical strings and varnish, chewing gum, car polish and other industrial applications.

New Zealand has a propolis industry and prior to the project it was understood that beekeepers on Kangaroo Island harvest Australian propolis. Propolis has enjoyed increased exposure on the back of demand for natural therapies and industry receives regular enquiry regarding supply. This study was to provide a factual basis for industry consideration of propolis as a commercial opportunity.

Study approach

Project objectives were delivered through the discharge of eight tasks:

1. Identification and survey of a small number of commercial beekeepers with an interest in propolis to determine their information needs.
2. Identification and survey of any existing Australian commercial beekeepers engaged in propolis production e.g. beekeepers on Kangaroo Island, South Australia.
3. Literature review to better understand propolis uses, floral requirements and markets.
4. Interview of researchers with a professional interest in propolis. Interviews were to include University of Sydney researchers Doctors Colin and Rujee Duke and Western Sydney University PhD student Ms Christine Murray and her supervisor Dr Chun Guang Li.
5. Research the New Zealand propolis sector including the Ministry for Agriculture, propolis buyers and processors and New Zealand beekeepers who are producing propolis for sale.

6. Complete preliminary analysis to determine the cost of propolis production and whether Australian propolis could be competitive on domestic and export markets. This analysis was to include an assessment of the impacts of low cost Chinese imported propolis on a prospective Australian industry; a review of the profitability of supply in different forms (i.e. raw or processed into simple products), and the identification of any competitive advantages for Australian producers (e.g. flora specific propolis).

7. Preparation of a project report and a short four page project summary outlining market opportunity and aimed at industry awareness raising.

8. Preparation of slides for presentation to commercial apiarist conferences and the presentation of findings to two state beekeeping conferences.
Propolis uses, composition, production processes and world supply

Bee production of propolis and its use in the hive

Propolis is produced by the European honey bee (Apis mellifera) with various subspecies including Caucasian lines (A. mellifera caucasica) and Ligurian lines (A. mellifera ligustica) claimed as being particularly productive (see for example Lebedev, undated and King, 2017). Propolis from Carnolian lines (A. mellifera carnica) has been shown to have weaker antibacterial properties (Huang et al., 2014). Anecdotal evidence suggests that wild honey bees that have not been bred for other traits (e.g. honey production, docility) are superior propolis producers (Tim Malfroy, commercial beekeeper, pers. comm., September 2018). Some tropical bees (especially Melipona spp.) also produce a form of propolis. Propolis from tropical bees is often referred to as geo-propolis (propolis mixed with soil) or cerumen. Australian stingless bees including Tetragonula carbonaria produce propolis. Propolis is not collected in any volume by the Asian bees (A. dorsata, A. florea and A. cerana). In this report, analysis refers only to the production of honey bee propolis from A. mellifera.

Honey bees collect propolis to prevent uncontrolled airflow in the hive, to maintain homeostasis, to reduce microbial growth and waterproof hive walls, to reinforce structural stability especially in wild hives, to reduce vibration and to make the hive more defensible – narrowing entrances and sealing holes. Propolis is also used to prevent putrefaction. Hive invaders such as beetles, lizards, toads and mice may be stung to death by honey bees and mummified in propolis inside the hive. Recent research also hints at a more subtle role in colony level immunity than direct defence against parasites and pathogens (Miguel and Antunes, 2011). King (2017) identified research that shows that a colony experiencing growth in fungus inside the hive will collect additional propolis to destroy the threat. In this instance propolis is not produced merely as a prophylactic but also as a direct cure for disease.

Human use of propolis

Humans have made use of propolis for medical and manufacturing purposes since ancient times. In modern times propolis is mostly used in natural medicine as a health enhancing food supplement, in medicine, dental and veterinary medicine, in cosmetics, as a food preservative or antioxidant or as a phyto-inhibitor (disease inhibitor) in agriculture. Propolis has been suggested as a meat and fish preservative and as an antimicrobial additive to food packaging (King, 2017 and Bogdanov, 2017). Propolis has also been used as an air disinfectant (Bogdanov, 2017).

A sample of current consumer products containing propolis is shown in Figure 1.
Propolis has been used for increasing the human body’s natural resistance to infection and lowering blood pressure and cholesterol levels. It has also been used in mouthwash products and toothpastes to prevent cavities and treat gingivitis and stomatitis (mouth inflammations), in cough syrups, oral pills, lozenges, ointments, lotions, and vitamins. Holistic therapists use propolis for the relief for inflammations, viral diseases, fungal infections, ulcers, and superficial burns along with acupuncture, ayurveda (a traditional form of medicine originating in India), and homeopathy (Miguel and Antunes, 2011).

Modern research shows that propolis is a valuable source of immuno-stimulant and the product is now widely used in preventative medicine and to boost the human immune system. Propolis has a potential role in the treatment of skin cancers (Duke et al., 2017). Antimicrobial activity is the most important biological property of propolis (Bogdanov, 2017). The human health enhancing effects of propolis can be divided into main and secondary. The main functional effects of propolis, along with the propolis type that has been shown to be effective, is reproduced in Table 1.
<table>
<thead>
<tr>
<th>Health benefit type</th>
<th>Specific Action</th>
<th>Propolis type for which cell culture and animal experiment data is available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimicrobial, anti-inflammatory, immunomodulating, wound and ulcer healing.</td>
<td>Antibacterial.</td>
<td>All propolis types.</td>
</tr>
<tr>
<td></td>
<td>Antiviral.</td>
<td>All propolis types.</td>
</tr>
<tr>
<td></td>
<td>Antifungal.</td>
<td>All propolis types.</td>
</tr>
<tr>
<td></td>
<td>Food preservative.</td>
<td>Poplar, Baccharis, Argentine, Egyptian.</td>
</tr>
<tr>
<td></td>
<td>Against parasites.</td>
<td>Poplar, Baccharis, Cuban, Mexican.</td>
</tr>
<tr>
<td></td>
<td>Anti-inflammatory.</td>
<td>Poplar, Baccharis, Cuban, Egyptian.</td>
</tr>
<tr>
<td></td>
<td>Immuno-stimulating.</td>
<td>Poplar, Baccharis, Cuban, Brazilian.</td>
</tr>
<tr>
<td></td>
<td>Anti-ulcer (stomach, skin, buccal/mouth).</td>
<td>Baccharis, Indian.</td>
</tr>
<tr>
<td></td>
<td>Wound healing.</td>
<td>All propolis types.</td>
</tr>
<tr>
<td></td>
<td>Improved corneal healing.</td>
<td>Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Hepato-protective.</td>
<td>All propolis types.</td>
</tr>
<tr>
<td></td>
<td>Anti-tumor, anti-mutagenic.</td>
<td>Poplar, Baccharis, Cuban, Taiwanese, Moroccan, Korean.</td>
</tr>
<tr>
<td></td>
<td>Anti-angiogenic.</td>
<td>Poplar, Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Cyto and Chemo-preventative.</td>
<td>Poplar, Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Antioxidant.</td>
<td>All propolis types.</td>
</tr>
<tr>
<td></td>
<td>Radiation protective.</td>
<td>Poplar, Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Anti-aging and increasing human life span.</td>
<td>Poplar.</td>
</tr>
<tr>
<td></td>
<td>Anti-Alzheimer, anti-dementia.</td>
<td>Poplar, Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Neurotrophic effects (protect/develop neurons).</td>
<td>Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Scopolamine-induced amnesia.</td>
<td>Poplar.</td>
</tr>
<tr>
<td></td>
<td>Muscle contracting at small concentrations.</td>
<td>Poplar, Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Muscle relaxant at higher concentrations.</td>
<td>Poplar, Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Local anesthetic.</td>
<td>Poplar, Baccharis.</td>
</tr>
<tr>
<td></td>
<td>Regeneration of cartilage and bone tissue, dental pulp, cicatrising (healing by scar formation).</td>
<td>Poplar, Baccharis.</td>
</tr>
</tbody>
</table>

Source: Adapted from Bogdanov 2017 (# also positive secondary health impacts not reproduced in this table)

In addition to human and animal health benefits, propolis possesses interesting physical properties that make it suitable for wood varnishes and musical strings. Propolis is a constituent in some violin resins, particularly older Italian recipes. Propolis is also utilised to increase friction between stings and bow immediately prior to playing. Propolis is used in musical instrument repair, especially accordions (Bogdanov, 2017). Propolis is suitable for industrial applications and it can be used in the manufacture of car polishes. More unusually, Ukrainian propolis has been shown to form an effective
near-infrared photodetector when applied to a film of various semi-conducting materials and Egyptian propolis has been shown to inhibit carbon steel corrosion in aqueous solutions (King, 2017).

Because of its acaricide (flea, tick and mite killing) and antibiotic properties, propolis has been proposed to assist beekeepers manage the Varroa mite and in the treatment of American foulbrood and wax moth (Antunez et al., 2008, Bogdanov, 2017 and King, 2017).

**Propolis composition and its classification**

Propolis is a heterogeneous mixture that honey bees produce from saliva, beeswax and the exude of buds, sap flow and other botanical sources. Typically propolis is comprised of resin (50%), beeswax (30%), essential oils (10%), amino acids (1%) and other organic compounds. Resin content may be as low at 15%. Other organic compounds may include parts of dead honey bees, pollen and wood (Miguel and Antunes, 2011). Resin collected as propolis has high antibiotic activity because it has a natural function to protect delicate growing or wounded plant tissue from attack from microorganisms and animals (Duke et al., 2008). The active chemical properties and compounds found in propolis seem to derive from the botanical sources of the product rather than any appreciable influence of the honey bee. Propolis in effect is more a botanical substance than a bee product both in true origin and beneficial effect (Bone, 2012). Propolis can be green, red, black or whitish in colour, but is normally dark brown. Propolis is sticky above 20°C while in cooler conditions propolis is hard and brittle (King, 2017).

A large number of pure-source propolis types have been identified and in most cases traced back to the source plant resin. The propolis type produced by individual hives will correspond to plants available in the geographic area. Furthermore, bees will continue to collect whatever resin is already in the hive, even if closely related resinous plants are nearby. As such, classification of representative propolis types by geographic area has legitimacy and is extensively practiced in the literature. The tendency of industry and researchers to work with bulk propolis sourced from multiple hives also smooths out inter-hive differences (King, 2017).

Classifications used in the literature include:

- **Temperate** – relatively uniform across southern and northern hemispheres, the old and the new world. Buds and shoots of the genus *Populus* (poplar) dominate and most often it is *P. nigra*. Birch and common aspen are also present in temperate propolis. This propolis is rich in flavonoids. Major temperate propolis producers include China, Korea, Russia and North America. New Zealand is also a significant producer of temperate poplar propolis.
- **Mediterranean** – notably different chemical profile to temperate propolis. It is suggested that various cypresses are the source of these propolis. Major Mediterranean propolis producers include Greece, Crete, Croatia and Malta. Sicily tends to produce a more temperate, poplar dominant, type.
- **Tropical** – including commercially significant Brazilian green propolis sourced from *Baccharis* spp. (the same family as daisies and sunflowers) and predominantly *B. dracunculifolia*. Red propolis sourced from *Clusia* spp. and *Dalbergia* spp. via Mexico, Venezuela, Argentina, Cuba and Brazil. Venezuela also produces temperate, poplar propolis.
- **Pacific** – sourced from the genus *Macaranga* and produced in Okinawa, Taiwan and Indonesia but paradoxically also produced in Morocco, Egypt and Kenya. Most commonly this is *M. tanarius*. This propolis is rich in flavonoids.

Surprisingly relatively little is known about Australian propolis types. An early Western Australia study showed useful medicinal properties from propolis collected from grass trees (*Xanthorrhoea*...
spp.) and eucalyptus spp. as a secondary resin source. East coast studies showed the presence of *M. tanarius* (also present in Pacific propolis), *Syncarpia glomulifera* (turpentine tree), *Lophostemon suaveolens* (swamp box) and several eucalyptus spp. Kangaroo Island propolis is rich in flavonoids and is sourced from native sedges (*Lepidosperma* spp.) and acacia species (mainly *Acacia paradoxa*). Huang et al. (2014) note that where poplar is not available honey bees in Australian seek out plants to produce propolis which contain the flavonoids of the poplar type propolis. Further studies show that propolis produced in Australia is markedly different from temperate European types. ‘It would appear that investigations into propolis types in Australia are currently scratching the surface of what could be a rich and rewarding field of therapeutic study’ (King, 2017).

**Flavonoids and pharmacological activity**

Flavonoids are a major component of propolis and make a significant contribution to its pharmacological activity. The quality of flavonoids is used as a criterion to evaluate the quality of propolis. Flavonoids have a broad spectrum of biological properties such as antibacterial, antiviral, and anti-inflammatory effects. According to their chemical structure, flavonoids are classified into flavones, flavonols, flavanones, flavanols, chalcones, dihydrochalcones, isoflavones, isodihydroflavones, flavans, isoflavans and neoflavonoids. It appears that the effectiveness of propolis as an antimicrobial may be linked to the synergistic action of its complex constituents (Huang et al., 2014).

Some of the better quality commercially produced propolis products are independently certified and marketed on the basis of their guaranteed flavonoid content. For example ‘This product is guaranteed to contain 30mg of bioactive flavonoid in each capsule or 30mg of flavonoid in each 0.5ml of liquid propolis spray’.

**Chemical standardisation and propolis regulation**

Propolis contains up to 500 different chemical constituents and there are no standard internationally recognised descriptors for propolis (Huang et al., 2014). National standards are only in place in China, South Korea and Brazil (Fung, 2016). The national standard in Brazil requires propolis to have a minimum 0.5% phenolic compound (Matos, 2014). Bogdanov (2017) proposes that the international standardisation of propolis should be progressed along floral lines as floral lines determine active constituents. Classification criteria might include: main biologically active substances, balsam (the ethanol extractable fraction of propolis), phenolics (aromatic hydrocarbons) and flavonoids (disease fighting nutrients that are also responsible for the colour of propolis). Good quality propolis would be low in organic content (bee body parts, wood, pollen), have minimal pesticide / heavy metal contamination, a high balsam content, high content of biologically active compounds, and low wax content.

In some countries, propolis is considered and regulated as a medicine e.g. Germany and Switzerland. In other parts of Europe, the United States (US) and Japan, propolis is regulated as a food supplement. Australian propolis from Kangaroo Island has, in the past, been exported to Japan without requirement to evaluate its chemical composition or to evaluate its biological activities (Duke et al., 2008).

In Australia, propolis is regulated as a complementary medicine, having one or more active ingredients. Propolis is listed under Schedule 14 of the *Commonwealth Therapeutic Goods Act 1989* (Bensoussan, et al., 2005 and the Therapeutic Goods Administration website, accessed August 2018). Propolis, like many complementary medicines is classified as a low risk material. Separately, it is noted that propolis should not be consumed by those who have honey, bee sting, conifer or poplar allergies, asthma or are using blood thinning products.
International trade in raw propolis is generally prohibited and there is an outright ban on importing raw propolis to Australia and New Zealand. Raw propolis is a viable conduit for honey bee diseases. To export processed propolis from Australia, certification is required along with an embedded endorsement. The endorsement states that the product has been prepared in accordance with Australian food hygiene regulations and in compliance with a HACCP based food safety program, that the product has undergone radiation treatment (at least 10kGy) and all precautions have been taken to prevent contamination with small hive beetle (DAWR MiCoR database, accessed August 2018).

Propolis product forms

Propolis starts out in raw form, is processed and then manufactured into a range of consumer complementary and alternative medicine products. There is little product form information available for industrial goods made with propolis.

Raw propolis can be ground in a mill and added to food or drinks or used in the production of propolis pills. Propolis pills are either pressed in briquettes or, more usually, the powder is contained within capsules. Large pieces of raw propolis can be chewed and swallowed but consumption in small quantities is recommended to avoid adverse reactions. Propolis can be freeze-dried but nothing is known about what this does to the synergistic properties of its active constituents. Furthermore, freeze-dried propolis offers little benefit over raw propolis which is stable and has a long shelf-life if stored in a cool, dry and airtight place (Bogdanov, 2017).

Propolis can be processed into a water-based form through the maceration of raw propolis, boiling the macerated product in water and the collection and removal of wax and other residuals from the surface. Propolis is not water soluble (Bone, 2012). However, Krell (1996) notes the existence of a patent to achieve water solubility. Most commonly, propolis is prepared as a tincture. Tinctures are medicines made by dissolving a drug in alcohol. Propolis tinctures are prepared in both ethanol and glycol. Ethanol is the most suitable solvent for extracting the most bio-active substances from the raw propolis. Glycol extracts less bio-active properties from the raw propolis but is more suitable for skin and cosmetic preparations. Propolis tinctures mixed with petrolatum (Vaseline®) and lanoline are used to make cosmetic face creams. With the addition of honey and oil, tinctures can be used to produce a paste that is suitable for application to cuts and abrasions. Tinctures mixed with lanoline, beeswax, petrolatum, ethyl-amino-benzoate and clove oil produce a formulation that is suitable for toothpaste (Bogdanov, 2017). Krell (1996) provides a comprehensive review of consumer products made from propolis along with recipes for their formulation.

Production process for raw propolis

Propolis is recovered by scraping used hive components including supers and frames. Propolis recovered in this way may contain a significant volume of beeswax and unwanted organic material (e.g. bee body parts, pollen and wood). Propolis from hive scrapings has a commercial value and is readily sold, for example, in both the US and New Zealand. Beekeepers participating in commercial propolis production typically add commercially produced, slotted plastic mats on top of the frames in the hive’s top super and underneath the hive lid – see Figure 2.
Some but not all proponents chock the lid to leave a ventilation gap. A proportion of commercially made mats are molded with ‘legs’ to create a bee space. Honey bees react to the 30mm long and 3mm wide vents in the mat by filling them with propolis. As with honey production, length of time required to fill the mat depends on colony strength, genetics and prevailing conditions. Some mat users report mat fills within six to seven days (Happy Valley Bee Products New Zealand http://www.happyvalley.co.nz/ingredients/propolis/) while once or twice per season may be more typical in other countries.

Once filled, propolis mats are removed by the beekeeper and either immediately scraped of propolis if the ambient temperature is less than 20°C or frozen and scraped at a time that is convenient to the beekeeper. Scrapings are bagged and stored in a freezer to avoid wax moth contamination. Raw propolis can be stored for at least a year under these conditions. In New Zealand, some propolis processors provide mats and once removed from the hive, provide a pickup service to recover them for propolis processing. A second set of mats is also provided by the processor to ensure production is not forgone while the first set of mats are harvested, cleaned and returned to the beekeeper.

**Propolis production per hive**

Propolis production per hive depends on many factors: bee breed, geography, climate, hive type, presence of a propolis source in nature and the strength of the bee colony. The literature points to an annual per hive production of between 50g and 400g with the potential to increase output to a maximum of 1 kg via the use of specialised procedures in addition to a propolis mat. Specialised procedures have been identified in the literature as including hive ventilation, the creation of uneven internal surfaces, use of hive entrance bars and ‘teasers’ such as gauze coated cotton to which mint oil, dill oil or formic acid has been added (Lebedev, undated).

New Zealand beekeepers report production from hive scrapings (supers and frames) and the use of a standard propolis mat of up to 500g per hive per annum (BeeVital New Zealand). Average production is probably closer to 220g per hive (revenue of $NZ27.5 per hive at a raw propolis value of $NZ125.5kg). Individual New Zealand beekeepers contacted as part of this study report annual yields as low as 100 grams (Frank and Mary-Ann Lindsay, beekeepers, Wellington, pers. comm., October 2018). In Australia, a South Australian beekeeper reports production of approximately 150g per annum, being between 200kg to 300kg per annum from 300 hives based on Kangaroo Island and a further 1,400 hives based on the mainland. Propolis production is encouraged by maintaining large numbers of honey bees in the hive (Danny Le Feuvre, commercial beekeeper, pers. comm., August 2018).
World production of raw propolis

There is no official data on world production of raw propolis. However, major producers are understood to include China and Brazil. Annual production in China has increased from 35 tonnes in 1984 to 300 tonnes in 2008 (Crane, 2009). Production in Brazil was 250 tonnes in 2004 and was thought to account for between 10% and 15% of world output. Most of Brazil’s propolis production is exported to Japan and this market has grown constantly (Miguel and Antunes, 2011). Other major producers include Russia, the US, Spain, Romania, Argentina and Chile. This study estimates total annual commercial production of raw propolis at between 1,800 and 2,400 tonnes per annum.

When raw propolis is converted to processed propolis the recovery rate is approximately 37% to 47% early in the season. Recovery rate falls to between 15% and 25% later in the season as nectar flows and bees mix more wax with the propolis. Hive scrapings are reported to yield 30% to 40% pure propolis (Ministry for Primary Industries New Zealand, 2016). Not all commercially produced propolis is converted to pure propolis, a proportion is consumed raw.

Major businesses in world propolis market

Key businesses active in the world propolis market are shown in Table 2.

Table 2: Major businesses in the world propolis market

<table>
<thead>
<tr>
<th>Business name</th>
<th>Country base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apis Flora</td>
<td>Brazil</td>
</tr>
<tr>
<td>Wax Green</td>
<td>Brazil</td>
</tr>
<tr>
<td>Comvita</td>
<td>New Zealand</td>
</tr>
<tr>
<td>Apiario Polenectar</td>
<td>Brazil</td>
</tr>
<tr>
<td>King’s Gel Propolis</td>
<td>Brazil</td>
</tr>
<tr>
<td>MN Propolis</td>
<td>Brazil</td>
</tr>
<tr>
<td>Ponlee Propolis</td>
<td>Brazil</td>
</tr>
<tr>
<td>Manuka Health New Zealand</td>
<td>New Zealand</td>
</tr>
<tr>
<td>Zhifengtang</td>
<td>China</td>
</tr>
<tr>
<td>Beijing Baihua Apiculture Technology Development Corp.</td>
<td>China</td>
</tr>
</tbody>
</table>

Source: Market Research Future, 2018
NB: Arataki Bee Products Ltd is a New Zealand private company for which data would not be available

Note dominance of Brazilian companies along with the presence of two Chinese and New Zealand operations. New Zealand company Comvita had an annual sales turnover in 2017 of $NZ156 million and profit of $9.4 million. In the same year Manuka Health New Zealand had an annual sales turnover of $NZ80 million and profit of $NZ3.5 million. Both Comvita and Manuka Health New Zealand have significantly broader commercial footprints than propolis manufacturing and supply.
New Zealand propolis industry

Overview of the New Zealand honey bee industry

The New Zealand beekeeping industry shares a number of similarities with the Australian industry as well as some significant differences – Table 3.

Table 3: Comparison of New Zealand and Australian beekeeping industries

<table>
<thead>
<tr>
<th></th>
<th>New Zealand</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hive numbers</td>
<td>2007: 313,000</td>
<td>2007: 572,000</td>
</tr>
<tr>
<td>Honey production</td>
<td>17,000 to 20,000 tonnes depending on seasonal conditions.</td>
<td>16,000 to 18,000 tonnes depending on seasonal conditions.</td>
</tr>
<tr>
<td>Exports</td>
<td>8,450 tonnes/year and does not import honey.</td>
<td>4,600 tonnes/year but imports twice this volume from China.</td>
</tr>
<tr>
<td>Honey price</td>
<td>Light clover: $NZ10/kg to 14/kg Manuka: $NZ11/kg to 127/kg</td>
<td>Canola: $A5/kg Eucalypt: $A5.50/kg</td>
</tr>
<tr>
<td>Honey production per hive</td>
<td>18.7kg/hive</td>
<td>59.5kg/hive</td>
</tr>
<tr>
<td>Beekeepers</td>
<td>7,814 registered businesses 1,160 with more than 50 hives</td>
<td>13,000 registered beekeepers 1,280 with more than 50 hives</td>
</tr>
<tr>
<td>Nomadic or sedentary</td>
<td>Mostly sedentary with some hive movement for kiwi fruit pollination and pasture seed pollination on the South Island.</td>
<td>Nomadic with beekeepers shifting hives to take advantage of seasonal nectar flows and crop pollination especially almond pollination in the Australian south east.</td>
</tr>
</tbody>
</table>

# Historically production has been as high as 30,000 tonnes.
Source: ABARES, 2016 and Ministry of Agriculture New Zealand, 2017

The number of New Zealand beekeepers, especially hobbyists, contracted substantially post establishment of the honey bee pest Varroa destructor in the North Island in 2000 and the South Island in 2006. In 2007, the total honey crop was 9,000 tonnes (Somerville, 2008). Since the establishment of Varroa in New Zealand, industry and government have worked to replace ‘free’ pollination services, supplied by wild honey bees, with a paid pollination industry. Industry and government have also worked to increase the value of apiary products including development of the Manuka honey industry, and to a lesser extent, development of a propolis sector. The industry has developed domestic and international markets for New Zealand propolis and these markets have been profitably supplied by New Zealand beekeepers and propolis processors. New Zealand beekeepers currently enjoy a buoyant, internationally focussed and profitable industry. There are now more New Zealand beekeepers than prior to the establishment of Varroa.

Floral sources of New Zealand propolis

The composition of New Zealand propolis has not been extensively reported. However, it is generally considered to be a ‘European’ style propolis obtained by honey bees from the exudates of poplar (Catchpole et al., 2015). New Zealand propolis is primarily sourced from trees of European origin – poplar, willow and birch (Hum Propolis (http://www.humnewzealand.com/about-us)). No information is available on the contribution made by native flora to New Zealand propolis production.
New Zealand propolis value and volume

Raw and processed pure propolis prices are collected annually by the Ministry of Agriculture New Zealand and are reported in summary form in Table 4.

Table 4: Prices received by beekeepers and processors for New Zealand propolis ($NZ/kg)

<table>
<thead>
<tr>
<th>Year</th>
<th>Raw propolis price received by beekeepers</th>
<th>Pure propolis price received by processors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>$33 to $100</td>
<td>$220</td>
</tr>
<tr>
<td>2014</td>
<td>$33 to $100</td>
<td>$220</td>
</tr>
<tr>
<td>2015</td>
<td>$53 to $183</td>
<td>$350 to $390</td>
</tr>
<tr>
<td>2016</td>
<td>$54 to $197</td>
<td>$360 to $420</td>
</tr>
<tr>
<td>2017</td>
<td>$54 to $197</td>
<td>$360 to $420</td>
</tr>
</tbody>
</table>

Source Ministry of Agriculture New Zealand, various dates

Demand from export markets in Asia is strong and propolis processors were focussed on supporting their existing suppliers while growing their beekeeper supply base. Processors supply propolis mats as well as a mat pickup service to encourage beekeepers to produce and harvest propolis (Ministry of Agriculture New Zealand, 2017).

No official data is collected on the volume of propolis production in New Zealand. Comvita is known to be a dominant processor and marketer who purchase approximately 14 tonnes/year of raw propolis – not all of which is New Zealand in origin (Comvita website, accessed August 2018 https://www.comvita.co.nz/blog-article/what-is-propolis/4600097). New Zealand imports around 35 tonnes/year of pure propolis which is multiples of local production (Bone, 2012). This study estimates total annual production of raw propolis in New Zealand at between 25 tonnes and 35 tonnes per annum, a pure propolis equivalent of between 10 tonnes and 14 tonnes per annum.

The ‘farm gate’ value of propolis production to New Zealand beekeepers can be estimated at between $NZ3.1 million and $NZ4.4 million per annum (average $NZ3.75 million). There is a high participation rate in propolis production in New Zealand by both large and small beekeepers. The scope for further growth in New Zealand propolis production is somewhat limited.

Factors affecting price received for propolis

Typically New Zealand beekeepers gross around $NZ25 to $NZ30 per hive per annum from propolis sales (Trevor Gillbanks, hobby beekeeper, Palmerston North, online communication, June 2016 https://www.nzbees.net/forums/topic/8193-selling-propolis/). This estimate is consistent with Somerville (2008) which noted reported revenue of $NZ20 per hive mat per year in 2007.

Processors purchase both scrapings and mats and pay beekeepers on either test result or processed propolis yield (Frank & Mary-Ann Lindsay, beekeepers producing propolis, Wellington, New Zealand, pers. comm., October 2018). Because processors pay beekeepers on test results or recovered yield they are prepared to purchase scrapings with as little as 15% pure propolis. In the past Australian propolis buyers have required a minimum of 50% propolis with some insisting on a minimum of 65%.

In 2018, demand for raw New Zealand propolis exceeds supply and there are no discounts or premiums offered for propolis source, floral type, active flavonoids or chemical contamination test results. Processed New Zealand propolis sells at a premium to processed propolis imported from China and Uruguay.
**Beekeeper harvest and the mat exchange system**

All but the very largest of New Zealand beekeepers harvest and sell only raw propolis. Harvest and sale of raw propolis is facilitated by the mat exchange system. Under the mat exchange system, processors contract beekeepers to supply propolis and contracted beekeepers are supplied with no-cost mats. Mats are placed in the hive by the beekeeper and removed when slots in the mat are filled with propolis. Once filled, mats are collected by the processing company.

Labour required for recovery of propolis from mats is typically provided by the processor and is covered within the processor’s cost structure. Wax recovered from the raw propolis may be returned to the beekeeper (Frank & Mary-Ann Lindsay, beekeepers producing propolis, Wellington, New Zealand, pers. comm., October 2018).

The mat exchange system encourages beekeepers to supply raw propolis. It negates the cost of mat purchase by the beekeeper ($NZ4 to $NZ14/mat) and the time and cost required to extract raw propolis from the mat. The mat exchange system also encourages beekeeper loyalty – beekeepers are less likely to supply other processors offering higher prices if mats belonging to their current processor are in place. The provision of a mat pickup service is a relatively recent development and reflects strong demand for propolis and aggressive competition between processors for supply (Ministry of Agriculture New Zealand, 2016 and 2017).

Mat sterilisation is essential if beekeepers are to be assured that diseases such as American foulbrood are not to be spread via mats returned from processors.

Beekeepers supplying processors may also scrape frames and supers to provide additional raw propolis. Propolis recovered from frame and super scrapings is taken by the processor and payment is made on the basis of test results or pure propolis yield.

**Appeal of propolis production to New Zealand beekeepers**

Propolis production is appealing to New Zealand beekeepers:

- Production can be incorporated within the beekeepers existing calendar of operations and removal of mats can be completed at the same time as honey harvest.
- There is no loss of honey or pollination fee income from the addition of propolis mats.
- Limited labour is required – especially if only un-scraped mats are supplied to the processor.
- Capital outlay is limited – mats may be provided by the processor and filled mats/hive scrapings can be stored by the beekeeper in an existing cool room/freezer.
- Processors pay on the basis of recovered yield and raw propolis with as little as 15% pure propolis will be purchased.
- High prices are achieved for raw propolis and there has been an upward trend in the price of the product.

Harvest of raw propolis by scraping hive components and use of mats can be profitable for beekeepers including those with small apiaries.
New Zealand propolis value chain and product demand

Raw New Zealand propolis is supplied by beekeepers to processors who produce pure propolis for export and manufacture into consumer health products in New Zealand. Propolis processing and product manufacture is a complex process. Propolis is totally insoluble in water and is a messy and difficult substance to handle in commercial quantity (Bone, 2012).

In New Zealand, propolis is purchased from beekeepers by processors who are professionals – they have a commitment in plant and equipment and supply retail product manufacturers. In Australia purchasers have tended to be inconsistent ad hoc traders looking for opportunistic profits.

Consumer products made in New Zealand include propolis capsules, tincture based sprays, lozenges and toothpaste. Consumer health products are sold online and through vitamin stores, health food shops, pharmacies and at airports. Retail ready products are exported and major markets are in East Asia – Figure 3.

Historically, propolis was not well-known to New Zealand consumers. However, this is changing and the profile and consumption of propolis in New Zealand is on the increase. New Zealand also has a major domestic customer base in its in-bound tourism sector, especially tourists arriving from Asia and purchasing propolis products in airport stores (Bone, 2012).

The Asian export market for New Zealand propolis products is growing and is dominated by sales to China, Taiwan, Japan and Korea. New Zealand propolis products are also exported to South East Asia (Thailand, Malaysia and Singapore), Europe (UK, Germany and Eastern Europe) and North America. Demand from markets in Asia for propolis is increasing and future growth is expected from markets in East Asia including China, Japan and Korea. East Asian markets are investing in research to better understand the therapeutic benefits of propolis and their research frequently compares New Zealand propolis to propolis sourced from China and Brazil. New Zealand, propolis has some distinctive characteristics in its flavonoids which stand out against propolis sourced from other countries (Bone, 2012).

New Zealand produces insufficient propolis to meet current market demand and imports low cost propolis from China and Uruguay to meet its manufacturing needs. Typically, New Zealand imports between 20 and 25 tonnes of propolis from China and a further 10 to 12 tonnes from Uruguay. Imports from these countries, exceed many times over, the output of true New Zealand-origin propolis (Bone, 2012).

Figure 3: Propolis value chain in New Zealand
Consumer products originating in New Zealand are often made from imported propolis with minimal transformation taking place in that country. Propolis products made from imported propolis are labelled as products of New Zealand and sold, often to Asian visitors or in Asia, as products of New Zealand. Typically a visitor to New Zealand from China will purchase propolis of Chinese origin that is minimally processed and ambiguously labelled as product of New Zealand. Australia has had the same issue with propolis and royal jelly products.

The strong and growing interest in propolis by medical researchers combined with international demand for New Zealand-origin product will continue to result in a situation where New Zealand’s ability to supply propolis is less than the available market opportunity. New Zealand propolis is possibly the highest-value natural health product produced in New Zealand in commercial quantity (Bone, 2012).

**Key players in the New Zealand propolis value chain**

The propolis processing sector in New Zealand is dominated by two major operations – Arataki Bee Products Ltd and Kiwi Extracts Ltd (Comvita). Most New Zealand propolis passes through these two companies operations no matter which end-user company gets the tincture or paste (New Zealand Bee Industry representative, pers. comm., October 2018). Profiles are provided on both businesses along with information on other industry operations.

**Arataki Bee Products Ltd**
Arataki Bee Products Ltd is based in Rotorua, North Island, New Zealand. The business was founded in 2001 and is part of the Arataki Honey operation established by the Berry family in 1944. Arataki Honey has more than 20,000 hives in Rotorua and Hawkes Bay. In 2012, the business was contract managed by Lew Bone and it is noted that in 2018 Haydn Bone is the CEO of Propolis New Zealand based in Nelson on the South Island (see profile below).

Arataki Bee Products Ltd is vertically integrated through the supply of raw propolis, extraction and product manufacturing. The company purchases only propolis of New Zealand origin and does not manufacture from imported material. Arataki Bee Products Ltd sources from both its own hives and offers a propolis mat supply and pickup service to New Zealand beekeepers. Ethanol-based extraction is used to process raw propolis and the resultant pure propolis is manufactured into a range of propolis based products. Arataki Bee Products produces mainly unlabelled bulk propolis-based products for sale to other consumer focussed companies. Bulk product has been supplied to all but one of the health product companies which sell genuine New Zealand propolis products (Bone, 2012). Comvita has its own sourcing and processing arrangements.

In 2018, it is noted that Arataki Bee Products Ltd retail a range of branded propolis products through both its shop and website including oral sprays, lozenges and tincture (Arataki website accessed October 2018, [http://www.aratakihoneyrotorua.co.nz/range/propolis_range.html](http://www.aratakihoneyrotorua.co.nz/range/propolis_range.html)).

**Kiwi Extracts Ltd (Comvita)**
Kiwi Extracts Ltd is based in Nelson on the South Island of New Zealand. It reports that 90% of its activities are associated with ethanol based extraction of bioactive compounds from propolis. In 2011, Kiwi Extracts Ltd became wholly owned by Comvita Ltd. Comvita is a global natural health company founded in beekeeping in New Zealand in 1974. Comvita currently has 33,000 hives in New Zealand. Comvita source raw NZ propolis and processed propolis from around the world. Raw NZ propolis purchased includes scrapings from frames/supers as well as production from mats.

Kiwi Extracts Ltd process propolis into bulk ingredients which Comvita then manufacture into a range of branded consumer health products. Branded consumer health products have a guaranteed minimum propolis flavonoid and other phenolic compound level of 15%. Comvita propolis products
include spray, elixir, toothpaste, lozenges, capsules and tincture. Comvita has a 50% shareholding with Australian honey packer Capilano in Medi Honey®. The joint business arrangement with Capilano has not been used to explore opportunities for propolis production in Australia.

**Manuka Health New Zealand Ltd**
Manuka Health New Zealand is located at Te Awamutu near Hamilton on the North Island of New Zealand. The company is based in beekeeping and products include Manuka honey, gourmet honey, royal jelly and propolis. Manuka Health New Zealand sources from 20,000 of their own hives and has long standing supply relationships with other beekeepers. The company was established in 2006, is currently owned by Australian interests and in July 2018 was considering a takeover offer from Comvita Ltd.

In 2017, Manuka Health New Zealand opened its Wairarapa Apiculture Centre to process its honey and propolis supply. The company offers a mat supply and pickup service to New Zealand beekeepers and its suppliers must complete a standard harvest declaration form for bee products intended for export. Manuka Health New Zealand products include capsules, tincture, alcohol-free liquid, lozenges and throat spray.

**Propolis New Zealand Ltd**
Propolis New Zealand Ltd is located at Tasman on New Zealand’s South Island. The company’s CEO is Haydn Bone and other “working family members” contribute to the business. The company explains that “no other company in Australasia has the same depth of experience with processing propolis”. Propolis New Zealand was established in 2014 and is a specialist wholesale bulk processor that does not import propolis or produce branded propolis products.

Propolis New Zealand sources directly from New Zealand beekeepers and sells pure propolis in various forms to natural health companies and marketers of complementary medicines. Propolis New Zealand use food grade (ethanol) solvents and appropriate extraction technologies to process raw propolis. Most of the company’s output is bulk liquid propolis. Some bulk liquid is contract manufactured into market ready unbranded propolis products including tinctures and sprays. Much of Propolis New Zealand’s output is exported to Asia.

Propolis New Zealand source directly from New Zealand beekeepers, purchase hive scrapings and material extracted from the beekeepers own mats. Propolis New Zealand will pay the freight on raw propolis sourced from New Zealand beekeeper suppliers. There is no difference in price paid by Propolis New Zealand for raw propolis sourced from scrapings or mats – payment is made on recovered pure propolis yield.

**Hum New Zealand**
Hum New Zealand is based at Taihape on New Zealand’s North Island. The business was founded in 1945 by the Tweeddale family who currently operate 20,000 hives. The Hum Propolis business was launched in 2012. The Tweeddale’s are the “single largest propolis producer in New Zealand”. They are a “single origin supplier” of propolis and all their propolis products are sourced from their own apiary. Although unstated in the company’s proportional material it appears that Hum Propolis has their own raw propolis contract processed. Hum Propolis only sell to wholesalers and their range includes tincture, extract, capsules and oral spray.

**Bee Products New Zealand**
Bee Products New Zealand is based at Nelson on New Zealand’s South Island. Bee Products New Zealand is a smaller family business that has developed its own propolis processing technology using olive oil rather than ethanol. Products are supplied in bulk quantities from one litre to 200 litres. Products include tinctures (requiring alcohol), propolis in olive oil, serum, and wellness booster.

**Others**
Other New Zealand propolis producers and marketers have been identified online. However, most of these businesses are thought to be resellers of other firms’ product or reliant on imported propolis from China and South America.

**Lessons learnt New Zealand propolis sector**

The following lessons from the New Zealand propolis sector are relevant to consideration of a propolis industry in Australia:

1. The industry is worth approximately $NZ3.75 million per annum to New Zealand beekeepers – 30 tonne of raw propolis production at a current value of $NZ125.5/kg. New Zealand imports approximately three times this volume for manufacture into retail products.

2. Per hive propolis production in New Zealand averages approximately 220 grams per annum. Limited data for Australia would indicate an average of between 150 grams and 200 grams per annum.

3. New Zealand propolis is sourced from flora of European origin and only a limited area in Australia will be able to produce similar European style propolis (e.g. Canberra, Tasmania).

4. Australian propolis sourced from native flora will have its own chemical profile. Research will be required to understand differences and educate the market on relative merits. At this point in time the market may not be sophisticated enough to price in premiums or discounts for different Australian propolis types. However, flavonoid level will be measured and priced in processed pure propolis.

5. The demand for New Zealand propolis exceeds supply, there are no premiums or discounts for quality. However, New Zealand propolis is able to successfully differentiate itself and command a higher price than imported pure propolis from China and Uruguay.

6. Harvest of raw propolis by scraping hive components and use of mats can be profitable for New Zealand beekeepers including those with small apiaries. Propolis production is achieved without loss of other apiary income or prohibitive labour requirements.

7. Beekeeper sales and profitability is facilitated by an established market, strong demand for raw propolis and the willingness of a number of established processors to provide free propolis mats and free mat pickup and delivery.

8. Processors will purchase raw propolis of all compositions, including scrapings with as little as 15% pure propolis. Processors pay beekeepers on test result or recovered yield. In the past Australian propolis buyers have required a minimum of 50% propolis with some insisting on a minimum of 65%.

9. The New Zealand sector is defined by professionalism – propolis purchasers are processors who have a commitment in plant and equipment and supply retail product manufacturers. In Australia purchasers tend to be small-scale or inconsistent traders looking for opportunistic profits.

10. All but the largest beekeepers sell their propolis as a raw commodity, in bulk form – scrapings and propolis ‘cracked’ from mats or ‘uncracked’ mats from which propolis is extracted at a central location.

11. Processing to supply manufacturers of consumer products requires capital equipment, technical ‘knowhow’, scale and access to markets. Two processors dominate the New Zealand industry.

12. “Propolis extraction and product manufacture is a complex process. Propolis is totally insoluble in water and is a messy and difficult substance to handle in commercial quantity” (Bone, 2012).
13. There appears to be scope for additional Australian propolis production, demand appears to be increasing and New Zealand has limited capacity to increase supply.
Australian propolis production

Australian regions where propolis is produced

At least some propolis is deposited in honey bee hives located in all parts of Australia. At this stage industry does not have knowledge on which areas in Australia are able to supply commercial quantities of propolis (Stephen Covey, Honey Supply Manager, Capilano, pers comm., September 2018). Preliminary data on production by region, possible floral sources and commercial production status is summarised in Table 5.

Table 5: Australian propolis production by region

<table>
<thead>
<tr>
<th>State</th>
<th>Propolis production</th>
</tr>
</thead>
</table>
| Queensland | • Higher rainfall areas including the east coast appear to produce commercial quantities of propolis. However, supply is rainfall dependent. Production coincides with late autumn and winter.  
• Warmer climate Queensland does not produce the same volume of propolis as New Zealand, Canada or the United Kingdom.  
• Floral species known to produce propolis in southern Queensland include hoop pine and spotted gum.  
• Commercial production has been attempted in the past and discontinued due to unachievable standards (resin content) and inconsistent demand. |
| NSW    | • Higher rainfall areas tend to produce more propolis and production in large quantity has been recorded up and down the NSW coast. Turpentine tree is understood to be an important source of propolis resin.  
• Propolis production is prolific in the Blue Mountains with silver wattle, acacia, Tomah ferns, grass trees, yellow bloodwood and red bloodwood all contributing to supply. Production also attributed to honey bee genetics.  
• The Central West of NSW does not seem to produce propolis in any volume despite having access to large areas of eucalypt forest.  
• Apiaries in the Monaro produce large volumes of propolis and the principal source seems to be native pine and black cypress.  
• Propolis is recovered and processed in the Young District of NSW. |
| ACT    | • Apiaries in the ACT produce large volumes of propolis and benefit from a cool climate and extensive plantings of European trees including poplar.  
• No known commercial production of propolis in ACT at the current time. |
| Victoria | • Victorian beekeepers report differing experiences with propolis. The most common experience is low volume production and certainly less than is achieved in countries like China and New Zealand. Mats have been trialled and propolis tends to accumulate unevenly across the apiary with weaker hives depositing most propolis at the beginning of winter.  
• Some beekeepers report consistent modest propolis accumulation across all of Victoria while others point to Western Victoria, through to and including the South Australian border, as a propolis production ‘hot spot’. In this area propolis is sourced by honey bees from banksia and heath.  
• No known commercial production of propolis in Victoria at current time. |
| Tasmania                        | - Propolis is accumulated in large volume in all parts of Tasmania.  
|                                | - Propolis production is particularly prolific in native prickly box areas.  
|                                | - No Tasmanian beekeepers currently collect and sell propolis. |
| South Australia                | - Propolis is produced in a number of locations on the South Australian mainland. Dryer areas are reported as being productive with small waxy plants and spinifex contributing propolis to managed hives. Beekeepers note that if strong hives with large bee populations are maintained, foraging bees will find sources of propolis in all parts of the South Australian mainland.  
|                                | - Kangaroo Island is a propolis production success story with a number of commercial beekeepers supplying local beekeeper processors and propolis researchers Dr Colin and Dr Rujee Duke. Propolis is sourced from a range of native species including sedge grass which is high in flavonoids and acacia. Dr Colin and Dr Rujee Duke will also purchase propolis from mainland South Australia. It is not known whether purchases are temporary for research purposes or a longer term commercial enterprise has been established. |
| Western Australia              | - Propolis is produced in Western Australian managed bee hives.  
|                                | - Important propolis sources include grass trees with eucalypts species functioning as a secondary resin source.  
|                                | - Western Australian beekeepers retail propolis products but it is not known whether these are manufactured from locally sourced propolis. |

Source: AgEconPlus consultation with commercial beekeepers

**Quality of Australian produced propolis**

Few studies are available on the chemistry of propolis produced by Australian honey bees (Massaro et al., 2015). Given that most Australian honey is produced from native flora and managed honey bees are present in native flora areas, it is likely that most Australian propolis will be sourced from Australian native plants and have unique chemical compositions. Sophisticated propolis buyers will be interested in the composition of flavonoids and not just their total percentage in raw propolis. Quercetin, a plant flavonol from the flavonoid group of polyphenols found in many fruit and vegetables is desirable in propolis while Rutin (also called rutoside, quercetin-3-O-rutinoside and sophorin) is the glycoside combining the flavonol and is less beneficial to human health (Michael Philippou, Bee Healthy Australia, pers. comm., October 2018).

At the current time, the market does not recognise quality differences between top end Chinese propolis and that produced in Australia (Jing Bang (Jim) Zou, Jim’s Bee Products Group, pers. comm., October 2018).

**Propolis production per hive in Australia**

Most Australian beekeepers do not keep records of per hive propolis production. As noted previously annual production was estimated at 150 grams/hive/year from data supplied by Danny Le Feuvre (beekeeper Kangaroo Island and South Australian mainland). This data is consistent with estimates recorded in the Australian literature of between 150 and 200 grams per year (Ghisalberti, 1979 in King, 2017). Australian production appears to be approximately 80% of the 220 gram average achieved in the colder New Zealand climate.
Actual propolis production achieved by Australian beekeepers will be dependent on a range of enterprise specific factors including hive location, the genetic makeup of the honey bees and the population of bees in the hive.

**Australian propolis value and volume**

There is no official data on the value and volume of propolis production in Australia. The sector is small and the ABARES (2016) survey of the financial performance of the honey bee industry does not attempt to quantify either value or volume. Rodriguez et al. (2003) estimated a national value of $2.5 million for propolis, wax and honeycomb. Most of this value would be associated with wax and honeycomb. CIE (2005) noted that there are very few, if any, propolis producers in Australia. Bone (2012) reported that he is not aware of any substantial commercial-scale propolis industry operating in Australia. Capilano note that there is very little to no propolis production in Australia (Stephen Covey, Honey Supply Manager, Capilano, pers comm., September 2018).

**Prices received and consistency of demand for Australian propolis**

Prices reported for raw Australian propolis are encouraging with Jim’s Bee Products Group, Young NSW purchasing raw material that is 40% to 50% propolis for between $A100 and $A120/kg (Jing Bang (Jim) Zou, Jim’s Bee Products Group, pers. comm., October 2018). These prices are consistent with prices received for raw propolis in New Zealand which currently average $NZ125.50/kg or $A115/kg (Ministry of Agriculture New Zealand, 2017). Dr Colin and Dr Rujee Duke are reported as paying up to $A300/kg for raw propolis of specific floral source from Kangaroo Island (Danny Le Feuvre, commercial beekeeper, pers. comm., August 2018).

Beekeepers who have produced propolis for trader buyers caution that the market is fickle with buyers demanding substantial free samples, randomly raising quality requirements and routinely disappearing from the market once supply arrangements have been agreed. Propolis buyers were active in the market in the 1970s. In the 1980s and 1990s there was no market for raw propolis and in the new century interest appears to have been rekindled (Murray Arkadieff, commercial beekeeper, South East Queensland, pers. comm., October 2018). Last century I imported propolis mats from Canada but could not find a buyer for the resultant product (Trevor Weatherhead, Executive Director, AHBIC, pers. comm., September 2018).

**Propolis processing in Australia**

Raw propolis sourced directly from the hive in Australia has value and value increases as the product is refined and concentrated into a smaller volume. Refinement is not difficult but commercial production suitable for incorporation into manufactured consumer products requires scale, appropriate equipment and technical knowledge (Michael Philippou, Bee Healthy Australia, pers. comm., October 2018).

The raw propolis refinement process is summarised in the table below. Figure 4 shows raw propolis collected from an Australian hive and visually appraised by a buyer at 15% to 20% resin. Figure 5 shows processed pure propolis resin ready for manufacture into consumer products.
**Table 6: Propolis processing stages**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Raw propolis                 | - Can contain more than 50% wax and organic matter contaminants.  
                               - Raw propolis is a conduit for honey bee diseases and cannot be internationally traded without irradiation. Raw propolis cannot be imported into either New Zealand or China i.e. Australian processing is required. |
| Resin block                  | - Raw propolis is stored at minus 5°C for five to six hours to harden and is then ground into a fine powder.  
                               - Typically alcohol (ethanol) is used to extract flavonoids and eliminate wax and organic matter contaminants.  
                               - Resin block can be internationally traded.                                                                                                           |
| Further extraction and filtration | - Secondary processing is undertaken to further concentrate flavonoid levels.  
                                - Filtration of liquid propolis concentrate is also completed.  
                                - Liquid propolis is centrifuged to remove heavy metal contaminants.                                                                                       |
| Bulk consumer products       | - Refined propolis is mixed with an emulsifier such as carob or pollen to reduce the sticky and hard to work with nature of propolis resin.  
                                - The mixture of propolis and emulsifier is typically ground into a powder for use in capsules or mixed with alcohol to produce a tincture or glycol for the production of skin creams. |

Source: Michael Philippou, Bee Healthy Australia

**Figure 4:** Raw propolis visually assessed by buyer at 15% to 20% resin

Source: Michael Clarke, AgEconPlus

**Figure 5:** Refined propolis resin ready for manufacture into consumer products

Source: Michael Philippou, Bee Healthy Australia
Processing of raw propolis into simple tinctures for personal use and sale is practiced by a number of beekeepers Australia wide.

**Larger-scale propolis processing, Young NSW**

Jim’s Bee Products Group operates a commercial propolis processing plant in Young NSW. The scale of the plant is not known but Jim reports that it is able to process “many tonnes” of propolis per year and possibly as much as 10 tonnes/year. The plant operates without the addition of heat and uses only alcohol (ethanol) to extract pure propolis from raw material. The plant resembles a medium sized distillery. It is claimed that the plant is able to produce refined propolis resin of the type shown in Figure 5. Refined propolis resin is then manufactured under contract, in a plant not owned by Jim, into consumer products which are sold in Australia and China (Jing Bang (Jim) Zou, Jim’s Bee Products Group, pers. comm., October 2018).

**Small-scale propolis processing, Kangaroo Island**

Kangaroo Island Living Honey (KILH) manages about 180 hives and produces approximately 20 tonnes of certified organic honey each year. KILH uses propolis mats and propolis is recovered from hives three to five times per year. Stronger hives are able to fill the mats more frequently. KILH does not scrape frames and supers to recover propolis. Propolis from frames and supers is of a lower quality and is too high in organic material (e.g. wood). Genetics is important in determining the volume of propolis produced but income earned from propolis products is insufficient to justify breeding for this trait. The business is better off concentrating on other genetic attributes such as honey yield (Shawn Hinves, KILH, pers. comm., October 2018).

KILH purchase propolis recovered from mats from other beekeepers on Kangaroo Island and most commercial beekeepers on the island use propolis mats. Commercial beekeepers on Kangaroo Island find that income from raw propolis sales as a useful adjunct to honey revenue.

In 2015, a South Australian Government funded project completed by SARDI showed that Kangaroo Island propolis had useful anti-bacterial, anti-viral and anti-fungal properties. Honey bees appear to be collecting propolis from a range of Kangaroo Island flora and not just the sedges and acacia identified in Colin and Rujee Duke’s research (Duke et al., 2017). Buyers of raw propolis on Kangaroo Island include KILH as well as Colin and Rujee Duke. Other commercial beekeepers supply Jim’s Bee Products Group, Young NSW.

KILH produces a propolis tincture from raw Kangaroo Island propolis which it sells as a branded product. Tincture making is not complex and is something that all commercial beekeepers could achieve (Shawn Hinves, KILH, pers. comm., October 2018).

**What has held back Australian propolis production**

An Australian propolis sector has not developed in the same way or to the same extent as has occurred in New Zealand. This has probably been due to the absence of one or more large-scale commercial propolis processors. A large-scale processor might be able to offer continuous purchase and beekeeper confidence in the sector, instigate a mat pickup/delivery service and aggregate small individual harvests into lots, that when processed, would interest manufacturers of consumer products. Jim’s Bee Products Group, Young NSW is the only known large-scale processor of raw Australian propolis and Jim’s business is low profile, Chinese community focussed and building off a small base.

Other reasons for the slow development of an Australian propolis production sector include:

- The lack of a pressing need to develop new apiary products that was present in New Zealand following the establishment of Varroa. Smaller beekeepers exited the industry in the first
decade of the 2000s and those that remained had additional costs associated with Varroa control. New sources of income were required to maintain business viability.

- The Australian honey bee industry is fully engaged producing honey and supplying pollination services. Beekeepers do not have time to investigate markets, purchase mats and harvest propolis. If additional labour is required to harvest propolis, it is expensive and may be difficult to secure.

- Inconsistent raw propolis production within the hive – Australian flora may not yield the consistent large volumes of raw propolis that poplar does in other countries and little is known about production from native flora. Research may be needed to identify areas, like Kangaroo Island, capable of consistently producing commercial quantities of propolis.

- A domestic market that is well-supplied with low cost Chinese propolis and an ambiguous labelling system that did not distinguish Australian sourced propolis from retail products manufactured in Australia. New country of origin laws requiring a clear statement of product source should now favour propolis extracted by Australian beekeepers.

Measures that would assist with the establishment of an Australian propolis sector include:

- Additional investment by larger-scale processors who are either trusted honey packers or part of a commercial value chain that supplies consumer product manufacturers.

- Independent testing and agreed quality standards of the type used for Manuka honey - although this has not been necessary for the development of the New Zealand industry where trust has been established between the processor and the beekeeper and payment is made on the basis of processor test results or recovered yield.

- Processors willing to purchase a range of propolis qualities with payment on the basis of their own test results. Lower yielding propolis is purchased in New Zealand and appropriate payment is made. Historically, there has been no market in Australia for lower yielding product and beekeepers have been discouraged from supplying all grades of propolis.

Analysis in chapter 6 of this report shows that it is not the high cost of labour or lack of potential profitability that has held back the development of Australian propolis production.

Lessons learnt Australian propolis production

The following lessons from the small Australian propolis sector are relevant to consideration of a larger profitable industry:

1. Some propolis is produced in all honey bee hives Australia-wide. Actual yield is variable and dependent on location and hive specifics. A number of Australian regions have productivity levels approaching that of cold countries such as New Zealand.

2. The quality of Australian propolis is understood to be acceptable. However, as the market increases in sophistication the types of flavonoids and chemical residues present in raw propolis may become more important. These data are not currently available.

3. Propolis harvest in Australia has been held back by the absence of consistent buyers. This is starting to change with other businesses looking to join the current single large-scale Australian processor. Raw propolis is a conduit for honey bee disease and must be processed in Australia.

4. Propolis processing requires capital equipment, technical ‘knowhow’, scale and access to markets. Small-scale processing of propolis into tinctures is currently practiced by beekeepers for both personal use and for sale.
Market for Australian produced propolis

World propolis demand

A number of international research firms prepare and sell propolis market reports – see for instance ‘Big Market Data’, ‘Decision Databases’, ‘Wise Guy Reports’ and ‘Wha Tech’ and while the quality of these reports may be questionable in some instances (New Zealand Bee Industry representative, pers. comm., October 2018), it is worth noting that all are bullish about the outlook for propolis products:

- The major market driver for propolis products is growing demand from the medical and healthcare industries.
- Global consumption of consumer products, containing at least some propolis, is forecast to increase from 2,300 tonnes in 2015 to 2,900 tonnes in 2021. In 2021, the worldwide retail value of propolis products is forecast to be $US600 million ($A860 million).
- China is the world’s largest consumer of propolis products. Brazil is also a major producer and consumer of propolis products. In Canada, propolis products are the biggest selling supplement in health food stores and are mostly purchased by customers of Asian origin. A proportion of these customers export their purchased propolis products to Asia. This same experience with export has been noted in both Australia and New Zealand.
- There are major counterfeiting issues with propolis in China that undermine total demand for propolis products but work in favour of sales from countries with credible regulatory systems.

Demand for propolis in China

China is a key potential market for Australian produced propolis. Chinese consumers are becoming increasingly aware of propolis and its associated health benefits. Demand for propolis products is strong in China and world production is limited. Pure propolis typically trades in China for RMB540/kg ($A110/kg), yet prices are quoted online as low as RMB50/kg ($A10/kg).

Propolis adulteration has become an open secret in the Chinese health products market. In 2010, a major propolis adulteration scandal broke resulting in a 50% reduction in sales of locally produced propolis products in that year. In 2011 sales fell a further 30%. Total loss in industry value was estimated at RMB1.5 billion ($A300 million) (Fung, 2016).

Between 2011 and 2016 there was virtually no recovery in the sale of locally produced propolis products. Instead, Chinese consumers switched to imported propolis products and Chinese companies, that previously produced propolis, become distributors of imported products. Most often propolis product imports are sourced from Australia, New Zealand, Japan, Brazil, and the US. Australian products are particularly well regarded by Chinese consumers (Fung, 2016).

However, Chinese research shows that Australian propolis products are mostly made from ingredients sourced from China. Some of these ingredients are Chinese in origin while others are imported from Brazil. China imports approximately 50 tonne of processed pure propolis from Brazil each year (Fung, 2016).

To capture value from trust in Australian origin propolis products, Chinese capital has been attracted to Australia to establish new consumer product manufacturing plants. However, establishment of these plants in Australia has not solved the propolis adulteration problem. Testing of 1,330 Australian and New Zealand sourced propolis products by the Chinese Food and Drug Administration in 2016 revealed that only 13 had the stated propolis content and most contained only ‘plant gum’ (Fung, 2016).
Establishment of a raw propolis supply sourced from Australian beekeepers with appropriate consumer product testing would meet the needs of the world’s largest propolis market and realise opportunity for sustained growth.

**Demand for propolis in Australia**

The health and dietary supplements sector is growing strongly in Australia. Growth has been due to a combination of domestic demand and export demand in Asia. In 2015, the category grew 27% in a single year and this growth was largely attributed to increased demand from Chinese consumers (Euromonitor International, 2016).

In 2016-17, propolis was the second fastest growing dietary supplement in Australia – Figure 6.

![Figure 6: Growth in Australian dietary supplement market 2016-17](image)

Source: Complementary Medicines Australia, 2018 (Euromonitor International research)

**Figure 6:** Growth in Australian dietary supplement market 2016-17

The outlook for growth in propolis sales in Australia is positive. Strong growth in product value recorded in each of 2013 (51%), 2014 (22%) and 2015 (28%) was tempered in 2016 and 2017 with 10% annual growth and a forecast to sustain annual growth at between 8% and 12% through to 2022 – Figure 7.

![Figure 7: Growth in volume and value of propolis sales in Australia](image)

Source: Euromonitor International Consumer Health database

**Figure 7:** Growth in volume and value of propolis sales in Australia
By 2022, the retail value of propolis sales in Australia is forecast to have increased from $A26 million in 2017 to $A40.1 million (Euromonitor International, Consumer Health database).

**Australian imports of pure propolis**

Australia imports pure propolis which could be at least partially replaced with product sourced from Australian beekeepers. Two to three companies in Australia each import approximately 20 tonnes of pure propolis per annum (Michael Philippou, Bee Healthy Australia, pers. comm., October 2018). Add to this imports by smaller operations and the total market for pure propolis destined for manufacture into consumer goods for consumption in Australia and re-export is estimated at between 60 and 80 tonne per annum. By way of comparison New Zealand imports approximately 35 tonne of pure propolis per annum.

**Australian buyers and buyer requirements**

Current and potential buyers of raw propolis from Australian beekeepers include the major honey packers, propolis importers, processors and consumer product manufacturers. Profiles are provided along with summaries of their interest in raw propolis purchase.

**Capilano Honey Limited**

Capilano is a large publically listed Australian honey packer supplied by approximately 600 beekeepers and headquartered in Richlands Queensland and with offices in Bayswater Western Australia and Maryborough Victoria.

Capilano would consider looking at raw Australian propolis if it became available. A market would need to be established. In the absence of an established Australian supply, buyers will lose interest in the purchase of Australian propolis or source propolis from other suppliers.

Potentially, a New Zealand style mat exchange system could be used whereby mats are supplied to beekeepers but harvest is completed by the beekeeper (rather than by the processor at a central facility).

There is no current specification for Australian propolis and the company is aware that setting a specification would be required if propolis is to be sourced from Australian beekeepers. An immediate challenge would be how to establish objective criteria for raw propolis and how to pay beekeepers according to quality.

The profitability of propolis processing will be determined by the price premium certified pure Australian propolis can attract over lower cost Chinese product. Consumer education will be required.

Entering the propolis market is further complicated by a lack of Australian knowledge on how to process raw propolis. The New Zealand industry has this capacity but quarantine restrictions prevent raw propolis being sent to New Zealand for processing.

As an aside, Capilano notes that it is often difficult to determine the country of origin of New Zealand propolis based consumer products and that new Australian country of origin laws will assist with the development of a genuine Australian propolis industry.

The industry is currently held back by the lack of an established propolis market (aside from supplements made with imported material) and local knowledge on how to process raw propolis.
Beechworth Honey
Beechworth Honey is a family-owned honey producer, honey packer and retailer located in Beechworth Victoria with a state-of-the-art packing plant centrally located in Corowa NSW.

Beechworth has completed its own analysis of the profitability of propolis production in Australia and concluded that it is not economically viable. Propolis production works overseas in small apiaries with access to low cost labour or where the beekeeper’s time is not already fully committed. In Australia, large apiaries require the full time commitment of the beekeeper and employed labour is in short supply and too expensive to commit to what is a low value task relative to the small volume of propolis that is recovered. Beechworth will not be sourcing propolis from Australian beekeepers.

Browns Bees, Mendooran and Kempsey
Browns Bees produces honey and exports queen bees and packages of bees around the world. The company imports beekeeping equipment and also has experience with bee pollen and royal jelly. Browns Bees has not dealt with propolis, understands that the market is abundantly supplied with low cost Chinese product and does not intend to collect or process propolis in the immediate future.

Jim’s Bee Products Group
Jim’s Bee Products Group is based in Young NSW with retail premises in the Sydney suburb of Ashfield. Jing Bang (Jim) Zou and his wife Litang Fan produce a range of canola and eucalyptus honeys, bee pollen products, fresh royal jelly using imported ingredients and propolis products including tablets and liquid propolis made from Australian sourced propolis.

Jim’s Young based operation was established in 2002 and includes large-scale propolis processing and resin production equipment sourced from China. Jim secured permanent residency in Australia with a Distinguished Talent Visa as a result of his work in propolis processing. In 2009, then AHBIC Executive Director Stephen Ware noted that Mr Zou “has researched and produced quality products which previously had been ignored by the Australian beekeeping sector” (Denis Gregory, Sydney Morning Herald, 4 October 2009).

Jim’s primary market for honey and propolis products is Australia. At the current time his output of propolis products is constrained by a lack of raw propolis supply. In time he would like to expand his exports to China where propolis is highly regarded as a cancer treatment and consumers are sceptical about the authenticity of local supply. “In China people collect resin from trees and pass it off as honey bee propolis” (Jing Bang (Jim) Zou, Jim’s Bee Products Group, pers. comm., October 2018). Jim currently exports about $250,000 worth of honey bee products, including propolis capsules and liquids, to China each year.

Jim states that he has capacity to handle “many tonnes” of raw propolis each year. Jim will purchase both hive scrapings and propolis sourced from mats. He requires beekeeper delivery of raw propolis to his Young based operation and is interested in sourcing raw propolis from beekeepers Australia wide. In 2019, he will expand on his current NSW and South Australian supply base and source raw propolis from Victoria. Jim pays beekeepers on his assessment of quality and the following prices were current in October 2018:

Table 7: Jim’s Bee Products prices paid for each grade of raw propolis

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage resin in raw product</th>
<th>Price paid ($/kg delivered Young NSW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No1 quality</td>
<td>40% to 50%</td>
<td>$100 to 120/kg</td>
</tr>
<tr>
<td>No 2 quality</td>
<td>30% to 40%</td>
<td>$80 to 100/kg</td>
</tr>
<tr>
<td>No 3 quality</td>
<td>20% to 30%</td>
<td>$60 to 70/kg</td>
</tr>
</tbody>
</table>

Source: Jing Bang (Jim) Zou, Jim’s Bee Products Group, pers. comm., October 2018
A sample provided by this report’s author was visually assessed by Jim as poor quality raw propolis with a maximum of 20% pure product.

**Propolis New Zealand**
Propolis New Zealand is a relatively new propolis processor with an experienced processing team. Haydn Bone of Propolis New Zealand has been researching opportunities to establish propolis processing facilities in Australia.

**Bee Healthy Australia Pty Ltd**
Bee Healthy Australia manufactures consumer royal jelly, bee pollen and propolis products from imported and local ingredients. The company also supplies bulk raw materials including propolis (minimum order 500kg), propolis powder (minimum order 500kg) and propolis capsules (minimum order 100,000 capsules).

Pure propolis resin and powder is imported from overseas in the absence of an Australian industry. Care is needed in sourcing propolis from China as there is both good and poor quality material available. The presence of poor quality generic material has somewhat undermined the international propolis market place.

Propolis is purchased on its flavonoid percentage and high quality propolis and propolis powder is 40% flavonoid and 98% pure resin. Buyers are increasingly interested in the composition of flavonoids and seek high levels of Quercetin and lower levels of Rutin. Propolis is tested for agricultural chemical and antibiotic residues and discounted when residues are detected.

The company notes that there is both a substantial demand for Australian apiary products and appropriate premiums for them, possibly in the range of 200% to 300% for Australian sourced propolis. Domestic and Asian consumers trust Australian sourced natural products.

Bee Healthy Australia is not currently equipped to process raw Australian propolis but is a possible buyer for the resultant pure extract.

**MT Dermaceuticals**
MT Dermaceuticals is a Frankston Victoria based company that researches, develops and manufactures topical and oral medications for the treatment of skin conditions including psoriasis and eczema. In 2018, the company was looking to source Australian propolis for testing in their R&D program. Specifically, MT Dermaceuticals wished to source alcohol-free propolis liquid extract and or concentrated propolis powder. Australian propolis was not available and the company was forced to source imported propolis from Lifeline Health and Bee Healthy Australia.

**Botanical Innovations**
Botanical Innovations is a flavour, fragrances and ingredient manufacturer based in Orange NSW. Botanical Innovations manufacture oils, essential oils, extracts, fermentations and powders. In 2018, Botanical Innovations had a large customer who wished to manufacture propolis extract from Australian propolis. Botanical Innovations is interested in purchasing propolis on an ongoing basis from interested parties. The company requires the propolis to be freshly harvested and frozen. Botanical Innovations will either collect the propolis or arrange for its transportation to its factory in Orange.

**Others**
Other potential supply chain partners have been identified online. They include, but are not limited to, BeeVital – a UK based group looking for raw propolis suppliers and Good-Combo a Sydney-based retailer which markets their propolis as sourced from Australia. Beekeepers who produce propolis say that there are many small-time trader buyers who want samples to test the market and rarely return to purchase. It is possible that at least some of these trader buyers confuse raw propolis with pure processed propolis and are dissatisfied with subsequent test results.
Pure propolis price

Available data on world prices for processed pure propolis are summarised in the table below.

**Table 8: Pure propolis prices around the world ($A/kg)**

<table>
<thead>
<tr>
<th>Country of origin</th>
<th>Descriptor and data source</th>
<th>Value ($A/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China – lower quality</td>
<td>• 10% flavonoid, 70% pure&lt;br&gt;• Data sourced from Bogdanov 2017, Alibaba online market place July 2018 and Bee Healthy Australia, October 2018</td>
<td>65</td>
</tr>
<tr>
<td>China – higher quality</td>
<td>• 40% flavonoid, 98% pure&lt;br&gt;• Data sourced from Bee Healthy Australia, October 2018</td>
<td>150</td>
</tr>
<tr>
<td>Brazil</td>
<td>• Data sourced from Bogdanov 2017</td>
<td>240</td>
</tr>
<tr>
<td>New Zealand</td>
<td>• Average of data supplied by the Ministry of Agriculture New Zealand, 2017</td>
<td>360</td>
</tr>
<tr>
<td>Australia</td>
<td>• Data supplied by Jim’s Bee Products Group, pers. comm., October 2018</td>
<td>360</td>
</tr>
</tbody>
</table>

Pure Australian propolis will need to compete against both lower and higher quality Chinese product. Lower quality Chinese product is available in Australia for $A65/kg. Higher quality Chinese product is available in Australia for $A150/kg. Good quality raw Australian propolis purchased at $A100 to $A120/kg will sell post processing as pure propolis for $A360 to $A400/kg (estimate based on New Zealand processing margins and data supplied by the Australian value chain) - a premium over good quality Chinese propolis of 240% to 260%. Industry advice is that the market is prepared to pay a premium of up to 300% for genuine Australian origin product. If Australian product is well marketed, production should be profitable for both beekeepers and propolis processors.

**Australian propolis unique points of difference**

Potential competitive advantages for Australian sourced propolis that will aid supply chain marketing of the product include:

- **Trust** – in both domestic and export markets Australian products are regarded as trustworthy having been produced in a country with credible regulatory systems.
- **Low chemical** – in 2018 Australia is free of the Varroa mite and has not been forced to use chemical miticides in hives. Effective regulation should also ensure low levels of residues, prior to processing, from agricultural chemicals and antibiotics.
- **Unique chemistries** – some Australian propolis will be sourced from native flora which may have unique flavonoid profiles or higher flavonoid levels. Some of this propolis may have new medicinal properties. Research will be required to establish whether and where these qualities exist.

**Lessons learnt Australian propolis market**

The following lessons from the Australian propolis market are relevant to consideration of a profitable industry in Australia:

1. The outlook for growth in world propolis demand is positive. Propolis consumption is increasing in both the developed and developing world. The world’s biggest consumer of propolis products is China.
2. The Chinese propolis market will continue to grow as long as Chinese consumers can be confident about the country of origin and integrity of the product. Raw propolis sourced from Australian beekeepers is well placed to meet China’s needs.

3. The Australian propolis market has grown strongly since 2012 and is forecast to grow at an average 10% per annum through to 2022. By 2022, the retail value of propolis products sold in Australia is forecast to be $A40 million per annum.

4. Australia imports an estimated 60 to 80 tonnes per annum of pure propolis. Propolis produced by Australian beekeepers could at least partially offset some of this imported material.

5. Companies with a potential interested in raw Australian propolis include honey packer Capilano (a commercial quantity of raw propolis would need to become available), Jim’s Bee Products Group (established processor looking for additional supply), Propolis New Zealand (interested in establishing Australian propolis processing facilities) and Bee Healthy Australia (possible buyer for the resultant pure extract).

6. There is both lower and higher quality Chinese propolis available in Australia. Pure Australian propolis will need to achieve premiums of between 200% and 300% to be profitable. If Australian product is well marketed, price premiums of this magnitude are possible.

7. Australian propolis competitive advantages which might be used to establish price premiums include trust in the integrity of Australian products, raw propolis that may be naturally low in chemical residues and unique chemistries in propolis sourced from native flora.
Profitability of propolis for Australian beekeepers

Beekeeper information needs

A small number of commercial beekeepers were identified and surveyed to determine the information that they would require prior to consideration of propolis harvest. A list of beekeepers contacted is included as Appendix 1.

The information needed by commercial beekeepers was:

- Investment required prior to harvest.
- The propolis harvest process.
- Labour requirements.
- The calendar of operations for propolis production and its criticality.
- The availability of buyers for raw propolis.
- Buyer requirements – characteristics sought and product form.
- Current and potential market size including consideration of domestic and export markets.
- Indicative net return on raw propolis supply.
- What critical mass is needed for a New Zealand style central buying network that supplies and picks up propolis mats and processes propolis into a pure form?
- Indicative net return on a value added product that could be produced by beekeepers.

Some information requests were more appropriately considered as future R&D projects:

- Which flora produces the most propolis?
- Why is there no standards/specification for raw propolis like there are for Manuka honey?
- How do you recover propolis from ‘slum gum’ – the black material left over when capping is processed?

Most of these information requests have already been addressed in previous sections of this report. The balance of this chapter is concerned with the profitability of raw propolis harvest, critical mass for large-scale processing and the making of a simple propolis tincture.
Preliminary costs and returns for beekeepers harvesting propolis

Table 9 provides a preliminary cost and return analysis for raw propolis harvest by Australian beekeepers.

Table 9: Preliminary costs and returns for beekeepers harvesting propolis ($/A/hive)

<table>
<thead>
<tr>
<th>Production steps and assumptions</th>
<th>AgEconPlus estimate of beekeeper input (hours/hive)</th>
<th>Your estimate of beekeeper input (hours/hive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mats placed in hives and removed from hives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mats placed in hives at the beginning of the season along with the first honey supers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mats removed once per year at the end of the season (NB: New Zealand and Kangaroo Island beekeepers remove and replace mats 3-4 times per season)</td>
<td>1 minute</td>
<td></td>
</tr>
<tr>
<td>Mat cracking and scraping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Filled mats removed from hive and placed in freezer to harden the raw propolis (assume ambient temperature &gt;20°C)</td>
<td>10 minutes</td>
<td></td>
</tr>
<tr>
<td>• Frozen mats removed from freezer, flexed and most propolis falls out. Run over mat with clean paint scraper to remove balance of propolis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• In winter when supers and frames are removed from hive, scrape with clean paint scraper to remove additional propolis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packaging and distribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Place raw propolis in clean air-tight bag and mail to processor (NB: New Zealand processors pay freight or collect filled mats).</td>
<td>1 minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total hours</td>
<td>12 minutes</td>
</tr>
<tr>
<td></td>
<td>Cost of labour</td>
<td>$25/hour</td>
</tr>
<tr>
<td></td>
<td>Cost of production labour</td>
<td>$5.00/hive</td>
</tr>
<tr>
<td></td>
<td>Postage cost</td>
<td>$0.10/hive</td>
</tr>
<tr>
<td>Mat capital costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• $10 per mat, one mat per hive, assume plastic mats last 10 years</td>
<td>$1/hive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost of production</td>
<td>$6.10/hive</td>
</tr>
<tr>
<td>Propolis production per hive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 150 grams of propolis @$100/kg</td>
<td>$15/hive</td>
<td></td>
</tr>
<tr>
<td>Net revenue</td>
<td></td>
<td>$8.90/hive</td>
</tr>
</tbody>
</table>

The preliminary estimate of raw propolis production costs and returns has used assumptions that may overestimate or underestimate net revenue for a particular beekeepers situation. Key assumptions are:

- Time required for mat placement and removal from hives – 1 minute assumed for a single placement and removal. If large volumes of propolis are trapped, the mat may need to be removed and placed three to four times per year (underestimate).
- Time required for mat cracking and scraping – 10 minutes assumed and 2 minutes estimated by Danny Le Feuvre, propolis producer, Kangaroo Island and SA mainland (overestimate).
- Cost of labour - $25/hour assumed and $45 to $50/hour suggested by Lindsay Bourke, beekeeper Tasmania (underestimate).
- Mat purchase cost - $10 purchase cost and 10 year life assumed but may cost less if purchased in bulk. However, mat may not last the 10 years assumed (neither underestimate or overestimate).
- Freezer available for storing raw propolis – no cost assumed but household freezer could be used or low cost domestic freezer purchased (underestimate).
Propolis production per hive – 150 g assumed but actual production highly variable and estimated in the literature for Australia at between 150 g and 200 g (may be under or over estimate).

On present assumptions production of raw propolis is profitable and is a useful addition to total income for all beekeepers, especially smaller operations where the beekeeper is more likely to have uncommitted time and additional income may provide a boost for a marginally viable enterprise. For example, raw propolis production for a 100 hive enterprise has the potential to add $890 to net revenue if labour is costed at $25/hour or $1,390 if the enterprise owner’s labour is used and has no opportunity cost. The economics of raw propolis production is enhanced for all beekeepers if the processor provides a mat pickup and extraction service.

Critical mass required for large scale processing

A New Zealand style central buying network that supplies and picks up propolis mats is viable for larger New Zealand propolis processors. The New Zealand industry is able to support two or possibly three of these businesses and processes an estimated 30 tonnes of raw propolis per annum. Throughput of between 5 and 10 tonnes of raw propolis would appear to be needed to support processing at scale.

Preliminary costs and returns for beekeepers producing propolis tincture

Krell (1996) provides a comprehensive review of consumer products manufactured from propolis along with instruction for their formulation. Australian beekeepers have manufactured propolis tinctures for personal use and sale. Tinctures are one way to add value to raw propolis without investment in the large-scale processing technology required to make pure propolis.

Table 10 provides a preliminary cost and return analysis for tincture making. The analysis is based on a 30% tincture which is commonly referenced in the literature. Tinctures with 5% and 10% are also produced and referenced in the literature. Tinctures should not exceed 30% as propolis will be wasted in a less complete extraction (Krell, 1996).
### Table 10: Preliminary costs and returns for beekeepers making propolis tincture ($A/litre)

<table>
<thead>
<tr>
<th>Production steps and assumptions</th>
<th>AgEconPlus estimate ($/litre)</th>
<th>Your estimate ($/litre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquor licence</td>
<td></td>
<td>$50.00</td>
</tr>
<tr>
<td>- Phone discussions with Liquor and Gaming NSW confirm that a liquor licence is required for even small volume sales of propolis tincture. While the application process and inspections will take time, annual fees for a low risk enterprise such as production and sale of propolis tincture are not onerous.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The lowest cost NSW licence, with no risk premiums, currently costs $107/year. Online searches reveal what appear to be similar licensing requirements in other jurisdictions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- With allowance for application time, inspection and licence fees, an annual cost of $250 is estimated and this cost has been spread across annual production of 5 litres of tincture (i.e. annual sales of 200 units of 25 ml dropper bottle retail packs).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw propolis cost</td>
<td></td>
<td>$30.00</td>
</tr>
<tr>
<td>- 300 grams of raw propolis is required for a litre of 30% tincture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Opportunity cost for 300 grams of raw propolis is estimated at $30 (raw propolis sale price of $100/kg).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propolis preparation for extraction</td>
<td></td>
<td>$12.50</td>
</tr>
<tr>
<td>- Remove coarse debris and freeze, break raw propolis into small pieces or grind in a coffee grinder into a fine powder. A small surface area to volume ratio is required to increase propolis contact with ethanol.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Time required to prepare 300 grams of raw propolis for ethanol steeping is estimated at 30 minutes at a cost of $25/hour.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethanol purchase</td>
<td></td>
<td>$4.65</td>
</tr>
<tr>
<td>- Pure medical grade ethanol of 70% alcohol is required. Non-medical grade ethanol may have chemicals added to make it unpalatable. Low cost alcohol may have been denatured. Alcoholic liquors may be less than 70% alcohol and therefore less effective at extracting active ingredients from the propolis (NB: Polish vodka is 98% pure alcohol and is suitable for tincture making).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Medical grade ethanol can be purchased from Sydney Solvents for $5.80/litre and 700 ml is required for a one litre of tincture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jar for steeping propolis ethanol mixture</td>
<td></td>
<td>$0.40</td>
</tr>
<tr>
<td>- A large sealable jar of at least one litre capacity is required for steeping the propolis and ethanol mixture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Jar purchase cost is estimated at $10 and the jar is assumed to last for 5 years, an annual cost of $2 that is spread over 5 litres of tincture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propolis steeping to extract active ingredients</td>
<td></td>
<td>$6.25</td>
</tr>
<tr>
<td>- Store the jar containing the propolis and ethanol mixture at a temperature of between 15°C and 20°C.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The effectiveness of the tincture is maximised with a steeping time of two weeks. Further steeping after this time will not dissolve any more active ingredient from the propolis into the tincture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The jar containing the propolis and ethanol mix will require shaking two to three times per day. This activity will take 15 minutes over the two week steeping period at a labour cost of $25/hour.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottles and labels</td>
<td></td>
<td>$270</td>
</tr>
<tr>
<td>- Glass dropper bottles with a capacity of 25 ml are available online and delivered for $6.15 each. With a label printed and attached total cost is estimated at $6.75 each. No allowance for exterior cardboard packaging has been made. Bottles are dark brown in colour as this best preserves the integrity of the tincture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 40 glass dropper jars are required for one litre of tincture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filtering and bottling labour</td>
<td></td>
<td>$12.50</td>
</tr>
<tr>
<td>- A plastic funnel and coffee filter papers will be required to twice filter impurities from the tincture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Labour will be required for filtration and bottling – twice filtering of tincture then pouring it into 40 dropper jars is estimated to take 30 minutes at a labour cost of $25/hour.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total production cost (excluding marketing and distribution)</td>
<td>$386.30</td>
<td></td>
</tr>
<tr>
<td>Total revenue</td>
<td></td>
<td>$678.40</td>
</tr>
<tr>
<td>- Retail price of 25 ml propolis tincture is $16.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net revenue</td>
<td></td>
<td>$292.10</td>
</tr>
</tbody>
</table>
Drawbacks associated with raw propolis value adding into tincture include:

- Requirements for a liquor licence to sell tincture.
- Risk of sickness or even fatalities if unsuitable alcohol is used (Krell, 1996).
- The cost of developing a market for the product – raw propolis can now be supplied directly to an Australian processor.

None of these drawbacks are insurmountable, production is profitable and the individual beekeepers decision to sell raw propolis or produce a tincture will depend on the circumstances of their individual enterprise.

**Lessons learnt profitability of propolis for Australian beekeepers**

The following lessons from the profitability analysis are noted:

1. Raw propolis production is modestly profitable for the assumptions used. Profitability for individual beekeepers will depend on the quantity of propolis produced per hive, whether surplus labour is available in the enterprise and the cost of any additional hired labour.

2. Establishment of a New Zealand style mat supply and collection service with large-scale propolis processing requires access to at least 5 tonne of raw propolis and substantial capital for processing equipment.

3. Production of value added propolis tincture is relatively straightforward and profitable for the assumptions used. Drawbacks include the requirement for a liquor licence, risks associated with the use of an unsuitable alcohol and the cost of developing a market for the product.

4. Raw propolis supply and tincture making is more profitable in smaller apiaries where the beekeeper is more likely to have uncommitted time and labour does not have to be employed.
Study conclusions and recommendations

The study has shown that profitable production of propolis by Australian beekeepers is possible. New Zealand provides a useful model for the creation of a propolis sector in Australia. There is a market for Australian produced propolis and the market is forecast to grow. The value chain is interested in sourcing Australian produced propolis and credible buyers are interested in investing in the sector.

Suggested next steps for beekeepers interested in propolis industry participation are:

1. Buy a small number of mats and trial them for a full year – or longer to account for seasonal, locational and hive strength variation.
2. Weigh propolis recovered from mats and scraping separately – some potential purchasers have indicated they may not be interested in propolis recovered from hive scrapings.
3. Keep an approximate record of the time required to crack mats and scrape hive materials – decide on the appropriate cost of labour for your enterprise.
4. Follow up with the potential buyers identified in this report – determine willingness to purchase, standards/specifications used to purchase, their assessment of the propolis harvested and proposed commercial arrangements.
5. Rework guide budgets provided in this report for your enterprise to determine whether either propolis harvest or tincture production is economically viable for your business.

Possible areas for future research arising from this study:

1. Development of a set of standards/specifications for Australian sourced propolis that would facilitate objective assessment by third parties of the quality of raw propolis.
2. Research which regions and which flora produces the most propolis, the propolis with the highest flavonoid levels and the most valuable flavonoid types.
3. Investigate whether it is technically and economically feasible to recover propolis from ‘slum gum’ – the black material left over when capping is processed.
4. Investigate the potential of propolis for the treatment of American foulbrood.

In time, it is possible that the Australian propolis harvesting industry might reach a size comparable to the New Zealand propolis industry, create opportunities in the value chain and deliver new, more effective medical treatments.
References


Happy Valley Bee Products NZ (http://www.happyvalley.co.nz/ingredients/propolis/)


King, DI (2017) Kangaroo Island Propolis: Improving characterisation and assessment of chemistry and botanical origins through metabolomics. Doctor of philosophy thesis Faculty of Pharmacy, University of Sydney


Lebedev, VI (undated) Propolis production in the apiary, Riboe, Russia. Accessed at https://pcela.rs/propolisproduction.htm


# Appendix 1: Persons contacted as part of the study

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
<th>Reason for contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Australian commercial beekeepers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ian Cane</td>
<td>Beekeeper, Gippsland, Victoria</td>
<td>Propolis information needs</td>
</tr>
<tr>
<td>Peter McDonald</td>
<td>Beekeeper, Castlemaine, Victoria</td>
<td>Propolis information needs</td>
</tr>
<tr>
<td>Graham Brooks</td>
<td>Beekeeper, South Australia</td>
<td>Propolis information needs</td>
</tr>
<tr>
<td>Sam Malfroy</td>
<td>Wheen Bee Foundation, Beekeeper Canberra</td>
<td>Industry knowledge and contacts</td>
</tr>
<tr>
<td>James Kershaw</td>
<td>Beekeeper, NSW</td>
<td>Propolis information needs</td>
</tr>
<tr>
<td>Tim Malfroy</td>
<td>Beekeeper, NSW</td>
<td>Propolis information needs</td>
</tr>
<tr>
<td>Tiffanie Bates</td>
<td>Researcher and beekeeper, Western Australia</td>
<td>Knowledge of WA beekeeping</td>
</tr>
<tr>
<td>Stephen Fewster</td>
<td>Beekeeper, Western Australia</td>
<td>Propolis information needs</td>
</tr>
<tr>
<td>Julian Wollhagen</td>
<td>Beekeeper, Tasmania</td>
<td>Propolis information needs</td>
</tr>
<tr>
<td>Lindsay and Yeonsoon Bourke</td>
<td>Beekeeper, Tasmania</td>
<td>Propolis information needs</td>
</tr>
<tr>
<td>Trevor Weatherhead</td>
<td>Executive director, AHBIC</td>
<td>Industry knowledge and contacts</td>
</tr>
<tr>
<td><strong>Australian beekeepers with propolis experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Danny Le Feuvre</td>
<td>Beekeeper, Kangaroo Island, SA mainland</td>
<td>Information on propolis production</td>
</tr>
<tr>
<td>Shawn Hinves</td>
<td>Beekeeper, Kangaroo Island</td>
<td>Information on propolis production</td>
</tr>
<tr>
<td>David Clifford and Bev Nolan</td>
<td>Beekeepers, Kangaroo Island</td>
<td>Information on propolis production</td>
</tr>
<tr>
<td>Murray Arkadieff</td>
<td>Beekeeper, SE Queensland</td>
<td>Information on propolis production</td>
</tr>
<tr>
<td><strong>Australian value chain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stephen Covey</td>
<td>Capilano Honey Limited</td>
<td>Honey packer, potential propolis purchaser</td>
</tr>
<tr>
<td>Jodie Goldsworthy</td>
<td>Beechworth Honey</td>
<td>Honey packer, potential propolis purchaser</td>
</tr>
<tr>
<td>Terry Brown</td>
<td>Browns Bees</td>
<td>Beekeeper with experience importing bee products</td>
</tr>
<tr>
<td>Jing Bang (Jim) Zou</td>
<td>Jim’s Bee Products Group</td>
<td>Purchases and processes Australian propolis</td>
</tr>
<tr>
<td>Michael Philippou</td>
<td>Bee Healthy Australia</td>
<td>Imports propolis, would like Australian propolis</td>
</tr>
<tr>
<td>Selina Mithen</td>
<td>MT Dermaceuticals</td>
<td>Interested in purchase of Australian propolis</td>
</tr>
<tr>
<td>Kerry Ferguson</td>
<td>Botanical Innovations</td>
<td>Interested in purchase of Australian propolis</td>
</tr>
<tr>
<td><strong>Australian propolis researchers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colin and Rujee Duke</td>
<td>School of Medical Science, University of Sydney</td>
<td>Chemical properties of Australian propolis</td>
</tr>
<tr>
<td>Christine Bradley and Prof. Chun Guang Li</td>
<td>Complementary medicine, Western Sydney Uni.</td>
<td>Quality differences and standards for propolis</td>
</tr>
<tr>
<td><strong>New Zealand propolis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lew Bone</td>
<td>Arataki Bee Products</td>
<td>Large scale propolis producer</td>
</tr>
<tr>
<td>Cliff van Eaton</td>
<td>Comvita New Zealand</td>
<td>Large scale propolis producer</td>
</tr>
<tr>
<td>Haydn Bone</td>
<td>Propolis New Zealand</td>
<td>Emerging propolis processor</td>
</tr>
<tr>
<td>Murray Reid</td>
<td>Ministry of Agriculture, New Zealand</td>
<td>New Zealand propolis sector</td>
</tr>
<tr>
<td>Frank &amp; Mary-Ann Lindsay</td>
<td>Beekeepers producing propolis, Wellington</td>
<td>Information on propolis production</td>
</tr>
<tr>
<td>James Ward and Mary-Anne Thomason</td>
<td>Beekeepers producing propolis, Tukapau</td>
<td>Information on propolis production</td>
</tr>
</tbody>
</table>
Australian propolis
market and production potential
by Michael Clarke
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