Māori Beekeepers: Reframing New Zealand's Apiculture Narratives

https://doi.org/10.33318/jpacs.2024.44(2)

Please provide author details[1]*, Author 2*[2]*, and etc.*[3]

Abstract

New Zealand's historical apiculture narratives are dominated by the colonial settlers' experiences of beekeeping, which have marginalised Māori experiences. This has perpetuated the notion that, historically, Māori had little to do with beekeeping. However, this article contests this notion and demonstrates that after the introduction of the European, or western honeybee Māori were active participants in the apiculture industry, both as commercial traders and beekeepers. Moreover, this article explores the current contributions that Māori beekeepers make to New Zealand's apiculture industry but continue to be ignored by the apiculture industry. Despite this, this article shows that Māori beekeepers are making important contributions in the apiculture research space, working with researchers and research institutions to explore climate change impacts, floral honey diversity in the native forests and aspects of honeybee colony health.

Keywords: Apiculture; Apiculture Narratives; Honeybee; Māori Beekeepers; New Zealand Apiculture

[1] Sample - Senior Lecturer, Discipline of Management and Public Administration, School of Business and Management, The University of the South Pacific, Fiji, email: suwastika.naidu@usp.ac.fj

[2] Lecturer, Discipline of Management and Public Administration, School of Business and Management, The University of the South Pacific, Fiji

[3] Consultant, Discipline of Graduate School of Business, School of Business and Management, The University of the South Pacific, Fiji

Introduction

New Zealand's historical apiculture narratives are dominated by the colonial settlers' beekeeping experiences, which have marginalised Māori experiences. Not unlike many other British colonies, much of New Zealand's historical narratives focus on the early settler's determination to replicate the agricultural practices of Europe and how the western honeybee (Latin name *Apis mellifera*) had to be introduced to improve agricultural crop outcomes. This has perpetuated the notion that Māori had little to do with New Zealand's colonial apiculture industry, except as sometimes traders and consumers of honey. It is acknowledged that before colonialism, Māori had little to no interaction with European honeybees; however, after the introduction of the honeybee, Māori were active participants in the apiculture industry and had an influential role.

This article employs a narrative review of existing historical apiculture literature, specifically focusing on identifying and highlighting the significant contributions of the Māori to the apiculture industry. By revisiting New Zealand's colonial apiculture history, this research aims to challenge and reshape the prevailing narrative, offering a more comprehensive and inclusive understanding of New Zealand's apiculture development from a Māori perspective.

Initially, a specific literature search[1] was conducted using the University of Waikato's library portal, but unfortunately, few relevant results were returned. The results of a Google search did not fare any better; there was little to no literature on Māori beekeepers (interestingly, there was a list of commercial Māori beekeeping entities, though). Nevertheless, it is evident that Māori beekeepers exist and have done so since the colonial settlers arrived. Thus, this literature review is informed by New Zealand's historical apiculture literature and non-peered reviewed articles (like news articles from Papers Past, a search engine of New Zealand's earliest newspapers, for example) to create a Māori apiculture narrative. Furthermore, this article includes current contributions that Māori make to New Zealand's apiculture industry that continue to be disregarded.

Māori worldview and links to the land

New Zealand has a unique natural environment because it has stayed largely isolated from the rest of the world for over 80 million years. Unsurprisingly, the settlers referred to the ancient forests as rugged virgin bush, as the forests were home to unique plants, animals, and insects (Native Forest Restoration Trust, 2024). Prior to the introduction of the European honeybee, native birds, bats, insects, and lizards played a vital role in the pollination of New Zealand's native plants (Morris, 2021). However, the greatest changes to New Zealand's landscape occurred once settlers arrived. With a strong focus on developing the land for agriculture, native forests were felled, wetlands were drained, and consequently, there was a significant loss of native insects and animals (Native Forest Restoration Trust, 2024).

However, for Māori, the land (whenua) is everything. Asher (1987) said that '*to early Māori, the land is bound up with survival, politics, myth and religion. It was not part of life, but life itself'.* For Māori, the land, soil and water are considered taonga[2] (sacred treasures), and Māori are the kaitiaki (guardians). Moreover, Māori see man and plants as having a common origin, so the native forests are seen as older relatives[3] and revered by Māori. Māori considered the forests as a food resource, a spiritual domain, a school room and a medicinal cabinet. Consequently, Māori held significant

[1] Search terms were 'Māori beekeepers' and 'Māori and honey bees'
[2] Taonga - for Māori, is something that is sacred and treasured. It can be an object or a natural resource.
[3] Forests are seen as the link between sacred ancestors [Papatūanuku and Ranginui] and Māori.

mātauranga[4] about the forests and the diversity of the animals that lived in the forests. Furthermore, much of the activity on the land is governed by maramataka (the Māori lunar calendar), where the different phases of the moon link to such things as agricultural, environmental and ecological practices. The result is that some days of the month (or year) are better for doing certain activities than others (for example, planting rather than harvesting). Mātauranga Māori has become more widely recognised because of its sustainable and holistic approach to environmental management and maramataka because of its ability to contribute to efficiencies.This is the traditional Māori worldview and how Māori organised their lives. However, this worldview was challenged when the colonial settlers arrived in New Zealand.

The introduction of the European honeybee to colonial New Zealand

It is generally accepted that Mary Bumby first introduced bees into New Zealand in 1839 (and quoted widely), but this is probably not true (James, 2022). Specifically, the hives would have had to travel more than sixteen thousand miles over the sea from England to reach New Zealand (the transportation of hives is the focus of a book by Reverend Cotton in 1842). In any case, honeybees were already introduced into Australia in the 1820s. The exportation of hives from Australia to New Zealand was well established by the end of the 1840s. Thus, whether the first introduced honeybee hives came from Australia or England is still being determined.

Regardless, before the signing of the 1840 Te Tiriti o Waitangi (Treaty of Waitangi) declaring New Zealand a British colony, settlers and missionaries had been arriving in NZ since the early 1800s. Furthermore, many of New Zealand's earliest and arguably most important settlers were also hobbyist beekeepers. Eliza Hobson, wife of the first governor of New Zealand, William Hobson (he co-drafted the Te Tiriti o Waitangi), and James Busby, who drafted the 1835 Declaration of Independence and also co-drafted the Te Tiriti o Waitangi, are just some of New Zealand's earliest beekeepers (Mithen, 2021).

The settlers cultivated land and created townships, and the missionaries preached the gospel and converted Māori to Christianity. The missionaries took it upon themselves to teach Māori reading and writing, as well as new gardening methods, carpentry, and farming. This included beekeeping because honeybees had a crucial role in New Zealand's farming development. The challenge thrown down by the Honourable Henry William Petre[5] said

> *One fact has not, to my knowledge, been mentioned. The flowers of the plants abound with honey, which the natives frequently suck. Thus, should bees be introduced into New Zealand, and I see no reason why they should not, they will find an abundance of food in the flower of the phormium tenax, as well as others. I mention this should anyone be disposed to take bees as an experiment. (Petre, 1971, p. 60).*

This is often quoted as the motivation for Reverend Cotton to teach Māori beekeeping, a key person who was instrumental in New Zealand's beekeeping history. Moreover, as part of their role to educate Māori about traditional farming practices, the missionaries saw beekeeping as to '*confer on the natives of New Zealand the pleasure and the profits of bees of their own'* (Cotton, 1842). Hive

[4] Mātauranga is the knowledge, comprehension, and understanding of everything visible and invisible existing in the universe.

[5] Henry William Petre was one of the founders of Wellington and one of NZ's prominent founding colonial families – going on to be a member of the colonial legislative council and treasurer. His father was the 11th Baron Petre and also the Chairman of the New Zealand Company.

products, such as honey and wax, made beekeeping a valuable commodity for communities with few resources because beekeepers traditionally rely on tacit knowledge rather than technical expertise (Parker, 2022). While Cotton's bees did not survive the sea voyage from England in 1844, he made up an apiary with swarms. From his apiary, Cotton taught Māori the skill of beekeeping, and he was regarded as a formidable force in New Zealand's earliest beekeeping. Fluent in Te Reo Māori, he wrote a beekeeping guide for Māori beekeepers called *Ko Nga Pi: me nga tikanga me te tiaki ratou, mo te mahinga I to ratou honi, i ta ratou ware*[6]. Cotton encouraged Māori to take swarms to make up hives for themselves and commented later that Māori quickly made skeps and straw hives because of their ability to weave flax and make kete (traditional baskets). Historical records show that Māori at Otaki caught swarms to make up their hapu's[7] apiary (New Zealander, 1847) while Māori also kept bees on Waiheke Island (Cotton, 1846).

Honeybees thrive in New Zealand

While New Zealand has about [40] species of native bees. These bees do not have hives or produce honey, nor could they undertake the pollination required by the settlers (Donovan, 1980). Moreover, New Zealand's native plants are adapted to other kinds of pollinators, such as native butterflies, flies, moths, beetles, and nectar-eating birds, such as tūī and bellbirds, as well as native bats and small mammals. As a result, native pollinators are considered a poor substitute for honeybees.

In the 1840s, the settlers widely recognised that pollinators such as honeybees were crucial to maximise crop production in New Zealand, an experience common to most British colonies. This was especially so because the settlers were forced to purchase seed from Britain yearly because crops like white clover could not set seed without honeybees (Ogden, 1988). At that time, the value of bees to the agricultural industry far outweighed any revenues earned by honeybee products. Thus, honeybee colonies were imported into colonial New Zealand because the honeybee was recognised as the most important pollinator of commercial crops, and it continues to be recognised as such today.

By the mid-1840s, there was a well-established feral honeybee population throughout the North Island, as noted by Reverend Cotton (Cotton, 1848, p. 112) - honeybees did not reach the South Island until 1842. Later, Isaac Hopkins[8], New Zealand's first government apiarist, recognised that wild feral hives not only survived in the native bush – they appeared to thrive. Hopkins noted that the diverse nature of New Zealand's forests made it an ideal environment for honeybees; the honeybees used the tree flowers for forage throughout the year and the holes in the trees as nesting sites. It was then unsurprising that by the end of the 1860s, wild feral hives could be found throughout New Zealand's forests and that Māori soon learned how to harvest the honey from the wild, feral hives.

While the domesticated honeybees became the main pollinators of many important food crops, the colonial farmers depended on pollination by domesticated and feral honeybee populations. The importation of hives and queen bees from European countries (such as Italy and Slovenia), America and Australia continued until the early 20th century, when the Apiaries Act 1924 was introduced. An

[6] Translated: Bees: and methods for their care, for the preparation of their honey and their pitch.

[7] Hapū - describes a sub-tribe and sits below an iwi. It can be comprised of one group to several hundred people that are related.

[8] Isaac Hopkins, arrived in New Zealand in 1858. He became an apiarist to the Department of Agriculture, established the government apiary at Ruakura Farm of Instruction and the first honey house in 1906. He was also instrumental in establishing the first Apiaries Act 1906. He also published the New Zealand and Australian Bee Journal – a first of its kind at the time.

Act meant to ensure New Zealand's bee populations remained largely disease and pest-free (it is noted that the bee disease *American Foul Brood* arrived in New Zealand approximately 35 years after the first hives were introduced). Consequently, with little to no honeybee pests or diseases, the feral honeybee populations inevitably flourished.

Māori readily sold and traded the honey they harvested with the settlers, whether from their own apiaries or wild, feral hives. Furthermore, Isaac Hopkins, the father of honey production in New Zealand, was among the first to recognise honey's importance and its links to Māori. This was probably inevitable because the settlers depended on food imports and food produced and sold by Māori before their farms had time to develop. Thus, Māori are considered by many as the first commercial beekeepers in New Zealand.

Early Māori recognise the loss of biodiversity and link it to the honeybees

Despite the entrepreneurial nature of Māori, not long after the introduction of honeybees, concerns were raised by Māori rangatira[9] about the 'white man's fly' (Māori's name for honeybees). Māori rangatira were vocal in calling the honeybees a pest, which they blamed for the disappearance of native birds and insects which fed on flowers of the native bush (New Zealand Herald, 1874). The colonial settlers considered the honeybees and their purpose in isolation, with crop pollination as the sole intention. Nevertheless, despite the colonial settlers being neither interested nor convinced that the honeybees were the problem, it was evident, even at that time, that honeybees were competing with other native insects, native bees, birds and bats, which were also reliant on nectar and pollen from New Zealand's native forests.

Noted colonial banker and author Alexander Kennedy (1873) said in his memoir.

> *The Maories, who are distinguished for the habit of accurately observing the facts of nature, have remarked that some of the small native birds are gradually disappearing, and they allege that those birds are in the habit of gathering their food by dipping their long tongues into the blossoms of native trees, but that since the introduction of bees, the latter have likewise sought the same blossoms for honey, and while concealed in the flower have stung the tongues of the birds, and so caused their death.* (Kennedy, 1873)

The obvious decline in biodiversity in New Zealand's native forests was of concern to Māori, and, unbeknown to the actors of colonial New Zealand, it set out the polarised positions of the Māori perspective of the environment and an ethic of sustainability against the colonial farmers. This position has not largely changed even in modern times. Researchers have only recently started examining the impact of introducing the European honeybee[10] on New Zealand's native biodiversity. Yet, because early Māori maintained unique local knowledge of their forests, the silence of the forests signalled the cause for alarm. Consequently, early Māori argued that the native pollinators seldom did well against the honeybees. Moreover, the honeybees thrived even during winter because of their natural ability to store honey - something the native pollinators do not do.

For Māori, the concept of kaitiakitanga underpins the environmental protection of flora and fauna, including native pollinators. So, while Māori did not view pollination in the same way as the colonial settlers, Māori had a clear understanding of the environment's mātauranga, the health of the te taiao

[9] Rangatira – Māori tribal leadership

[10] For example – Nepia, R. (2020). *Understanding the role and impact of introduced honey bees in a submontane indigenous forest ecosystem*. University of Waikato (PhD).

(environment) (Erueti et al., 2023). Furthermore, it was apparent that the feral honeybee hives upset the natural balance within the forests, a key element of the Māori worldview.

Toxic honey and the tutu plant

Moreover, at that time, there was little understanding of toxic honey, of which Māori were often the victims (Oamaru Mail, 1892). Māori were well acquainted with the tutu plant because it is considered a taonga and a traditional Rongoā plant (traditional medicinal plant). The tutu plant is found widely throughout New Zealand. It was used by Māori as a food source (such as a food sweetener, for example), as a medicinal herb for treating various illnesses and as an indelible ink used in tattooing. Furthermore, Māori showed the earliest settlers and missionaries how to make fermented wine from the tutu berries. However, Māori were aware that most of the plant's parts were deadly poisonous and that even a minute amount ingested could cause death.

Not surprisingly, Māori were the first to recognise rori te tutu (tutu poisoning) and linked it to honey consumption. The honeybees feed on the honeydew produced by sap-sucking vine hoppers that feed on the tutu plant at certain times of the year. While the honeydew is not toxic to the honeybees, it is toxic to humans (and other mammals). The local Māori tribes would caution the settlers against consuming honey at certain times of the year (Tipa, 2012).

Regardless, early Papers Past articles from the 1800s through to the early 1900s are littered with honey poisoning cases. Speculation as to which plant(s) were the cause of the toxic honey was often considered at the annual Australasian Medical Association Conference ignoring the Māori mātauranga of the tutu plant. As expected, it was found that most of the toxic poisoning victims were usually found to have consumed wild feral honey (Bay of Plenty Times, 1889; Evening Post, 1900).

Maori beekeepers in modern times

Most literature on the history of New Zealand's beekeeping does not include Māori perspectives; however, Māori beekeepers remain invisible even in modern times. This becomes evident when looking at New Zealand's apiculture industry statistics. New Zealand has 10,509 registered beekeepers (Apiculture New Zealand, 2023). Over 75% of New Zealand beekeepers own fewer than 10 hives; thus, most beekeepers in New Zealand are hobbyists. While commercial beekeepers tend to be few in New Zealand, they tend to dominate the apiculture market; 5.7% of commercial beekeepers operate 84.8% of the hives in the country (Ministry for Primary Industries, 2021). Unfortunately, there is no separate data collected on Māori beekeepers, and while the NZ Ministry for Primary Industries (MPI) collects data on colony losses annually, there are no statistics for Māori beekeepers losses (Ministry for Primary Industries, 2022). The University of Victoria (Wellington, New Zealand) conducted probably the first primary research to establish the scale and involvement of Māori within the apiculture industry in 2022 (these results have not yet been published) (Poutama, 2022).

Regardless, the Māori worldview continues to influence how Māori practice beekeeping and sets them apart from traditional Western beekeepers. The pūtake[11] in Māori beekeepers incorporate the concepts of kaitiaki of the natural environment where the beehives are placed, the welfare of the Māori beekeepers, and the welfare of the honeybees. This is demonstrated when looking at the

[11] the reason for being, usually associated with the justification for taking up a task.

movement of hives during the year. While there is little research in New Zealand that explores the migratory beekeeping practices and their impact on the transportation of beehives, it is evident that Māori beekeepers tend to use their tribal land, thus moving their hives less.

Although historically, Māori would use mostly feral colonies for their trade, this is not the case today. In an earlier pilot study at the University of Victoria, carried out in 2021, for an internet investigation on the origins of manuka honey sold on e-commerce sites, it was evident that eleven different commercial Māori beekeeping entities were selling their honey online (publication in progress).

Indigenous beekeepers and sustainability

It has been more recently recognised that indigenous knowledge has and can be used to significantly contribute to the science of pollination (IPBS, 2016). In New Zealand, this is demonstrated by the *Toitū te Whenua, Matatū ana te Wao Nui a Tāne* research project that seeks to establish a Māori place-based and culturally based toolkit to monitor the wellbeing of the forests in the Motueka catchment (Walker, 2019).

Additionally, there is an overall decline in pollinators. Due to that reason, despite the vast scientific knowledge available, indigenous knowledge is also crucial. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, IPBES, recognises the value of indigenous peoples' local knowledge as a resource that, when combined with scientific support, can enhance and bring diverse perspectives to pollination and beekeeping (IPBES, 2016). So, while there is little research within New Zealand that looks directly at how indigenous knowledge contributes to pollination understanding, greater research is being carried out on how Māori mātauranga knowledge can contribute to and address the growing concerns about biodiversity (Lambert & Mark-Shadbolt, 2021).

Most beekeepers go beyond the apiary itself and consider the surrounding environment that maintains and improves the resilience and well-being of honeybees. In the context of Māori beekeeping, combining modern beekeeping methods with their cultural knowledge of native plants and their whenua, Māori beekeepers have arguably moved towards sustainable beekeeping over other beekeepers. Māori beekeepers offer an alternative perspective to traditional notions of beekeeping by putting more emphasis on interconnectedness and caretaking principles. Moreover, honeybees appear to play a promising role in the economic and cultural well-being of the Māori in three main ways.

Firstly, Māori, like many indigenous communities, have suffered from rural-urban migration, where, during the early 1900s, Māori were forced to move to cities to find work. For Māori, their land is crucial for their cultural well-being and health. As a result, iwi[12] has been focusing on bringing urban Māori back to their tribal lands (Thom & Grimes, 2022). Despite significant land loss during colonialism and the fact that much of the land returned to Māori is considered scrubland and unsuitable for agriculture, the land is often suitable for beekeeping (Derraik, 2008). Soil with deficient nutrients is ideal for growing mānuka trees, and mānuka honey is a high-value crop. Consequently, beekeeping also allowed the iwi to bring their people back to their whenua[13] because much of the Māori-own land has great tracks of mānuka growing on it. For example, Ngāti Kuia

[12] Iwi - is a prominent tribe. It is a large group of people that have descended from one primary ancestor and can be made up of several hapū.
[13] Whenua – is land.

introduced beekeeping in 2019 to build whānau[14] skills but discovered it bought their whānau home, closer to their whenua.

Secondly, mānuka honey has also provided Māori whenua trusts and such with the opportunity to create mānuka plantations (Stowell, 2016) which embrace the principles of kaitaiki[15] and whanaungatanga[16]. Mānuka honey has also seen the growth of Māori networking groups advocating for more Māori beekeeping involvement in the apiculture industry. The Miere Coalition is one example; it works on the East Coast of New Zealand and is made up of the Poutama Trust, Te Temu Paeroa, the Federation of Māori Authorities and Ngāti Porou Holdings. Consequently, there has been an increase in the number of Māori beekeepers and commercial agribusinesses involved in the production of mānuka honey even though they remain largely invisible to the apiculture industry.

Thirdly, Māori have been able to create intergenerational employment opportunities (the Ngati Porou Miere Collective is an example of this). In the past, commercial beekeepers were driven to form partnerships with the Māori landowners to access the mānuka trees; in more recent times, this has changed. By the mid-2000s, many iwis, hapu and families had taken up beekeeping; this provided their whānau with a career pathway and gave the Māori landowners a good income stream[17].

Māori beekeepers and mātauranga practices

Some Māori beekeepers have incorporated maramataka into their beekeeping practices (Hurkmans, 2020) as they believe it will create new knowledge and generate opportunities for Māori. For example, Māori beekeepers on the east coast of New Zealand use the flowering of the cabbage tree and the rewarewa to determine the flowering of the manuka scrubs (Waka, 2022, pp. 17-18). So, while the honeybee is an exotic import into New Zealand, ngā matatini[18] Māori acknowledges that Māori beekeepers share a close connection with their honeybees – the traditional way of knowing will enhance kotahitanga[19]. A further example is when native bees hover over manuka scrub – Māori beekeepers use this as an indicator that their honeybees will be foraging on manuka flowers within ten days (Waka, 2022, p. 18).

While the native forests have visibly shrunk since the arrival of the settlers, Māori's mātauranga of the native trees/shrubs (their flowering and fruiting cycles) easily sits and compliments science (Muru-Lanning, 2022). More recent research has shown that the 1860s Māori view of the introduced honeybees is correct; their presence significantly impacts the native and indigenous species of New Zealand (Beard, 2015). Besides increasing the pollination of exotic weeds, the native birds, bats, lizards, and insects are losing the battle against honeybees for food sources. European honeybees are renowned for being both very efficient and voracious consumers of nectar and pollen; they have no 'off' button.

In 2019, more than 25,000 hives were placed on Department of Conservation land, with a review

[14] Whānau - is a family group and connected through a common ancestor. An iwi or hapū group can also be considered whānau members.
[15] Kaitaiki - kaitiakitanga means Māori are guardians or trustees of the natural environment or a natural resource.
[16] Whanaungatanga – is the sense of family connection. It is created by sharing experiences and working together.
[17] Stowell, L. (2016, Feb 19). Manuka a growth industry. *Whanganui Chronicle*. Retrieved from https://www.nzherald.co.nz/wanganui-chronicle/news/article.cfm?c_id=1503426&objectid=11592110
[18] Ngā matatini - acknowledges that Māori live in a diverse world, and as such, there are many ways in which Māori can express themselves in relation to business and from their worldview.
[19] Kotahitanga - means unify Māori (can be on non-tribal grounds) but for the benefit of Māori).

identifying that conservation land could possibly hold more than 500,000 hives. However, because recent research has found that the honeybee is a threat to native species, there are much-reduced hive numbers in conservation parks (about a third of conservation land in New Zealand now excludes hives), (Hancock, 2019).

It is acknowledged here that nurturing mātauranga Māori is not without challenges because taking land from Māori for colonial farming practices also took away their role as custodians of the land and therefore kaitiaki (Pomare et al., 2023). Yet Māori beekeepers are valuable because they can bring a richness of knowledge to the apiculture industry.

From this perspective, Māori hold a critical role in ensuring the sustainable development of New Zealand's land, ecosystems, and biodiversity (Erueti et al., 2023). However, while New Zealand's government is mandating greater inclusion of Māori and their cultural knowledge of New Zealand's ecosystems, balancing Māori and non-Māori priorities has been challenging.

The lack of partnership with Māori beekeepers

Māori beekeepers bring rich cultural and local knowledge to their beekeeping; however, this is rarely acknowledged. While it is accepted that beekeeping is one of the most widespread agricultural activities practised worldwide, the following sections offer examples of how contributions by Māori beekeepers are excluded by the apiculture industry.

Mānuka and its relationship to Māori beekeepers

The Treaty of Waitangi has mandated that Māori be consulted as part of the recognised principles of protection and partnership. Consequently, the requirement to consult has become a statutory requirement in most cases, and thus, the New Zealand government has integrated Māori values into New Zealand's legislation such as the Resource Management Act 1991, and environmental conservation plans such as the New Zealand Biodiversity Strategy 2000. Moreover, in non-statutory situations, many government agencies are actively including Māori worldviews in their work, especially agencies such as the Department of Conservation and the New Zealand Conservation Authority (New Zealand Conservation Authority, 2023).

However, while there have been significant changes in New Zealand's apiculture industry, it is argued here that there has been little to no consultation with Māori prior to the changes. This can be demonstrated using the case study of mānuka and mānuka honey. Mānuka has been a contentious issue for Māori over many years, and not just because of its commercial value.

Mānuka, an indigenous plant of New Zealand, is a subspecies of Leptospermum scoparium. More commonly known as tea tree, it is found in Australia (82 varieties), Malaya and New Caledonia (Salmon, 1998). However, none of the varieties found outside New Zealand could or should be classified as mānuka because of the cultural link of New Zealand's mānuka to Māori. Mānuka is an integral part of traditional Māori healing practices known as Rongoā Māori and its medicinal properties were well documented by Captain Cook's crew when the local Māori tribe (Ngāti Hei) treated the crew for scurvy, diarrhoea and colds (Harvey, n.d.). The medicinal properties of mānuka were well established in Māori culture long before Dr Molan's research of mānuka wound dressings in the mid-1990s (New Zealand Marine Studies Centre, n.d.). Moreover, mānuka is taonga valued by Māori as a spiritual cleanser in traditional Māori ceremonies, the wood has been used for building purposes (for example in the building of waka) but also mānuka has cosmetic purposes as well.

Moreover, mānuka is considered one of the named protected taonga in Treaty Settlement legislation for many iwi (for example it is named in Te Rūnanga o Nagi Tahu settlement documents (Te Runanga o Toa Rangatira & Settlements, 2012).

For beekeepers in general, mānuka honey has been seen as a financial windfall for what is otherwise a labour-intensive and time-consuming occupation. Dr Molan discovered that mānuka honey contains unique and high concentrations of methylglyoxal (MGO), which possess antimicrobial, anti-inflammatory, and wound-healing properties (Schmidt et al., 2021). As a result, mānuka honey is significantly more expensive to purchase than other honeys and plays an important role in New Zealand's honey export market. It is estimated that by 2027, the annual mānuka honey trade will be worth more than $1.2bn annually (Or, 2023). Yet mānuka remains contentious for Māori and this is demonstrated in the two following issues.

The first issue is the definition of mānuka honey, which was made a legal standard in 2018 by the MPI. MPI carried out a 3-year scientific study to authenticate mānuka honey (Ministry for Primary Industries, 2018). In this instance, science was the only knowledge tool and dominated any discussions about the legal definition. Although the legal definition did not have the wholesale support of the apiculture industry (Ryan, 2018) because the definition impacted all New Zealand beekeepers, Māori beekeepers were arguably the beekeepers most impacted by MPI's definition (Harrison, 2019). Māori beekeepers in the north of New Zealand found that their honey failed to meet the scientific requirements of the legal definition even though their honeybees fed on nothing but mānuka honey flowers. Furthermore, at no time were Māori or Māori beekeepers directly consulted about the definition.

The impact on the Māori beekeepers was immediate. Prior to the legal definition of mānuka honey, beekeeping was lifting Māori out of poverty. After the legal definition was enforced, the Māori beekeepers faced a significant loss of profits, job losses and significant difficulties (Harrison, 2019) as they found that at least 50% of their honey harvest failed to meet the legal definition (Williams, 2019). Moreover, when the Māori beekeepers demanded a review of the legal definition, the scientific definition remained the dominant knowledge system, and the views of the Māori beekeepers were afforded a lesser status (Durie, 2004). If anything, scientific knowledge was used to reduce the standing of the Māori beekeepers, and MPI missed the opportunity to create new knowledge that reflects both the science and the inclusion of Māori mātauranga.

Secondly is the ongoing debate on whether the word *mānuka* is a Māori word and should be protected by intellectual property law mechanisms. Numerous court cases across many jurisdictions have attempted to protect the word *mānuka* from being used by others outside New Zealand with limited or no success. However, these cases have been largely driven by large players in New Zealand's apiculture industry like the Manuka Honey Appellation Society[20]. Only one Māori iwi has attempted to wade into the intellectual property cases – Ngāi Tahu. These cases have done no more than establish that current intellectual property laws cannot protect indigenous rights such as Māori's rights to kaitiaki mānuka.

The commercialisation and appropriation of the plant by apiculture players inside and outside of New Zealand have overshadowed mānuka's connection to Māori. The court in this case ruled that manuka (without the macron over the 'a') was a descriptive term of honey rather than an authentic honey that is produced in New Zealand. Therefore, apart from imposing a legal definition of mānuka

[20] *Manuka Honey Appellation Society Inc. v Australian Manuka Honey Association Ltd* [2023] NZIPOM

honey that discriminates against Māori beekeepers, the New Zealand government's failure in protecting the term mānuka from being used by outsiders has been another blow to Māori and Māori beekeepers. In many ways, the case study of mānuka honey has shown that the voice of Māori is not being properly considered. Nonetheless, Māori have been actively trying to protect their rights to kaitiaki their taonga mānuka.The Mānuka Charitable Trust, established in 2020, is taking a collaborative approach to protect mānuka across New Zealand by uniting Māori and manuka honey producers (so not specifically Māori beekeepers). However, even the Trust has admitted that legal intellectual property protections are no longer possible under the current law and only the New Zealand government can address the issues (Scoop Independent News, 2023).

Climate change and beekeeping

New Zealand's climate is often described as mostly temperate, and thus ideal for beekeeping. More recently New Zealand has faced extreme weather events and in 2023, there was record flooding in the Hauraki, Auckland region (January 2023) and cyclone Gabrielle (February 2023). Consequently, New Zealand had one of its poorest honey production seasons since 2012 (Staff Reporters, 2023). The impact of the weather events on beekeepers across New Zealand was immediate, resulting in the loss of thousands of beehives. The North Island was hit the hardest, with the number of hives dropping by over 116,000 from 2022 to 2023 (Ministry for Primary Industries, 2023). In the Tai Rāwiti region, where many of the beekeepers are Māori, it is estimated that 5000 beehives were lost in that region alone (Radio New Zealand, 2023). Climate change poses a significant threat to beekeeping and beekeepers globally due to dwindling biodiversity and shifting weather patterns (Neumann & Straub, 2023).

Climate has always been significant for Māori, and as a result, they possess extensive knowledge about their local weather and climate; knowledge that has been collected across many generations and many seasons (NIWA, n.d.). Māori are renowned for recording historical weather events in place names (and their meaning) so that clues are left about the hydrology and climate of local regions (King et al., 2008). In addition, current research shows that there is a convergence between traditional science and Māori historical environment knowledge of their local weather and climate (King & Skipper, 2006). Māori have traditionally used environmental indicators to predict weather and to forecast the optimum days to carry out certain activities. For example, the behaviour of different native birds were associated with rain (karearea), storms (kākā) and the arrival of spring (pīpīwharauroa).

So, while traditional science should not be displaced, it can, together with Māori mātauranga, create greater opportunities for beekeepers to face the challenges of climate change. It is from this perspective, Māori have sought to partner with others outside the apiculture industry to explore, enhance and generate new understandings of weather and climate that embraces mātauranga Māori with traditional science (NIWA, n.d.)

The following are examples of these partnerships.

The first is between Landcare Research, Plant and Food Research and the University of Waikato who have partnered with Māori landowners in a 5-year project to learn about New Zealand's native honey landscape (Landcare Research, 2021). Focusing specifically on Māori-owned land, the researchers and Māori aimed to increase honey production and protect honeybees and other native plant species like mānuka.

Another partnership is at the University of Auckland, where researchers, together with an iwi delegation from Ngāti Porou, are investigating the honeybee's circadian rhythm (with the view that any changes may be able to detect a worsening health of the colony). Māori beekeepers from the east coast of New Zealand participate in the research by sharing their experiences and their local mātauranga (Yeats, 2023).

Another example is where Māori beekeepers and their iwi are investigating whether other native honeys, such as kanuka and rātā honey (these also have medicinal properties), can be commercially produced and commercialised (Zucchetta et al., 2022). Māori iwi and Māori beekeepers want to be able to diversify their beekeeping, which will secure a sustainable future in alignment with their worldview and tikanga values.

Māori have been keen to share their experience of beekeeping with their whānau of the Pacific. Delegations from the Pacific islands, such as Easter Island, have come to New Zealand to forge closer ties with Māori and Māori beekeepers specifically (Te Karere, 2018).

Hive numbers and honey prices

Beekeeping has not been without issues for beekeepers, including Māori beekeepers. Beekeeping has placed much pressure on land and Māori landowners because of significant growth in hive numbers. New Zealand is considered to have more hives per capita than any other country in the world (Dean, 2021; Newstrom-Lloyd, 2016) and hive numbers were at their peak in 2019 with more than 918,000 beehives (Ministry for Primary Industries, 2023). The value of mānuka honey led to a 'gold rush' mentality in New Zealand, which drove the hive numbers up and enticed people into beekeeping – beekeeper numbers peaking in 2020 (Ministry for Primary Industries, 2023). The price of manuka honey skyrocketed from $20 per kilo to over $200 per kilo for top grade honey, resulting in intense competition for mānuka sites and a mānuka crime wave of vandalism, hive thefts, and poisonings (Ainge Roy, 2016; Wright, 2018).

As a result of the increased hive density and proximity, there is a greater risk of increased spread of honeybee diseases and the likelihood of honeybees suffering from malnutrition and stressors that make them susceptible to disease (such as American Foul Brood, for example) (Newstrom-Lloyd, 2016). Moreover, the arrival of the exotic varroa mite (Varroa destructor) pest has spread throughout New Zealand in both the domesticated and feral hives. One of the most problematic honeybee pests, varroa mite has become one of the main causes of hive losses in New Zealand as hive numbers have soared (Stahlmann-Brown et al., 2022). The costs of controlling for varroa mite are evident and impact on the profits of beekeepers generally, not just Māori beekeepers. However, for Māori and Māori beekeepers, the worry is that while current research does not support varroa mite infestations spilling over into native pollinator populations, there is concern that the viruses spread by the mite can (Paynter, 2022).

In addition, more recently, honey prices have bottomed out, and mānuka honey no longer sustains the high prices it achieved during the pre-Covid and Covid times. This has seen the demand for mānuka honey drop by an estimated 11% (Apiculture New Zealand, 2023) but also seen some of the iwis adapt to the economic pressures the beekeeping industry faces. For example, Ngāi Tahu's Oha Honey has formed a partnership with The Mānuka Collective to minimise its losses and manage increasing costs (Srinivasa, 2023). Despite challenges, beekeeping remains a crucial component of New Zealand's economy, generating over $379 million in honey exports in 2023 (Ministry for Primary Industries, 2023).

Conclusion

This article shows that Māori beekeepers remain significantly invisible and underrepresented by the traditional apiculture historical narratives. Despite this, Māori beekeepers have always been part of New Zealand's apiculture industry since the introduction of the European honeybee. The importance of Māori beekeeper contributions, while more recently recognised by researchers and research institutions, has gone largely unrecognised by the mainstream apiculture industry. Furthermore, there is a strong argument for integrating the two world views (of traditional science and Māori mātauranga) at both an ethical and policy level so that neither participant is compromised.

This article also uncovered parallels with the struggles of beekeeping between mainstream beekeepers and Māori beekeepers; however, there are also clear differences in the purpose and context of beekeeping. Māori iwi view beekeeping as a way to reconnect with their ancestral lands and create intergenerational employment while also practising Tikanga. Thus, reframing apiculture narratives to include Māori beekeeper perspectives expands and moves our understanding beyond New Zealand's traditional apiculture narratives.

Finally, this article establishes that further research into Māori beekeepers and their practices is needed. This area could provide insights into New Zealand's apiculture industry from a Māori perspective, where there are currently gaps in the literature.

Bibliography

Ainge Roy, E. (2016, November 04). Honey wars: Crime and killings in New Zealand's booming manuka industry. *The Guardian*. https://www.theguardian.com/world/2016/nov/04/manuka-honey-wars-new-zealand-crime-booming-industry-poisoning-beatings

Apiculture New Zealand. (2023). *About us*. Apiculture New Zealand. Retrieved 24 August from https://apinz.org.nz/about/

Asher, G., & Naulls, D. (1987). *Māori Land*. New Zealand Planning Council.

Bay of Plenty Times. (1889, May 16). Poisonous (?) honey. *Bay of Plenty Times*, *XVB1*(2416), 3.

Beard, C. (2015). *Honeybees (Apis mellifera) on public conservation lands: A risk analysis.* Wellington New Zealand: New Zealand Government. https://www.doc.govt.nz/globalassets/documents/science-and-technical/honeybees-on-public-conservation-lands.pdf

Cotton, W. C. (1842). *My bee book*. Rivington.

Cotton, W. C. (1846). *Journal of a residence at St John's College* (Vol. 11).

Cotton, W. C. (1848). *A manual for New Zealand beekeepers*. R Stokes.

Dean, S. (2021). Does New Zealand have too many hives and not enough bee food? *NZ Lifestyle Block Magazine*. https://thisnzlife.co.nz/sheryn-clothier-has-new-zealand-got-too-many-hives-and-not-enough-bee-food/

Derraik, J. (2008). New Zealand manuka (Leptospermum scoparium : Myrtaceae): A brief account of its natural history and human perceptions. *New Zealand Garden Journal*, *11*(2), 4-8.

Donovan, B. J. (1980). Interactions between native and introduced bees in New Zealand. *Journal of Ecology*, *3*, 104-116.

Durie, M. (2004). *Exploring the interface between science and indigenous knowledge.* 5th APEC Research and Development Forum, Christchurch New Zealand. https://www.massey.ac.nz/documents/486/M_Durie_Exploring_the_interface_Between_Science_and_Indigenous_knowledge.pdf

Erueti, B., Tassell-Matamua, N., Pomare, P., Masters-Awatere, B., Dell, K., Rangi, M. T., & Lindsay, N. (2023). 'Purakau o te Ngahere': Indigenous Maori interpretations, expressions and connection to taonga species and biosecurity issues. *Knowledge Cultures*, *11*(1), 34. https://doi.org/10.22381/kclll20233

Evening Post. (1900, March 27). Another case of honey poisoning. *Evening Post*, *LIX* (73), 2.

Hancock, F. (2019, March 10). Are honey bees good for our native species? *Newsroom*. https://newsroom.co.nz/2019/03/10/the-table-manners-of-honey-bees/

Harrison, R. (2019). What is manuka honey? Maori beekeepers 'could have been making half a million'. *Te Ao Maori News*. https://www.teaonews.co.nz/2019/03/28/what-is-manuka-honey-maori-beekeepers-could-have-been-making-half-a-million/

Harvey, D. (n.d.). Mānuka Tree – History of the mānuka tree. *Quarter Acre Paradise Gardens*. Manuka Tree - History of the Manuka Tree (daleharvey.com)

Hurkmans, M. (2020, 8 May). Abuzz about maramataka for bee-keeping. *Te Ao Maori News*.

IPBES. (2016). *Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production.* Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. https://files.ipbes.net/ipbes-web-prod-public-files/spm_deliverable_3a_pollination_20170222.pdf

James, M. (2022, Aug 02). Don’t believe everything you hear: The arrival of the European honey bee to NZ. *Apiarists Advocate*. https://www.apiaristsadvocate.com/post/don-t-believe-everything-you-hear-the-arrival-of-the-european-honey-bee-to-nz

Kennedy, A. (1873). *New Zealand*. Longmans, Green & Co.

King, D., Goff, J., & Skipper, A. (2008). Facing natural hazards with Maori environmental knowledge. *Water & Atmosphere*, *16*(2), 24-25.

King, D., & Skipper, A. (June 2006). Understanding local weather and climate outcomes using Maori environmental indicators. *Water & Atmosphere*, *14*(2).https://niwa.co.nz/water-atmosphere/vol14-no2-june-2006/understanding-local-weater-and-climate-using-maori-environmental-knowledge

Lambert, S., & Mark-Shadbolt, M. (2021). Indigenous knowledges of forest and biodiversity management: How the watchfulness of Māori complements and contributes to disaster risk reduction. *AlterNative: An International Journal of Indigenous Peoples*, *17*(3), 368-377. https://doi.org/10.1177/11771801211038760

Landcare Research. (2021). *The honey landscape model (October 2016 - September 2021)*. Wellington New Zealand: New Zealand Government. https://www.landcareresearch.co.nz/discover-our-research/biodiversity-biosecurity/ecosystem-resilience/species-and-ecosystem-conservation/honey-landscape/

Ministry for Primary Industries. (2018, June). *Manuka honey science definition standard*. Wellington, New Zealand. Retrieved from https://www.mpi.govt.nz/dmsdocument/17374/direct

Ministry for Primary Industries. (2021). *Report on the 2021 New Zealand colony loss survey*. Wellington New Zealand: Ministry for Primary Industries. https://www.mpi.govt.nz/dmsdocument/50221-Report-on-the-2021-New-Zealand-Colony-Loss-Survey

Ministry for Primary Industries. (2022). *Report on the 2022 New Zealand colony loss survey*. Wellington New Zealand: Ministry for Primary Industries. https://www.mpi.govt.nz/dmsdocument/56146-Report-on-the-2022-New-Zealand-Colony-Loss-

Survey#:~:text=This%20loss%20rate%20implies%20that,the%20profit%20margin%20of%20beekeepers.

Ministry for Primary Industries. (2023). *MPI Apiculture Monitoring 2023*. Wellington New Zealand: Ministry for Primary Industries. https://www.mpi.govt.nz/dmsdocument/60523-2023-Apiculture-monitoring-data/sitemap

Mithen, R. (2021, June 2). Professor Richard Mithen: Some thoughts about honey and honey bees. *National Science Challenges*. https://www.highvaluenutrition.co.nz/2021/06/02/professor-richard-mithen-some-thoughts-about-honey-and-honey-bees/

Morris, B. (2021, Mar-Apr). The birds and the bees. *New Zealand Geographic*, (168). Author: issue, page no. Retrieved from https://www.nzgeo.com/stories/the-birds-and-the-bees/

Muru-Lanning, C. (2022, June 1). The place for mātauranga Māori is alongside science. *The Spinoff*. Retrieved from https://thespinoff.co.nz/atea/01-06-2022/the-place-for-matauranga-maori-is-alongside-science

Native Forest Restoration Trust. (2024). *The facts*. Native Forest Restoration Trust. https://www.nfrt.org.nz/the-facts/

New Zealand Conservation Authority. (2023). *Maori customary use of native birds, plants and other traditional materials (Report and discussion paper)*. Wellington New Zealand: New Zealand Government. Retrieved from https://www.doc.govt.nz/Documents/getting-involved/nz-conservation-authority-and-boards/nz-conservation-authority/maori-customary.PDF

New Zealand Herald. (1874, 8 October). A Māori opinion on the trees and the stars. *New Zealand Herald*, 3.

New Zealand Marine Studies Centre, (n.d.). *New Zealand native plant use.* University of Otago. Retrieved from https://www.otago.ac.nz/__data/assets/pdf_file/0024/295611/new-zealand-native-plant-use-062823.pdf

New Zealander. (1847). Bees. *New Zealander*.

Newstrom-Lloyd, L. E. (2016). Bees without borders: What is the limit?. *The New Zealand Beekeeper Journal*, *24*(9), 22-27.

NIWA. (n.d.). *Climate and Māori society* Retrieved from https://niwa.co.nz/te-kuwaha-and-maori/climate-and-maori-society#main-content

Neumann, P., & Straub, L. (2023). *Beekeeping under climate change.* Journal of Apiculture Research, 62(5), 963-968.

Oamaru Mail. (1892, September 8). Items. *Oamaru Mail, XVII*, (5374), 3. Retrieved from Papers Past. Papers Past (natlib.govt.nz)

Ogden, S. C. (1988). *Contribution of honeybees to white clover pollination in hill and high country grasslands under development in Otago.* University of Otago, Otago New Zealand.

Or, M. (2023, May 23). IPONZ ends manuka honey trade mark battle. *Australasian Lawyer*. IPONZ ends manuka honey trade mark battle | Australasian Lawyer (thelawyermag.com)

Parker, H. E. (2022). *Honey and humble: Bee introductions, environment, and ideology in Aotearoa, New Zealand, 1839-1900.* University of Waikato. Hamilton New Zealand.

Paynter, H. (2022). *Expert commentary: Varroa mite*. CSIRO. https://www.csiro.au/en/news/all/articles/2022/july/expert-commentary-varroa-mite

Petre, H. W. (1971). *The account of the settlements of the New Zealand Company. Reprint of the fifth edition 1842*. Capper Press.

Pomare, P., Tassell-Matamua, N., Lindsay, N., Masters-Awatere, B., Dell, K., Erueti, B., & Te Rangi, M. (2023). Te Mauri o te Kauri me te Ngahere: Indigenous knowledge, te Taiao (the environment) and wellbeing. *Knowledge cultures*, *11*(1), 55-83. https://doi.org/10.22381/kc11120234

Poutama Trust. (2022, May 10). *The Māori Beekeeping Survey / He Uiuinga mō te Mahi Tiaki Pī*. Poutama. https://poutama.co.nz/the-maori-beekeeping-survey-he-uiuinga-mo-te-mahi-tiaki-pi/

Radio New Zealand. (2023, March 20). *Cyclone takes out thousands of beehives, fears for bee health*. Radio New Zealand. https://www.rnz.co.nz/news/country/486376/cyclone-takes-out-thousands-of-beehives-fears-for-bee-health

Ryan, K. (2018, January 30). *Beekeepers welcome MPI U-turn on Manuka honey.* Radio New Zealand. *Beekeepers welcome MPI U-turn on Manuka honey | RNZ*

Salmon, J. T. (1998). *Native trees of New Zealand*. Reed.

Schmidt, C., Eichelberger, K., & Rohm, H. (2021). New Zealand mānuka honey - A review on specific properties and possibilities to distinguish mānuka from kānuka honey. *LWT*, *136*, 110311. https://doi.org/https://doi.org/10.1016/j.lwt.2020.110311

Scoop Independent News. (May 22 2023). *Manuka Charitable Trust disappointed by Intellectual Property Office ruling on honey.* Scoop Independent News. Retrieved from https://www.scoop.co.nz/stories/BU2305/S00340/manuka-charitable-trust-disappointed-by-intellectual-property-office-ruling-on-honey.htm

Srinivasa, Y. (2023, October 9). Timaru-based honey producer acquires part of Ngāi Tahu's Oha Honey. *Stuff Ltd.* https://www.stuff.co.nz/timaru-herald/133083061/timarubased-honey-producer-acquires-part-of-ngi-tahus-oha-honey

Staff Reporters. (2023, January 5). Wet weather killed 2023 honey production. *Rural News.* https://www.ruralnewsgroup.co.nz/rural-news/rural-general-news/wet-weather-killed-2023-honey-production

Stahlmann-Brown, P., Hall, R. J., Pragert, H., & Robertson, T. (2022). Varroa appears to drive persistent increases in New Zealand colony losses. *Insects*, *13*(7).

Stowell, L. (2016, February 19). Manuka a growth industry. *Whanganui Chronicle.* https://www.nzherald.co.nz/whanganui-chronicle/news/manuka-a-growth-industry/CJBE7YO2I3ZA23WIE2PESVC4FY/?c_id=1503426&objectid=11592110

Te Karere TVNZ. (2018, April 19). Rapa Nui delegation head to the East Coast to learn more about manuka honey. *Maori Television*. Retrieved from https://www.youtube.com/watch?v=ahNTG9BBT3A

Te Runanga o Toa Rangatira, & Settlements., T. O. o. t. T. (2012). *Ngati Toa Settlement Summary.* http://nz01.terabyte.co.nz/ots/fb.asp?url=livearticle.asp?ArtID=-670688307

Thom, R. R. M., & Grimes, A. (2022). Land loss and the intergenerational transmission of wellbeing: The experience of iwi in Aotearoa New Zealand. *Social Science & Medicine*, *296*, 114804. https://doi.org/https://doi.org/10.1016/j.socscimed.2022.114804

Tipa, R. (2012, January 10). Aitaka a Tane the Tutu paradox. *Te Karaka*. https://ngaitahu.iwi.nz/opportunities-and-resources/publications/te-karaka/he-aitaka-a-tane-the-tutu-paradox/

Waka, P. (2022). *Maramataka: Traditional Māori environmental insights contributing to contemporary beekeeping*. Plant And Food Research Report.

Walker, D. P. (2019). *Toitū te whenua, Matatū ana te Wao Nui a Tāne: A cultural health monitoring and assessment technique for New Zealand indigenous forests.* Lincoln University, Lincoln New Zealand.

Williams, L. (2019, March 30). *'Devastated' Northland mānuka honey producers seek chemical markers definition review from MPI.* Radio New Zealand. https://www.rnz.co.nz/news/national/385953/devastated-northland-manuka-honey-producers-seek-chemical-markers-definition-review-from-mpi

Wright, J. (2018 November 26). Honey not a gold rush for all. *Rural News*. https://ruralnewsgroup.co.nz/rural-news/rural-opinion/honey-not-a-gold-rush-for-all

Yeates, J. (2023). *Research project spies on honey bees, for their health*. University of Auckland. https://www.auckland.ac.nz/en/news/2023/08/01/researchers-improving-lives-of-honey-bees.html

Zucchetta, C., Tangohau, W., McCallion, A., Hardy D. J., & McCormick, A. (2022). Exploring the chemical properties and biological activity of four New Zealand monofloral honeys to support the Māori vision and aspirations. *Molecules*, *27*(10), 3282.