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A HISTORY OF HONEY BEES IN THE HAWAIIAN ISLANDS

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ABSTRACT

The first successful honey bee hives to the islands arrived on O'ahu in 1857. Though honey bees slowly established themselves over the next few decades, few took interest in them. Only at the turn of the century when entrepreneurs saw a potential fortune in honey production, did growth ensue. Soon, lucrative honey ventures appeared on all major islands. Over the years, beekeeping in Hawai'i has had its share of booms and busts. This paper covers the establishment and history of beekeeping in Hawai'i with special emphasis on the growth of the industry on the island of Hawai'i.

KEYWORDS: *Honey bees, Hawaiian Islands, pollen, wax, hives*

INTRODUCTION

For centuries, humans have exploited honey bee colonies, by raiding feral hives for honey and wax. Over time, man learned how to keep bees in established, managed hives to periodically harvest bee products. Though much of bee biology, communication, and behavior is now understood, much more remains a mystery. However, honeybees are recognized and appreciated as the single most important and efficient insect pollinators of food plants on earth. The State of Hawai'i, and in particular the Island of Hawai'i, are rich in commercially important ornamental and food plants that require insect pollination. The fact that honey bee hives are easily managed and mobile allows beekeepers to artificially and quickly increase the numbers of bees in an area with flowers in bloom to maximize pollination and production of bee products (Figure 1).

Honey is the principal bee product, and comes in "extracted form," where it has been removed from the comb, strained, and packed into containers. Another popular honey product, "comb honey," is sectioned without being removed from the wax comb.

Bees contribute other useful products too. Pollen is collected by worker bees to feed developing young. Since most hives collect far more pollen than is consumed, beekeepers fasten pollen traps to hive entrances to capture excess pollen. Excess pollen is consumed as a food supplement, and used in body moisturizers, shampoos, and conditioners.

Royal jelly is a secretion of the hypopharyngeal glands of worker bees and used to feed developing young. During the first three days of development, all bee larvae are fed royal jelly. After three days, drone and worker larvae are fed a mixture of honey and pollen known as "bee bread." Queen larvae are fed royal jelly during their entire larval development. Since only small quantities can be removed and the extraction process tedious, royal jelly products are very expensive. Presently, no commercial collecting and marketing of royal jelly occurs in Hawai'i.

Beeswax is an important by-product, and used in candles, batik art designs, cosmetic products, and as a bonding agent in musical instruments (wax holds accordion and concertina reeds in place). Twelve to

eighteen day-old worker bees secrete wax from special wax glands on their undersides after consuming large quantities of honey. Bees massage the oval wax scales until malleable enough to be used in cell construction or to cap cells containing honey. Though modern science has developed a number of substances to meet the wax needs of today's world, many craftsmen still prefer the uniqueness of beeswax, since it is a mixture of substances that cannot be duplicated artificially. Its value as a commodity has been treasured by most world cultures, and has always commanded a high price.

Wax was not unknown to Hawaiians. Prior to the arrive of honey bees in Hawai'i, Captain John Kendrick of the American brig Lady Washington reported that "80 pounds weight of very fine beeswax had drifted onto the shores" of O'ahu during his visit in 1794 (McClellan 1940). Mr. Kendrick also noted that beeswax "had also been procured from the natives of the other islands" but it is not known how this wax was acquired.

Propolis, a commodity lesser-known to many, is a mixture of plant resins and gums collected by workers to insulate the hive by sealing cracks and crevices. Propolis is collected using special equipment, or by scraping the propolis from the covers and edges of hives during inspections. Propolis is used in a variety of processed products including tinctures, toothpaste, and chewing gum. Given the multitude of products extracted from hives and the efficient, thorough job of plant pollination conducted by honey bees year-round in Hawai'i, it is no small wonder that the honey bee is an important resource to Hawai'i.

The arrival of Honey bees to Hawai'i

At the first meeting of the Royal Hawaiian Agricultural Society in August 1851 on the island of O'ahu, a committee was appointed to bring the first honey bees into Hawai'i. Henry A. Pierce, partner of Charles Brewer, shipped a "fine hive" from Boston to Honolulu in 1852 on the good ship *R. B. Forbes* (Krauss 1978). Unfortunately, as the ship passed through the tropics on its way to Cape Horn, the increase in temperature melted the honeycomb and killed the honey bees. Another colony was ordered from New Zealand at about the same time, but was never shipped due to an apparent misunderstanding (McClellan 1940). A second attempt to ship bees from the U.S. Mainland was made in 1853, again from Boston. Two hives, one packed in ice, were shipped to O'ahu. The hives arrived in poor condition, and were later auctioned to C. R. Bishop, husband of Bernice Pauahi Bishop, for thirteen dollars (Krauss 1978). The bees survived for a short time, then died out. The society then made a public offer of ten dollars to "the person who shall introduce the first honey bee into the islands."

On 21 October 1857, three hives of German dark bees *Apis mellifera mellifera* were shipped to Honolulu by William Buck of San Jose, California (Eckert 1951, Krauss 1978) on the American bark *Fanny Major* (Spoehr 1992). The trip took eighteen days and the colonies survived the journey in good condition. They were purchased by the Society for one hundred dollars each. The hives were placed under the care of Dr. William Hillebrand in Nu'uanu Valley. There they thrived, and successfully established themselves such that by the following year, the three original hives had increased to nine colonies by swarming (Nieman 1942). Other species of honey bees were soon brought to the Islands. Italian bees *Apis mellifera liguistica* were purchased in Los Angeles, shipped to San Francisco, and then brought to the Islands on the steamer *Lehua* in 1880 by Sam G. Wilder (Chamber of Commerce, 1941).

The rise of the Hawaiian Beekeeping Industry

Following the successful introduction of honey bees in 1857, healthy colonies hived off the nine in Nu'uanu Valley and established feral colonies in the wild of Hawai'i's forests, then abundant with diverse flora. Before the rapid growth of the industry at the beginning of the twentieth century, Hawaiian honey bees existed solely in feral colonies or those few hives maintained by hobbyists.

In the late 1890's, interest in beekeeping rose dramatically for two reasons. U.S. Mainland entrepreneurs saw fortunes in ranching, and subsequently introduced large numbers of cattle to the Islands. Feed for cattle was needed to sustain large populations, so the industry began wide scale cultivation of

algoroba, *Prosopis pallida,* also known as mesquite and known locally as kiawe. A native tree of Italy, this species was introduced to Hawai'i in 1828 by Father Alexis Bachelot, head of the first Catholic Mission to Hawai'i (Greene 1941). Kiawe grows well in dry hot climates, yields nutritious beans for feeding cattle, shade for roaming herds, sturdy wood for fence posts, and an even and slow burn as charcoal. To increase kiawe bean yield, honey bee hives were established near ranching operations to promote pollination. In addition, it was found that kiawe nectar produced a very good light honey, so commercial honey production followed. Kiawe blooms from March until September, and a single kiawe tree with a thirty-foot spread has the potential to produce over two and half pounds of honey yearly (Nieman 1942). Kiawe forests rapidly expanded, and by 1935 one hundred thousand acres on Maui and even larger areas of the island of Hawai'i were covered with the trees, becoming Hawai'i's foremost nectar source (Nieman 1942).

Sugarcane cultivation and the accidental introduction the sugarcane leafhopper *Perkinsiella saccharicida* Kirkaldy also stimulated the growth of the beekeeping industry. Leafhoppers feed on sugarcane and produce a sweet excretory product called honeydew. Bees in areas where sugarcane was cultivated found honeydew irresistible as a substitute nectar source. Though bees preferred nectar from flowers in bloom, they often turned to collecting honeydew when flowers were unavailable. The abundance of leafhoppers stimulated nectar collecting and produced greater honey yields. Colonies grew rapidly and hived off into new colonies.

The abundance of the sugarcane leafhopper prompted the Hawaii Experiment Station to take a more active interest in bee culture beginning in 1905. Station employees were instrumental in bringing new and improved strains of queens and worker bees to Hawai'i. Efforts were also made to increase the number and range of nectar and pollen sources.

Other nectar sources

During the time of the industry's rapid growth, Hawai'i's predominant nectar source was kiawe, though many other nectar sources were available to island bees, including 'ilima *Sida fallax*, lantana *Lantana camara*, guava *Psidium guajava*, koa *Acacia koa*, 'ohi'a lehua *Metrosideros polymorpha*, ha'uoi or 'oi *Verbena bonariensis*, pili *Heteropogon contortus*, ti-leaf *Cordyline terminalis*, California pepper *Schinus molle*, Christmas berry *Schinus terebinthifolius*, pineapple *Ananas comosus*, coconut *Cocos nucifera*, and other plants. However, the amount of nectar extracted from kiawe blossoms surpassed all other plants.

Large-scale planting of *Macadamia integrifolia* on the Big Island was an added stimulant to the industry. The first macadamia trees arrived on O'ahu from Queensland, Australia in 1892 (Crawford 1937). The flowers were an excellent source of nectar, and pollen for expanding colonies. Urata (1954) observed that honey bees were "the most abundant and industrious of all the insects that work the flowers of macadamia" and the "most efficient dispersers of pollen clumps, and are therefore the most efficient pollen vectors." Gary et. al. (1972) further speculated that a greater vigilance in managing colonies could tremendously aid macadamia growers produce greater crop yields.

Hawaiian honeys are known for their excellent quality. According to the National Food Law, honeys are to be "levorotatory," meaning that their chemical solution is one that rotates a plane of polarized light counterclockwise. Further, such honeys should not contain more than twenty-five percent ash, twenty-five percent water, and not more than eight percent sucrose (Chamber of Commerce 1941). Hawaiian floral types classed under this system are indeed levorotatory honeys, meaning that they are considered "real honey."

Quarantines

The Territorial Government operated an apiary in which queens of different races, such as Italians, Carnolians *Apis mellifera carnica*, and Caucasians *Apis mellifera caucasica*, were imported and subsequently introduced to nuclei hives containing worker bees removed from existing "queenright" hives. Queen bees of any race are then quickly accepted by queenless worker bees. As a precautionary measure to protect island bees from possible contamination, import cages and attendant bees shipped with queens were destroyed after

the queens were extracted. The Territory instituted a ban on the importing of packaged bees beginning on 17 September 1908. As of 1 December 1909, no serious bee diseases of any kind had been reported. The presence of bacillary diseases in California and elsewhere "makes the quarantining of bees and honey entering the Islands a necessary measure for the protection of the industry" (Fullaway 1909). The ban remains in effect today.

Honey as a Hawaiian commodity

The first export of honey from Hawai'i to the U.S. Mainland occurred in 1894 with a shipment of eight gallons (Nieman 1942). By 1897, 109,000 pounds were shipped. Oddly, most honey exports were not to U.S. Mainland markets, but to markets in the United Kingdom and Germany (Crawford 1937, Philipp 1953). One contemporary account of honey production noted:

"In February last [1908] an experimental shipment of one thousand cans of honey went to Japan, and in August one hundred tons of island honey, largely the product of the American Sugar Company apiaries, on Molokai, was shipped to San Francisco by F.L. Waldron, the principal part of which was destined for the London market. The shipments were put up in five-gallon tins, two to a case" (Spoehr 1992).

From 1905 to 1916, average honey shipments amounted to forty thousand dollars annually, increasing sharply to a figure of $356,536 in 1918. Though the honey bee disease American Foulbrood and the eradication of the sugarcane leafhopper later took their toll on honey production, average honey shipments from 1918 to 1941 totaled some 1,315,270 pounds (Eckert and Bess 1952). The peak production record in the Territory occurred in 1918 with 2.4 million pounds produced. Prices for honey were high at this time, some fifteen cents per pound (Philipp 1953), stimulated by the demands of the First World War (Eckert & Bess 1952). By 1919, the industry was valued at over $300,000 (Crawford 1937).

During the 1920-1930s, three events occurred that led to the rapid decline of the Hawaiian beekeeping industry. First, the price of honey dropped from a high of fifteen cents to an all time low of three cents per pound during the Depression (Philipp 1953). Second, successful control of the sugarcane leafhopper in 1920 (Eckert and Bess 1952) substantially reduced the availability of honeydew as a nectar source for honey bees. Finally, American Foulbrood, a disease affecting developing honey bee brood, was accidentally introduced in 1929 or 1930 on Maui (Eckert 1951).

The eradication of the leafhopper was a boon to the industry. "Honeydew honey" was considered a poor grade of honey and used primarily by the baking trades. In 1905, a detailed chemical study was conducted by D. L. Van Dine and Alice R. Thompson on the characteristics of Hawaiian honey. They judged the honeydew product as "very decidedly abnormal in its chemical composition" (Van Dine 1908). Van Dine and Thompson discovered that bees preferred floral sources and would only collect honeydew if no other sources were available. In December 1936 a discussion was held at California's State Beekeepers Association to propose a plan to keep Hawaii's honeydew product from California markets (Keck 1937).

The Territory's Board of Commissioners of Agriculture and Forestry and government employees supervising the import of queens understood the ramifications of any accidental introduction of disease and took steps to prevent such an introduction as early as 1908 (Eckert 1950). Unfortunately, a poor understanding of Foulbrood, coupled with a lack of consistency in hive inspection and management virtually wiped out all colonies in the Islands once it appeared. To eradicate it, colonies were burned on all islands except Lana'i and Ni'ihau where the disease was never established (Eckert 1951). By 1935, few viable honey operations were left and the industry and production drastically slowed (Honey's 1981).

Despite these problems, exported beeswax reached a high in 1939 with sixty one thousand pounds shipped (Chamber of Commerce 1941). In 1940, honey ranked eighth in value of agricultural food products exported by the Territory. It was surpassed only by the sugar, pineapple, coffee, banana, papaya, potato, and nut industries.

From 1941 to 1952, production was reduced to exports averaging one-half million pounds per year, despite the rise in honey prices caused by World War II (Philipp 1953). In 1952, twenty-five commercial

honey producers were doing business in Hawai'i, caring for some 11,900 hives (Philipp 1953). In 1953, the accidental introduction of the cosmopterygid moth *Ithome concolorella* Chambers, a kiawe pest, was unwelcome news to a devastated but slowly recovering industry (Namba 1956). Due to these early misfortunes, the Hawaiian honey industry took almost twenty years to recover to its previous levels of production.

The following are brief historical sketches of beekeeping by island.

Ni'ihau

The lesser-known, "forbidden" island of Ni'ihau was purchased by brothers Francis and James Sinclair from Kamehaheha IV (Alexander Liholiho) in 1863 (Joesting 1984). A. F. Robinson, descendant of the Sinclair clan and manager of Ni'ihau, brought in honey bee colonies from Kaua'i in 1918, where they were successfully established on vast tracts of Robinson-owned land used for sugarcane and cattle. Ranching was, and remains, the predominant industry on Ni'ihau. Colonies apparently fared well on this island, isolated from Kaua'i by 17 miles. The Robinsons' strict rules forbidding all outside visitors to the island except by formal invitation also helped protect the health of the honey bee population on Ni'ihau from Foulbrood contamination. Foulbrood quickly spread to Moloka'i, O'ahu and Kaua'i from Maui. Fortunately, strong colonies were well-established on Ni'ihau before word was received of the outbreak on Kaua'i. Subsequently, A. F. Robinson banned all imports of honey bee colonies from Kaua'i and reported that American Foulbrood was never a problem on Ni'ihau (Eckert 1951). Personal communication with a former Ni'ihau resident living in Hilo confirms that beekeeping continues to thrive on Ni'ihau to this day.

Kaua'i

Beekeeping on this island began in the late 1890s with colonies shipped from O'ahu. E. C. Smith had a beekeeping concession on the island until 1913, the year that the Robinson clan took an interest in beekeeping. Later, the Robinsons bought Mr. Smith's bees and his leases. The Kaua'i Honey Company was in operation at that time with interests on Kaua'i, Maui and possibly other islands (Eckert 1951). The Garden Island Honey Company appeared to the first beekeeping operation that began commercial queen-rearing (Eckert and Bess 1952). Honey from apiaries on Ni'ihau and Kaua'i were shipped directly to the U.S. Mainland from Port Allen, Kaua'i (Chamber of Commerce 1941).

O'ahu

O'ahu's strategic placement in the Hawaiian archipelago saw the first introduction and successful establishment of honey bees cited earlier. The beekeeping industry istself was actually "born" on O'ahu, on a balmy Sunday afternoon in 1893 when a swarm of bees blown by the trade winds appeared in the back yard of the brothers Lee and Oswald St. John Gilbert in Honolulu (Nieman 1942). This marked the beginning of the Sandwich Island Honey Company. The brothers, having no prior knowledge of bees, quickly set up hives and immersed themselves in research. They eventually purchased the exclusive right to place bees on all islands (Chamber of Commerce 1941). Oswald St. John Gilbert earned the nickname the "Honey King." O'ahu's other honey venture, The Hawaiian Honey Company, was located in 'Ewa and managed approximately eighteen hundred colonies of hybrid bees, yielding some 180,000 pounds of honey annually. Incorporated in 1901, Hawaiian Honey Company shipped some fifty to sixty tons of honey and wax from Honolulu, and was famous for its "Crystal" and "Vitalic" brands. By 1907, the first beekeeping association was formed to advance and protect the interests of the industry. Commercial beekeeping interests were steadily growing. By the early twentieth century, the Sandwich Islands Honey Company and two other businesses had incorporated. At its peak, Sandwich Islands Honey was reported to have had ten thousand colonies in operation (Eckert and Bess 1952) and by 1908, an estimated twenty thousand hives were established on all major islands managed by seven corporations and numerous individuals (Crawford 1937).

O'ahu's beekeeping industry was most robust at the beginning of the twentieth century and reached its peak in the mid 1930s, but was later destroyed by Foulbrood. O'ahu did not develop ranching to the degree that the outer islands did, so the driving force that developed the beekeeping industry on those islands was not as evident here.

Moloka'i

In 1898, the first bees were brought by E.C. "Pearl City" Smith to J. Munro, the first apiarist on the island. Mr. Munro started the apiaries of the American Sugar Company (ASC), which later became the world's largest producer of honey (Chamber of Commerce 1941). Commercial beekeeping began around 1900 and increased under the direction of Moloka'i Ranch Ltd. Some twenty-four hundred colonies were known to exist under Ranch management between 1923-1932 (Eckert 1951). "Asco Brand Kiawe Honey" was the principal product of ASC for many years (Chamber of Commerce 1941), and produced the world's record honey crop from permanently established apiaries in 1935.- one half million pounds of kiawe blossom honey (Eckert and Bess 1952). American Foulbrood led to the decline in 1937 with the destruction of several hundred colonies, followed by two thousand two hundred colonies in 1938 (Eckert 1951). From 1938-1948, commercial honey production on Moloka'i virtually ceased. In 1948, the Ranch tried to revitalize the industry and hired apiarist Allen Luce. When Mr. Luce assumed control, only eighty-six colonies existed, of which thirteen were infected with Foulbrood (Eckert 1951). As of 1953, this disease was successfully eradicated, as no feral swarms were found to have it. Encouraged by their victory, University of California, Davis researchers continued to study the disease, and purposely infected several colonies at the Moloka'i Ranch with the disease to study resistance-building. As a result, bees demonstrated a greater resistance to Foulbrood, which was due to several factors. Subsequently, steps were taken to reproduce these strains and cross breed in an attempt to increase overall resistance in all races (Eckert 1950, 1951).

Lana'i

Approximately two hundred colonies were sent to Lana'i from Maui in 1910. It was reported that six colonies became "sick" in 1916 and were burned (Eckert 1951). Eckert does not name or describe the nature of the "sickness" but concludes that no evidence of it was found after destroying the colonies. George C. Munroe was the manager of the operation from 1911-1923. In 1923, the Hawaiian Pineapple Company acquired the island and operated the colonies. In 1948, the Company imported six Italian queens. It was suggested that the kiawe available on Lana'i could support five hundred well managed colonies. In 1950, the Company gave the bees to the Vocational Agriculture Department of the Lana'i School System (Eckert 1951).

Maui

Beekeeping reached its peak on Maui in the early 1930s. The Kaua'i Honey company owned two thousand colonies on Maui as well as colonies on other islands (Eckert 1951). Beekeepers marketed their product through one source on Maui and were said to have sold some 255,000 pounds of honey in 1934. Unfortunately, Maui has the distinction of being the first island where American Foulbrood was detected. One report claims that the disease arrived in 1929 or 1930 (Eckert 1951), while another report suggests that it arrived in 1933 (Eckert and Bess 1952).

Kaho'olawe

Oddly enough, the small island of Kaho'olawe took center stage in 1919 as the future "center of the honey industry of the Territory, if plans of the recently formed Kahoolawe Honey company materialize" (Kahoolawe 1919; Ambrose 1935). The Kahoolawe Honey company was formed by Honolulu businessmen to exploit the honey market's rapid boom. Rufus Robinson and Lee St. John Gilbert, vice president and manager of the Algaroba Feed Company were the primary backers of this new venture. The men reached an

agreement with Angus McPhee, Kaho'olawe's new lessee, on July 1, 1919 "for the exclusive right and privilege. . . to raise bees and honey and to place bee hives and such buildings and structures as may be necessary for the care and manipulation of the honey and wax produced by such bees, upon the island of Kahoolawe" (Spoehr 1992). By August, Kahoolawe Honey Company was incorporated, and by December of that year, hives were in place and production began. After initial investment, the principals did little to invest more into the business for reasons unknown. The firm failed to expand its operations, perhaps reacting to the fall of honey prices after the prosperous years of 1919-1920. The corporation was finally dissolved on 21 June 1928 (Spoehr 1992).

During the 1930s, Kaho'olawe's isolated west side became an attractive target for bombing by the U.S. military. After the bombing of Pearl Harbor on 7 December, 1941 and the declaration of martial law the following day, ranching activities ceased and all human inhabitants were evacuated. U.S. Army and Navy took command of the island thereafter and used it solely for military purposes (Kaho'olawe Island Conveyance Commission 1993). All military bombing of the island was halted in 1990.

Hawai'i

Growers of coffee *Coffea arabica* in Kona were the first to exploit honey bees on the Big Island. In the late 1890's, bees were brought from O'ahu and used experimentally for three years. The project was later abandoned (personal communication). Large cattle enterprises were being established across the state, and ranchers began to develop large tracts of Hawai'i island. Honey bee colonies were brought in to increase kiawe bean yield and further establish kiawe forests, a source of rich and nutritious cattle feed. By 1935, it was estimated that over one hundred thousand acres of kiawe forest covered the Big Island (Greene 1941). Around the turn of the century, two large ranching operations, Parker Ranch and Hind Ranch, followed Maui and Moloka'i's lead and introduced bees to pollinate kiawe. Hind Ranch owner Robert Hind arranged for the delivery of hives. Ichiro Goto managed some three to four hundred hives from 1912 to 1932. Extracted honey was packed in five gallon containers and shipped annually from Puako harbor to Honolulu. Later, Mr. Goto leased the hives for three years, and then phased out of beekeeping.

In 1907, Parker Ranch established hives on the drier northwest and western sides of the island. Kakuichi Yano, formerly of Moloka'i Ranch, was enlisted by Parker Ranch manager W.F. Carter to manage four hundred hives on the Big Island. Extracted honey from this operation was sold directly to Davis and Company who brokered the honey on the New York exchange. In 1936 the Ranch leased the bees to Mr. Yano, who along with his son Sanshiro, maintained six hundred colonies until 1950. The hives were then returned to the Ranch where they were managed until the kiawe moth wiped out much of the kiawe blossoms in 1952. The hives were then sold to Allan Luce and Woodrow Miller. Mr. Luce moved the operation to Waimea and called his business the Hawaiian American Honey Company. Mr. Luce's success in reviving honey production was attributed to moving the bees away from the declining kiawe forests and into expansive 'ohi'a lehua forests. In 1966, he sold the business to Mr. Miller. Mr. Miller moved the company from Kamuela to Pu'uanahulu. In 1970, this company became the largest honey producer in the Islands, controlling the majority of the State's production. Most of the fifteen hundred hives were located on Waimea's Pu'u Wa'awa'a Ranch. In 1973, Jim Powers of Powers Apiaries, Inc., a national honey production firm operating in North Dakota, Arizona, and Florida, bought out the Hawaiian American Honey Company. Mr. Powers moved the operation to Kealakekua, and renamed it Powers Apiaries. Mr. Powers hired Allan Luce and Sanshiro Yano to help improve honey production. Within four years, the number of hives increased to four thousand. Mr. Luce expanded the bees' foraging areas to include Christmas berry and macadamia. The only other large honey enterprise in the early twentieth century on this island was the Hawaiian Honey Farm. Run by Eizo Kobayashi, the Hawaiian Honey Farm operated out of Kainaliu with approximately two hundred hives from 1927-1943.

Through the years, other businesses specializing in bee-related activities such as pollination services, queen-rearing and bee removals took hold. In 1963, Roy Oness started a honey and pollination business

called Oness Honey Farms. Based in Waimea, Mr. Oness operated one hundred twenty-five hives of his own. In 1966, Mr. Oness terminated his leases and moved the company to Hilo. He continued his operation but reduced the number of hives when he expanded his business interests and incorporated his honey company into Agri. Business Hawai'i. In 1982, he ceased commercial operation.

In 1975 Michael Sinclair founded Sinclair Honey Farm. Located in Honomalino, Mr. Sinclair managed five hundred hives. In 1988, Mr. Sinclair and wife Kathy expanded their interests to include queen-rearing and marketed the queens under the label of Hawaiian Queen Company. In 1996, Michael Krones bought out the Sinclairs, but continues to use the name Hawaiian Queen Company for honey production and queen-rearing.

By 1976, Mr. Powers owned thirty-five hundred hives on Hawai'i and began expanding to other islands in the state, especially Moloka'i with its large kiawe forests (Beekeeping's 1976). During this time, Mr. Powers brought in the Weavers from Texas to start a queen-rearing operation called Kona Queen, then managed by Carroll Wharton.

Kona Queen Company was established in Kealakekua, a spot that averages nearly 75 degrees year round and has an abundance of nectar sources in bloom suitable for queen-rearing (Tillman 1982). The absence of the destructive Varroa mite *Varroa jacobsoni*, the tracheal mite *Acarapis woodi* and the Africanized Honey Bee *Apis mellifera scutellata* in Hawai'i has contributed to the vitality of the queen rearing industry on the Big Island. Queen rearing companies have been supplying Hawaiian queens to U.S. Mainland and international markets in an effort to introduce resistant strains to better fight these pests.
In 1988, Garnett Puett and Benny Cariaga bought Powers Apiaries and renamed it the Captain Cook Honey Company. The present operation manages some thirty-eight hundred hives. In 1981 Gus Rouse became manager of Kona Queen. In 1992, Mr. Powers sold the queen-rearing business to Mr. Rouse, who continues the operation to this day.

In 1982, Paul O'Leary established Beeboppers. Initially located in Hilo, Mr. O'Leary specialized in bee removal and sold hive equipment and supplies. In 1984, the business moved to Kea'au, Puna, and was expanded to include honey sales. In 1988, the merchandise was sold off and the company was transferred to Robbie Poznasky, who then moved the operation to Kona. Today, Beeboppers provides bee removal services only.

Charles Martens started a honey and bee removal business in 1985 in Nanawale, Puna, called Insight. He amassed his two hundred hives by collecting swarms, dividing established colonies, and accepting colonies from hobbyists. Mr. Martens sold the business in 1989 to Robert St. John, who then called the business Puna Bees. Mr. St. John increased the number of hives to 375 and added candle production. In 1994, Mr. St. John sold Puna Bees to Eric Hutchinson. Mr. Hutchinson operates the business from Nanawale to this day, but has since phased out bee removal services. He manages three hundred hives and concentrates on honey and candle sales.

Richard Spiegel presently owns and operates the Volcano Island Honey Company, located in Ahualoa. Managing one hundred hives, the company markets kiawe honey in its natural form. Mr. Spiegel began keeping bees in 1976, and in 1979 began to market a gourmet honey under the label "Rare Hawaiian White Honey." At this time, his company was called Menehune Honey, but in 1980, he changed the name to Ohana Honey Company. In 1983, he purchased a honey company from Michael Botello and Paul Charboneau, former UHH College of Agriculture students of Dr. Jack Fujii and Mr. Spiegel. Mr. Botello and Mr. Charboneau had acquired the ASA Hive and Honey Company from Peter Hughes, who originally established the company in 1979. The two marketed a table grade honey under the "Rainbow Gold" label. After Mr. Spiegel bought out the company, he continued to market table grade and gourmet honeys, but later dropped "Rainbow Gold" to focus exclusively on marketing gourmet honey nationally. In 1984, he changed the name to Volcano Island Honey company.

In 1990, Randle and Pam Brashear started the Honaunau Honey Company and sold honey only. The Brashears then switched to queen production and established Big Island Queens in 1992. They operate the company to this day.

Walter Patton presently owns and operates the Hawaiian Honey House based in Papa'ikou. Begun in 1991, the Hawaiian Honey House manages some 430 hives, and sells honey, candles, and provides bee removal services. Mr. Patton also wholesales honey from the hives of other beekeepers.

Some farmers on the island use honey bee colonies primarily for crop pollination and handle bee products as a secondary activity. For example, Bryne Kubo manages twenty acres of macadamia nuts in the Panaewa area of Hilo and uses 60 hives for pollination. Russell Messing (1991) noted that beekeepers in Hawai'i are "only just beginning to receive fees for pollination services" from commercial growers, and that many local agribusinesses would benefit by such services. He further observed that competition for good beekeeping sites near commercial plantations and robust feral bee populations appear to satisfy current commercial pollination. Hawai'i island beekeepers are recognizing the potential for pollination services for existing and new agricultural enterprises, and are attempting to provide them (personal communication). Like their U.S. Mainland counterparts, beekeepers on Hawai'i must continually educate and remind farmers of the importance and value of insect pollination to crop yield..

The future of the Hawai'i Island beekeeping industry

With the demise of sugar, farmers, and state and county officials have been considering new agricultural alternatives for the vast tracts of fallow sugarcane land. A number of crop possibilities have been suggested as replacements for sugar, though none are currently being cultivated on a wide scale. Beekeepers are in the enviable position of contributing to the local discussion of possible crops, providing pollination services and healthy, vigorous queens.

In 1983, growing interest among hobbyist beekeepers and entrepreneurs led to the formation of the Big Island Beekeepers Association (BIBA). BIBA meets quarterly to enable beekeepers to share experiences and information. BIBA also provides educational displays at the Hawai'i County Fair and conducts presentations to community groups and schools. There are presently forty-five members.

A community outreach program targeting displaced sugar workers but open to all local residents started this year. Walter Patton's Bee Enterprise Educational Services, Inc., (BEES) a non-profit foundation, initiated the Hawaii Honey Bee Project, which offers instruction, equipment, and supplies to community members interested in beekeeping.

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Figure 1: Beekeeper inspecting a brood frame from an established honey bee hive