The Business of Honey: Rebuilding the Apiculture Industry of Trinidad & Tobago

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REBUILDING THE APICULTURE INDUSTRY OF TRINIDAD & TOBAGO

Summary

The Imperial British Government, their policies and legislation have been instrumental in guiding the establishment of the Apiculture Industry in Caribbean islands Trinidad & Tobago (T&T) in its formative 60 years, since early 1901. Success of the Industry supported by protective legislation and a rich diverse ecosystem contributed to an internationally recognized high-quality multi-flora honey. However with Independence in 1962, while legislation remained unchanged, divergent interests by subsequent Governments saw declining support, away from this primary industry and focus instead on the expansion of the Petrochemical Industry for which the islands became a key world Producer. This left most of the burden of building the Industry to Beekeepers. With a decline in national production and increase in price, the lucrative market is attracting new interests. On one side, beekeepers sharing a passion for improving and expanding Beekeeping products, and on the other, business persons seeking to capitalize on the high prices by engaging in practices of relabeling illegally imported honey of questionable source and quality, some traced to China, center of the global honey laundering racket. The move by the Minister of Trade and Industry to seeks legislative change to open the local market without the necessary Infrastructure leaves the local Industry with honey voted “best honey in the world” unprotected. Given the success of the application of honey in diabetes and the fact that Trinidad and Tobago has a diabetic rate twice the global average, the move also exposes the general population to further health risks and food safety issues. It also leaves the revenue earning potential of medicinal honey unexplored.

The Business of Honey: Rebuilding the Apiculture Industry of Trinidad & Tobago

Honeybees *(Apis mellifera)* are considered not only a vital benefit to agriculture through pollination of many food crops, but their primary product, honey, is regarded as the most important product of beekeeping from a quantitative and an economic point of view. Although honey is food for bees created by bees, its value to humans is highly rated. Considered the nectar of life in Ayurvedic medicine it has been used for centuries, traced to 8000 years ago as depicted by Stone Age paintings (Eteraf-Oskouei & Najafi, 2013; Subrahmanyam, 1996).

A published review of the medicinal and cosmetic application of bee honey by Edirweera & Premarathna (2012) highlights the use of fresh bee's honey in the treatment of eye diseases, throat infections, bronchial asthma, tuberculosis, hiccups, thirst, dizziness, fatigue, hepatitis, worm infestation, constipation, piles, eczema, healing of wounds, ulcers and used as a nutritious, easily digestible food for weak people, and old bee's honey to treat vomiting, diarrhea, rheumatoid arthritis, obesity, diabetes mellitus and in preserving meat and fruits.

Its effectiveness and potency in treatment of various conditions in both human and animals, as an antioxidant, anti-inflammatory, and possessing antimicrobial activities useful in wound and burn management, treating periodontal disease Its effect on blood sugar, body weight, lipid profile, C-reactive protein, nitric oxide, proinflammatory prostaglandins and homocysteine levels, have also been well documented in scientific studies. (Yaghoobi, Kazerouni & Kazerouni, 2013; Aparna et al, 2012; Al-Waili Salom Al-Ghamdi & Ansari , 2012; Edirweera et al, 2012; Sherlock et al, 2010); Gethin, 2007).

According to the World Health Organization (WHO) Codex Alimentarius (CA) for Honey, 'Honey is the natural sweet substance produced by honey bees from the nectar of plants or from secretions of living parts of plants or excretions of plant sucking insects on the living

parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in the honey comb to ripen and mature.' It goes on to describe 2 different types of honey based on their source 'Blossom Honey or Nectar Honey is the honey which comes from nectars of plants' while 'Honeydew Honey is the honey which comes mainly from excretions of plant sucking insects (Hemiptera) on the living parts of plants or secretions of living parts of plants.' (Codex Stan 12-1981).

And while the global trade and demand for honey has continued to increase, the global decline of bee populations and increase in occurrence of Colony Collapse Disorder (CCD) pose a major threat to ecosystems, agriculture, food production and national health, while the burden of poor production quality standards and the practice of illegal trade of ultra-filtered artificial honey compromise the purity of the product and pose a threat to global food safety and consumer health.

The expanding billion-dollar health-food industry and demand for natural products, has been matched by the expanding research that shows honey to not only contribute a nutritional benefit but also function as a health food with inherent medicinal properties due to its biological composition (Montenegro & Mejias, 2013). And, although general chemical analysis is still lacking for a large sector of the global industry, with the exception of Manuka honey, the potential healing benefits of floral varieties on the composition of honey and its medicinal action remains unrealized.

Changes in the global Industry have been guided, on the supply-side, by legislation and regulations, as well as the infrastructure for beekeeping and practises of Beekeepers, while on the demand-side, by Consumers, both commercial users, for its use in the food, the cosmetic and the medicinal industry, and for the household user, as a natural sweetener, health food and medicine.

According to Guoda, Chun and Fuliang (2001), global trade of honey has steadily increased along with its value since the 1970s. Between 1989 and 1991, world trade in honey increased by almost 30,000 tonnes worth US$317.6 million, with developing countries collectively accounting for 68.6 % of total honey exports, showing a 13% increase from 1983. In 2006, with Colony Collapse Disorder (CCD) occurring across the United States (US) and the European Union (EU), US production for 2011 fell 16% below the previous year and was accompanied by record high in honey prices. According to the 2010 FAO update, China, Argentina and Mexico became major suppliers together producing 60 % of world-traded honey while the EU and US produced only 18%.

As reliance by the EU and US on imported honey continued to increase steadily to meet local market demands, China became the main recipient of the honey export revenue having continued the capacity to produce greater quantity lower priced honey (Guoda et al, 2001; FAO 2010 update). However eventual restrictions ensued on China's honey because of contamination and unenforced quality control testing to meet international trade standards.

While the US Department of Commerce levied an anti-dumping duty of 221 per cent in 2001 on Chinese honey to minimize the price threat to US honey producers, the EU imposed a ban on all imports of animal products from China for the period 2002-2004, citing residues of veterinary medicine in food and antibiotics including chloramphenicol, 8 streptomycin, and tetracycline (CIAF Market Survey #1, 2012).

By 2002, as Chinese honey imports to the U.S. dropped more than 40 per cent, honey imports from India began increasing, with over 2 million pounds of honey the same year, peaking at 26,000 tonnes in 2011 and representing an unprecedented 4,000 per cent increase in

Indian production since 2001, while honey from Vietnam accounted for just under 30,000 tonnes (Buckwalter, 2012).

Only in 2008, was it realized by the U.S. Department of Commerce and the Department of Homeland Security, that this production increase for India was not real, but linked to a global illegal honey transshipment scam originating in China and involving the "ultra filtration" of honey which removed all pollen traces preventing the means of identifying the source of the honey. The use of fake country-of-origin documents for shipments, replacement of labels on Chinese containers with fraudulent ones and switching of honey containers in a third country such as India, Malaysia, Indonesia, South Korea, Russia, Thailand, Mongolia, Taiwan and the Philippines became all part of the illegal trade (Berfield, 2013).

Honey laundering as it has come to be called, involves key players of the honey production beginning with the Apiary and continuing to the wholesaler and retailers across the world as a means to avoid paying duties on already low cost Chinese honey. According to a CIAF report (2013), the EU ban and US anti-dumping duty had given rise to the illegal trafficking of adulterated Chinese honey coming via third-party countries.

According to the 2012 US Public Ledger report, approximately one-third or more of all the honey consumed in the US in 2011, was likely to have been smuggled from China relying on the ultrafiltration technique. Montenegro et al, (2013) explain that honey derives it biological qualities from its source, some which may be toxic and "not suitable" for human consumption, which explains why the Food Safety Division of the World Health Organization reports that food safety becomes a high risk if honey does not contain the identifying pollen as it removes all traces as to whether it is from a safe source (Schneider, 2011).

With the increased protective actions being taken by the U.S. Department of Commerce and the Department of Homeland Security against illegal importation of honey from China, suppliers must now seek new markets to trade their artificial low cost honey.

With strategic moves by the Minister of Trade and Industry of Trinidad & Tobago (T&T) to implement legislative change to allow the importation of honey into the market, coinciding with already underway trade talks with the Chinese government to expand trade and generate investment opportunities, its seems that they have found their target, represented in the form of the nations of the Caribbean Common Market (CARICOM).

Should this legislative change be passed, the unregulated importation of honey will aggressively compete price-wise with the small but vibrant apiary sector that currently has 320 registered beekeepers with 400 apiaries producing an annual average of 3 gallons per hive (Made in T & T-Part 1, 2014). This move will not only negatively impact the Industry that has won several Awards at the prestigious London Honey Show for “best honey in the world” and most recently at the South Florida Bee Congress of August 2014, but also limit the product development potential of medicinal honey given the recent application of honey in diabetes. The fact remains that Trinidad and Tobago has a diabetic rate that is twice the global average and the dissemination of benefits of honey can also expose a nation to additional threat if contaminated and artificial honey is distributed and consumed (Castillo, 2013).

The Historical Framework

The 5,128 square kilometers Caribbean twin-island State of Trinidad and Tobago is located 11 degrees north of the Equator and at its closest point lies only 13 Km North East of the South America coastline, boasting a rich biodiversity of fauna and flora but also natural

resources of Oil and Natural Gas. Once the home of an indigenous South American Amerindian and Carib population, following colonization by Spain and then the English, the population steadily increased from 18,000 by the end of the 18th century to its current standing of 1.3 million persons.

While geographical location and actions of the Imperial Government during colonial days can be credited for the establishment, development and protection of the Apiculture Industry and its award winning honey, the post colonial governments can take responsibility for its significant breakdown.

Honey from Trinidad and Tobago is known for its award winning taste due to feeding on multisource plants from its rich bio-diverse ecological links with South America. And although falling under the control of the BeeKeeping Act of 1936 amended last in 1949, it presently has no properly enforced measures of standardization, production, quality controls or regulatory grading or labeling requirements to meet the changes that has taken place in Apiculture Industry or world food production.

Traced to the late 18th century when moveable hives were introduced to the British Colony, it was the Imperial government who established the foundation of the Apiculture Industry in 1901 and 1902 with the introduction of the Black bee (*Apis mellifera mellifera*) and Italian bee (*Apis mellifera ligustica*) to T & T (Solomon, 2010). Over time more beekeepers were trained, and placed against the backdrop of rich virgin tropical rainforests with broad biodiversity of ecosystems across the twin islands of nearly 2500 species of flowering plants, the European bee population soon spread across the islands with both apiaries and wild hives giving rise to a high quality multi-floral honey that was exported to the EU, eased by policy that supported its status as a British/European Colony.

To protect the Industry from pests, the Beekeeping and Bee Products Regulations of 1935 was passed, restricting imports of honey into the islands along with establishment of the Apiaries Unit and Inspector of Apiaries. This centralized office established strict measures of control and monitoring of the Industry through application procedures for Apiary Licensing. Under this Act, the first Trinidad apiary was registered on January 30, 1937, and by May 31, 2010, 1,534 apiaries were registered in Trinidad and Tobago (Solomon, 2011).

The Apiaries Unit was a specialised and centralized extension service unit within the Ministry of Agriculture, staffed by both monthly paid Agricultural Assistants, and daily-rated workers and responsible for visiting Apiaries and monitoring the quality of extraction, preparation and packing of honey under the control of the Inspector of Apiaries (Solomon, 2010).

Although the last amendment of the Beekeeping and Bee Products Act 67:53 was in 1949, many changes in the global and local Industry have taken place. Independence from the British Monarchy in the 1960s and the expanding economic role of Trinidad and Tobago in the global market as a major oil producer catapulted government attention away from the agricultural sector as a major producer and exporter of sugar and cocoa towards the Petrochemical Industry (Besson, 2011).

While on paper, there was expressed Government support of the Industry, in reality, many of these promises were not fulfilled and this is expressed in several ways inclusive of inaccessibility to agreed forested state lands, delays in reimbursements of agriculture incentive programs, lack of financing for micro-business development and product standardization which has forced the remaining stakeholders to be self reliant in the production, quality control, marketing and distribution of their product. This has limited subsector's development by leaving

the burden of development and expansion of the industry shouldered by the beekeepers, with high market prices led by the demand-supply imbalance.

The decentralization and disbanding of the Apiary Unit in 1988 is considered a major turning point affecting the subsector development of the Apiculture Industry. Although the title of the Inspector of Apiaries remained, without the support systems in place, the duties could not be fulfilled. This dysregulation of the Industry has been associated with many unregistered Apiaries with reports by Solomon (2010) indicating that by 2010, the percentage was as high as 44%.

This lack of monitoring has impacted adherence to proper hive management, while industrialization, urbanization and changes in land use along with the continued use of neocorticoid insecticides by farmers, which are harmful to the bees, along with the illegal importation of GMO seeds by farmers has resulted in a steady decline in honey production (Gangadeen, Made in T&T, Youtube Video, 2014).

The invasion of the Africanized bees into Trinidad in the 1970s destroyed many European-strain hives. And while the numbers of beekeepers rapidly declined, the production output by those who were able to harvest the Africanized bees were rewarded with higher production capacity per hive. As land use in Trinidad reached saturation, governments' offer of access to forested state lands for beekeepers failed to materialize (Cabinet note, 1997, Minute Reference 189-1/23/97; Bede Rajahram personal communication, 2014).

In addition to the weak infrastructure, little has been done to develop the needed competitive expansion and marketing of the domestic Industry should legislation permit the importation of honey. The premature actions to open the market by the Ministry of Trade and Industry coincide with talks with the Chinese governments to expand trade, generate investment

opportunities and identify potential infrastructural projects in Trinidad and Tobago, including the establishment of honey labs (Scott, 2014). According to the Ministry, the need for the labs are the result of "sanitary issues' and problems with the handling of the honey, which coincidentally remain the same issues that the US and the EU hold against China for the honey they produce (Scott, 2014).

Since 1998, the reduced government support spurred the institutionalization of the Caribbean Beekeeping Community, which followed the first Caribbean Beekeeping Congress with the Association of Caribbean Beekeepers' Organisations, a regional representative body. With concerns over the impact of Industry changes in the local economy, three independent Beekeeping bodies have been formed in Trinidad and Tobago; Trinidad and Tobago Beekeepers Association (TTBA), Association of Professional Beekeepers (AOPB) and Tobago Apiculture Society (TAS).

Before the most recent move by government, some stakeholders sought to create a more uniform face of the Industry. ALL Trinidad & Tobago Apiculture Cooperative Society Ltd (ATTAC) registered on July 3rd, 2014. With the move to open the market, much of their efforts have been sidelined a month after starting as the Beekeeping bodies have now formed a Federation of Independent Apiculture Associations and Co-operatives (FIAAC) to focus on working specifically to protect the local interest by preventing legislative change to open the market.

After meeting with the membership of ATTAC, it has been determined by this Researcher that alliance with this group will provide the immediate support to achieve the study objectives of understanding the Industry. Through the acquisition, dissemination and collaboration of ideas and information affecting the Industry, the organization may also benefit

from the necessary human resource support, by a Researcher not only committed to contributing to the Holistic Healthcare and safety of food source of our twin Islands but also motivated to help build on the untapped resources offered by the Apiculture Industry of Trinidad & Tobago.

Methodology

To generate the necessary background for this research, an assessment of the overall framework of the Apiculture Industry in Trinidad and Tobago has been done focused on building an integrated understanding of the external and internal variables and trends impacting the development of the local Apiculture industry with a specific focus on honey. Unstructured interviews with Beekeepers, Cooperative members, consumers and other stakeholders in Trinidad and Tobago have been conducted along with attendance at Apiculture meetings.

Reviews of Caribbean history books, newspaper articles and government documents have formed the foundation of this study along with current affairs in Industry blogs and specialist journals. Electronic database Pubmed is the main source of scientific research while statistical information relevant to this research was provided by online searches with international Agencies such as Food and Agriculture Organization (FAO) and the World Health Organization (WHO).

Informal interviews with 40 persons who showed interest in purchasing honey from three market segments was done for an insight into the local perception of honey in Trinidad.

Study limitations: With the exception of the experiences documented by the interviewed Beekeepers, only one study by Gladstone Solomon traces the difference in production between Trinidad and Tobago. Efforts to access the full article by this researcher failed, and the process for meetings and conducting interviews were difficult given time limitations. Although there are

several published documents based on personal interviews, in order to develop the material for the recommendations, where relevant, scientific studies completed by other researchers with similar geographic and beekeeping practices have been used.

Findings

While the Imperial British Government policies and legislation have been instrumental in building the Apiculture Industry in Caribbean islands Trinidad & Tobago (T&T) in its formative 60 years, following Independence in 1962, divergent interests by the new Governments saw declining support, away from this primary industry with focus instead on the expansion of the Petrochemical Industry for which the islands have become a key world producer.

These Government actions along with enforced and unenforced legislation, the Beekeepers and practices and Consumers knowledge of the beekeeping products and access have been found to be the triad key factors currently affecting honey production growth and expansion of the Apiculture Industry of Trinidad and Tobago. While each component of the triad is interrelated, for ease of presentation, the findings have been categorized into three categories.

(1) The Legal Framework

(2) The Apiculture Industry Analysis

(3) Consumer Analysis

(1) Legal Framework

Legislative and Environmental Factors. Government actions appear to negatively impact the growth and expansion of the Apiculture Industry, from inadequate enforcement of the current Beekeeping legislation, to moves to open the local market to imports without ensuring that the necessary infrastructure within the local Industry is established.

Although many changes have taken place in the Apiculture Industry at a local and international level, the Beekeeping and Bee Products Act 67:53 has remained unrevised since 1949 and a gradual deregulation of many of the systems set in place to both protect and develop the local Industry. The disbanding of the Apiaries Unit and the move to a figurehead role of Inspector of Apiaries, is considered the single most negative impactful act against the Industry, leaving the Industry mostly unregulated, and exposing the Industry and consumers to the unmonitored actions of 44% unregistered apiaries identified in 2010 (Solomon, 2010).

The focus of the Ministry of Trade to make the legislative change to allow the importation of honey also increases the competitiveness pressure on the local Industry and eliminates any competitive advantage that countries, such as the US imposed to protect its domestic producers against Chinese honey imports. The CARICOM trade agreement states that goods originating from a CARICOM Member State sold to another member state is exempt from tariffs and taxes leaves the domestic producer exposed.

The move by Ministry of Trade and Commerce also contradicts government policy of other Ministries. The investment profile and incentive document published by the Ministry of Food Production, Land and Marine Affairs states intentions to not only expand the Industry beyond honey, pollen, royal jelly and beeswax, but also 'to increase production from 44,000 litres, to 200,000 litres per annum' through incentives to improve management practices and increase the numbers of hives. Yet, outside of a few meetings, no further action has been taken to facilitate this process or for said reimbursements, which is slow in coming as one interviewed Beekeeper expressed.

Also without chemical analysis or documented proof of origin that can be traced to the actual Grenadian Beekeeper, or the presence of properly enforced regulatory systems that

protects the national boundaries from illegal imports to the region, the use of a CARICOM Member State as illegal trans-shipment points for honey laundering remains too easy. As of July 2014, illegally imported honey, some packaged as honey from Trinidad, remains on retail shelves in Trinidad & Tobago in spite of reports to Customs and Excise Division who confirm that large illegal imports are taking place. This, a confirmation of our poor preparation to manage our borders and inability to protect unsuspecting consumer from exposure to possible health risk.

The decision to open the market shows disregard for community health by contravening the existing regional policies as set out in the Treaty of Chaguaramas. The Treaty outlines the framework of trade, and places a restriction on trade of good if there is deemed a threat to industry and human health.

Article 65 Environmental Protection Clause of the Chaguaramas treaty states that trade of good within the region should be considered only if it preserves, protects and improves of the quality of the environment as well as protection of the life and health of humans, animals and plants. The decision to open the market also ignores the potential threat to domestic producers as stated in Article 92 and subject to Article 150.

Given the limited knowledge of the domestic consumer market and their uncertainty about determining honey quality, the importation of honey of questionable quality can be detrimental to the Domestic Producer as well as compound an already existing health crisis. That Grenada cannot supply its domestic market, that an easy to follow pattern has already established by Chinese Honey laundering, there is legislative “dis-regulation”, absent infrastructure and that illegal honey is already available without any legal recourse are red flags.

Beekeeping as a labour intensive activity requires commitment to caring for the bees with production levels an interplay of this, access to food (nectar) and other environmental factors.

The increase in quarrying, logging and bush fires impact the natural habitat and foraging patterns of bees while government policy such as the development of the aluminum smelter in Pt. Fortin in predominantly forested areas are responsible for reduced production and displacement of some Beekeepers (Rajahram, 2010).

Differences between honeys are attributed to geographical origin, harvesting season, storage conditions and the botanical sources that are responsible for these biological activities (Sherlock et al., 2010). In Trinidad and Tobago, these qualities have not been analyzed as the market has gone unregulated for over 30 years and responsibility has been placed solely on the shoulders of individual beekeepers. According to Rajahram (2010) on average, local hives produce approximately 3 tonnes per annum which does not meet the production demand.

Access to “suitable apiary sites” have been cited as a key limitation to the development of commercial beekeeping as cited by the response to position statement on the importation of honey by ATTAC (2014) . And, although approval for access was given to beekeepers in 1997 as per Cabinet Minute No. 189 of January 23rd 1997, permits have not been issued, with more recent requests in 2010 to the then Minister of Food Production, Land and Marine Affairs, Vasant Bharath going unheard (Castillo, 2010; Solomon, 2010). The Minister who now holds the portfolio of Minister of Trade, Industry and Investment is also the one responsible for seeking legislative change to the Beekeeping and Bee Products Act, 1935 to allow the importation of honey.

Since 2002, the EU has imposed heavy restrictions on imported honey. This has forced debarred honey exporters to seek new markets having less strict regulations. These restrictions will not only impact our re-entry into these markets as we do not currently conduct any grading,

chemical testing or adhere to any international Honey Standards such as those presented in the Codex Alimentarius (Addendum 1).

According to EU Standards, Chinese honey is not permitted due to the presence of antibiotics in samples, while restrictions on honey from India have also been imposed because of lead and illegal animal antibiotics. So, while efforts to stimulate global consumer demand make low priced honey from China attractive, it will also open our market to the entry of honey of questionable quality, impacting food safety and our local Industry (The Public Ledger, 2012). Given the efficient network of honey laundering, not until independent chemical and pollen testing is established and becomes a standard procedure should the population feel comfortable of the safety and source confirmation of imported honey.

(2) The Apiculture Industry

Assessment of the Apiculture Industry has been done by looking at the various factors that contribute to honey production and its quality.

Beekeepers. Beekeeping in T & T has been practiced for the over 100 years with many Beekeepers who remain in the Industry today, ones who have weathered the changes in the Industry with a few making major contributions to the research and development of the Industry, such as Gladstone Solomon of Tobago and Bede Rajahram of Trinidad. While there are still a relatively small number of new comers to the market who are less than four years old, many have been encouraged by their personal interest in beekeeping and the availability of training.

Spurred by Government incentives given to the Apiculture Industry, some of these younger Apiaries have been formed by Beekeepers with a more marketing savvy background, including social media interests. Those who have entered the market are also part of a strongly emerging social structure within Trinidad and Tobago who no longer hold the perception of the

"primitive farmer", but one passionate about innovation, health and exploring business development opportunities across this primary sector (Maynard, personal communication, 2014).

Yet since knowledge, access to modern equipment, financial resources and business experience vary within the Industry among the present 320-registered beekeepers in addition to the unregistered ones, in Trinidad and Tobago, domestic production quantity and quality levels vary too greatly. The proposed action by ATTAC for their membership to develop only Grade 1 and Grade 2 honey as well as other secondary Beekeeping products will help standardize the process. However this requires much needed focus, guidance and education.

With the government decision to impose legislative change, ATTAC has entered into the an alliance with FIAAC which appears to have sidelined many of the much needed primary business goals such as consumer education effort, building their own brand and launch of education workshops to expand the numbers of Beekeepers.

Many registered beekeepers are members of one of the three major Apiculture Organizations referenced earlier TTBA, AOPB and TBA and several have joined the newly established Apiculture Cooperative ATTAC. While the Corporative remains focused mainly on securing membership, without a strong cohesive brand-building program delivered to its membership, their membership continues to be self-focused and build their personal brand especially pushed by the fact that the present domestic supply does not meet current demand.

Bee species. A Beehive contains three types of bee. The Queen Bee responsible for perpetuating the bee colony by laying eggs, the drone, responsible for mating of the queen bee, and the female worker bee, who carries out every function in the hive unrelated to reproduction including the collection of nectar and honey making.

In Trinidad much of the production is reliant on the smaller more aggressive Africanized

strain of Bees, while in Tobago, it has been the larger European Honey Bee since the first introduction of the Black bee (*Apis mellifera mellifera*) and Italian bee (*Apis mellifera ligustica*).

Variations between production and species seem to differ across various regions. A comparative study of honey production by Africanized and European honeybees in Costa Rica, by researchers Spivak, Batra, Segreda, Castro and Ramírez (1989), found that while intermediate broods tended to produce more honey, there was no significant difference in production between the bee types. In comparison, reports by Solomon (2011) President of the TAS describes a higher production level by Africanized bees.

Past president of the Trinidad and Tobago Beekeepers Association and Apiculture Historian Bede Rajahram is quoted to observe that while the ‘ The European honeybees will start work around eight, nine in the morning, the Africanized bees start work around four. If you go to an apiary before the sun comes up, the bees are out already, and they work until the sun comes down. They produce much larger quantities of honey as compared to the European bees.’ (Castillo, 2010).

Given these variables between bee species between the islands and variables in production quantity across regions, efforts should be made to determine the factors that affect production so as to fully harness the productivity of the different species of honeybees. As Beekeeper Jolee Herbert notes, “a happy bee is a productive bee” (Herbert, Personal Interview, August 18th, 2014)

Extraction. Honey is harvested when the bees cap the hive, indicating full maturity of the honey (Krell, 1996). This process of harvesting honey and honey preparation inclusive of extraction remains guided by the Beekeeping and Bee Products Act, 1935 amended in 1949. However, with the disbanding of the Apiary Unit, there is no means to ensure that a consumer

can know what is bottled and sold has been extracted at the correct time, is hygienically done or whether it is actually uncontaminated honey.

The minimum level of extraction procedure as defined by legislation of 1949 allows room for a wide variation in standard of extraction among Beekeepers in Trinidad and Tobago who have different practices in how they remove honey from the comb and the conditions of extraction. Some employ modern methods while others adhere to more traditional techniques.

The absence of legislation enforcement places the responsibility of the practice of good beekeeping on the Beekeeper, so that it is possible that honey that has not reached full maturity is processed from some hives because they are taken from uncapped hives under varying conditions of extraction (Gangadeen, Made in T&T, youtube video, 2014). Some beekeepers rely on extraction with the use of a mechanical centrifuge done in an extraction room, while others rely on the more traditional methods of pressing or draining honey.

Processing. Both raw honey and pure honey are available in Trinidad and Tobago and as a result of unchanged legislation, differing standards of extraction and processing methods exist, giving rise to many variations of quality available. In general heat is used to change the viscosity of the honey to facilitate a more easy extraction. However the difference between raw and pure honey lies in their differing processing method for preparation.

Raw honey is an unprocessed and unpasteurized form of honey being taken from the hive with gentle heat, without undergoing any altering process and although may be strained or filtered will usually contain some bee pollen whether visible or not and may also have a crystallized appearance. Pure honey, on the other hand is usually heated to achieve a certain level of consistency and depending on the exposure of the heat can result in some active biological properties of honey being lost as well as can cause changes in sugar composition. Again, this

may be filtered.

As the business of beekeeping develops, so too has the availability of equipment designed to improve extraction and processing that will minimize damage and loss, and improve honey presentation. Pasteurization, which is the heating process can result in the darkening of colour, changes in flavor, and can reduce active enzyme and yeast activity within the honey reducing its shelf life (Airborne Honey, 2014; Jianquan, 2011). Other processes that will affect the appearance include filtration and straining.

Although practiced in other countries, honey infused flavors is not common in Trinidad and Tobago. While legislation is clear on grading for export, for the domestic market nothing has been done, and labeling laws only require the use of the word "honey" to be used on either glass or tin containers and have not kept to date with current international labeling standards for food production. In Trinidad, most honey producers today sell honey of varying quality from nectar honey to honeydew in plastic or glass bottles of varying sizes and with varying labeling quality and can vary with raw honey presented pure, with comb or as chunk honey or creamed honey and sold at a premium price at an average of $40 USD for a 750 ml of honey.

Contamination of honey. While Trinidad has received many awards for its honey, there are also questions that arise regarding the purity and quality of honey across the market as practices among Beekeepers vary. Studies have shown that as honey inherits biological properties from the plants and attributes, so too can it inherit certain toxicity. As Al-Waili, Salom, Al-Ghamdi and Anasri (2012) explain "Honey produced from flowers of certain plants can cause honey intoxication and various symptoms such as dizziness, weakness, sweating, nausea, vomiting, hypotension, shock, and arrhythmia and even death."

Contamination of honey can also result from exposure to environmental conditions as

well as from harvesting practices inclusive of the use of pesticide on plants used for feeding. According to Roman (2005) industrial dusts and smokes, exhaust gases, toxic gases and pest control products contain toxic elements that with overuse can accumulate in the environment and can be transferred to plant and animal organisms contaminating not only plant products used by the honey bee but also can accumulate in the bee.

Since early studies by Leita, Muhlbachova, Cesco, Barbattini and Mondinil (1996) concluded that honey bee products and the examined environmental markers may be considered useful parameters to assess the presence of environmental contaminants as is done in the US and Canada. This leaves further development of legislation to be done regarding hive location and "suitable for consumption" guidelines as several sectors in Trinidad are Industrial sites. The recent US trend of Urban Beekeeping may not be an option in Trinidad until further development is done as the Africanized Bees are aggressive and unpredictable.

According to the FDA veterinarian newsletter (1998), contamination may come from spraying of field crops with pesticides, the use of microencapsulated pesticides on field crops and medicine used by beekeepers. A review article by Al-Waili et al ((2012) identifies pesticides, heavy metals, bacteria and radioactive materials as other sources of contaminants. Currently in T&T there is no legislation that refers directly to controlling of air pollutants emitted by industries and although as members of the Commonwealth and the United Nations, can benefit from research and technological advancement from other more developed member countries, little is being done to regulate environmental impact and exposure especially from the three major energy based industrial sites which is also adjacent to large areas of foraging lands.

While Pesticides, which are linked to human genetic mutations, may also found in honey, so too are antibiotics used in apiculture in treating bacterial disease may also be found in honey.

Although considered a residue, it may still be linked with antibiotic resistance which is identified by the WHO as "one of the three greatest threats to human health."

In Guyana, honeybees in hives located within the city of Georgetown are also exposed to non-floral sugar sources primarily from the sugars spilled from the local soft drink factory exhibiting a high productivity. However by definition, the product which is sold as honey should not be considered "honey" and without the necessary legal standards or enforcement, consumers are none the wiser. In Trinidad, a more deliberate practice of placing sweetened water in foraging areas has been used by some beekeepers to feed their bees especially during the dry season when flowering plants are fewer (Gruny, land owner, personal interview, 2014). Other practices that have been identified include the use of sugar additives such as molasses and corn syrup to thicken the "honey" after extraction.

Grading of Honey. Trinidad and Tobago continues to conform to a legislation set more than 70 years old requiring grading only for an export product under the Beekeeping Act Chap. 67:53 Article 38. On the local market, since most of the legislative stipulations are not enforced, some beekeepers have been found to label and sell as honey any product by bees created from flower nectar or sugar water alike, as well as from the sap excreted by insects. This honeydew variety was seen by road-side vendor along the North East of the island in the region of Sangre Grande, with labels describing it as honey. One beekeeper explained that the presence of rubber trees in the area accounted for this honeydew production. So far flavored infused honey has not been seen on the local market, but as the market develops, so too will these practices that will require proper labeling which would distinguish them from honey that has the flavor from the mono-flora variety which it was created from.

While the product participation in International Shows has earned several Beekeepers

across the islands International award, the local market access is limited in enjoying the benefit of domestic grading. The proposed production of Grade 1 and Grade 2 honey by ATTAC is one step closer to this process however documentation is lacking and could be guided by the more established US Standards for Grades of Extracted Honey (1985) (Addendum 2). In addition no scientific research has been done to examine the specific qualities of and composition of honey and its relation to the foraging environment in this region.

Marketing. Although ATTAC has set out to create an umbrella brand with a business plan for marketing honey of its membership, this has been slow to materialize. In the meantime, most Beekeepers have continued to be self reliant on selling their honey directly to gourmet shops, specialty stores and small food marts using their personal brand associated with their Apiary. This has kept the Industry segregated with Beekeepers competing among themselves. Those beekeepers using more modern extraction and processing techniques are the ones who are also more confident in the marketing of their product even without the necessary chemical testing, which adds to the quality gap and adds to the consumer confusion.

Recent television and radio interviews by ATTAC members have focused mainly on the effect of importation without enough being placed on educating the consumer of the Corporative, its membership or developing a brand identity.

(3) Consumer Assessment and Product Development

Consumer profile. Marketing efforts must target the right consumer and understanding their purchasing habits is a key to product development. Lack of consumer education has left a mostly urban population disconnected from the process of Beekeeping with many consumers relying on their childhood memories of beekeeping as a traditional practice associated with road-side vending.

Over 10 days, 40 adults who were "looking at honey" were informally interviewed at a small Grocery (15), a Green Market (10) and at a Wellness Center (15) to get an overall idea about why they purchased honey, what they knew of honey and their perception of the local honey. They were shown some Beekeeping terms and asked to explain them and were asked about how they felt about the governments' decision to import honey.

All interviewed individuals said they purchased honey as a sugar substitute and/or for medicinal purposes. While most of the interviewed groups were familiar with the terms "honey" and "honey with the comb", many were not familiar with other beekeeping terminology and could not definitively tell the difference between "pure" honey and "raw" honey, "unpasteurized", "pasteurized", "creamed honey", "filtered or strained honey", or "fermentation", and neither did they understand the implication of these terms, how it affects the properties of honey or how it should affect their purchase decision.

Several persons in each of the 3 groups expressed concerns over their inability to identify good quality honey and did not realize that apart from the word "HONEY" there were different descriptions on some of the labels for the extraction and processing method of the honey. Most were aware that all Beekeepers were required by law to be registered and assigned an apiary number.

While many of those consumers at the health centre pursued direct contact with beekeepers to choose their supplier, many were unaware of the options of extraction and processing available to local Beekeepers and mostly relied on word of mouth for referrals of good honey brands.

Those at the food mart said they sometimes purchased from road-side vendors from areas where beekeeping is known to take place, believing that the traditional beekeeping practice

ensured a fresher and better quality honey, and considered it to be a traditional agricultural practice, while those at the Green Market considered Beekeeping as a more progressive small Business enterprise.

There were a few persons in each group who complained about not being able to find good quality honey as they knew that some vendors were selling honey with added sugar syrup and molasses and they thought that the importation of honey was a good idea to improve the quality. None considered the health implication of the importation of substandard and artificial honey into the islands if testing was not required and few knew that illegally imported honey was already being labeled and sold as local honey at the same price as the local honey. Others said that they had seen bottled honey labeled from other countries in certain shops at lower prices than the local honey.

For the majority of interviewed participants, the importation of honey seemed to be a good idea, feeling that it too difficult to get honey. Many consumers were unaware that some of the beekeepers in both Trinidad and Tobago had won international awards. Few knew how to tell the difference between pure honey and honey with added sugar and most associated crystallization with the presence of sugar additives to it.

Product development. Honey is used for household consumption as food and medicine, for commercial use in food production and as a cosmetic additive along with the other beekeeping products. Recent developments in the Industry may guide further product development for its culinary value and medicinal value.

Culinary Value. Although production levels are restricted and there are wide variations in quality of honey, some of what is produced in Trinidad and Tobago meets with International standard for competition. The experience of the “older generation” Beekeepers contribute

significantly to the understanding of how the local flora influences the quality of honey and this has guided the selection of Apiary location by some Beekeepers.

Outside of illegally imported and bottled honey, Beekeepers in Trinidad & Tobago are responsible for selling their honey which they do under their personal label and Apiary number, allowing those beekeepers, with greater resources and marketing savvy to make the greatest strides in the local market with their products reaching local gourmet food shelves. And this is observed among some of the new-comers to the market who are less than four years old.

To date in Trinidad and Tobago, great focus has been placed on culinary properties of honey, partly the result of the international respect earned by Trinidad and Tobago since winning the silver medal with their first entry in 1987 and continuing their successful participation in the prestigious annual events. While Collins (2014) indicates that Tobago beekeepers have won 31 awards and their colleagues in Trinidad winning have won 18 (Collins, 2014), a more recent publication suggest 58 awards between 1987 and 2000 including the prestigious Henders Cup from the London Honey Show leaving London for the first time for 1999 and 2000. This trend continues with the most recent award given to Trinidad Beekeeper Bede Rajahram at the South Florida Bee Congress in August 2014.

As explained by Kaškonienė, (2008), taste and flavor are the two most important characteristics of honey and the main indicators for the acceptance of product by the consumer. And while T & T is known for award winning tasting honey due to feeding on multisource plants, little has been done to improve or standardize production and extraction across the Industry to meet an International Quality of Control standard and neither have there been efforts to explore flavored honey from mono-flora varieties.

In 2014, development of the Honey Flavor Wheel by the UC Davis Honey and

Pollination Center, in a conjoint effort with Robert Mondavi Institute of Wine and Food Science and the UC Davis Department of Entomology and Nematology broadened the once traditional four category list of sweet, bitter, sour and salty to over 100 types of honey based on qualities of fruity, floral, herbaceous, woody, spicy, nutty, confectionary, caramel and earthy, introducing to the market a new appreciation and perspective of honey as part of a more intriguing culinary experience (Arrington, 2014).

Medicinal Honey. Today, as the limitations of Western medicine are recognized for many unhealthy side effects, honey as a natural product has been the center of focus for many new allopathic medical studies as well as to offer clinical support to its use in traditional medicine. These range from its effect on blood sugar, body weight, lipid profile, C-reactive protein, nitric oxide, proinflammatory prostaglandins and homocysteine levels and its positive effect on diabetes HTN, dyslipidemia, obesity, and cardiovascular disease (Edirweera and Premarathna, 2012) to its use in treatment of wound and burn management and treatment of infections as a result of its unique properties as an anti-bacterial, anti-inflammatory, anti-oxidant and anti-viral agent.

In determining the potential application of honey and potential for product development, a brief analysis is offered on the composition of honey, which is reported to contain about 200 substances (Eteraf-Oskouei & Najafi, 2013). As explained by White and Doner (1980) the principal physical characteristics and behavior of honey are due to its sugars, while the minor constituents are largely responsible for the differences among individual honey types.

Several factors affect the particular composition of honey, however generalization from a few studies describe honey to be composed of several carbohydrates, mostly fructose and glucose comprising 85% to 95% of the total sugars explaining its use as a natural sweetener.

Compared with many other natural foods, honey contains a much wider array of sugars not commonly identified in other foods. As White (1957) explains, some dual formations occur with sucrose, kestose, melezitose and raffinose introduced with the nectar, while maltose, isomaltose, erlose and dextrantriose may be formed as secondary products by transglucosidation in the body of the bee. Understanding the complexity of the sugar structures in honey may guide our appreciation of how it is metabolized by the human body.

Honey has other unique properties and active agents that confer important natural health, and healing abilities. Montenegro et al (2013) identify several organic acids, amino acids, proteins, enzymes, lipids, flavonoids and vitamins responsible for biological properties. For example, according to White (1957), the action of glucose-oxidizing enzyme in the pharyngeal gland of the honeybee identified by Gauhe results in the production of gluconic acid and peroxide. This peroxide is believed to be a key factor in giving honey its antimicrobial properties.

According to White, amino-acid content of honey has also been used as a measure of honey purity by means of the formol titration (Tillmans & Kiesgen, 1927). Its presence by up to three times at its minimum levels, is said to distinguish it from artificial honey. The presence of phenolic acids and flavonoids, superoxide dismutase (SOD), reduced glutathione, ascorbic acid, tocopherols and catalase as identified by Beretta et al (2007) and referenced by Eteraf-Oskouei et al (2013) are considered the main source of honeys' protective effect in free radical-mediated diseases in vivo through a synergistic action.

In Trinidad and Tobago chronic disorders such as diabetes and heart disease have emerged as the major causes of adult morbidity and mortality, and the country is listed as having the widest prevalence and fastest-growing rate of diabetes in the world according to a reported

study by John Hopkins University. It is listed as having almost twice the global average at 12 percent to 13 percent (Castillo, 2013). Shortfalls in the public health care system in the treatment of people with diabetes now make it the number 2 killer in the twin island state affecting the relatively small population of 1.3 million people (Baboolal, 2012).

With research confirming that the therapeutic and biological properties of honey are derived from the flora, the exploration of developing medicinal plants for the production of honey remains an untapped opportunity given the unique qualities that honey can inherit, the current need to expand the global consumer honey market and the current need to preserve honeybees as a species.

According to studies by Mahabir and Gulliford (1997), herbal remedies using medicinal plants is common in Trinidad and Tobago, particularly where access to allopathic health care is unavailable or limited. Lans (2007) suggests that the multi-ethnic background of the population has contributed to this pattern where folk medicine has been passed from generation to generation. Mahabir et al (1997), note that among the diabetic community, some of the most frequently mentioned plants used specifically for diabetes include caraili, aloes, olive-bush, and seed-under-leaf while vervine ((*Stachytarpheta jamaicensis – Verbenaceae)*, chandilay, soursop, fever grass, and orange peel were preferred for other indications.

Since the early 1920s, the safe use of honey among diabetics has been recorded. A report in the Medical World, on the Treatment of Diabetes by Dr. Desiderius de Beszedits, of Coyuca de Catalan, Guerrero, Mexico, “the employing of honey-diet in the treatment of diabetes may look antiscientific, antimedical, even rather silly to the theoretical minded, uninitiated or to a superficial observer.” However, an increase availability of evidence based studies have demonstrated the benefit of honey in the treatment of diabetes mellitus in diabetic rodents and

patients as well as its effectiveness in the treatment of acute and chronic free radical-mediated conditions noting that when combined with anti-diabetic drugs there was an improved glycemic control, enhanced antioxidant defenses and reduced oxidative damage (Nazir, Samad, Haroon, Kidwai, Siddiqi & Zehravi, 2014; Erajura, 2014).

Honey has also shown potential in wound and burn treatment. In Europe and Australia, medically-certified honeys have been licensed as medical products for professional wound care (Khan, Abadin, Rauf, 2007; Gethin, 2007). Even more recent studies on the application of honey to burn and wound healing have shown it to possess equal or slightly superior effects when compared with conventional treatments for acute wounds and superficial partial thickness burns (Yaghoobi et al, 2013).

The topical use of honey has been shown to prevent the dressing from sticking to the healing wound, and may reduce odors, swelling, and scarring when used to treat wounds. Tested in a comparative study against Silver Sulfadiazene (SSD) on wound patients aged 10-50 years with first and second degree burns on less than 50% of body. Researchers found that the honey dressing improved wound healing, makes the wound sterile in lesser time. Tests on honey also have shown it to have a better outcome in terms of prevention of hypertrophic scarring and post-burn contractures, and decreases the need of debridement irrespective of time of admission. (Baghel, Shukla, Mathur and Randa, 2009; Visavadia, Honeysett & Danford, 2008, Gethin, 2007).

Other studies have also found other potential uses of honey such as in processed foods. A study by Ezz El-Arab, Girgis, Hegazy and El-Khalek (2006) found that substituting sugars with honey in processed food can inhibit the harmful and genotoxic effects of mycotoxins, and improve the gut microflora. It also been shown to have a positive impact on an inflammatory

model of colitis as referenced by Eteraf-Oskouei et al., (2013) and is as effective as prednisolone treatment, a drug also commonly used for the treatment of gout, arthritis, psoriasis and chronic allergic reactions.

Recommendations

Following the overall framework outlined and the development of the research design which has been focused largely on the current status and developments taking place today, a list of recommendations is presented in a triad approach for Government, Apiculture and Consumer although there is overlap in the evidence and findings. The recommendations generated will be shared with ALL Trinidad & Tobago Apiculture Society Ltd. which is structured to support several of the objectives listed in the theoretical framework of this study.

Government Action plans

1. Address Legislative change - Develop analysis of impact of Legislation change. Before implementing legislative change, government must fulfill its mandate and support of the Apiculture Industry and act with consistency in the interest and protection of the Apiculture Industry. Allow a re-assessment of progress before change of legislation is allowed.
    (i) Fulfill their agreements to allow Beekeepers access to Forested State Lands as per Cabinet notes 1997, Minute Reference 189-1/23/97
    (ii) To promptly attend to the reimbursement of the Beekeepers as per Ministry of Agriculture Incentive program (2012).
2. Establish Independent testing facilities and proper infrastructure
    (i) To address chemical composition, contamination, pollen and quality of product already on market and that entering the market. Given the current global trade of contaminated honey and use of ultrafiltration, the use of nuclear magnetic resonance

spectroscopy can be explored as it is able to distinguish between different honey types, and can pinpoint the area where it was produced.

(ii) Introduce Honey grading systems for all honey. Can follow guidelines set by the USDA Standards (Addendum 2)

(iii) Establish Labeling law standards.

3. Lobby Ministries for better integration of policies between Ministry of Agriculture, Ministry of Trade and Commerce and the Ministry of Health.

4. Lobby Ministry of Agriculture

(i) To explore opportunities for medicinal honey

(ii) To issue certification for use of government forested lands for forage

(iii) To implement stricter regulations on pesticide use in agricultural lands and regulation of GMO seeds.

4. Lobby Ministry of Health to explore medicinal honey and to develop public health programs.

B. Apiculture Stakeholders

1. Establish collective certification process as well as a gold standard of production

(i) Defining honey and honey standards

(ii) Grading of honey

2. Introduction of Quality Control Labeling Seal – (Attachment)

(i) To allow beekeepers who are part of the cooperative to use the seal which allows consumers to identify that product have met gold standard of production.

(ii) Allow establishment of marketing support to build micro enterprise. (Use of video clips of Corporative members)

3. Micro Business development program

(i) Education - Beekeeping programs and training for new beekeepers. (Currently underway)

(ii) Identify and create necessary support systems to encourage business development of hobby bee keepers from production side to market side .

(iii) New product development opportunities – Medicinal honey, soaps, candles etc.

C. Consumer

1. Public Education Campaign on the value of honey and types of honey.
   1.1. Social Media Projects
      1.1.1. Facebook page (Established ATTAC – working on building likes)
      1.1.2. Video clips
      1.1.3. Articles
      1.1.4. Television Interviews (Several television interviews have already been done)
      1.1.5. Radio Interviews
      1.1.6. Social media Interventions
      1.1.7. Attendance at special Events
2. Establishment of School Education Program
   2.1. Establishment of science project - “Seeds for Bees” project - give schools packets of seed to which will encourage bee pollination. Requires working with high school /primary school teachers and get project into education program.

Conclusions

At present where demand is already exceeding supply, initial focus must be placed on developing the production capacity by removing the obstacles to production and growth. Lack of

the government support from enforcement of legislative regulations, inadequate infrastructural support, unresponsiveness to invasion of Africanized Bees, inadequate funding, inadequate training and restricted access to forage lands, have all worked to shrink the Apiculture Industry of Trinidad and Tobago, while lack of developments of the legislation to meet current practices and developments within the global food and Apiculture Industry, including chemical testing and grading have further curtailed growth.

The production of registered Beekeepers has the capacity to increase at least twice the current levels with the right infrastructure given the year round favorable climate and rich biodiversity, so educating new Beekeepers can further increase capacity and potential can be realized within a year.

While strategies for increasing growth is being done, strategies for enhancing the product quality should occur. For the Beekeeping community, the opening of the local market to honey imports is detrimental to the Industry and given the present structure this could be true. As a pre-emptive plan it acts against an Industry lacking systems to meet the primary objectives set out by the Ministry of Food and Production to promote self reliance, food security and to double local honey production. In addition, given the current global increase in trade of contaminated honey, whether through chemical or antibiotic additives or sweeteners, the opening of the market without the necessary chemical testing or grading infrastructure adds further strain to the National health care system.

With focus on the development and expansion of the domestic product inclusive of consumer education, this concern can be alleviated if domestic brand recognition is supported and enforced with testing, grading and labeling laws of all honey. Furthermore, should investment be directed to further development of Beekeeping products, and output increases, the

export market opportunities are highly lucrative given the present culinary quality of the domestic honey.

The potential for attracting more revenue from honey is also high given the new developments in culinary honey and clinical studies that show its' health and medicinal benefit. The need for further product development research supported by the establishment of labs and testing facilities can significantly improve the safety standards for honey produced and consumed. Opportunities for medicinal honey should also be explored considering that there are indigenous plants that have been used in traditional medicine to treat diabetes and other inflammatory diseases and if shown to be beneficial further exploration of other healing plants in the region.

As expressed by Zumla and Lulat (1989) 'The therapeutic potential of uncontaminated, pure honey is grossly underutilized. It is widely available in most communities and although the mechanism of action of several of its properties remains obscure and needs further investigation, the time has now come for conventional medicine to lift the blinds off this 'traditional remedy' and give it its due recognition.'

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Addendum

1. Codex Alimentarius

2. US Standards for Grades of Extracted Honey (1985)