5. Maturation of stingless bee pot-honey: a new frontier in the gastronomical market

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Abstract

With the goal of sustainability in the development of rural communities in Maranhão State, Brazil, a project of social-environmental development based on the farming of native stingless bees, named 'Native Bee Project', was implemented. During 10 years working in the context of social technology, several obstacles had to be overcome— from illiteracy to development of inexpensive techniques for processing honey, to overcoming inappropriate legislation while stimulating change in cultural perceptions. The development and enhancement of honey maturation techniques by the Native Bee Project brought new market possibilities and prospects, and attention to strong components of gastronomical and geographical value of the product. Although applied on a regional scale, the Native Bee Project concept provides a model for conservation of stingless bees and relocation of their bounty to a more appropriate market.

Key words:
meliponiculture, processing, stingless bees, northeast Brazil, pot-honey, social-environmental development, gastronomical market.

Introduction

Meliponiculture, or the raising and farming of stingless bees, has been sparking interest for the past few years, not only in rural communities and their income generation, but also in the gourmet market, where professionas use the product, either for its medicinal properties or for its outstanding flavors (Drummond and Malheiros, 2012).

Stingless bees belong to a taxonomic tribe called Meliponini. Its species have a pan-tropical distribution. It is in the Americas, however, that a great part of its diversity is displayed, and where the farming of these insects manifests itself most intensely (Villas-Bôas 2012). Even though these bees are designated as "stingless", they have only undergone atrophy of the sting, and have other defense mechanisms.

One of the largest obstacles to meliponiculture lies in the market chain. Meliponine pot-honey is different from the commercial honey extracted from combs of the reknowned *Apis mellifera*, which belongs to a different bee tribe. The honey of stingless bees has a short shelf life and ferments easily due to its high water content (between 25 and 30%) (Sodré, 2008). This problem forces the producer to either keep the product refrigerated or submit it to one of two kinds of treatment usually employed to increase shelf life: pasteurization or dehumidification. Both techniques have their own inconveniences —mainly alteration of the product's qualities, changing its taste— very appreciated by the gourmet market. Another inconvenience is the high cost of such treatment, considering production above 100 kg. In Brazil there is production, such as that

from the 'Projeto Abelhas Nativas' (Native Bee Project) in Maranhão, which will be processing, in 2012, around 1 ton of honey (Drummond & Malheiros, 2012), making pasteurization or dehydration impossible for independent and family producers which cannot afford the prohibitive investment.

Between 2001 and 2011, the Native Bee Project developed, in Northeast Brazil, techniques for the production, processing and commercialization of stingless bee honey. On a family scale, where this development was centered, a new niche of the consumer market was addressed (Drummond & Malheiros, 2010). That market has proven rigorous in regard to the origin, extraction process, social-environmental value and local flavors of this pot-honey.

The Native Bee Project is a community project based on meliponiculture, including 18 rural communities in different stages of development, encompassing 180 families (Drummond et. al., 2008). Over the years, the project has developed a processing technique for the honey, called maturation, which allows for conservation of honey with no need for refrigeration, in hermetically closed bottles with a shelf life of over two years.

The maturation consists of controlling the natural fermentation process that follows honey extraction. The honey is marketed in such a way that every bottle specifies the location of origin, following the specific guidelines of TPAN (Technology of the Native Bee Project).

The challenge for the Native Bee Project is to combine biological conservation with rural sustainable development, and to adopt cheaper production and commercialization processes for stingless bee products. Results, general conclusions and future prospects are presented and discussed in this chapter.

5.1 Native bee biodiversity and commerce

A large part of the success in the pollination of plants depends upon bees, and many on stingless bees. Furthermore, there are plants that can be pollinated by *Apis mellifera* (known as African bees) and by multiple native species. Some native plants, however, can only be pollinated successfully by stingless bees, native from the same region.

Considering this interrelation as a product of the evolution of the bees and the plants (the stingless bees have interacted with the plants of Central and South American for many millions of years, unlike *Apis mellifera*, which was only introduced to Brazil in the 18th century), one can recognize how important these bees are for the maintenance of local biodiversity. The food sources of hundreds of traditional peoples depend of these bees. In Brazil, it is estimated there are close to 200 species, of which a good portion have market potential with their honey, pollen, and wax and propolis (cerumen).

5.2 The disturbing impact from the introduction of *Apis mellifera* in Brazil

The introduction of *Apis mellifera* in Brazil in the 18th century was the foreshadowing of a disturbing scenario that is perceived in the 21st century. The first lineages introduced, originating from Europe (APACAME, 2012), were tame and less productive, and were confined to the south and southeast of Brazil. However, with the goal of increasing productivity, a more aggressive lineage was brought from Africa in 1956. Due to lack of control, the African lineage spread throughout Brazil in the following years, and then through the rest of the Americas. This led to an Africanization process of all the *Apis mellifera* lineages existing in tropical America. The expansion of Africanized bees gradually led to a shift in the behavior of several traditional communities. While apiculture adapted to the new lineage of *Apis mellifera,* resulting in the expansion of its practice, stingless beekeepers found themselves lacking motivation. This was for several reasons. Honey of the stingless bees is not competitive compared to that of *Apis mellifera* (there are differences in production and pattern). Another reason is that stingless bees are much more sensitive to degradation of ecosystems, resulting in a decrease in the population of native species with time. A third reason is the fact that many people were alarmed when facing an unknown species, similar to the native bees, but much more aggressive. To many producers, the stingless bees were affected not only by ecosystem degradation, but also by the introduction of *Apis mellifera*, and especially with its Africanization. There are scientific data that confirm the impact and others that do not (Paini, 2004; Roubik 2009). However, for the traditional communities of many regions in Brazil, many periods of loss in the diversity of native species coincide with the periods in which the Africanized variety was introduced to the region.

5.3 Stingless bee farming for the survival of rural communities

In Brazil, from the second half of the 20th century until the decade of 1970, whole families were often

devoted to the farming of native stingless bees. In northern and northeastern Brazil, records show farmers had up to 2000 colonies (Kerr, 1997). Indigenous communities in the Americas had rituals based on the main product of these bees, the honey, such as the Maya (Cortopassi-Laurino, 2002), in Mexico, and the Guajajara (Schroder, 2002), in Brazil. Starting in the 70s, there was a decline in numbers of Native Bee nests, probably due to combined factors, such as environmental degradation from agricultural expansion, and the expansion of Africanized bees, which led to countless families quitting the practice. Much of such information, including the technical knowledge, was kept only in oral tradition and in memory by the elders.

Today however, thanks to the action of organizations which provide assistance to these communities, many recognize the importance of stingless bees as agents for maintenance of ecological integrity, mainly because, being stingless, they can be kept near homes, acting as an important source of food and a pollinating agent for their agriculture.

5.4 Native stingless bees and *Apis mellifera* make different products

The pot-honey and pot-pollen of stingless bees are distinct from the honey and pollen produced by *Apis mellifera*. The honey from stingless bees has a higher water content (roughly 28 to 30% water content), which makes it subject to fermentation, and the pollen is usually a fermented mass. The fermentation renders commercial use impractical or at a disadvantage, relatively to similar products from *A. mellifera.* Artificial techniques such as pasteurization and dehumidification (Sodré, 2008), have been utilized to stabilize the product, but with some loss of quality. Traditionally, the honey from stingless bees is used medicinally to heal physical and spiritual illnesses. One possible reason for such medicinal application is that the honey is usually kept in pots of cerumen (a mixture of wax and resin). During storage, the honey may acquire some components of cerumen, known to have several medicinal effects. For this reason, when one drinks the honey from stingless bees, one may be actually ingesting a compound of honey and propolis.

5.5 On the need for regulation and recognition in Brazil and abroad

With the purpose of stimulating the practice of meliponiculture in traditional communities, several Brazilian organizations have projects of technical assistance, mainly in the north and northeast regions (Villas-Boas, 2012). In spite of the success of these experiences, they have faced problems regarding commercial and environmental regulations. Unlike the honey from *Apis mellifera*, there are no sanitary regulations for the honey and pollen of stingless bees, which would allow commercialization in large urban centers, or exportation. The honey of Native Bees is kept under the same restrictions of the honey from *Apis* and is treated as such, in spite of being a very different product, both in quality and extraction technique. This effectively keeps it at the margin of the market, even though there is great demand. The lack of regulation resulted in legal uncertainties that discourage distribution among national commercial centers, thus making it an unknown product not only in Brazil, but also in the United States and Europe. Besides the lack of commercial norms, the keeping of stingless bees suffers setbacks due to an environmental legislation completely out of touch with the reality of most beekeepers. With the goal of ensuring the preservation of native species, the current legislation does not enforce its protection and does not give traditional communities the liberty to farm meliponine bees without the risk of being criminally persecuted and penalized.

5.6 Actions to valorize the products of stingless Native Bees and the role of research institutions

Acknowledging the necessity of unifying Brazilian stingless beekeepers, and adopting a more political posture in support of community enterprises based on meliponiculture, Slow Food Brasil has stimulated, since Terra Madre Brasil 2007, the formation of working groups that unify efforts to improve commercial and environmental regulations. These groups, working from experience with traditional communities in the north and northeast, proposed commercial regulation, taking advantage of the fact that the federal government made regulation of animal-origin products open to public input. They expected to overturn the current scenario for meliponiculture in traditional communities in Brazil. The document, subscribed to by 12 entities, 3 networks and 13 researchers from several research institutions in Brazil, had in fact very little effect. Many are still too attached to the cultural practices of traditional apiculture.

A process of this scale cannot advance without the knowledge gathered in research institutions. Aware of such a need, researchers from numerous institutions in the state of Maranhão, as well as representatives of civil society, put together a

network geared exclusively towards community meliponiculture. With support of the Maranhão Research Fundation (FAPEMA), institutions such as the Federal University of Maranhão (UFMA) and the University of Maranhão (UEMA), as well as civil organizations like Semi-Arid Articulation of Maranhão (ASA/MA), the Maranhense Association for the Conservation of Nature (AMAVIDA) and Brazilian Service of Support for Micro and Small Enterprice (SEBRAE/MA) have formed the Maranhense Network Research with Native Bee Social Purposes (REPANS-MA). Its mission is to foment academic-social synergism. Although such a network has shown little practical effect this far, this experience is expected to serve as an example for similar experiments in other regions of Brazil.

5.7 Strategies for commercialization of pot-honey

For the Native Bee Project, which has advanced considerably in the production and commercialization system under the auspices of AMAVIDA, the commercialization was left in to a private company. This company, besides incorporating innovative systems for the processing of the main product, pot-honey, emphasizes production and handling practices, especially sanitary standards. Thus, the company answers for processing and sale of Native Bee products from 18 rural communities and 180 families that employ the PAN Technology in its production.

This undertaking arose as the project's own solution, considering the producers' lack of entrepreneurship experience could cause large delays. Instead, a consolidated channel of commerce was chosen, so sales could proceed under existing legal regulations. The company, although private, is of a social character, founded by the creators of the Native Bee Project and its technologies, and acts with the intention of fair commerce. As it does not strive for profit, the prices passed on to the consumer are those necessary for maintaining the commercialization system. Thus, the producers get back from the investment, in addition to the value of the price of the honey in the local market, a bonus of over 100% corresponding to conservation of the bees, and sanitary procedures. Locally, all the production of honey from stingless bees outside the Native Bee Project comes either from traditional hives (which are natural trunks with nests) kept around houses, or from predatory extraction, when the nest is destroyed in the field for honey extraction. This unprocessed honey is sold for around R$10 (USD 5) the liter to a commerce which passes it on at R$15 (USD 7.5). The producers in the Native Bee Project earn, in addition to the R$10 (USD 5) which they would earn selling locally, a R$15 (USD 7.5) bonus for conservation, resulting in R$25 (USD 12.5) per liter. It is, therefore, a good trade value for the producers.

Meanwhile, the producers look for ways of organizing themselves as they can. Currently, they are part of a recently formed association, the AMELPAN (Stingless Bee Keepers Association of Project Native Bee), which strives to, at first, improve production conditions of its associates and second, to take charge of incorporating the processing steps normalized by TPAN, including the commercialization of its products.

The enterprise strategy within the Native Bee Project was to adopt the technique of honey maturation as a processing norm in these 18 rural communities. The technique was systematized by the project from observation of standard procedures of rural producers who, unknowingly, had already adopted the practice. What was done, from the daily practical experience of the farmers, was to take note of details that guaranteed honey conservation for several months. Although the technique may yet be perfected (requiring years of research), the enterprise chose to keep ties with artisan production. The family or cottage-industry scale identity of this product gains more and more consumers, while linking the product to a cultural, regional identity (such as packaging in buriti straw (*Mauritia flexuosa*) (Figure 1). Thus, it can fulfill its social function and allow a larger number of families to participate and benefit from project earnings.

Photograph: SM Drummond

Figure 1. Native bee honey-based products valorizing local handcrafts

Conceptually, in the Native Bee Project, the product "honey from stingless bees" should not be seen as a commodity such as the honey from Africanized bees. Once the product benefits from a maturation process, possesses unique characteristics of family agriculture and represents small-scale production, it must be commercialized with added value. The sale in personalized bottles helps to guarantee substantial reward to producers. For this reason, we believe separation from norms of international commerce may allow for a legislation more in tune with regional reality, without compromising quality standards—as has occurred with other artisan products in Brazil.

5.8 Pot-honey production history

The path of meliponiculture in Brazil is marked by production on a small scale, which fulfills only the local production limits. Although stingless bee honey is a product appreciated by those who know it, the demand has not been sufficient to stimulate a market-scale production, simply because the local market does not exist. Locally, it is seen merely as medicinal and, for this reason, only used as such. In larger consumer markets, it is seen with reservations because it is unknown, being labeled as honey from Africanized bees. However, in the market of organic and natural products, it has shown certain appeal, capturing the interest of those in the gastronomy business.

In spite of difficulties stemming from lack of specific legislation for commercialization, and lack of regulation in Resolution No. 346 of CONAMA (2004), which deals with beekeeping, the market for this sort of product has attracted interest, but also worries.

Nonetheless, the Native Bee Project has seen a constant increase in production. In an optimized scale of production, a community with 50 participating families, starting off with 50 colonies could, in a 5-year interval, produce 1.6 tons of honey, generating annual earnings of R$1600 (USD 800) per family. However, a strong cultural component allied to the lack of educational background and scientific knowledge in these communities inhibits an increase in production scale, keeping it behind demand.

In a production projection of four communities, the growth rate in productivity is quite slow in the first three years, after which there is a spike in production, which may be slight, depending on the community. However, even if that demonstrates a positive response from the community, it is still subject to setbacks from climate conditions, as observed in 2007, when production rates lowered, due to the meagre flowering of plants in the Cerrado (Brazilian savanna) (Figure 2).

As a result, the annual income of the community, although relatively low, advances appreciably, considering that income is often under R$70 (USD 35). Thus, production generating an increase of R$30 (USD 15) in family income has an impact comparable to that of the 'Bolsa-Familia', the program of assistance against poverty by the Brazilian government.

An analysis of the history of each community reveals interesting trends. The Todos os Santos community, which traditionally raised bees in hives (without any handling) over 20 years, was the one which demonstrated the strongest resistance in adopting new handling techniques. Preazinho, another community, having a honey of high value in the gastronomical market, still retains old habits of not investing in animal farming. The community of Moura showed a progressive increase in productivity that suffered due to lack of flowering in plateau regions of the Cerrado. On the other hand, the community of Limoeiro, which had previous experience in beekeeping, has shown a steady growth in productivity (Figure 2).

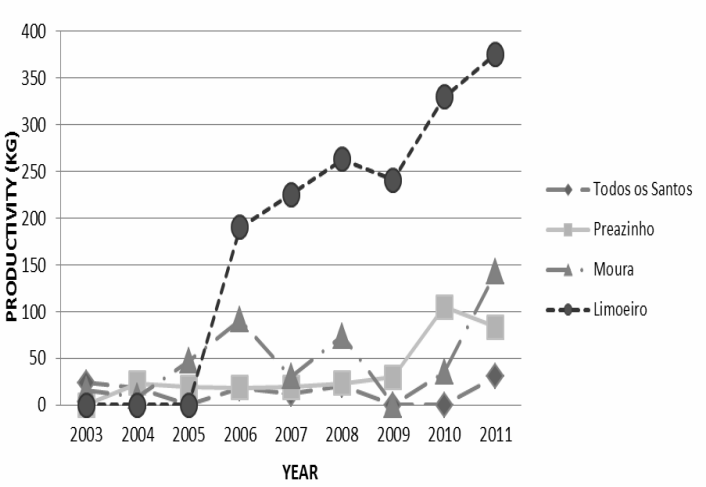

Figure 2. Annual variation in production of Native Bee honey in four rural communities in northeastern Maranhão, Brazil

The cases of success and failure are informative for rural communities in Brazil. Because production of honey from stingless bees is limited, it is always compared to the farming of Africanized bees. While a colony of Africanized bees produces between 30 and 50 kg of honey each year, the most productive stingless bees colonies produce between four and six kg. Therefore, it is obvious Africanized bees produce

more and a stingless beekeeper with few colonies would have difficulty supporting themselves with the low production expected.

However, from an economical point of view, an analysis should not be made in such a simple fashion. Several factors must be considered: a) the price of stingless bee honey, b) the costs of infrastructure, c) the cost of maintenance and safety, and d) the annual cost of production. We shall look at each of these aspects in further detail:

5.8.1 The price of stingless bees honey

Much is said of honey sold at R$60 (USD 30), R$80 (USD 40), R$120 (USD 60) per liter. On a domestic scale, and depending on the region, it is completely possible. In larger-scale production, such as 1 ton, these prices don't hold up. It is the law of supply and demand. But if we consider reasonable prices of R$20 (USD 10)/kg or R$25 (USD 12.5)/L, which is how much is paid to the producers in the Native Bee Project, this value stays reasonably above what is paid to the producers of Africanized bee honey— around R$2 and R$3 (USD 1-1.5)/kg, depending on the price of the dollar, since this honey is a commodity.

5.8.2 Assembly of infrastructure

Besides the hive boxes, which are much simpler than those for Africanized bees, a stingless beekeeper will need a small space where he can keep the bees (the meliponary), beesuits and sometimes veils, which may be unnecessary depending on the species being kept, and handling utensils such as hive tools, spatulas, etc. In the case of Africanized bees, hives are more elaborate and costly, special garments such as overalls, veils, boots and gloves, a smoker and smoker fuel, and an apiary site separated from populated areas, a honey extraction house, and extraction equipment, including centrifuge, a dehumidification facility, and large storage tanks, are mandatory.

5.8.3 Maintenance and safety costs

In the case of Africanized bees, besides the maintenance of equipment, one must also consider safety issues. Apiaries must be kept far from residential areas or areas with significant human and animal presence. Stingless bees can be kept in backyards and farms. This allows a more significant participation of the youth and women, without compromising other domestic affairs.

5.8.4 Economic weight of production

Meliponiculture must be a complementary practice to productive activities, and perhaps never an exclusive enterprise. On a domestic scale, a meliponary of 50 colonies per family would be enough to generate considerable income. However, many people start bee keeping expecting rapid income, as with the Africanized honey bee, which is not the case for stingless bees. Profit will require discipline, patience and persistence. On average, satisfactory production does not begin until the third year.

5.9 The product: the mature pot-honey of the Native Bee Project with Origin Designation.

The honey and pollen of the Native Bee Project have stood out in the Brazilian market for their qualities, especially in the gastronomy field. In specialized internet blogs and publications, likewise, further attention is given to the fact that the Native Bee Project has adopted simple measures for processing the honey and the pollen, allowing for prolonged conservation and facilitating storage and commerce.

In order to highlight these qualities, the project began to designate the honey and pollen as ‘nathoney’ and ‘natpollen’, and the mature nathoney was designated iraina (the word for native bee honey in the Tupi language). Therefore, for the Native Bee Project, honey and pollen are generic denominations for products of mellifera bees (of the genus *Apis*), while nathoney and natpollen are generic for fresh products from bees of the tribe Meliponini, and iraina is the generic denomination for mature nathoney, i.e. nathoney that has undergone the specific processing of stabilizing by maturation.

With respect to nathoney, in issue No. 138 from May, 2010, the magazine *Menu* presents gastronomical qualities of the products (Marques, 2010) and, in her blog, food stylist Tânya Volpe presents a list of iraina from several communities of the Native Bee Project in different menus (Volpe, 2010). The reason for these highlights is that maturation enhances and reveals taste qualities of regional flora, in a way that each community produces iraina with its own particular taste. The product origin is revealed by its taste. This has been highlighted in major national events, where nathoney tasting workshops have become common. For this reason, iraina is now commercialized and labeled by the species of producing bees, the region of origin, and the biome of production.

In summary, the quality of the iraina produced by Native Bee Project communities is not *necessarily* linked to a producing species, nor to a specific geographic location, but often to the maturation process employed.

5.9.1 The maturation of pot-honey

The process of maturation of stingless bees honey is linked to the concept that not all fermented

honey is spoiled honey. In traditional communities, which have been raising Native Bees for years, it is not believed honey can become spoiled. Traditional producers store the honey, often reusing alcoholic beverage bottles, for months in the dark, sealed with rustic corks made of corncob. These are corks that don't completely seal the bottle, allowing gas exchange between the interior and the exterior of the bottle and, maturation of the honey.

Among indigenous people, many appreciate ritualistic cults that involve honey from Native Bees in an advanced state of maturation, such as the Honey Feast from the Tenetehara (or Guajajaras), for example (Barros and Zannoni, 2010).

The honey, when extracted applying hygienic practices and submitted to a maturation period that averages 6 months, may be consumed even 2 years later. In the Native Bee Project, the process of maturation basically follows the same principles involved in the maturation of raw, wild honey.

Maturation processes, listed below, are very important to ensure control of both process and product:

a) Not mixing honey from different colonies – this way, besides commercially validating the product, any maturation deviation can be isolated from the rest of the inventory.

b) To collect and maintain the honey in clean, small bottles of 500 mL, hermetically sealed —bottles with this capacity are more appropriate for extraction utilized by the Native Bee Project the 'glossador'; variants can be isolated from the rest of the inventory.

c) Between collection and bottling, not to transfer the product —the honey collected in 500 ml bottles can be maturated in the bottle, which avoids risk of contamination.

d) To take extreme hygiene measures during collection and handling —to clean the boxes with cloth and brush before opening it and making use of veils, caps, gloves, aprons and an extraction tent.

In this process we point out two important resources for collection which can possibly be replaced by other alternatives, but which have proven to be effective within technology adopted by the project and the rural communities in Maranhão.

The 'glossador' (Figure 3) —a manual honey extractor which, despite the slow process compared to an electric extractor, is the only one adequate for maturation. Extraction of the honey occurs without bubbling or excessive air injection, minimizing the risk of contamination that may compromise maturation; in addition, harvesting is done from the pots directly into the 500 mL maturation bottles.

Photograph: SM Drummond

Figure 3. Manual extractor "glossador" utilized for the harvesting of Native Bee honey and which guarantees its sanitary quality

Extraction tent (Figure 4) —a shelter for the extraction of honey in 3 x 3 square m covered with mosquito net that, besides keeping the collection site isolated during handling, excludes dust and Africanized bees that invade during the collection process.

Photograph: SM Drummond

Figure 4. Extraction tent with a community group

5.9.2 Procedures of maturation of iraina

a) Following the collection of the nathoney, which must rigorously follow hygienic practices, the 500 mL bottles must be kept hermetically closed, in dark environments, and protected from sudden temperature variation (Figure 5a).

The honey bottles will remain under these conditions until the final cycle of maturation. Fermentation starts naturally around 15 days or less, as a result from the natural action of yeast present in the honey.

b) After 15 days the cap of every bottle must be loosened, to let out the gas that forms inside, and then immediately closed again. This procedure must be

repeated once every week while fermentation is occurring. With time, the pressure from fermentation will decrease.

c) During the process of fermentation, a layer of foam will form in the surface of the honey. As fermentation decreases this foam will become more consistent and will tend to stick to the internal walls of the bottle to the point when, if one slightly tilts the bottle, the ring of foam will not fall down into the honey (Figure 5b)

Photograph: SM Drummond

Figure 5. Honey from Native Bees

a) Maturation room **b)** Native Bee honey in different stages of maturation – left bottles: mature honey; right bottles: honey in maturation. Notice foam on the honey.

d) When gas production ceases completely and the foam on honey declines, the product is ready for bottling.

In order to be safe, one should wait another month before bottling. The reason is that after incomplete maturation, there is a risk the product inside the bottle might produce gas when: a) the bottle is kept in an excessively hot environment or under direct sunlight, b) bottles have been subject to sharp blows, dropped, etc., and c) bottles are submitted to sudden pressure changes (such as during air transport).

It is yet unknown why some honeys ferment and others do not, but all of them, submitted to bacteriologic and physio-chemical analysis, haven shown to be within the standards for human consumption, even after the maturation period. These analyses will be presented as studies progress.

5.10 State of the art and future development

The process of maturation utilized by the Native Bee Project has allowed for a recently unknown quality of nathoney to gain recognition. The inherent diversity of regional flavors is accentuated by the floral diversity of each ecosystem where the meliponaries are found, possibly permitting attainment of a Geographical Indication seal. This is what has captured the interest of food specialists, who have been exploring this diversity in the preparation of different products. Because of a justifiably anticipated demand, nathoney tasting workshops are becoming popular, to the point where one could soon qualify as a professional in nathoney tasting.

Today we are planning a prototype for an industrial maturation unity involving large volumes of nathoney (up to five tons). Care is being taken to make the maturation process economically viable for low income producers, who remain our main target in Brazil.

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