Ancient Maya Beekeeping
(ca. 1000-1520 CE)

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ABSTRACT

This research integrates sixteenth century and later written descriptions of the people of the Maya lowlands with archaeological evidence from Postclassic (1000-1520 CE) sites in the Yucatan to examine the significance of beekeeping in the ancient Mayan world. These various lines of evidence illustrate the numerous connections between the production of honey, religious practices, beliefs, and trade between Mayan centers. The model of Postclassic Maya apiaries developed here may be used both to predict the nature and location of beekeeping for future archaeological research and to evaluate new, or otherwise unexamined, data from archaeological sites.

METHODS

To learn about Mayan beekeeping practices, I examined Spanish accounts, ethnographic accounts, and contemporary information that included information on the appropriate habitat for apiculture in the Yucatan Peninsula. By comparing the Spaniards' accounts of 16th century beekeeping with more recent accounts, I was able to conclude which aspects of beekeeping tradition remained unchanged or were only slightly affected during the last five hundred years. To examine more ancient practices, I focused on the material traces of apiaries that would preserve at archaeological sites. Historically, Mayan beekeepers use stone plugs, called panucho plugs, to seal the hives.

By comparing these diverse sources of information, I drafted a model for such practices and then evaluated the efficacy of this model by using archaeological site reports that exist for Yucatán and Cozumel. Included in this model are characteristics of beekeeping, such as where apiaries were kept, the labor costs of each apiary, and production of beekeeping goods themselves. I will focus on five main topics: location of apiaries, size of apiaries, yields of beehives, labor requirements, and development and sustainability.

HISTORICAL SOURCES

An important source of information is Bishop Diego de Landa's account of the Yucatec Maya of the sixteenth century in his book Relación de las cosas de Yucatán. In this account Landa describes the beekeeping practices of both domesticated *Melipona beecheii* (the most-used stingless honey bee) as well as the practices of hunting and collecting honey from wild bees in the forests. Some groups that Landa observed tended apiaries, drawing honey and wax from the hives in ways that preserved the bee colonies and established a symbiotic relationship. The bees and their honey were considered sacred and valuable. Another important historical source is Diaz and Oviedo descriptions of beekeeping on Cozumel during the Spaniards' first few visits to this island. These accounts plus the ethnohistoric information were key to developing a model of size and location of the average ancient Maya apiary from the Postclassic period.

CONTEMPORARY AND ETHNOGRAPHIC STUDIES

Because Maya beekeeping and the stingless bees are nearly extinct, G. R Villanueva (2005) and others have recorded a vast amount of statistical and behavioral data on beekeeping practices in eastern Yucatán. The information they gathered is of great, not only for ecological and apicultural conservationists, but also provides insights into past practices. For instance, the type of log hives that Villanueva (2005) observed in use, along with stone panucho plugs sealed with mud, match the descriptions and archaeological evidence of hives from Postclassic sources, such as the account by Landa (1566) and the site reports of Postclassic sites in Yucatán and on the island of Cozumel (Crane 1999). The type and size of log hives, the number of colonies managed by a father within a nuclear family, and the size and construction of the shed or *palapa* in which the colonies are protected seem largely unchanged (Figure 1a & b). The real lesson from Villanueva's research is not merely the data on yields per hive or size of hive clusters but the continuity of a practice that has endured for at least five hundred years despite intense outside pressures working against it. It also shows a Maya perspective on stingless beekeeping that is yet to be discussed in scholarly accounts.

RELIGIOUS TRADITIONS

Alcohol, and the honey which is used in fermentation to produce alcoholic drinks, are both very important in Maya feasting rituals. Diego de Landa described the numerous feasts among the 16^{th} century Maya, including political, agricultural, and calendrical events, most of which involved the consumption of balché (an alcoholic beverage made from fermenting the bark of a tree) (Landa 1566 in Tozzer 1941).

These bee-products were not just used in important ritual activity - Bee-Gods were worshipped directly as well. Sharer (1994:552) discusses a particular ritual that celebrated Maya beekeepers who prepared during the month of Zotz for the feasting ritual held the following month, Tzec.

> "Incense was burned and pictures were painted on the incense boards, using honey as paint. The object of the feast was to increase the yield of honey, and the owners of hives contributed an abundance of it, from which was a wine was brewed with the bark of the balché tree; heavy drinking of this beverage concluded the ceremony."

Diana Cohn (2005:656-657), currently working in a partnership with El Colegio de la Frontera Sur (ECOSUR) on the program "The Bee Works," sheds further light on the immense religious importance of *Melipona beecheii* to the ancient Maya. She writes:

> "Native "Xunan Kab" were so revered during the times of the Classic Mayan period that they were depicted as gods. The Mayans prayed to the stingless bees and in the temple of the Descending or Diving God at the coastal ruins of Tulum and interior Coba, they carved stone relief images – with a depiction of Ah Mucen Kab, their god of beekeepers, bees, and honey."

Objects have been found that link beekeeping to Maya religion. One prime example of this is a mother-of-pearl pendant depicting Yax Balam (Xbalanque) with the body of a bee. According to Kerr (2003:6), Xbalanque is depicted as many things, but most interestingly as a beekeeper and bee emulator. He explains that Mok Chi', the image that Xbalanque takes, can be translated by reading the glyphs as follows: "that MOL (T581) can mean 'to gather' and MANIK (T671) can mean 'sweet'. The written name thus means to 'gather sweet' and that is exactly what Mok Chi' does" (Kerr 2003:6).

GEOGRAPHIC LOCATION

Xunan-kab, the Mayan term for *Melipona beecheii*, can be found ranging from present- day Mexico to Costa Rica. Transition: although wide range – hives found on in certain environments. For example, the Spaniards' accounts do not describe any apiaries near the ocean. This is corroborated by contemporary ethnographic accounts in which coastal areas are avoided; the apiaries are protected under *palapas* (palm-roofed shelters that cover the racks of hives) to shield them from hurricanes and harsh weather coming from the sea (Villanueva et al. 2005:39). The Grijalva expedition in 1518 recorded apiaries on the inland side of the villages. The inland side of the archaeological site of Cozumel has panucho plugs but the ocean side does not.

As both the reports of the Spaniards during the times of first contact and the ethnographic contemporary reports show that honey was almost entirely used for balché production, it follows that areas which have the most panucho plugs were most likely the areas that produced the most balché. It would also follow that these areas would then export some balché to areas where apiaries were not as viable or at least not well established.

APIARY SIZE

The Spanish accounts from 500 years ago describe apiaries with a greater number of hives than have been recorded in more recent times. While some of this variation is likely attributable to exaggeration by the Spaniards, not all of the evidence should be dismissed as an overstatement. The Spaniards, primarily Diaz and Oviedo (Crane 1999:292), describe, "apiaries with 1000-2000 hives in trunks of trees, well made, with their openings and entrances… the extremes plugged with a stone for each end." The ethnographic accounts, mainly the study of hives in the present-day Zona Maya in Yucatán by Villanueva et al. (2005:36) show that families in the mid twentieth century often had 50 to 200 hives. Due to present trends, economic difficulties, and the introduction of other species, the largest known hive clusters in apiaries today are only 12. I think it is likely that Postclassic period apiaries contained between 200 and 2,000 hives. This may seem like a vast range, but it indicates two rather important points: (1) this was not a small family industry consisting of little groups of four to ten hives, and (2) honey was not mass produced on a large scale, at least within a small area.

Likely, the number of hives did not exceed the low thousands, due to the number of available pollen sources within the range of the bees. Porter-Bolland agrees with other scholars, in that *Melipona beecheii* have a maximum territorial range of 300 square km (2001:305). This limit would be further enforced by the bees' practice of culling pollen from secondary-growth plants as the Maya started to cut down the forests of Yucatán (Villanueva et al. 2005:35). This deforestation not only acted to limit the amount of pollen available to honeybees, but also made the species considerably more dependent on domestication due to the destruction of their natural habitat. In the wild, *Melipona beecheii* chose to live in logs that are typically more than 30 cm in diameter. As these trees would have been, and continue to be, the ones most often targeted by loggers, they would have become increasingly scarce (36). Thus the amount of honey and wax being produced was enough, in conjuncture with other construction efforts, that the Maya's pattern of resource use was not sustainable, as the plugs found have shorter diameters in the coastal and deforested areas showing a reduction in production and availability of resources for their key production goods.

HONEY AND WAX YIELDS

One log colony of *Melipona beecheii* can produce an average of 2 kg of honey per year (Aguilar 2001:44-49). Ratnieks (2001:1) is slightly more conservative in estimating yields of honey, stating, "…each hive makes 0.5-1.0 kg of honey per year." Wallace (1978:19), in personal communication with Norbert Kauffeld, confirmed that, "it is probable that the smaller wooden hives used in Pre-Columbian Yucatán would have produced one-half to two cups of honey [each]."

It seems that after initial contact with the Spaniards, the Maya ramped up production of honey and wax in order to pay Spanish tribute demands. Surviving tribute lists from 1549 show that 163 Maya villages paid the Spaniards in wax and 157 villages paid them in honey (Crane 1999:293). The total for the year amounted to 3 metric tons of honey and 281 metric tons of wax (1999:293), which Calkins (1974) determined was approximately half a kilogram per inhabitant per year.

In times of necessity, hives may be completely robbed of their honey and wax to dramatically increase yields, but this was not a long-term strategy as it would have undermined the sustainability of the colonies. In contemporary groups, hives are only robbed when their beekeeper has essentially given up on the colony and wishes to reap the last rewards before moving on to either a different species of honeybee or to an entirely different occupation (Villanueva et al. 2005:39).

Harvesting time for honey can vary depending on the scale of the apiary and labor involved. At most, it can be harvested, albeit in smaller yields, up to every other month (Villanueva et al. 2005:19). Alternatively, some groups only harvest twice per year with larger, more labor-intensive yields. Porter-Bolland (2001:309) did extensive research on flowering plant species that *Melipona beecheii* pollinate and compared yields of colonies to both rainfall and flowering species. In this way, honey and wax yields can be generalized by the seasons due to bee's need of pollen to produce these goods. Based upon Bolland's plant-flowing information, the best times for honey harvests were between February and March, and then again between May and June. If the beekeepers harvested after June, it would likely have been in smaller amounts, or else they would risk taking the necessary stores of the bees during the July thru December period when the fewest species are flowering. This is further demonstrated in Porter-Bolland's other data which compare the four stages of *Melipona beecheii* hive cycles to the months of the year, which show a decrease in activity in July thru December that matches much of the flowing cycles in the region. Additionally, it is during this time of low blooming that most rains occur, which make it much harder for *Melipona beecheii* to survive. This correlates well with the family *Lonchocarpus* (of which the balché tree is a member), which Porter-Bolland (2001:314) shows as blooming during March and April.

LABOR REQUIREMENTS

For people keeping bees, the primary labor requirements are protection and custodial duties. One of the foremost duties would be to ensure the safety of the hive, both from animal predators as well as the weather. Landa refers to such an animal threat, stating that the "animal which they call camhol … eat nothing but honey." (Landa in Tozzer 1941:203). Because hives were located away from heavily populated residential areas, these animals could completely destroy an apiary if they were not properly protected. Wallace (1978:40) echoes these sentiments, noting that, "It would not take much of a wall to keep an armadillo from raiding the hives, but the coati-like Tayra and the raccoon would be a different story." Protecting the hive colony is often accomplished through the creation of a protective shed (*palapa*) for the hives. Within the *palapa*, the hives are often stacked on large "A" framed wooden racks, one on top of another. Archaeological evidence, especially on Cozumel, suggests that similar structures were once made from stone rubble and surrounded the hives in a ring or approximate rectangle (Wallace 1978).

It is unclear whether a separate group would have been responsible for the storage and protection of the honey once it was harvested; if the actual beekeepers did not perform these tasks, then these others would at least have worked with the beekeepers during the harvesting process. Wallace (1978:20) notes that the most popular and effective method of preserving recently harvested honey is to boil it, creating a thicker honey that can be prevented from fermenting unintentionally.

To extract the honey, the panucho (or plug) was removed from the side of the hive where the honey nodules were located. A panucho fits into both lateral ends of a beehive. Archaeologically they are found in both limestone and coral varieties, but today they are primarily made out of wood. These plugs would be used to keep the hive closed and would only be removed when the beekeeper needed to harvest honey or wax or check on the hive itself. A select number of pods were pierced and the hive was then tipped to let the honey drain out. While this honey is quite pure, present-day groups will often strain the honey as it comes out of the hive by placing a basket of woven vine stems between the collection vessel and the hive (Crane

1999:295). Partially due to the religious importance of bees, and partially due to respect and care of the colony to preserve longevity, the bees are handled extremely carefully, especially during extraction. Redfield and Villa Rojas cover this in detail (1962:50):

> "Bees are handled with some circumspection; in removing the honey, care is taken not to injure or kill any of the insects. If a bee becomes honey-soaked, it is dried and freed; if one is killed, it is buried in a bit of leaf. This is because the bees are under the protection of certain deities, who watch over them and become angered if their wards are not treated properly."

Some studies have shown that objects other than woven baskets were used for straining. Redfield and Villa Rojas found the widespread use of perforated wooden disks for straining in the northeastern Yucatán town of Chan Kom. These disks are called *chichipche* and are placed directly above the jars for honey harvesting (1962:49). These disks unfortunately would leave little archaeological evidence behind as they would have long since decomposed, and the soil in most sites is wet enough to remove most if not all of this evidence that might otherwise be preserved in particularly arid areas.

DEVELOPMENT AND SUSTAINABILITY

Initial development of an apiary generally occurs in three different ways. Firstly, *Melipona beecheii* colonies may be directly taken from their natural habitat. The log hives they naturally choose may be brought into a village and then used to propagate an apiary full of colonies, eventually domesticating the bees. The second way to develop a colony is by capturing a homeless colony of *Melipona beecheii* from the wild and then cloning it into an apiary. Vietmeyer (1991:365) describes this process as, "the simplest and cheapest way for beekeepers to acquire a colony." Finally, a new colony can simply be cloned from an existing one, in which a currently functioning colony is divided into two smaller colonies, often with the use of intentionally placed, or relocated, queen bees. This was the case in Chan Kom (Redfield and Villa Rojas 1962:49), where, "A man wishing to begin keeping bees secures some from the hive of a neighbor, not from the bush." This step is most often used in already established apiaries as a means of growth and not necessarily as a step to start a new apiary.

New log hives would be made from whatever lumber was available, particularly trees with larger trunk diameters that could accommodate a colony of bees inside of them. Villa Rojas (1945:57) notes that Maya in the 1930s would use sections of trunk from the *Vitex gaumeri* tree because it was frequently hollow by nature, and not only in a state of decay as other hollowed species often were. Cohn (2005:659) confirms this in a contemporary context when speaking with apiculturists in Quintana Roo, Mexico, "The logs are mainly from the Verbenaceae family, genus Vitex, a tropical hardwood tree." Crane (1999) notes that these crafted hives were often described by Spaniards as being decorated and carved by their owners but that this practice may not have been done as frequently, if done at all, in industry-focused beekeeping as opposed to the domestic use.

As for the sustainability of the colony itself, *Melipona beecheii* is a largely self-sufficient species. Provided that their basic needs of water, nectar, pollen, and shelter are met, they will likely thrive (Vietmeyer 1991). Each log hive represents one colony and each colony nurtures its own queen, which in turn produces offspring for that colony. After approximately two to three years, the queen will become too old and the colony itself will replace her by growing a new queen. This is accomplished via the production and feeding of royal jelly, a special type of honey, to a specific young larva that develops into the new queen for the colony (Vietmeyer 1991:365). This process can repeat itself over many decades, with some beekeepers in present-day Quintana Roo, Mexico reporting hives that are "over 40 years old and [each housing] more than 3,000 stingless bees" (Cohn 2005:659). Given the correct circumstances, this longevity saves beekeepers from continually needing to start new colonies unless they have resources and desire to do so.

ARCHAEOLOGICAL EVIDENCE – BUENA VISTA

The archaeological site of Buena Vista is in the southern Cozumel, approximately 1.5 to 3 km inland from the eastern Caribbean coast and in the midst of the densest vegetation and forests on the island. Freidel (1976:367) concluded that Buena Vista was a large and dispersed community of families that shared a "nucleated core" at the center of the settlement. The panucho plugs are the primary archaeological indicators of the practice of beekeeping. It is in this nucleated core area that the majority of plugs were found (Wallace 1978:32). This suggests an industry-level production of honey and honey products, as the same levels of panuchos were not found in the residential areas in the periphery of the site.

As Wallace used the SPSS tools to perform statistical analysis upon the plugs at Buena Vista (1978:10), which contained the most plugs at Buena Vista - 22 total. These panucho plugs were of both coral and limestone compositions, found in small clusters together, were unbroken, and were found in the upper layers near the surface (1978:33).

The pairings of panucho plugs demonstrate not only spatial pairings, but pairings of both length and width dimensions of the plugs. It is this evidence that demonstrates their use as hive plugs, as not only are the pairings approximately 50 cm apart, as predicted by contemporary measurements, but these pairs also exhibit the same diameters – factors that are unlikely to occur together by chance.

Also unlike other operations at Buena Vista, Operation 67 did not contain trash deposits near the panucho plugs (Wallace 1978:34). Archaeologically, this demonstrates that these plugs are not refuse or debris, but an item that was used and further demonstrates that there were special constructed areas designated for this larger-scale beekeeping practice. Additionally, and quite similar in construction and height of Features 16a and 16b at Aguada Grande, there is a rock wall on both the east and west sides of the panucho plugs. While not forming a circle like the stones observed at Aguada Grande, the rough construction of the stones, and the approximate height of at least a meter suggests use as both a wall around the apiary as well as a potential platform or shelf for either the log hive colonies or other (probably wooden) construction that would support the log hives.

ARCHAEOLOGICAL EVIDENCE – AGUADA GRANDE

The site of Aguada Grande is located on the northeastern point of Cozumel, approximately 0.75 km inland from the Caribbean. The occupation of the site was during the Postclassic, approximately 900-1520 CE. Friedel (1976) reports 73 panucho plugs, some made of limestone, others of coral. Wallace (1978), however, counted and examined 30 plugs from the site. These plugs were found in twin stone circles, on the western, or inland, side of the site (Wallace 1978:2). The panuchos that Wallace examined were found in clusters in Trench 1/Pit 2, from Structure 16a, the more northern of the two stone circles; the dimensions of each were recorded, including their length, width, and thickness measured at maximum diameter, minimum diameter, and thickest point (Wallace 1978:10). Wallace then performed analyses on these data points for each plug, which given the sample sizes, produced statistically significant comparisons between sites and panuchos within sites (1978:10). In sum, the average plug size was smaller than those found at Buena Vista, but slightly larger than plugs found at San Gervasio. The variability in the size of the plugs corresponds with their use as hive plugs - the dimension that varies least is their diameter, and the dimension that varies most is their thickness (1978:10). This shows that those crafting these plugs were paying attention and working the stone/coral in a way to best fit inside the opening of the log hives, and were least concerned with the thickness of the actual plug, as variation in this dimension would have almost no impact on the plugs effectiveness or the hive's production.

Panuchos are found in two different contexts on Aguada Grande, suggesting different production sites or activity areas for the beekeeping industry. Firstly, some seem to be in a central setting, likely in controlled production such as Structure 16a and

16b, which contain clusters of plugs (1978:14). The northernmost circle, 16a, is "approximately 725 cm in diameter as opposed to 625 cm for 16b" (Wallace 1978:37). The walls of the stone circles were crumbling and architecture was hard to determine. However, it was estimated that they were 1.5-2.0 m tall when standing and separated from each other. Structure 16b had an 80 cm gap on its eastern wall that may have been the entrance to the apiary (Wallace 1978:38).

The other type of deposit, classified as "housemounds" by Wallace (1978:14), include "both interior deposits (often sealed between successive floors) and midden remains adjacent to structures." The panuchos found in housemounds are likely simply hives kept and tended by households for the use and trade of honey and wax by household members, whereas the large stone circle features, which contain clusters of up to 50 panuchos, may be large-scale or "industrial-level" honey production areas.

The full scope of the beekeeping industry is, however, unknown. Of the area that just Structure 16a occupied, only 20 percent was excavated and 50 panucho plugs were discovered (Wallace 1978:40). It is entirely unknown just what percent of the apiary those 50 plugs represented, as the archaeologists may have simply excavated the only areas with plugs, or on the other hand, could have easily excavated the area with the lowest panucho plug density. Without more areas being excavated to increase the sample sizes of the data and specifically the density of each apiary, it is hard to estimate exactly how big some of these community apiaries may have been. Likely, they were composed of 100-200 hives at the minimum, to produce enough wax and honey as the community would need for themselves, with larger apiaries being able to serve other communities and offer tribute payments to the Spaniards.

Intriguingly, there was evidence of potential religious activity in Feature 16a as well. On the west wall of the structure, a small niche (visible in Figure 8 below) was found in the rubble walls; associated with it were fragments of a bee god incense burner (Wallace 1978:41). Citing Tozzer (1941) and Schwarz (1948), Wallace (1978:41) agrees, "... bees and honey were religiously important ... that [the niche] was serving as an insect altar." Only one other such niche was found on the site of Aguada Grande - it was located within a field wall just west of Structure 16a.

CONCLUSIONS

This research has shown that beekeeping and honey production were important activities of Postclassic Maya society. Comparing the historical sources, the ethnographic studies, and current research to the archaeological record has resulted in a richer understanding of the complexities of production and use of beekeeping goods. The next steps for future research are below:

1. Palynology Analysis could be performed on the layers of soil most closely associated with panucho plugs found in situ. This would be very effective, as the main item that Melipona beecheii transport and store is pollen itself. It would not only naturally collect around hives, but would be deposited whenever honey, and to a lesser extent wax, was spilled or otherwise came into contract with the ground. Palynology would also reveal the types of pollen, potentially on a plant-specific if not genus-specific level, which could better determine instances of intentional gardening and production of toxic and psychoactive honey products.

2. Residue Analysis could be used on stone, coral, and ceramic materials believed to be associated with honey production. Stone and coral panucho plugs could be analyzed to confirm their use as hive stoppers, as they would likely produce the most consistently positive results for honey and/or pollen residues. Additionally, testing vessels used for storing raw honey, vessels used for boiling honey for preservation, and vessels or vats used for fermentation would be a greater challenge as this analysis is costly and, given the current lack of identification or association of such vessels with honey, large sample sizes would have to be tested to generate useful results.

3. Further Field Survey, suggested by Wallace, is an activity that would both be possible and fruitful, given the high rate at which panucho plugs can be found on the surface, or having been reused in ancient buildings' architecture. Unlike many other items, panucho plugs have a distinct size, shape, and composition that make them easy to identify on the surface.

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