Introduction: Honey and Beekeeping in the Ancient Near East: a Short Survey

The importance of honey and beeswax in the Ancient Near East can be inferred from Egyptian, Canaanite, and Hittite sources. Textual and pictorial sources from ancient Egypt are of particular interest. The Story of Sinuhe, attributed to the Middle Kingdom (20th century BCE), alludes to the abundance of honey and oil in his place of residence in the Land of Canaan; Thutmose III recounted carrying off 430 honey jars as booty following his conquests of Canaan in the 15th century BCE; in another text, he mentions 264 honey jars collected as tribute. Depictions of horizontally stacked cylindrical beehives arranged in rows, along with honey production, are known in five wall paintings and reliefs from Egypt, dating from the mid-3rd millennium to the mid-1st millennium BCE. In the most detailed representation, in the 15th century BCE Tomb of Rekhmire, there are three rows of beehives and beekeepers are shown collecting honey. In Egyptian texts, honey is mentioned as a sweetener used by the elite and also appears in offering lists and in connection to medication and ointment production. Honey jars were bestowed as royal gifts. Beeswax was ascribed with magic powers in Egypt, where it was also used as a marine sealant, in the lost-wax metal-casting method, in medicine production, and more.

In 14th–13th centuries BCE texts discovered in the Canaanite city of Ugarit in northern Syria, the word for honey is nbt, and in Akkadian it is ṅūtu—the counterpart of the biblical term nafet (see, e.g., Psalm 19:11; “… sweeter than honey and the honeycomb”; the word “honeycomb” is a translation of the Hebrew phrase, nafet tsufim). Honey is mentioned in Ugarit in administrative, literary, and ritual texts. In the latter, it appears as one of the foods offered to the gods (attention the biblical prohibition to burn honey on altar, Leviticus 2:11). The bee plays a unique role in Hittite myths and, in Hittite law, severe punishment was dealt out to bee-swarm and hive thieves. Yet no apiary was discovered in the Ancient Near East, perhaps since the hives were made of perishable materials, located outside the settlements and were not preserved. In Classical Greece and the Hellenistic period hives were made as fired pottery cylindrical vessels; they are known from various sites, but never found in situ in an organized manner as in the Tel Reḥov apiary.

In the Hebrew bible, the word “honey” is mentioned fifty-five times, sixteen of which as part of the figurative expression “land flowing with milk and honey.” It is widely accepted that the term honey (in biblical Hebrew דבש, dvash) refers to a syrup that was extracted from fruit such as dates and figs, since honey that is explicitly bees’ honey is mentioned only twice, both times in connection to wild bees (Judges 14:8–9; 1 Samuel 14: 27). Furthermore, there is no biblical mention of beekeeping as a branch of production. However, a textual study conducted by Tova Forti maintains that a considerable number of the occurrences of the word “honey” do, in fact, refer to bees’ honey. This conclusion is supported by the
unique discovery of the Tel Reḥov apiary, dated to ca. 900 BCE. This is the only apiary to be found in an archaeological site in the ancient Near East and the Eastern Mediterranean world. In this article, I discuss this exceptional discovery of an industrial apiary and its implications to the early history of beekeeping.

**The Tel Reḥov Apiary**

Tel Reḥov (Arabic: Tell es-Ṣarem) is located in the Beth-Shean Valley in north-east Israel, 5 km south of Tel Beth-Shean, close to the main north–south route traversing the Jordan Valley and a route leading west to east from the Jezreel Valley toward Transjordan (Fig. 1). The mound is located close to fertile land and water sources. Excavations between the years 1997-2012 revealed exceptional architecture and abundance of finds mainly from the 10th–9th centuries BCE (Strata VI–IV). The city was one of the largest in biblical Israel during the 10-9th centuries BCE.

The apiary was discovered in the heart of a well planned and densely built urban quarter of Stratum V, Area C, near the northwestern corner of the mound (Figs. 2-3). About thirty beehives were uncovered, each individual hive was made of unbaked clay mixed with straw and shaped as a hollow cylinder measuring ca. 80 cm in length and 40 cm in diameter, with a ca. 4 cm thick wall, and a volume of ca. 56 liters (Figs. 4-7). One end of the cylinder was closed by a clay wall with a small ‘flying hole’ (about 2-4 cm in diameter) in its center that allowed the bees to enter and exit the hive, keeping unwanted animals away. The opposite

5 The excavations were directed by the author on behalf of the Institute of Archaeology of the Hebrew University of Jerusalem and sponsored by Mr. John Camp (USA.). Dr. Nava Panitz-Cohen was the supervisor of the main area (Area C) throughout the seasons and is a co-editor of the final report. For earlier summaries, see Mazar 2008, 2013; 2015; 2016; Mazar et al. 2005; final report: Mazar and Panitz-Cohen (eds.), in press. The research and publication of the apiary was supported by a grant of The Eva Crane Foundation. The present article is based on a Hebrew article published in Igeret, Bulletin of the Israel Academy of Science. Much of the present English version is based on translation by Inbal Sammet of the latter article (included in Mazar 2016).

end of the cylinder was fitted with a portable clay lid with a handle that could be removed to allow honey extraction from the honeycombs (Fig. 6). The hives were arranged in three parallel rows, each at least three-tiers high. They were installed in an area that had been deliberately lowered and surrounded by walls on at least three sides. The beehive rows were separated by broad aisles (1.85 and 1.2 m wide) intended to facilitate honey collecting; they were built with the hive lids in the central and eastern rows facing each other. Altogether, thirty hives were uncovered in the bottom tier, but there must have been many more, as the rows were not preserved entirely, and we can reconstruct twenty hives in the bottom tier of the eastern row alone. If all three rows were of identical length, we may assume that the apiary contained about sixty beehives in the bottom tier; since there were three tiers of hives, the apiary could comprise about one hundred eighty hives. The uncovered remains and the proposed reconstruction (Fig. 7) indicate a well-planned apiary that was industrial in nature.

The apiary was destroyed violently and suddenly. An 80 cm thick destruction layer containing fallen mud-bricks and charred wood beams covered the beehives and crushed their upper parts (Figs. 4, 5). The hives were no longer used in the subsequent stratum (IV) of the 9th century BCE when new structures were built over their ruins.

**Natural Sciences Research**

Four natural sciences studies have been conducted in relation to the Tel Reḥov apiary.

The first was a chemical analysis of the beehive walls. The analysis of the lipid assemblage extracted from two hives pointed to a high correlation between the extraction mixture and the lipid composition that is characteristic of heated beeswax. This constituted the first scientific proof that the installations we discovered were indeed beehives.

The second study focused on identifying pollen found in the soil extracted from the beehives. This study was undertaken by Dr. Dvorah Namdar jointly with a team of researchers from the Weizmann Institute of Science, the Faculty of Agriculture of the Hebrew University in Reḥovot and the Volcani Institute.

7 Mazar et al. 2008. The study was conducted by Prof. Mina Weinstein-Evron and Sylvia Chaim of the University of Haifa.

8 Weinstein-Evron and Chaim 2015. The study was conducted by Prof. Mina Weinstein-Evron and Sylvia Chaim of the University of Haifa.
provided evidence of a variety of plants, which does not differ from the modern-day flora in the Beth-Shean Valley. The representation of *Ziziphus* pollen and pollen representing a variety of herbaceous plants that must have grown nearby is noteworthy.

The third study was dating the apiary using $^{14}$C dates measured on charred grain. The samples came from large quantity of charred grain found flowing from a storage jar in the eastern part of the apiary, and charred grain found in destruction layer in the western part of the apiary. Eleven measurements from three samples were measured, providing a range of calibrated dates between 968-862 BCE (1 sigma or 68% probability) or 970-840 (2 sigma or 95% probability). Few dates from additional contexts from the same stratum in Area C enable to narrow the time span of this stratum to 926-896 (1 sigma or 68% probability) or 970-847 (2 sigma or 95% probability)$^9$. Based on dates from the previous and later strata (dated to the 10th and 9th centuries respectively) we concluded that the apiary was in use during the last decades of the 10th and early decades of the 9th centuries BCE, that means the end of the Solomonic era (if indeed it was an historical era) and the early kings of the Northern Kingdom of Israel.

The fourth and most fascinating study focused on lumps of black material found in one of the hives. These were suspected to be remains of charred honeycombs that had burned during the destruction of the apiary in conflagration. A first clue to this identification was the remains of a bee in one of these lumps that was observed during the excavations. Prof. Guy Bloch of the Institute of Life Sciences of the Hebrew University of Jerusalem, assisted by Ido Wachtel, used an electron microscope to establish that these were indeed the remains of honeycombs and bees: bee’s eyes, muscles, legs, and wings could be identified (Fig. 8). To date, these are the only ancient bee remains that have ever been discovered in the Ancient Near East. In a joint study with Professors Stefan Fuchs of the Goethe University in Frankfurt and Tiago Francoy of the University of

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$^9$ The dates from the apiary were published in Bloch et al. 2010; Mazar 2016: 44-45. Details will be presented in Mazar and Streit, in press. For additional dates from Stratum V measured before the apiary was discovered see Mazar et al. 2005.
São Paulo University in Brazil the sub-species of the bee was identified by measuring the size and shape of the wing’s veins (Bloch et al. 2010). The evidence was consistent with the anatomy of the sub-species *Apis mellifera anatoliaca* (Anatolian honey bee), and unlike that of the *Apis mellifera syriaca* (Syrian honey bee), which is typical of the Southern Levant. The Anatolian Honey bee is particularly productive and easier to raise for commercial purposes than the aggressive Syrian bee, and is presently at the base of the Turkish honey industry—the second largest in the world. This bee is adjusted to the climatic conditions of Turkey: cold temperatures and high humidity in the mountainous areas and severe heat conditions in the Central Anatolian plateau during the summer. Could this honey bee have been indigenous in Israel in the Iron Age? This is not probable. Another possibility is that the beekeepers of Tel Reḥov imported bee swarms from Anatolia, a minimal distance of about five hundred kilometers (see further below).

Discussion

The use of cylindrical beehives made of unbaked or fired clay, hollow tree trunks, or wickerwork is well known from traditional societies across the Mediterranean basin and eastern Asia. Until recently, it was common in Egypt to build walls to a height of ten or more tiers of beehives. Similar hives are known in the entire Eastern Mediterranean and Middle East including northern Iran, the Gulf and eastern Africa (*Fig. 9*). This form, which imitates a hollowed tree, represents a tradition that lasted more than 4500 years. In many places, it was customary to build beehives near houses or even in basements below a raised ground floor.

Based on ethnographic evidence, we may assume that each hive of this type could yield 3–5 kg of honey and 0.5–0.7 kg of beeswax annually, depending on their maintenance level, collection methods, and annual precipitation. If we reconstruct at least 100 hives in the Tel Reḥov apiary, the yield would have been about 500 kg of honey and 50-70 kg of beeswax per year. This amount exceeded the producers’ private consumption, creating tradable surplus, which turned the apiary at Tel Reḥov into a profitable enterprise; this explains its careful spatial organization and industrial nature.

The discovery of Anatolian bees at Tel Reḥov raises the question whether it is plausible that bee swarms have been imported to the Beth-Shean Valley directly or indirectly from one of the Neo-Hittite states in southern Turkey that existed during this period, such as Sam'al, Carchemish, Que, Gurgum? And if so: what was the route of such a trade? We suggested trade along the Phoenician coast perhaps by ships, through port towns like Tyre or Akko. In contrast, Simon suggested that the swarms arrived through the Orontes Valley, via inland Syrian commercial centers (such as the kingdom of P/Walastin). There is no archaeological evidence for such trade except a single Neo-Hittite seal impression from Hazor 2010: 16-19.

10 Crane 1983; Kritsky 2010.
11 Kritsky 2010: 15, Fig. 1.9, reproduced in Mazar 2016: 39.
13 Kritsky 2010: 18, an example from Venice, Italy.
14 Simon 2014.
Stratum Xa\textsuperscript{15} and the vague biblical allusions to horse trade between Egypt and Que (Cilicia in modern-day southern Turkey), involving Solomon’s merchants (1 Kings 10:28).

If we are correct in concluding that the bees found at Tel Reḥov originated in Anatolia, we have to address the question why anyone would take pains to import bee swarms of a particular sub-species over such a long distance? Economic activity of this sort required knowledge, skills, and far-reaching commercial ties extending to the Neo-Hittite kingdoms located in modern-day Turkey. Importing bees swarms from such a distance raises many questions. It would be essential to prevent the Anatolian queens from mating with the local Syrian honey bee drones. How this was done? Did the ancients had the required knowledge in bees biology so that they could maintain Anatolian bees along a considerable time? Perhaps new swarms had to be brought annually. In any case such a trade would have required vast knowledge and experience in beekeeping and international economic ties\textsuperscript{16}.

The only parallel for similar operation is a text inscribed on a memorial stele of Shamash-resh-ušur, an Assyrian governor of Suhu on the mid-Euphrates region (modern-time south-eastern Syria), dating to the first half of the 8th century BCE (a century and a half after the bee swarms arrived at Reḥovot).\textsuperscript{16}

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\textbf{Fig. 9} A modern clay hive, village of Nahf, Lower Galilee, Israel. A: general view B: detail of hive with honeycomb.
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\textsuperscript{15} Ben-Tor, Ben-Ami and Sandhause 2012: 79, Fig. 2.39, 132 Fig. 2.11:12.

\textsuperscript{16} I thank Dr. Yossi Slabezki from the Faculty of Agriculture of the Hebrew University in Reḥovot and the Volcani Institute for advise concerning beekeeping and bee’s biology.
half later than the Tel Reḥov apiary). Shamash-resh-uṣur recounts rearing honey bees and boasts of being the first among his ancestors to have done this. His inscription says, among other things:

“I am Shamash-resh-uṣur, the governor of Suhu and the land of Mari...Bees that collect honey, which none of my ancestors had ever seen or brought into the land of Suhu, I brought down from the mountain of the men of Habha, and made them settle in the orchards of the town ‘Gabbār-built-it’. They collect honey and wax – and I know how to melt the honey and wax – and the gardeners know too. .....

(Dalley 1984: 203).

According to this account, the bees were brought from Habhu, identified as a place in the vicinity of the Zagros Mountains in Iran or the eastern Taurus Mountains, about four hundred kilometers north of his seat. It is possible that in this case, too, the imported bees were Anatolian. This text sheds light on the plausibility of importing bees from faraway during the Iron Age.

The significance of the apiary is also evident from the cultic rituals that were carried out within its confines. Two finds attest to this practice: a four-horned altar decorated with two naked female figures (perhaps fertility goddesses) flanking an incised tree (Fig. 10) and a richly decorated tall chalice with petals. The cult practices must have been intended to increase the yield of the apiary. The affiliation between cultic practice and industry was common in the ancient world as attested in several cases such as copper-mining sites (in Timna in southern Israel and in Cyprus) and in olive oil industry (at Tel Miqne-Ekron). Remarkably, the biblical laws forbid burning offerings containing honey on altars (Leviticus 2:11); could it be that this was a common practice, as might have been conducted at the Tel Reḥov apiary, which was proscribed in a later period because it was regarded as foreign?

A storage jar bearing the inscription lnmsḥ, meaning Belonging to Nimshi was found in the apiary. The name nmš (Nimshi) also appears in an inscription from the subsequent 9th century BCE stratum at Tel Reḥov, as well as on a jar from a 10th–9th-centuries BCE occupation layer at Tel ‘Amal, situated 6 km northwest of Tel Reḥov. Nimshi is mentioned in the Bible as the father or grandfather of Jehu, founder of the dynasty whose rise to power ensued the fall of the Omride dynasty in 842 BCE (1 Kings 19:16; 2 Kings 9:2, 14, 20). The threefold recurrence of the name in the same region during the same time period leads to the assumption that the Nimshi family was one of influence and prominent status at Tel Reḥov, which may have also been the family’s seat, being the largest and most significant city in the region during this period. Moreover, we suggest that the Nimshi family may have also been the one to build the apiary and profit from it.

One of the questions raised by the discovery is why was the apiary located within the confines of the densely built and populated city? Experts estimate that a traditional beehive of the type found at Tel Reḥov consists of 10,000–15,000 bees at the peak of activity. If indeed there were 100 active hives, the number of bees in the city would have reached a million to a million and a half! How is urban life maintained under these conditions? This question is not a simple one to answer. Written sources (particularly Roman and Talmudic ones), as well as ethnographic observations, show that, indeed, bees have been often raised near dwellings and that their residents apparently grow accustomed to living in proximity to apiaries. Since beehives were considered as production facilities of valuable commodities, safeguarding and maintaining them must have been important factors that led to their positioning close to dwellings within the city limits. It appears that only a centralized royal or municipal governing body or a powerful local family (such as the Nimshi family at Tel Reḥov) could have initiated such an enterprise, set it up, and imposed it on the city’s inhabitants. This has implications for our understanding of the social and economic systems in this early stage of the Israelite Monarchy.

As to the economic value of the apiary’s products, I raised the hypothesis that the beeswax, rather than the honey, was a major high value product. Beeswax was crucial for the ‘lost-wax’ metal casting method. As we now know, the large scale copper mines at Khirbat en-Nahas in Fainan, at the foot of the Edom mountain range of Jordan, and in Timna in the Arabah Valley, were operating on an unprecedented scale during the 10th and first half of the 9th centuries, 18 Ahituv and Mazar 2014 inscription No. 5; Mazar 2016: 90, fig. 82.
which correspond with the activity of our apiary\textsuperscript{19}. Could it be that industrial apiaries of the type found at Tel Rehov served a copper industry that existed somewhere in the Kingdom of Israel? Biblical tradition tells of the splendid copper utensils installed in Solomon’s temple in Jerusalem: “The king had them cast in the ground in the plain of the Jordan between Sukkoth and Zarethan” (1 Kings 7:46). Sukkoth and Zarethan are identified as sites in the central Jordan Valley, 30–35 km south of Tel Rehov. Even if the story does not faithfully reflect historical reality, it may echo a historical memory about a metal industry that existed during that period in the central Jordan Valley, not far from Tel Rehov. While this is an intriguing hypothesis, it cannot be proved.

It is difficult to assess how long the beehives were in use. They did, however, meet their end in a fierce conflagration, and structures that were completely different in plan were constructed on their ruins in the subsequent stratum (Stratum IV, 9th century BCE). The destruction of the apiary and the fact that it was not subsequently reconstructed indicate that it was considered extraneous to the city’s life. We do not know who or what the agent of destruction and conflagration was. Evidence from a paleo-magnetic study conducted by Dr. Erez Ben-Yosef indicates a possibility that it was an earthquake that destroyed the area of the apiary, starting fire and bringing down the mud-brick walls surrounding the apiary. As mentioned above, radiocarbon dates from this area point to a date at the close of the 10th century or the beginning of the 9th century BCE\textsuperscript{20}. In any event, it seems that many commoners in the city were happy to see the apiary in flames.

Tel Rehov apiary is a unique archaeological find; its interdisciplinary exploration involves research in the fields of natural sciences and ethnography, combined with the study of textual and iconographic sources from the Ancient Near Eastern, as well as biblical sources. These intertwine create a comprehensive picture, telling the tale of an aspect of ancient economy that was until recently obscure.

\textsuperscript{19} Levy, Najjar and Ben-Yosef 2014; Ben Yosef 2012.

\textsuperscript{20} Previously we attributed this destruction to the conquest of the city by Shoshenq I (biblical Shishak) ca. 920 BCE (Bruins, Van der Plicht and Mazar 2003). However later excavation seasons have indicated that this was a local destruction, not found elsewhere in the city.
BIBLIOGRAPHY


Abbreviations
BASOR Bulletin of the American Schools of Oriental Research.
PNAS Proceedings of the National Academy of Sciences of the United States of America.