BALSAM: THE MOST EXPENSIVE PERFUME PLANT IN THE ANCIENT WORLD

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Introduction

Historical sources from the Hellenistic and Roman-Byzantine Periods made frequent mention of the Opobalsamum plant or the "Balm of Judea" (hereinafter referred to as "balsam"), as the plant source of a valuable perfume. The pure perfume was a sought-after commodity among the upper class, and due to the high price it commanded, a counterfeiting industry developed.[1] The perfume's prestige was due to its unique aroma and the medicinal properties attributed to it for treating various illnesses;[2] it was renowned for its ability to treat headaches, early-stage cataracts, and blurred vision.[3] It was used as well as a diuretic, as a curative for respiratory diseases and coughing, and as an anti-toxin — for example, as a snake venom antidote.[4] It also served the field of gynecology in the

* We are pleased to dedicate this article with respect and great admiration to Professor Daniel Sperber, the most illustrious contemporary scholar in the field of material culture as reflected in Rabbinic literature and from the perspectives of classical literature and archeological findings. This study was inspired by his important research which places the historical sources in their authentic settings.

1 M. Stern, *Greek and Latin Authors on Jews and Judaism* (Jerusalem: The Israel Academy of Sciences and Humanities, 1974–1984); Y. Feliks, "The Incense of the Tabernacle," in D.P. Wright, D.N. Freedman, and A. Hurvitz, eds., *Pomegranates and Golden Bells* (Winona Lake, Indiana: Eisenbrauns, 1995), 125–149.

2 David Iluz et al, "Medicinal Properties of *Commiphora gileadensis*," *African Journal of Pharmacy and Pharmacology* 4, no. 8 (2010): 516–520.

3 Strabo, *Geography* [Geographica], trans. H.L. Jones (London, Harvard University Press, 1961); Scribonius Largus. *Compositiones*, ed. G. Helmreich (Leipzig: Teubner, 1887).

4 Dioscorides, *The Greek Herbal of Dioscorides*, trans. R.T. Gunther (New York: Hafner Publishing Company, 1959); Scribonius Largus. *Compositiones*.

treatment of cervical infections and in delaying menstruation.[5] One of balsam's most famous uses was for treating injuries and healing tissue.[6]

Balsam was counted among the renowned perfume and incense plants, like myrrh and frankincense, that grew in restricted habitats. The plant grew wild in Arabia.[7] Its great importance stemmed from its rarity; only in Judea and in the oases of Jericho[8] and Ein Gedi did it grow as a cultivated plant, as noted by Pliny the Elder (23-79 CE): "But every other scent ranks below balsamum. The only country to which this plant has been vouchsafed is Judaea."[9] According to an ancient tradition cited by Josephus, the plant was brought there by the Queen of Sheba.[10]

Growing balsam was a monopoly reserved for the ruler. At first balsam was cultivated under Jewish rule, but after the destruction of the Second Temple (70 CE), the Roman crown (*fiscus*) took over. The perfume and pharmaceutical industries used every part of the plant: the wood (xylobalsamum), the fruit, the bark, and the pure sap.[11] The products generated much revenue for the Roman royal treasury. Even after the Roman emperor took control of the balsam cultivation, actual production remained in Jewish hands,[12] and the method for producing perfume was kept a secret.[13] Indeed, until the end of the Byzantine period the plant was considered the trademark of the Land of Israel. During the

5 Dioscorides, *Greek Herbal of Dioscorides*, 1.18.

6 Ludolph von Suchem, "Description of the Holy Land," *Palestine Pilgrims Text Society* (PPTS) (London, 1890), 12: 69–70.

7 Pausanias, *Description of Greece*, trans. W.H.S. Jones (Cambridge, MA: Harvard University Press, 1961), 9.28.3.

8 According to *Yosifon* the name *Yeriḥo* (Jericho) stems from *ray'aḥ* (scent) because of the balsam found there (D. Flusser, ed., *Sefer Yosifon* [Jerusalem: Bialik Institute, 1978]), 1.155–156. See also Rashi's commentary on Ezek 27:17 and bBer 43a.

9 Pliny Gauis, *Naturalis Historia*, ed. W.H.S. Jones (Cambridge, MA: Harvard University Press, 1989), 12.111.

10 Flavius Josephus, *Jewish Antiquities*, trans. R. Marcus (Cambridge, M.A., Harvard University Press, 1966), 7.174

11 Pliny, *Naturalis Historia*, 12.115–119.

12 Eusebius Caesariensis in E. Klostermann, ed., *Das Onomastikon der Biblischen Ortsnamen* (Georg Olms Verlagsbuchhandlung: Hildesheim, 1966), 86; *Babylonian Talmud — Shabbat* (Brooklyn: Mesorah Publications, 1997), 26a.

13 Saul Lieberman, "A Preliminary Remark to the Inscription of En-Gedi" (Hebrew), *Tarbiz* 40 (1970): 24–26; Y. Feliks, "Concerning the Expression 'hei ganeiv zevutei de-ḥavrei' in the En-Gedi Mosaic Pavement" (Hebrew), *Tarbiz* 40 (1971): 256–257; B. Rosen and S. Ben-Yehoshua, "The Agriculture of Roman-Byzantine En-Gedi and the Enigmatic 'Secret

Middle Ages, balsam cultivation moved to Egypt and for some one thousand years was based within the presence of the royal garden at Matariyya, northeast of Cairo.[14] Recent centuries have witnessed an overall decline in the importance of this plant.

There are opinions, summarized in Amar's *The Book of Incense*,[15] that identify the Balm of Judea with the "balm" ("*tsori*") mentioned in the Bible (Gen 43:11; Jer 8:22). However, the evidence is insufficient to prove this and *tsori*'s identification is open to debate. The commonly accepted binomial of balsam in the classical sources (*Commiphora gileadensis*[16]) belongs to the incense plant family, Burseraceae.[17] This plant grows wild today in the dry, stony hills around the Red Sea (particularly within the borders of Saudi Arabia, Yemen, Oman, and Eritrea).[18] This identification has several solid foundations including the morphological description's agreement with those mentioned in the historical record and the perpetuation of the names balsam (in Greek), balasan and basham (in Arabic). First and foremost, this identification is grounded in a tradition of interpretation surrounding the plant that has remained almost unbroken up to modernity.[19] A similar plant that was included in the generic term "balsam" was apparently the *Commiphora kataf* (Forssk.) Engl.[20]

of the Village.'" *En-Gedi Excavations* II, Final Report (1996–2002). (Jerusalem: Israel Exploration Society, 2007), 626–640.

14 M. Milwright, "Balsam in the Mediaeval Mediterranean: A Case Study of Information and Commodity Exchange," *Journal of Mediterranean Archaeology* 14 (2001): 3–23; Idem, "The Balsam of Matariyya: An Exploration of Medieval Panacea," *Bulletin of the School of Oriental and African Studies* 66 (2003): 193–209.

15 Z. Amar, *The Book of Incense* (Hebrew; Tel Aviv: Eretz Press, 2002), 58–78.

16 Bot. syn.: *Amyris gileadensis* L., *Amyris opoBalsamum* L., *Balsamodendrum ehrenbergianum* O. Berg, *Balsamodendrum gileadense* Kunth, *Balsamodendrum opobalsamum* Kunth, *Commiphora opobalsamum* (L.) Engl.

17 For instance, see P. Alpini, *De Balsamo Dialogus* (Leiden, 1718); C. Linnaeus, *Opobalsamum declaratum in dissertatione medica* (Upsala, 1764); F.N. Hepper, *Illustrated Encyclopedia of Bible Plants* (Leicester, U.K.: Intervarsity Press, 1992); Y. Feliks, "The Incense of the Tabernacle," 125–149.

18 A.G. Miller and M. Morris, "Plants of Dhofar, the Southern Region of Oman: Traditional, Economic and Medicinal Uses," *The Office of the Advisor for Conservation of the Environment* (Muscat: Diwan of Royal Court Sultanate of Oman, 1988), 306; J.R.I. Wood, *A Handbook of the Yemen Flora* (with color illustrations by Hugo Haig-Thomas) (Kew, UK: Royal Botanic Gardens, 1997), 197.

19 Amar, *Book of Incense*, 59.

20 Z. Amar and D. Iluz, "The Persimmon in the Land of Israel," in E. Meiron, ed., *City of*

In this study, we have researched for the first time how the *Commiphora gileadensis'* perfume was produced, its resin's properties, the quantities of resin obtained, the resin ducts' structure, and additional aspects. The main objective was to compare these findings with the descriptions of balsam found in historical sources, and especially in Pliny the Elder's *Naturalis Historia*. This would enable us to determine why balsam was such a source of fascination; why it was, in comparison with the other perfume and incense plants such as myrrh and frankincense, so highly prized and so costly.[21]

The study was conducted on *Commiphora gileadensis* plants germinated from seeds at the Chelsea Physics Garden in London that arrived in Israel for the first time in the year 2000. These were then planted in the botanical gardens of Kibbutz Ein Gedi and Kibbutz Ketura, and in the hothouses of the authors. The plants took and grew well, attaining the height of bushes that produce fertile fruit. As of the writing of this article, the maximum stem diameter is approximately 10 cm.

Physical Properties

The aromatic resin of the plant is secreted as a result of wounds caused by, for instance, the branches rubbing against each other or a deliberate incision. Crushing the leaves or breaking a branch releases a strong scent, and slitting the branches of the plant and the fruit causes an exudation of aromatic, sticky sap. The sap that initially emerges spreads quickly (for about two seconds) over the branch surface. It is transparent and very volatile, with a sharp, pleasant odor. The subsequent sap that then appears, however, becomes milky and thick within a few seconds and solidifies somewhat, covering the cut place on the branch with a thin film. After several days, the sap turns yellowish-brown. This description corresponds to the one given in historical sources from the Roman period,[22] for instance, as well as to the one given in an early nineteenth century pharmaceutical text.[23]

David: Studies of Ancient Jerusalem, the Eleventh Annual Conference (Jerusalem: n.p., 2010), 61–73.

21 Pliny, *Historia Naturalis*, 12.111–123.

22 Pliny, *Historia Naturalis*, 12.116.

23 A. Duncan, *Edinburgh New Dispensatory* (Edinburgh, 1804), 152.

This examination of the plant, further elucidates balsam's ancient Greek and Latin name "Opobalsamum," or the "juice of the balsam," which alludes to the watery sap that generally did not develop into solid resin. The resin was transparent and whitish or yellowish in color. Balsam's watery sap was distinct from that of other resin plants such as myrrh and frankincense, where a viscous liquid was exuded or the drops of sap thickened into "tears." In frankincense and myrrh production, collection occurred over several months between the slitting of the plants and the oozing of the sap, which then hardened into resin (in a relatively large quantity) and was collected with special scraping knives.[24] In contrast, the sap from the balsam was harvested at the same time the incision was made and was completed very quickly in order to limit the waste caused by its high volatility. In the experiments that we conducted, we used a gas chromatography-mass spectrometer (GC-MS) to test the components of the transparent, volatile sap that was exuded first and the milky sap that was exuded in the next stage. The results showed that there was no difference in the composition of the volatile components.

Harvesting Resin

In the past, resin was harvested by cutting a slit in the stem using sharp instruments, as Pliny described: "Incision is made in it with a piece of glass or stone, or with knives made of bone — it strongly dislikes having its vital parts wounded with steel, and dies off at once, though it can stand having superfluous branches pruned with a steel knife. The hand of the operator making the incision has to be poised under skillful control, to avoid inflicting a wound that goes below the bark...the trickle collected by means of tufts of wool in small horns pours out of them into a new earthenware vessel for storage."[25]

It seems that the ancients used cutting tools made of steel, similar to the traditional societies today who use them to collect myrrh and frankincense.[26]

24 T. Monod, "Les arbres á encens (Boswellia sacra Flückinger, 1867) dans le Hadramaout (Yémen du Sud)," *Bulletin du Muséum National d'Histoire Naturelle*, sér. 4, 1, sect. B (1977): 131–169; N. Groom, *Frankincense and Myrrh: A Study in the Arabian Incense Trade* (London: Longman, 1981); Miller and Morris, "Plants of Dhofar," 84, 305–306.

25 Pliny, *Historia Naturalis*, 12.115–116.

26 See Monod, "Les Arbres," 131–169; Groom, *Frankincense and Myrrh*; Miller and Morris, "Plants of Dhofar."

The lack of sterilization, together with prolonged usage, caused them to rust. Modern research indicates that the use of iron can cause toxic contamination of the tissue of certain plants and suppress their development, while the use of knives made of stone, bone, or glass reduces such damage.[27]

The skill required in making an incision of proper depth was of critical importance. Following the directions that Pliny gave,[28] we harvested the sap using shallow incisions made by thin, sharp knives. An incision in the stem, particularly at its wide base, creates a broad surface from which the maximum amount of sap can be obtained, with minimal harm caused to the plant. The sap was either collected directly in small test tubes or, in the case of broad incisions, with small plastic sheets (obviously, different than those used in antiquity) that absorbed the sap. The resin could be easily scraped off the plastic sheet into a container. In this way, the maximum amount of material was extracted, and the waste that plagued the earliest methods of absorption (using wool) was avoided. According to Feliks, a similar technique using palm fibers was implemented in the past for they have ideal properties for easy absorption and exudation of the sap. Feliks maintained that this technique is alluded to in an inscription found in the synagogue from the Byzantine period at Ein Gedi that mentions "the village secret," which was apparently associated with the harvesting of balsam.[29]

Quantity of Sap

Theophrastus (4th century BCE) noted that the quantity of sap collected in two balsam gardens in Syria was small — one man working an entire day could accumulate only one shell-full ("concham"), i.e., some six cubic centimeters: "From the larger park are obtained twelve 'hmixoaia' and from the other only two such vessels."[30]

Each of these vessels held 1.65 liters; thus, one may calculate that they produced some twenty-three liters of sap per year. The pure sap could be mixed with neutral carrier oil and other ingredients in order to increase the quantity of the finished product. Sources demonstrate that more land was dedicated to

27 Rosen and Ben-Yehoshua, "The Agriculture of En-Gedi," 634.
28 Pliny, *Historia Naturalis*, 12.115.
29 Feliks, "Concerning the Expression," 256–257.
30 Theophrastus, *Enquiry into Plants*, trans. A. Hort (Cambridge, MA: Harvard University Press, 1990), 9.6.

balsam planting and cultivation during the Hasmonean and Roman periods than before. In addition, the amount of sap collected from each tree also rose.[31] This was due to improved cultivation techniques introduced at that time, such as the development of irrigation systems.[32] Given the absence of reliable data regarding the total amount of land dedicated to balsam plantations, the number of trees on each parcel of land, and the amount of sap collected from each tree, it is impossible to estimate the amount of sap collected.

Based on the collection attempts that we made at Ein Gedi (utilizing the traditional technique), we found that one can obtain a quantity of 2 cc per hour, with two or three people simultaneously extracting sap from one plant. We did not, however, obtain adequate data regarding the plant's recovery time or the time needed for the tissue at the incision site to mend and for the plant to refill with sap in a way that will not impinge upon its growth and normal function. Our experience indicates that in a mature plant (a one-meter-tall bush whose side branches are two centimeters in diameter, and is approximately five years old), a lull of a month or two between extractions is sufficient to allow regular extractions throughout the year without harming the plant's endurance, although the scars will remain, even up to several years. The best time for extracting the sap is during the hot summer months, as noted in the classical sources ("at time of the Dog-star"),[33] since the amount of sap exuded is the greatest at this time. The plant may also recover most quickly during the summer. Our observations revealed that growing intensity was also strongest during the hottest days of summer, in contrast to other seasons of the year.

Modern Techniques for Extracting Sap

Incisions made in the stem of the *Commiphora gileadensis* show that the plant's resin ducts are relatively large (0.15 mm in a stem with a diameter of 6 mm), and are located radially at fixed intervals around the trunk or stem along the

31 Pliny, *Historia Naturalis*, 12.117.

32 J. Patrich, "An Agricultural Development in Antiquity: Improvements in the Raising of the Afarsimon and in its Extraction" in Z. Safrai, E. Friedman, and J. Shwartz, eds., *Hikrei Eretz: Studies in the History of the Land of Israel* (Ramat Gan: Bar-Ilan University Press, 1987), 139–148; Z. Hirschfeld, *Longing for the Desert: The Dead Sea Valley in the Second Temple Period* (Tel Aviv: Yedioth Ahronoth & Ḥemed Press, 2004), 75.

33 Dioscorides, *Greek Herbal of Dioscorides*, 1.18; Theophrastus, *Enquiry into Plants*, 9.6

extreme end of the phloem cell tissue, close to the bark (see fig. 1). This is in comparison to the small resin ducts found, for example, in the myrrh (*Commiphora habessinica*) scattered throughout the core of the plant (see fig. 2). This explains why a superficial incision is sufficient to extract the sap, while deep, intensive cuts may cause serious and unnecessary damage to the xylem and phloem cells and cause the plant to die. Due to this sensitivity, which is characteristic of balsam (and not of myrrh), specific instructions are given for making careful incisions in the balsam stem that are not mentioned in conjunction with other aromatic plants.

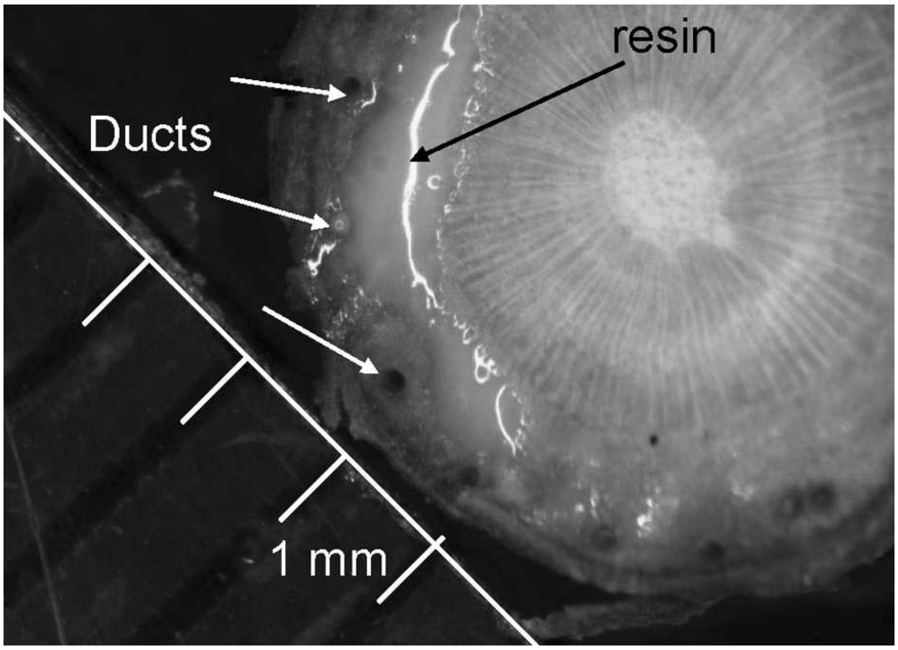

Figure 1. Incision in the stem of *Commiphora gileadensis*, 3 mm in diameter. The resin ducts in radial array are close to the phloem cells.

As mentioned above, in the ancient world the balsam sap was collected from incisions that might have significantly reduced the amount harvested. Today, we have more advanced methods to extract the sap using tools that enable us to make use of more of the material and damage the plant less. The main problem in directly harvesting sap from the resin ducts is that the sap solidifies, making collection difficult.

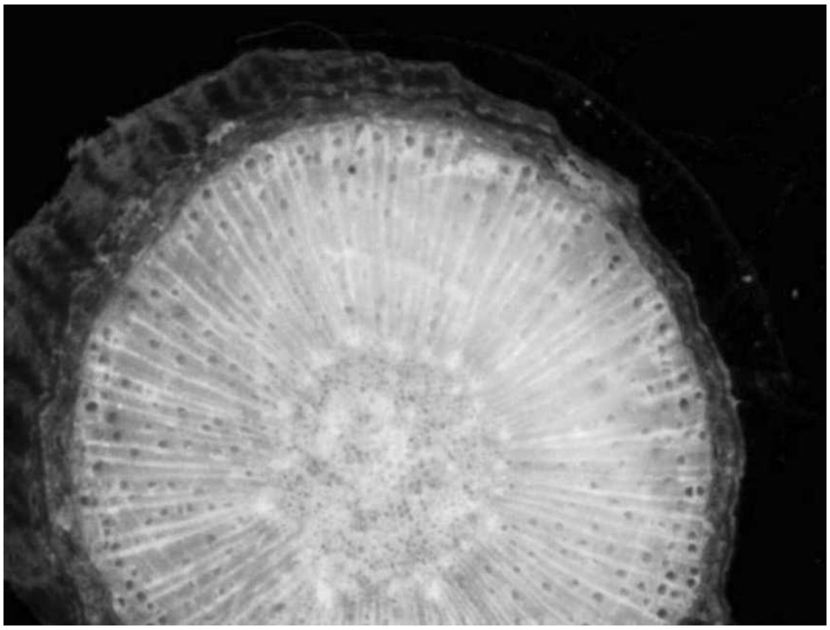

Figure 2. Cross-cut in stem of the *Commiphora habessinica*; resin ducts are scattered.

As part of our study, we examined several methods for direct extraction of sap from the plant. Cutting off the edges of the stems and inserting thin tubes using a syringe in a vacuum did not produce satisfactory results; after the first exudation of sap, the flow stopped. Inserting a syringe in the center of the stem after removing the wood was not effective. As a result of these procedures the flow of sap stopped immediately. In fact, the sap continued to flow only through the incisions made on the side of the stems, while the main limb remained intact. We did obtain significant results by perforating the stem (at a thickness of at least 1.5 cm) and creating a vertical groove between the bark and the xylem tubes, which drained the resin off the exudate of several resin ducts. We inserted a syringe that drew off the exudate into this groove or channel. The amount of exudate obtained within thirty minutes was approximately half a cubic centimeter. Eventual stoppage of the flow resulted either from equalization of pressure or because there was no longer sufficient pressure to push the syringe plunger.

Another, similar, method we employed was the insertion of capillaries into the vertical drain groove that was made in thick stems (3 mm on average) (see fig. 3). It is important to make sure that the ends of the capillaries are positioned with the opening facing downward in order to take advantage of the gravitational pull. The capillaries fill up with sap, but the drops reaching the end are exposed to air and solidify, thus stopping the flow. This method can be improved by extending the capillaries in the tube and keeping it sealed, creating pressure-chamber conditions. The amount of exudate obtained is 100 microliters over a period of five to ten minutes. Subsequently, the amount of sap decreases, but the flow continues, albeit at a very slow rate. Using these techniques, it is possible to leave the suction pipes in the plant for extended periods, enabling the plant to again create sap, and thus it is possible to optimally utilize the amount of exudate secreted by the plant. The best way to do this is to insert a capillary at the end, a thin pipe that enables the introduction of a layer of air, while not sealing the pipe entirely. This technique creates a vacuum that causes the sap to continue to flow but also prevents the entry of air in a way that would cause the sap to solidify. This technique causes or allows the sap to continue to flow for quite some time, and over one cubic centimeter of sap was obtained.

Figure 3. Insertion of capillaries into the vertical drain groove made in thick stems.

By making horizontal incisions in the stem, as had been done in the past, a large quantity of sap is obtained immediately. Nonetheless, after several minutes the tree stops secreting sap. Indeed, the damage caused to the tree is greater and in the long run can be critical. The horizontal incisions create scars on the plant that leave their impressions even after many years. In contrast, by employing the capillary system, the damage to the tree is insignificant, and many perforations can be made at the same time and more frequently. Therefore, the amount of sap that accumulates may be far greater than that obtained from the incision method. An additional advantage is that there is no need to wait for hours in the heat to collect the sap, as must have been the case in ancient times. Using our technique, the capillaries are connected and then the operator can return several hours later to collect what has accumulated.

Based on a rough estimate obtained after the first results, the incision method produces approximately 5-6 cubic centimeters in one day (once a month) from a large tree. The perforation system produces five to ten times more. If one assumes that this amount can be obtained every day then the perforation method can produce over one hundred times the amount obtained using the incision approach.

We further researched methods of propagation, starting with seed propagation. Our experience showed, however, that growing plants from twigs is quicker and easier. Germination from seeds was not productive enough as the time it takes to go from seeding to resin collection is quite long. Using twigs, the number of plants we produced was much greater than seeding; furthermore, we could maintain the plants' genetic quality (keeping them the same as the original) and ensure that the plants were virus free. After a year, the desired materials can be harvested from the young plants (future research will have to examine the method of propagating plants using tissue culture). The number and size of resin ducts in relation to the diameter of the tree (3 mm) confirm that the young branches contain a relatively large amount of sap (see fig. 1).

After the plants are allowed to mature, they the can be pruned between the age of four and five years (at least once annually), and the material found throughout its stems, leaves, and seeds can be extracted. Using this technique, within a relatively short time commercial quantities can be produced. In fact, during the Roman period, this technique brought in most of the revenue to the state treasury (fiscus), as Pliny noted: "There is a market even for the twigs too;

within five years of the conquest of Judaea the actual loppings and the shoots fetched 800,000 sesterces (one sesterce is valued at two and one-half asses). These trimmings are called 'xylobalsamum'; they are boiled down in perfumes, and in manufacture they have taken the place of the actual juice of the shrub."[34]

Counterfeits

Pliny notes the high price fetched by balsam: "In no other case is more obvious fraud practiced ...so much does it pay to increase the quantity of adulteration."[35] The method of adulteration that was practiced in ancient times was to mix up the sap with donkey's milk.[36] The question is why they did not mix the sap with sheep, cows, or goats' milk which was commonly found in the human domain. From experiments that we conducted, it appears that the *Commiphora gileadensis* (similar to rennin, i.e., the enzyme used to coagulate milk and the sap of other plants, such as figs) caused curdling of kosher animals' milk. This property was mentioned in ancient sources which noted that only genuine sap caused milk to curdle,[37] while the milk of non-kosher animals did not curdle.[38] Therefore, in order to avoid having the adulteration detected by means of the curdling test, some swindlers mixed balsam sap with the milk of a donkey, the most common of the non-kosher animals found in domesticity in ancient times.

Pliny states that another method for detecting the adulteration of pure sap was its dilutability: it solidified in hot water and sank to the bottom of the container while the adulterated substance floated on top of the water like oil.[39] In the tests that we conducted, the first volatile sap (serum) floated on the surface of the water in both cold and hot water — apparently due to its low specific weight, while the milky, dense sap was diluted by cold water and sank in hot water. This milky sap was apparently the one mentioned by the ancient sources. If this is the case, it is

34 Pliny, *Historia Naturalis*, 12.118.

35 Ibid., 12.123.

36 *Tosephta*, ed. M.S. Zuckermandel (Jerusalem: Wahrmann Books, 1970), *Bava Batra* 5, 6, p. 405.

37 Dioscorides. *Greek Herbal of Dioscorides*, 1.18; Aristotle. *Historia Animalium*, trans. A. L. Peck (Cambridge, MA: Harvard University Press, 1965), 3.20, p. 225.

38 Z. Amar, U. Merin, and D. Iluz, "Curdling of Milk as a Criterion for Determining *Kashrut* of Animals in the Bible" (Hebrew), *BDD: Journal of Torah and Scholarship* 21 (2009): 75–94.

39 Pliny, *Historia Naturalis*, 12.123.

evident that most of the exudate used to prepare the perfume and medicines came from the second “milky” stage, while most of the sap from the first, volatile stage could not be utilized.

The adulterated “Balsam oil” material was mixed with basic carrier oils or other aromatic oils and, when tested, floated on the water. Nevertheless, one cannot rule out the possibility that the Jewish balsam tree growers also developed a technique for getting the most out of the first-stage volatile exudate as well, and this was one of their professional secrets.

Summary

Preliminary tests conducted on the *Commiphora gileadensis* plant demonstrated a correspondence to the description of balsam and the sap harvested from it that is mentioned in ancient sources.

Modern attempts to produce balsam sap may explain why this substance was so important and prestigious in antiquity, by highlighting its properties and the technical difficulties in collecting the liquid’s volatile sap. Using a perforation method to harvest the sap and combining this with improved techniques to propagate balsam plants, the possibility of producing perfume from balsam in commercial quantities may be in our grasp.

We hope that the restoration of balsam cultivation in the Land of Israel and the intensive studies that researchers have recently been pursuing in the perfume and pharmaceutical industry will make it possible to discover more of this plant’s hidden secrets. Perhaps this will reawaken the demand for balsam perfume and return it to its previous status and prestige.

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