AGRUMED
Archaeology and history of citrus fruit in the Mediterranean:
Acclimatization, diversifications, uses

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The history of *Citrus medica* (citron) in the Near East: Botanical remains and ancient art and texts

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*Citrus medica*'s area of origin, like all other citrus forms, lies in South East Asia. However, Weisskopf and Fuller¹ have suggested that, in contrast to other citron fruits, the citron actually originated in the westernmost area of Asia, probably in the central Himalayan foothills where it was first domesticated (fig. 1). Another unique characteristic of the citron, in comparison to other domesticated *Citrus* species, is that it has a very thick albedo. This feature resulted in the citron’s long shelf life, making it since antiquity a preferable product for long distance trading. These two distinctive characteristics (westernmost origin and relatively long preservation ability), may be part of the explanation why the citron was the first citrus crop to migrate westwards. The earliest botanical evidence for *C. medica* cultivation outside its area of origin was found in the Near East.

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Fig. 1 - Map showing the plausible area of origin and centre of domestication of *C. medica* (modified after Weisskopf, Fuller 2013), together with Near Eastern archaeological sites where ‘secure’ *C. medica* botanical remains were recovered.

(1) pollen, Ramat Rahel near Jerusalem, 5th-4th century BCE; (2) pollen, Carthage 4th-early 3rd centuries BCE; (3) pollen, seeds and charcoals from sites in southern Italy, since the 3rd/2nd century BCE; (4) seed and fruit remains from the Egyptian desert, Roman period.

In this article, the westward migration route of citrus is traced by using three lines of evidence: (i) micro and macro archaeobotanical remains, (ii) ancient texts and (iii) ancient art artefacts (e.g. wall reliefs, coins, mosaics). In the case of the archaeobotanical remains, the validity of some of the remnants is questionable due to several limitations regarding identification issues and their archaeological context (mainly uncertainties relating to stratigraphy and/or chronology). This article aims to integrate all relevant information related to the history of the citron in the Near East, together with a discussion concerning the reliability of evidence. Additionally, this study will show that the citron was introduced into the Near East as an elite product (rather than a cash crop) and that it gradually penetrated the Jewish culture and tradition.

1. Archaeobotanical evidence

*Citrus* seeds dating to the Sumerian period (4,000 years BCE) were discovered in the Nippur archaeological excavation in the south of Babylonia. As the seeds found in the excavation were charred, they could only be identified as *Citrus* – the specific species could not be determined. Tolkowsky pointed out that the period to which these seeds belong cannot be precisely dated. Furthermore, he emphasized that their presence in Nippur does not necessarily indicate that the tree from which they came from was cultivated in Babylonia at the time. If the citron tree had grown there on a limited scale in ancient times, Tolkowsky believed that it would have become a common tree during Alexander the Great’s conquest in the late 4th century BCE. However, the Greek botanists accompanying Alexander reported that the citron was grown only in Persia and Media (described in Theophrastus’s book, *Enquiry into Plants*, ca. 310 BCE), therefore, Tolkowsky deemed the evidence from Nippur to be inconclusive. Although, he did state that if these were actual citron seeds they had probably been brought to Nippur either as an offering
to a divinity, or as a gift to a king. The seeds were dated purely on their unreliable archaeological context. Plus, recent investigations show that advanced identification methods – which were not available at the time of the Nippur excavation – are required to properly analyze Citrus seeds; therefore it is likely that they were misidentified.

This is also the case for seeds from the archaeological site of Hala Sultan Tekke (Cyprus), discovered in a layer dated to the 12th century BCE; however, although they resembled Citrus the exact species could not be identified. These remains had not been directly dated to confirm their age (e.g. by accelerator mass spectrometry radiocarbon dating) and were from an unsecure archaeological context: an unsealed stratum. Unfortunately, the remains can no longer be located, so attempts to re-examine the seed assemblage were unsuccessful (David Moster, personal communication).

Even allowing the ambiguous identification and inconclusive dates and contexts of the remains from Nippur and Cyprus, the presence of Citrus seeds must still surely indicate that the fruit was imported, not necessarily that the tree was grown locally. Indeed, it appears that since antiquity the citron was considered a valuable commodity due to its healing qualities, symbolic use, pleasant smell and rarity; and it is possible that it was known to some people in the region purely by reputation alone. Liran reached a similar conclusion when he suggested that the citron was only grown by the wealthy as evidence of their status, as it was a rare commodity that only they could afford. In addition, citron is a non-edible fruit, unlike other Citrus species, but it can preserve for months due to its thick albedo.

Recently published pollen findings from the Persian Royal Garden – adjacent to the extravagant palace excavated at Ramat Rahel near Jerusalem (Israel) – shed new light on the earliest possible date of C. medica cultivation in the Mediterranean. While examining one of the plastered pools in the garden, dating to the 5th-4th century BCE, fossilized C. medica pollen found trapped in one of the plaster layers was identified – various structures within the garden were plastered in several layers, most probably due to ongoing maintenance. The unique palynological spectra extracted from this plaster layer included, in addition to C. medica, other palynological evidence of special and highly-valued trees introduced from remote parts of the Persian Empire (e.g. the cedar of Lebanon, Cedrus libani), together with native fruit trees and various ornamentals.

Additional botanical evidence, in chronological order, derives from an area outside of the Near East: the Punic port of Carthage (Tunis, North Africa). Here, pollen from the sediment level contemporary with the 4th/early 3rd centuries was extracted, suggestive of the citron’s early cultivation here.

The occurrence of both pollen and citron seed remains dated to the Roman period in several sites throughout the Mediterranean, attests that the citron was well known in the region at that time. Seeds assemblages from secure contexts were retrieved from Roman settlements in remote Egyptian desert locations. Most of the remains were desiccated and therefore very well preserved. In southern Italy relatively rich collections of both micro- and macro-botanical remains are available, dated prior to the Egyptian evidence: starting already at the 3rd/2nd centuries BCE. In most cases the remnants were recovered from high-status gardens owned by the affluent. The palynological evidence from this region shows that C. medica was the first Citrus species to migrate west, probably via the Near East, followed by the lemon (C. limon).
2. Textual evidence

2.1. The citron in Greco-Roman sources

According to Tolkowsky, the first textual evidence of the citron was probably from the play *The Beotias*, written by Antiphanes (408-334 BCE). Only a portion of this play has survived thanks to a brief mention, several centuries later, in the *Deipnosophistae* ('dinner-table philosophers'), by Athenaeus (early 3rd century CE). Though the citron is not actually mentioned by name, good looking and very delicious apples are described as part of a delivery from the Persian ruler; it is described as a unique fruit, very rare and therefore very expensive.

Fifty years later (ca. 310 BCE), in a much more reliable written source, Theophrastus provides a precise description of the citron in his book *Enquiry into Plants*:

> And in general the lands of the East and South appear to have peculiar plants, as they have peculiar animals; for instance, Media and Persia have, among many others, that which is called the ‘Median’ or ‘Persian apple’. This tree has a leaf like to and almost identical with that of the Arbutus, but it has thorns like those of the pear or white-thorn, which however are smooth and very sharp and strong. The ‘apple’ is not eaten, but it is very fragrant, as also is the leaf of the tree. And if the ‘apple’ is placed among clothes, it keeps them from being moth-eaten. It is also useful when one has drunk deadly poison; for being given in wine it upsets the stomach and brings up the poison.

The text goes on to give exact instructions on how to grow the tree along with two key observations: the first being the tree's unique quality of bearing fruit during several seasons – meaning new fruit can grow on the same tree alongside fruit that grew during the previous year – making the citron tree a symbol of eternal spring and fertility, which inspired many poets and artists; the second observation concerned the tree's flowers having a prominent pistil, which makes them more fertile than other sterile flowers. From a different literary fragment by Theophrastus, it appears that the discovery of sterile flowers with no pedicle was first made by Persian gardeners, who then informed the Greek botanists. They, and perhaps Theophrastus himself, first recognized this trait's significance in identification. The pedicle of the citron develops from the style and the stigma, whereas in other *Citrus* species this part degenerates. Nowadays some citrons no longer produce pedicles due to crossbreeding with other citrus types. However, in isolated faraway places, where other species of *Citrus* are not grown, all citrons grow a pedicle. The *Arbutus* mentioned in Theophrastus's text is related to the eastern strawberry tree (*Arbutus andrachne*). Tolkowsky holds that the description of the citron leaf as having a round base and a pointed end, much like the *Arbutus*, eliminates any intent to reference it to a different *Citrus* since they all have either winged petioles or very narrow chisel shaped leaves. The pear mentioned within this text is related to the wild Syrian pear (*Pyrus syriaca*).

Scholars argue that Theophrastus's statement that the tree grew in Media and Persia is further evidence that prior to ca. 300 years BCE the citron was not widely cultivated outside these two places. Theophrastus's descriptions in *Enquiry into Plants* – which he published in around 310 BCE – were based on observations by a number of Greek scholars who accompanied Alexander the Great and his army on all their campaigns and conquests throughout Asia Minor, Syria, Israel, Egypt, Persia and modern-day Pakistan. However,
though the scholars passed through the area west of Persia twice, they did not mention having observed the growing of citron trees. This leads us to the conclusion that the citron tree was limited to the Iranian Plateau and had not yet been cultivated west of there. On the other hand, Theophrastus did not describe the fruit itself but rather its characteristics, which suggests that the citron fruit was well-known to the Greeks. In approximately 35 BCE the citron was still being described as an exotic fruit: the Roman author and poet Virgil calls it the ‘Median apple’ and states that it is antitoxic and has scented oil. A complete survey of the Greco-Roman written sources of the citron (and other Citrus species) can be found in Pagnoux (this book).

2.2. The citron in the Hebrew Bible and Jewish tradition

The verse in Leviticus 23:40 instructing the holding of the four species during the Feast of Tabernacles (‘And ye shall take you on the first day the fruit of goodly tree, branches of palm trees, and the boughs of thick trees, and willows of the brook; and ye shall rejoice before the Lord your God seven days’) clearly refers to two known species (willow and palm); however, researchers are finding it difficult to determine whether ‘the fruit of goodly tree’ and ‘boughs of thick trees’ refer to specific species or should be summarized as general instructions. The word הָּדָּר (‘goodly’) mentioned in Leviticus does not necessarily indicate a tree; it may also be a noun meaning ‘glory’ or ‘grandeur’, which is typical of the poetry and prophecy in the Hebrew Bible.

As for the ‘fruit of goodly tree’, a phrase determined in the Septuagint (3rd century BCE) consists of a noun referring to a grand and delightful fruit. This appears to be the intention in Leviticus 27:30 and Nehemiah 10:36, where the verses do not refer to any specific kind of tree. The phrase is not mentioned in the description of the Feast of Tabernacles in Nehemiah 8:13-15, where five different species are mentioned. Within the description in The Second Book of the Maccabees 10:6-7 there is no mention of ‘the fruit of goodly tree’, but rather ‘ivy-wreathed wands and beautiful branches and also fronds of palm’.

From the 1st century CE there were significant change to the texts in which the four species mentioned in Leviticus 23:40 are defined: palm, willow, myrtle and citron. In Antiquities of the Jews 13:5 372; late 1st century CE), Flavius Josephus describes how the Jews threw citrons at Alexander Jannaeus for disrespecting the libation ritual (compare to Mishna tractate of Sukkah 4:9). However, the documents from the days of Chazal indicate that the citron was fully accepted as part of the holiday tradition, with no mention of any kind of objection, suggesting that before the days of Chazal other traditions were not practiced. A survey of the Jewish written sources on the citron was recently published by Langgut.

3. Ancient art artefacts

Citron fruits appear on the following ancient Near Eastern artefacts: reliefs, coins and mosaics. The main problems lie with the association of the citron’s early appearance on these artefacts in terms of: (i) the presence’s significance and (ii) identification.

(i) The appearance of Citrus on ancient art artefacts does not necessarily point to authentic cultivation, but could suggest familiarity with the citron.
(ii) *Citrus* identification is mainly doubtful in the case of wall reliefs. Several suggestions have been previously raised to connect fruits evident on ancient Near Eastern reliefs to the citron. For example the French archaeologist Loret claimed that at the Karnak Temple, Egypt, which was built in the time of Thutmose III (1,490-1,450 years BCE), citrons are evident in the reliefs. Another example originates from an Assyrian relief where cone-shaped objects held by figures were suggested by Bonavia to be citrons. In my opinion it is impossible to clearly define what is depicted in these two reliefs. Other scholars have also previously reached the same conclusion.

More robust evidence derives from the 1st century CE, where the citron appears alongside the palm branch on coins from the 4th year of the Great Jewish Revolt (69-70 CE). Several decades later, in the days of Simon bar Kokhba (132-136 CE), the citron was coined again alongside the other three species used in the Feast of Tabernacles; the citron also appears on oil lamps found in ancient Israel, dated to the same period. These artefacts corroborate with the textual evidence, which indicate that by the 1st century CE the citron was a fixed element in this particular celebration. Later, citrons were depicted in the Dura-Europos synagogue wall paintings in Syria (before 256 CE), in the decoration above the Torah niche. From the 4th century CE, during the Byzantine era, the citron appears not only in synagogue mosaic pavements, lintels and screens, but also in many Christian mosaics in Israel and Jordan.

It is interesting to note that in some of these Byzantine mosaics the citron fruits appear with 'thin hips'; according to Bar-Joseph, which indicates malformations similar to those caused by the viroid infection. Similar symptoms were also present on the bar Kokhba coins mentioned earlier, dated to the 2nd century CE. These findings indicate, with reasonable conviction, cases of citrus viroid disease (CVd) infections in *Citrus* trees growing in the Near East almost two millennia ago.

### 4. Suggested *C. medica* diffusion route

Based on the evidence presented in this article, it seems that the citron made its way from the South-East to the Near East via Persia, and from there spread to the Mediterranean Basin and into Europe. This suggested route of diffusion: central Himalayan foothills-Persia-southern Levant, lies on the same latitudinal range (ca. 32°N; fig. 1). Therefore, while being grown along this route, *C. medica* was exposed to the same amount of day light and benefited from similarities in the cycle of seasons. Though the habitats along this suggested route are different (in the southern Levant for example, *C. medica* requires watering mainly during summer and much more care in order to thrive in comparison to its area of origin), citrons do not require the cool temperatures of some Rosaceous fruit trees, and can therefore grow at various elevations. Indeed, according to Diamond, the Eurasian east-west orientation allowed domesticated crops from one part of the continent to be grown elsewhere due to similarities in climate and the cycle of seasons, something that was almost impossible for crops in the two Americas.

Based on the earliest reliable evidence pointing to *C. medica* cultivation (the pollen from Ramat Rahel near Jerusalem and Theophrastus’s writings), the suggested date of citron’s westward migration is around the 5th century BCE. Though the evidence near Jerusalem is dated slightly earlier than Theophrastus’s book (5th-4th century BCE and late 4th century BCE, respectively), Theophrastus was probably describing an already well-
established citron cultivation, which most likely represents several generations of *C. medica* cultivation.

## 5. Summary

Citron originated in the central Himalayan foothills and then seems to have made its way from the South-East to the Near East via Persia, to the eastern Mediterranean and finally across to the Mediterranean Basin and Europe. The first robust evidence of citron cultivation originates from Ramat Rahel near Jerusalem, where fossil *C. medica* pollen grains were found in a Royal Persian Garden dated to the 5th-4th centuries BCE. The citron was probably brought from the Iranian Plateau to flaunt the power of the Persian imperial administration. Theophrastus’s work from the 4th century BCE, are consistent with the citron being already well established in Persia and Media. In later periods citron remains appear in relation to prestigious gardens, as it was a rare plant that only the rich could afford. We can therefore suggest that the spread of the citron, a non-edible fruit, was helped more by its high social status and religious and magical features (e.g. healing qualities), rather than its culinary qualities.

Two unique features may explain why the citron was the first citrus crop to migrate westwards: (i) citron originated in the westernmost part of Asia in comparison to other *Citrus* species; and (ii) the citron, unlike other *Citrus* species, can be preserved for months due to its very thick albedo, resulting in a relatively long shelf life. Due to these two factors, it was possible to use the citron as a long-distance trading product during antiquity. The suggested route of diffusion: central Himalayan-Persia-southern Levant, lies on the same latitudinal range and therefore, while being grown along this route, *C. medica* benefited from similarities in day length and seasonal cycles that encouraged its diffusion and success in these new regions of cultivation.

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NOTES


2. Recent studies indicate that citrus seeds sometimes appear difficult to recognize due to changes caused by preservation processes, their morphological variability and their relatively low state of preservation; the problem also lies in the similarity of the general morphology of citrus seeds and other seeds (e.g., *Maloideae* types, subfamily of the *Rosaceae*), especially when mineralized (Coubray et al. 2010; Pagnoux et al. 2013; Fiorentino et al., this volume).

5. Theophrastus of Eresos (287-372 BCE) – the great Greek botanist who wrote the Enquiry into Plants which contains elaborate and accurate illustrations of the East-Asian flora – provides descriptions of the citron tree. See more details in the paragraph dealing with ancient texts.
6. Coubray et al. 2010; Pagnoux et al. 2013; Fiorentino et al., this volume.
13. Outside the Near East, only citron remains from secure archaeological context are mentioned in this article. For a detailed discussion on some of the inconclusive citron remains (e.g. the remains from Cumae, Italy, presented by Bui Thi Mai, Girard 2014), see Langgut 2017.
15. Van der Veen 2001; 2011; Thanheiser et al. 2002; Van der Veen, Tabinor 2007; Bouchaud et al., this volume.
16. Pollen, seeds and charcoals.
18. Russo-Ermolli et al., this volume.
20. Antiphanes was an important writer of the Middle Attic comedy; he began to write around 387 BCE in Athens.
25. Hādār in Hebrew means Citrus but also ‘glory’ or ‘grandeur’.
29. Loret 1891.
30. Bonavia 1894.
32. Also called The First Jewish-Roman War.
35. See review by Ben-Sasson 2012.
39. Became a fixed element in the Feast of Tabernacles (Judaism), most probably since the 1st century CE.
40. Citron cultivation outside South-East Asia most probably started around the 5th century BCE.
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