Ethnobotany and archaeobotany significance of Oriental hackberry (*Celtis tournefortii* Lam.) in Anatolia: From Neolithic traditions to modern applications

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Review

Abstract

Background: Oriental hackberry (*Celtis tournefortii* Lam.) is a scattered tree species that generally exhibits a sparse distribution across various regions of Türkiye. Oriental hackberry is a tree species occurring in the natural flora of Anatolia and has been considered valuable throughout history in terms of nutrition, health, and cultural significance. This review study focuses on the ethnobotanical significance of the Oriental hackberry, which is a vital species particularly in arid and semi-arid areas.

Methods: In this study, archaeobotanical and ethnobotanical information related to Oriental hackberry -an ecologically significant species that lives in scattered form in nature and serves as a bridge between the past and the future- was compiled from printed sources. In addition, some ethnobotanical information obtained from field observations was also included.

Results: Archaeobotanical findings indicate that the fruits of this rare tree have been utilized as a food source in the Anatolian geography since ancient times, a tradition that persists to the present day. It is valued in agricultural areas as a boundary tree between farmland and for its shade. Furthermore, its fruits and leaves are traditionally utilized for medicinal purposes. In certain regions, the tree is accorded special cultural value and is protected with great diligence.

Conclusions: This research aims to compile various folk botanical (ethnobotanical) information about the Oriental hackberry before it is lost.

Keywords: Ethnobotany; Archaeobotany, *Celtis tournefortii*, Oriental hackberry, Anatolia

Background

Human-plant relationships extend back to the beginning of human life. These connections have become the subject of research in all their dimensions. Archaeobotany is a scientific discipline that examines how ancient societies used plants based on remains recovered from archaeological excavations. Folk botany (ethnobotany), on the other hand, is a field that investigates the relationship between plants and humans and aims to compile all local knowledge related to plants from which people benefit in various ways. Archaeobotany focuses on the past, whereas folk botany focuses on the present. While

archaeobotany relies on excavation data, folk botany collects information through field studies and oral transmissions. Both attempt to understand human-plant relationships from different perspectives. The term folk botany is preferred by some authors instead of the foreign term “ethnobotany (Ertuğ, 2014).

In Türkiye, there remains a rich body of folk botanical knowledge that is still awaiting compilation and documentation, in addition to the knowledge that has already been lost. In recent years, the number of qualified studies in this field has increased substantially. The investigation of species known to have been utilized from the past to the present, such as *Celtis tournefortii* (çitlenbik, dardağan), holds particular significance within such studies. The ethnobotanical narrative of Oriental hackberry, which is rarely encountered among wild fruit-bearing plants and serves as a bridge between the past and the present, is expected to contribute to increasing awareness of this species.

Plants have constituted an indispensable resource for humans since the beginning of life, not only for nutrition but also for meeting basic needs such as health, shelter, and weaving (Nesbitt, 1995). Many plants that are present on dining tables today originate from the regions of the Middle East and India, where the earliest human settlements emerged. Archaeobotanical studies indicate that cereals, legumes, hard-shelled nuts such as pistachio and almond, and flax were first domesticated in Central Anatolia, Northern Mesopotamia, and the Levant region. Over time, these plants spread to Europe, the Caucasus, and more distant regions, forming the foundations of agriculture (Bingham *et al.* 2012).

Hard-shelled fruits have held an important place in human life throughout history due to their nutritional value and their ability to be stored for long periods. Species such as almond, walnut, hazelnut, and pistachio have been among the primary sources of energy owing to their high oil and protein contents and have been domesticated and widely cultivated across different climates and geographical regions. Similar to these hard-shelled nuts, the fruit of Oriental hackberry is also collected from nature and stored in dried form for use throughout the year. Archaeological findings indicate that such species have been gathered since the Neolithic period and stored by settled communities for year-round consumption. In addition, the well-developed hard shell structure of the fruit not only protects the inner part from mechanical damage but also provides advantages in terms of transportability along trade routes.

Recent detailed ethnobotanical and archaeobotanical studies have revealed the importance of wild food plants in human nutrition (Erkal, 2008). From historical periods to the present, humans have discovered plants occurring in nature and utilized them for various purposes. Through this process, the beneficial properties of plants in medicine, food, textiles, and other fields have been learned and applied, leading to the accumulation of cultural knowledge concerning human-plant relationships. Ultimately, a body of plant-related knowledge that connects the past with the present and has become established as a tradition within societies has emerged. In this context, the concept referred to as traditional ecological knowledge has developed. Traditional ecological knowledge (TEK) refers to a body of knowledge based on experiences and beliefs that have developed through long-term interactions between humans and their environment. The compilation, documentation, and archiving of ethnobotanical and archaeobotanical elements, and their transformation into databases, require systematic and long-term studies supported both by individual initiatives and institutional frameworks, as observed in many countries (Yolcu and Aça, 2019).

Hunter-gatherer societies were required to be keen observers of nature, as their survival depended on living in close dependence on natural resources. Consequently, humans specialized in gathering possessed detailed knowledge of when particular plants or fruits would ripen and when they would sprout (Eren and Çelik, 2023). Understanding the historical and cultural uses of plants constitutes an important research field within the disciplines of archaeobotany and ethnobotany. While archaeobotany investigates the interactions that past societies established with plants through archaeological remains, ethnobotany-also referred to as folk botany-examines the traditional knowledge and practices related to plants within contemporary societies.

Archaeological records and traditional plant knowledge reflect the cultural and ecological value of the Oriental hackberry tree. Remains of trees with drupaceous and sweet fruits, such as Oriental hackberry, can be encountered particularly in Neolithic settlements in Central Anatolia. Archaeobotanical studies conducted in Neolithic settlements in Anatolia (10,000-7000 BC), which are mostly settlement-focused, remain quite limited (Eren and Çelik, 2023). Archaeobotanical data indicate that Oriental hackberry has been known and utilized in Anatolia since the Neolithic period. For instance, seed remains belonging to *Celtis* species have been identified in Neolithic settlements such as Höyücek and Bademağacı in the Mediterranean region (Duru and Umurtak, 2008).

Plant utilization traditions throughout human history provide important insights into the ways plants have been used by local communities. Many plant species collected from nature have gradually been domesticated and incorporated into agricultural production. Plants used particularly for medicinal purposes have consistently occupied a central place in scientific research. Today, the discovery of active compounds in many pharmaceuticals has been made possible through ethnobotanical studies based on traditional knowledge of plant use (Farnsworth, 1990). The fruits of Oriental hackberry are known and consumed under different local names in various regions of Anatolia. For example, the fruits of *Celtis tournefortii*, known as "çitlembik" in Central Anatolia, are commonly consumed as a snack during the winter months (Ertuğ, 2014).

Oriental hackberry is a tree species occurring in the natural flora of Anatolia and has been considered valuable throughout history in terms of nutrition, health, and cultural significance. In this study, archaeobotanical and ethnobotanical information related to Oriental hackberry -an ecologically significant species that lives in scattered form in nature and serves as a bridge between the past and the future- was compiled from printed sources. In addition, some ethnobotanical information obtained from field observations was also included.

Tree of *Celtis tournefortii* Lam. (Oriental hackberry)

Celtis tournefortii Lam., commonly known as Oriental hackberry or eastern hackberry, is a native tree species that naturally grows in the arid and semi-arid regions of Western Asia and the Caucasus, and in Türkiye it is distributed particularly in Central and Eastern Anatolia. Belonging to the Cannabaceae family, Oriental hackberry has the ability to grow within a wide altitudinal range of 300-1500 m and can survive in exposed rocky areas. In Southern Anatolia, individuals reaching heights of up to 13.5 m have been recorded (Demirbağ *et al.* 2025). The species occurs in Türkiye, the Balkans, and East Asia, with its widest distribution found in Anatolia (Fig. 1). In Europe, it extends from Sicily eastward through the Balkans to Crimea and Cyprus. It is known from Croatia, Bosnia and Herzegovina, Albania, North Macedonia, and Bulgaria. Records of the species in Western Asia originate from Türkiye, Iran, and Iraq, while its distribution in the Caucasus includes Armenia, Azerbaijan, and Georgia (Zieliński *et al.* 2012). Despite this wide distribution, the species generally exhibits an irregular and scattered pattern of occurrence wherever it is found.

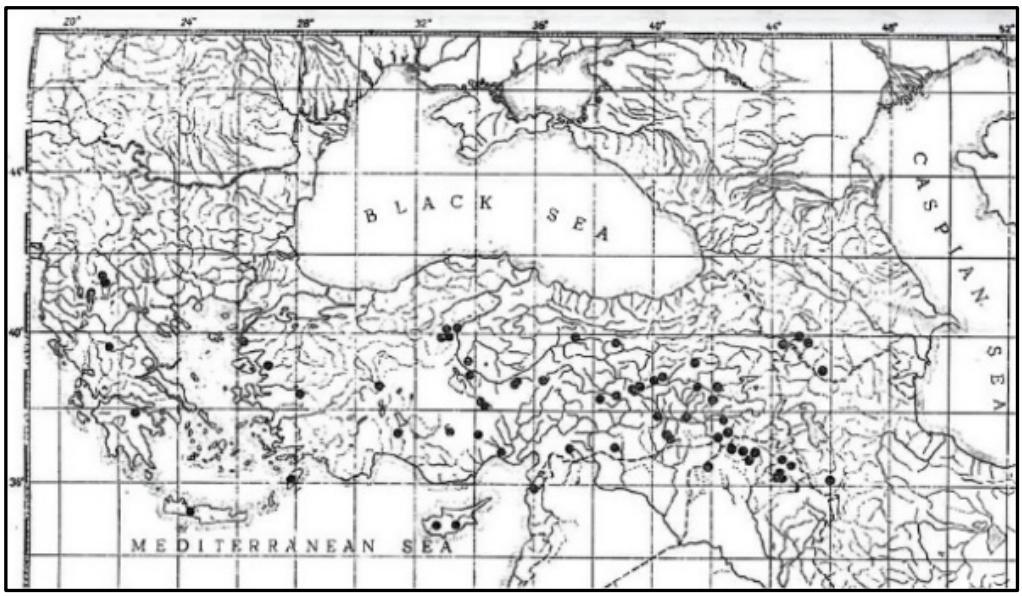

Figure 1. Distribution of *Celtis tournefortii* L. around the world (Browicz and Zielinski, 1982).

Materials and Methods

In this study, archaeobotanical and ethnobotanical information related to Oriental hackberry -an ecologically significant species that lives in scattered form in nature and serves as a bridge between the past and the future- was compiled from printed sources. In addition, some ethnobotanical information obtained from field observations was also included.

Search Strategy: The search strategy was designed to be broad, encompassing the literature in English, Turkish, and relevant regional languages (including Hebrew sources). This approach has maximized the historical data available on archaeobotany in the Near East and Anatolia.

This systematic review follows the PRISMA 2020 guidelines. A comprehensive literature search was conducted across Web of Science, Springer, Scopus, Google Scholar, and DergiPark databases (1963-2025). Keywords included "*Celtis tournefortii*", "Oriental hackberry", "Anatolia", "Archaeobotany", and "Ethnobotany". (Fig. 2).

Selection Criteria: This study includes peer-reviewed articles, doctoral theses, and archaeological excavation reports that provide primary data on the use, cultural value, or historical remains of the *C. tournefortii* species in Turkey and around the world.

Data Synthesis: Data were categorized into four themes: (1) traditional agricultural practices, (2) food and snacks, (3) ethnomedicine, and (4) archaeobotanical evidence (Fig. 3).

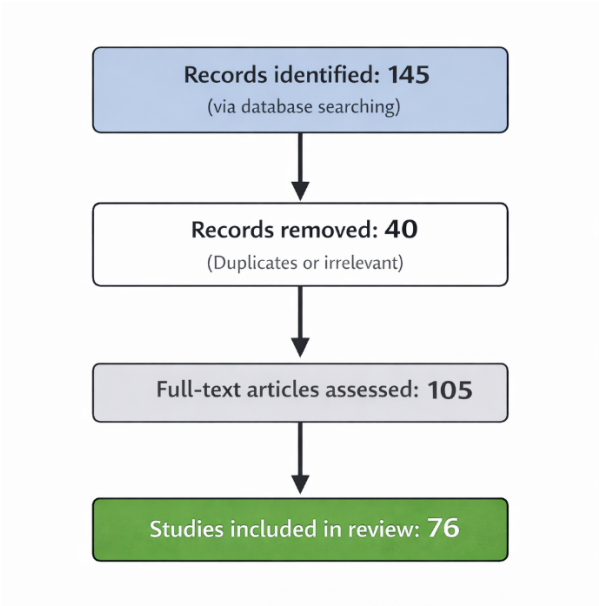

Figure 2. Flow diagram of Study.

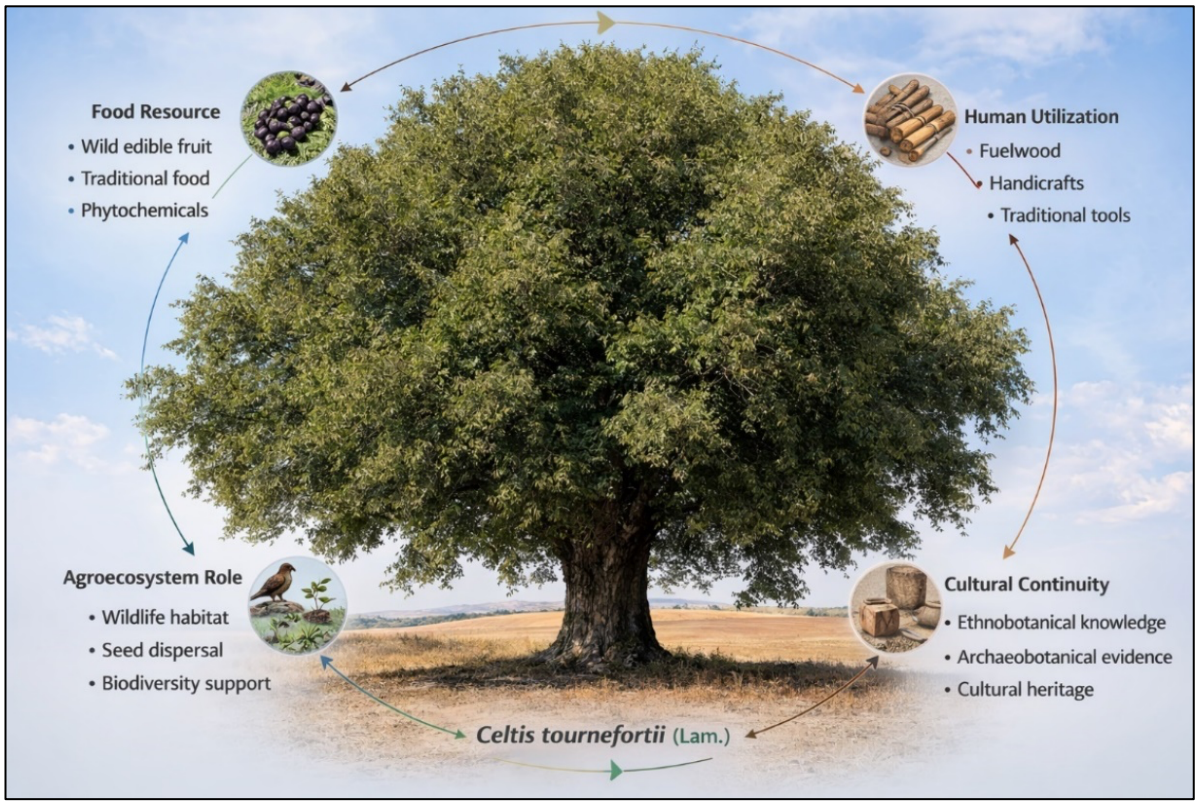

Figure 3. Uses of *Celtis tournefortii* L.

Results

Oriental hackberry From an Ethnobotanical Perspective

Utilization in agricultural lands

While 9.2% of Oriental hackberry individuals occur in forest areas, 90.8% are located in agricultural lands such as fields, vineyards, and gardens. Field observations reveal that a large proportion of mature individuals within the study areas are preserved in cropland as shade trees (Demirbağ, 2023). Both humans and animals benefit from their shade. In agricultural landscapes where it occurs, Oriental hackberry, with its broad crown that often exceeds its height, provides a unique natural shade for shelter and resting during hot and sunny periods. It can therefore be stated that the species continues to exist as a component of the local land structure from both ecological and sociological perspectives (Doygun and Ok, 2006; Gültekin, 2007). In addition, many old individuals possessing monumental tree characteristics are present on privately owned lands (Demirbağ, 2023). Consequently, in the areas where it is distributed, the species has persisted as an important component of nature for local communities (Fig. 4).

In some areas where Oriental hackberry occurs naturally, it is preferred as a boundary tree between agricultural fields. In its use as a boundary tree, the consideration that its wide shade may have negative effects on agricultural crops growing beneath it also plays a role. When necessary, its branches are pruned and used as firewood. With its multipurpose utilization, it constitutes a supportive element in rural community life.

The concentration of Oriental hackberry individuals mainly in areas close to rural settlements and within agricultural production sites indicates that the species is consciously or indirectly protected by local communities and that a use-based value is attributed to it. It is understood that individuals occurring in scattered form within populations are mostly dispersed and reproduced naturally through the consumption of the fruits by birds and the subsequent dispersal of seeds via droppings (Demirbağ, 2023).

Figure 4. Example of Oriental hackberry trees functioning as boundary and shade trees within agricultural land. Kuran Village, Seydişehir, Konya (Photo: Demirbağ, 2025)

The presence of more than 90% of naturally occurring Oriental hackberry individuals within agricultural lands indicates that the species performs a functional role as a component of agroecosystems. This distribution suggests that Oriental hackberry is not only an element of natural ecosystems but also a semi-protected component of rural environments shaped by human influence. Individuals left or naturally established along the boundaries of fields, vineyards, and gardens indicate that the species is maintained within production systems due to its multifunctional utilization potential.

From an ecological perspective, it can be stated that Oriental hackberry individuals may function as a microclimate-regulating element in agricultural lands through their morphological structures. Owing to their broad crown architecture, the shade they provide has the potential to reduce soil surface temperatures and limit moisture loss, particularly under semi-arid and arid conditions. Through this characteristic, Oriental hackberry trees also contribute to the continuity of soil biota. In addition, the fruits of the species constitute a food source for various wildlife species, especially birds, thereby establishing an ecological connection (habitat bridge) between agricultural lands and fauna (Demirbağ and Yılmaz, 2023). These characteristics also contribute to the conservation and development of agro-biodiversity.

In conclusion, the high presence of Oriental hackberry individuals within agricultural lands can be regarded as a local and natural example of traditional agroforestry practices. The functions of the species-such as providing shade, serving as boundary markers, supporting wildlife, and supplying an energy source-make it a native genetic resource that should be considered within the frameworks of sustainable rural landscape planning and climate change adaptation strategies. In areas where it naturally occurs, the species can be integrated into agricultural production systems.

Utilization as a snack

There are records indicating that *Celtis* species have been collected as wild fruits in the folk cultures of the Middle East, the Balkans, and the Mediterranean. Owing to their low lipid content but relatively high sugar content, they have been utilized particularly as dried fruits or stone fruits. Although direct ethnobotanical field studies on this subject are limited, folk-flora compilations from regions where the species occurs indicate that local communities occasionally collect these fruits.

The fruits of *Celtis tournefortii* are known by various local names, particularly in the Aegean, Central Anatolia, Eastern Anatolia, and Southeastern Anatolia regions. In the Aegean Region, it is referred to as “sarı çıtlık” (Sevgi and Akkemik, 2022). This species, also known as eastern hackberry (Yaltırık, 1998), is called “dağdağan” in Gaziantep, “dağum” in Erzincan and Tokat (Baytop, 1994; Polat *et al.* 2012), and “davi” in some parts of Adıyaman and Şanlıurfa (Demirbağ, 2023). In Central Anatolia, its fruits are collected and consumed as a snack during the winter months (Ertuğ, 2014). In the Buldan district of Denizli Province, the fruits of Oriental hackberry, locally known as “çıtlık,” are eaten as a snack (Ertuğ *et al.* 2004).

Oriental hackberry fruits are generally collected when they reach full maturity during September-October. After harvesting, the fruits are dried on drying racks and are either consumed directly or offered for sale in markets and herbal shops; they are frequently traded, particularly in districts where the species is abundant (Kızıl and Tonçer, 2014). The fruits are sold for food purposes during the autumn and winter months in regions such as Malatya, Elâzığ, Mardin, Adıyaman, and Diyarbakır (Fig. 5). In addition, although it is now a largely forgotten tradition, after the fruit was eaten the hard seeds were used by children as toys, being blown through a metal tube or reed and shot like small projectiles (Kılıç, 2019; Olgun, 2019).

Figure 5. Oriental hackberry fruits sold during autumn in the Malatya and Diyarbakır regions (Photo: Demirbağ 2023; Arslan 2024; Özçelik 2024).

In the Yeşilli region of Mardin, the fruits of *Celtis tournefortii* are consumed fresh, and when fully ripe they are fried, mashed, and mixed with honey or molasses to be used as a winter food. The species thus serves both as a food source and as a functional food, particularly within rural communities (Yeşil *et al.* 2019).

Considering their ecological and genetic diversity, Celtis species also constitute an important food source (Abah, 2018; Yıldırım *et al.* 2017). The fruit pulp possesses a high nutritional value and appetizing properties due to its rich content of dietary fiber, pectin, and antioxidant compounds. The aromatic sweetness provided by this rich nutritional composition enables the fruit to be traditionally consumed with great appreciation. Owing to its favorable flavor and health profile, the fruit also holds potential as a natural sweetener and nutritional supplement for the food industry (Vidal-Cascales, 2021).

Medicinal applications

The seeds, leaves, and fruits of Oriental hackberry possess significant medicinal potential. It has been reported that the fruits and leaves of the plant may be used in the treatment of diabetes (Geçibesler *et al.* 2017). While the ripe fruits are consumed as a snack in the regions where they occur, they are also believed to be beneficial for various ailments (Chiej, 1984). The species has been recorded as being used in the relief of stomach pain and in the treatment of influenza and common cold (Polat *et al.* 2013), as well as for conditions such as shortness of breath, asthma, and goiter (Akan *et al.* 2013; Arasan, 2014). Some *Celtis* seeds have traditionally been used in the treatment of diarrhea (Çakılcıoğlu *et al.* 2007), dysentery, and peptic ulcers, while certain species have also been employed for epilepsy, foot perspiration, and wound healing. An infusion prepared from the leaves is used internally to relieve stomach pain. Furthermore, in India the plant has traditionally been used in the treatment of fractures, sprains, and joint pain (Moerman, 1998).

In Anatolia, the medicinal use of wild plants dates back to very ancient times, even to the Hittite period, as evidenced by plant names recorded in medical tablets. Particularly in rural areas, local communities have generally relied on plants growing in their surroundings or those brought into cultivation for the preparation of remedies (Baytop, 1999). The fruits of Oriental hackberry contain significant fatty acids important for human health, including linoleic acid (49.5%), oleic acid (18.6%), and palmitic acid (8.8%), indicating that the species represents a nutritionally valuable resource. In addition, antimicrobial activity tests have demonstrated that fruit extracts of the species are effective against various bacteria (Yılmaz *et al.* 2021).

Information regarding the mechanisms of action of *Celtis tournefortii* in traditional medicine is limited. Its fruits have been used in traditional medicine for the treatment of gastrointestinal ailments such as diarrhea, hemorrhoids, stomach pain, respiratory distress, and chest pain. In addition, the fruits have also been utilized as a tooth-strengthening agent and for wound healing. The leaves are reported to be used in traditional medicine for the treatment of various conditions, including kidney stones, stomach pain, menstrual bleeding, epileptic seizures, and excessive foot perspiration. The antioxidant, antimicrobial, and anticancer effects of the leaves and fruits have also been supported by scientific studies. In particular, leaf extracts have been shown to be effective against pathogenic microorganisms such as *B. subtilis*, *P. aeruginosa*, *S. aureus*, *E. coli*, and *C. albicans*, and to inhibit the proliferation of cancer cell lines. Additionally, *C. tournefortii* has been reported to exhibit a protective effect against copper-induced liver damage. This protective effect has been attributed to the extract's ability to enhance antioxidant capacity and reduce oxidative damage (Touhtouh *et al.* 2025).

Oriental hackberry contains flavonoids, phenolic acids, sterols, fatty acids, saponins, tannins, alkaloids, ascorbic acid, and chlorophylls a and b (Özrenk *et al.* 2012; Keser *et al.* 2017; İkinci *et al.* 2018). Chemical analyses conducted on some species of the genus *Celtis* have revealed various biological effects of fruit and leaf extracts (Chevallier, 1996; Simchoni and Kislev, 2011; Ota *et al.* 2017; Temiz *et al.* 2019). In particular, the seeds of *C. tournefortii* are used by local communities to help facilitate the passage of kidney stones, while its leaves are reported to possess properties that relieve stomach pain, regulate menstruation, provide sedative effects, and support digestion (Temiz *et al.* 2021).

Oriental hackberry has been used in traditional medicine in the Iranian region, and various medicinal properties have been attributed to the species. Some studies have shown that extracts of the plant may possess anti-inflammatory, antibacterial, and even anticancer properties. In addition, the species has also been investigated in relation to certain chronic diseases such as diabetes and cardiovascular disorders. The species also contains secondary metabolites that may exhibit specific physiological and phytochemical properties. Some of the reported secondary metabolites consist of phenolic compounds, alkaloids, terpenoids, and other active constituents (Zeidali and Heydari, 2025).

There are records concerning the traditional uses of the genus *Celtis* in regions where it occurs naturally around the world. Within the genus, including *C. tournefortii*, many species are known to be used by local communities for purposes such as reducing fever, relieving pain, treating gastrointestinal disorders, supporting dental health, and providing antimicrobial effects (Samadd *et al.* 2024). Although some studies provide examples of utilization specific to particular species, many forms of use have been reported as common applications for the genus *Celtis*, since their fruits are morphologically similar.

Utilization of wood

Oriental hackberry wood is hard and durable, and it possesses a high energy value when used as fuel. The natural distribution areas of Oriental hackberry are generally forest-poor landscapes where trees available for human use are limited. For this reason, Oriental hackberry trees are among the species frequently utilized by local communities on privately owned lands to meet their needs for construction and fuelwood. In rural areas, the use of its wood has traditionally involved either the complete cutting of the tree or the pruning of its thick branches for firewood. This practice has continued from the past to the present. In many places, cut stumps of Oriental hackberry can still be observed within agricultural lands where the wood has been utilized (Fig. 6). However, it can be stated that such practices have declined in recent years due to the increasing availability of alternative energy sources and construction materials.

Figure 6. A cut stump of a Oriental hackberry tree. Kahta, Adıyaman (Photo: Demirbağ, 2022).

The hard wood of Oriental hackberry has frequently been used in agricultural tools. It has traditionally been utilized particularly in the production of handles for tools such as hoes, shovels, and hammers. In rural areas, the trunks and thick branches of Oriental hackberry can also be observed as construction materials in small traditional structures. In addition, the wood has been used in the making of cradles and sieves (for legumes, flour, and olives) (Karahan, 2015; Özkan and Tırak Hızal, 2023) (Fig. 7).

Figure 7. Examples of a cradle and flour-olive sieves made from Oriental hackberry wood.

Oriental hackberry from an Archaeobotanical Perspective

There are studies indicating that macro-botanical and palynological remains belonging to *Celtis* species have been found in pre-agricultural settlements. Archaeological evidence suggests that such wild fruit-bearing species were likely collected and processed as food by human communities, and this interpretation has been evaluated and discussed in the literature (Michael *et al.* 2019).

Archaeobotanical records from Central Anatolia indicate that certain wild fruit trees were widespread in the past. Among these, *Celtis tournefortii* is particularly noteworthy. It can be stated that *C. tournefortii* has been a component of ecosystems

in Central Anatolia since the early Holocene period. Archaeobotanical records show that some wild fruit trees, such as Oriental hackberry and almond species, have been present since around 8000 BC, even before oak woodland reached its maximum expansion (Woldring and Cappers, 2001).

During the Neolithic period (10,000-6000 BC), with the transition to a settled way of life, humans began to use plants in a more systematic manner. In this period, the foundations of agriculture were established, and plants became vital resources for food, medicine, and other aspects of human life. Among the plant remains identified in 26 Neolithic settlements examined in the Mediterranean region, the hackberry plant found at Höyücek was determined to be in its wild form (Martinoli and Nesbitt, 2003). In the same region, at the Bademağacı settlement, seeds of hackberry (Celtis spp.) were also identified together with wild species such as apple, pear, plum, cherry, pistachio, terebinth, hawthorn, bitter vetch, and flax (Duru and Umurtak, 2008).

Studies on the ancient remains of Oriental hackberry also reveal the seasonal patterns by which human communities accessed wild plant resources. With the arrival of autumn and the increase in the availability of wild fruits, the inhabitants of the Çatalhöyük settlement frequently moved toward hills and mountainous areas. It has been reported that 67% of the remains recovered from excavations in these areas belong to *C. tournefortii* and *Amygdalus* (wild almond) species. These remains indicate that Oriental hackberry and almond fruits were collected for storage and year-round consumption. Less frequently, species such as wild plum (*Prunus* L.), fig (*Ficus* sp.), sumac (*Rhus coriaria*), blackberry (*Rubus* spp.), and wild apple (*Malus* sp.), found in a burial context, have also been identified (Mellaart, 1963).

In analyses conducted on Neolithic plant remains, mineralized (petrified) *Celtis* fruits were identified in 70% of the total samples and in 92% of the samples subjected to detailed analysis (Fairbairn *et al.* 2002; 2005). Compared with charred remains, mineralized fruits are better preserved in archaeological contexts and can persist without undergoing carbonization. Although precise identification at the species level cannot be achieved morphologically, the stones show similarities with those of different native Turkish species in the existing reference collections. From an ecological perspective, *C. tournefortii* appears as an important resource, as observed in communities such as those of Aşıklı Höyük (Zeist and Roller, 1995; Ertuğ, 2000). Based on this evidence, it can be stated that Oriental hackberry fruits constituted a small but regular component of the diet (Atalay and Hastorf, 2006).

The discovery of very ancient remains of Oriental hackberry in the Central Anatolia region indicates the historical significance of the species. Among the 14 Neolithic sites identified in Central Anatolia, it has been reported that the most remarkable plant remains found at Aşıklı Höyük belong to the genus hackberry (*Celtis*). These remains, frequently encountered in clusters of seeds particularly in the northern part of the mound where refuse deposits are concentrated, are considered to belong to *Celtis tournefortii*, a species commonly distributed in continental climates (Gülçur, 1994; Van Zeist and De Roller, 1995; Ergun, 2016; Ergun, 2018).

A considerable number of hackberry (*Celtis* spp.) plant remains have been identified at the Can Hasan III settlement in Karaman and at the Çatalhöyük settlement in Çumra, Konya (Eren and Çelik, 2023). In particular, it has been reported that fruit stone remains have survived to the present day for thousands of years in a heavily lime-encrusted condition. In studies conducted at the Pınarbaşı settlement in the same region, charred remains belonging to hackberry (*Celtis* spp.) and almond (*Amygdalus* sp.), which indicate dry woodland environments, were also identified (Ergun, 2008).

Remains of Oriental hackberry have been identified during excavations carried out at Tatarlı Höyük, located in the Fertile Crescent region approximately 24 km east of Ceyhan (Adana), a site of importance in terms of plant production and agricultural activities. Examination of the recovered seed samples revealed that most of them were preserved in carbonized and mineralized forms (Al Bayati, 2019). A similar study was conducted through the examination of Old Assyrian and Hittite textual records in order to better understand the formation conditions of communities and the patterns of trade and plant consumption in Bronze Age Anatolia. In investigations carried out at the Büklükale settlement in Kırıkkale Province, located in central Türkiye, mineralized and petrified Oriental hackberry seeds were likewise recorded among the archaeological remains (Fairbairn *et al.* 2019).

Archaeobotanical excavations conducted at the settlement known as Çemialo Sırtı within the borders of Beşiri (Batman) recorded hackberry fruits together with numerous legume and cereal seeds dating to the Iron Age (1st millennium BC) and the Middle Bronze Age (2nd millennium BC) (Kutlu *et al.* 2018; Kutlu and Altundağ Çakır, 2021). At the Boncuklu Höyük

settlement located in the Konya Plain, carbonized and mineralized remains of Oriental hackberry seeds and shells were also identified (Baird *et al.* 2018).

Among local communities in the Ergani district of Diyarbakır, *Celtis tournefortii* is used for symbolic and ritual purposes. The species is particularly mentioned in practices related to the preparation of amulets and spiritual protection (Aslan, 2025). In this respect, the study indicates that the species possesses not only nutritional and medicinal significance but also cultural value.

The hackberry tree is also mentioned in medieval texts related to the Talmud. The medicinal use of its fruit was recorded in the 1st century CE in the writings of Dioscorides (Feliks, 1994). Dioscorides noted that this fruit was beneficial for stomach disorders, menstrual pain, intestinal ulcers, and diarrhea (Amichay and Weiss, 2020). In the 12th century, Ibn al-Baytar, quoting Dioscorides in his work, reported that in Damascus (Palestine and Syria) a marmalade prepared from hackberry fruits was used particularly against infant cough (Feliks, 1994; Lev, 2002).

Excavations at Tel Rehov revealed hundreds of *Celtis australis* seeds dating to the Iron Age, and two hackberry trunks were found at Tel Jezre'el (Liphschitz and Biger, 1998). Hackberry seeds were also identified in the Cave of the Spears in the Judean Desert associated with the Bar Kokhba Revolt (Simchoni and Kislev, 2009). These findings also indicate that the species, owing to its hard wood structure, could be used for the production of durable construction materials. Indeed, its wood was used in construction, while its edible fruits were occasionally sold in markets (Liphschitz and Biger, 1998).

Amulets have also been crafted from *Celtis* species to provide protection and bring good fortune (Schiller, 1996). Indeed, in the Buldan district of Denizli province (*C. australis* and *C. tournefortii*), one of the most common practices involving evil eye talismans is the creation of small, perforated charms from the branches of the nettle tree-locally known as 'çıtlık' (*C. australis*)-which are harvested before sunrise. While these amulets are specifically pinned to the shoulders of children, they are also utilized for livestock; it is known that in the past, they were prominently hung around the necks of camels (Ertuğ *et al.* 2004). Similarly, special value is attributed to Oriental hackberry through local nomenclatures such as *te'vi* and *taav* in Şanlıurfa (Balos and Akan, 2008), and through designations like 'nazar ağacı' (evil eye tree) and 'ziyaret ağacı' (shrine tree) in the Adıyaman region (Demirbağ, 2023).

In a study conducted at the Atapuerca-Gran Dolina archaeological site in Spain, endocarp (stone) remains belonging to *Celtis* species were identified in Lower Pleistocene layers (Allué *et al.* 2015). The occurrence of these remains together with stone tools and other archaeological materials suggests that early hominins may have collected and consumed *Celtis* fruits. Although precise identification at the species level was not possible, the findings indicate that this genus may have been included in human diets from very early periods. For species such as *C. tournefortii*, which occur in the Mediterranean and Western Asian floras, these results provide an indirect yet significant archaeobotanical framework for interpreting prehistoric human-plant relationships.

Mentesh Tepe, a multi-layered settlement located in Azerbaijan near the Zeyem River-one of the tributaries of the Kura River-and approximately 10 km from the foothills of the Lesser Caucasus Mountains, provides the opportunity to trace agricultural development from the Neolithic to the Bronze Age. Research conducted in the region has identified hackberry and grape (*Vitis vinifera*) among the wild fruit seeds collected from forested areas. However, precise dating of the identified seeds has not been possible because they were preserved in a mineralized state (Astruc, 2022).

Several archaeobotanical studies have demonstrated the presence of seed endocarps and plant remains belonging to the genus *Celtis* in human settlements. These studies support the view that the genus may have been incorporated into human dietary practices since the Pleistocene period, indicating that its fruits have long been collected and consumed. The archaeobotanical evidence obtained for species of this genus constitutes meaningful indicators in this regard. From a climatic perspective, the climatic changes at the beginning of the Early Holocene may have positively influenced the expansion of *Celtis* species. This situation can be explained by the frequent and abundant occurrence of *C. tournefortii* endocarps in Neolithic settlements in the Eastern Mediterranean and the Near East. In particular, findings from the Dmanisi archaeological site in Georgia have been reported as belonging to *C. tournefortii*. In the same study, palaeobotanical remains of the species were also reported from Douara Cave (Syria), Theopetra (Greece), and the Ezero wetland (Bulgaria) (Martínez-Varea, 2023). Table 1 shows how the *Celtis tournefortii* tree has been used by people over the years. This summary table also demonstrates the high value that has been placed on this ancient tree throughout history (Table 1).

Table 1. Ethnobotanical and archaeobotanical uses of *Celtis tournefortii Lam.*

Use Category	Uses (Summary)	Plant Part(s)	Evidence Type	Region / Context	References
Agroforestry	Shade tree, boundary tree, microclimate regulation, agroecosystem component, wildlife support (bird-mediated dispersal)	Whole tree, fruit	Ethnobotanical / Ecological	Türkiye (agricultural landscapes)	Demirbağ (2023), Demirbağ & Yılmaz (2023), Doygun & Ok (2006), Gültekin (2007)
Food	Fresh and dried fruit consumption, processed foods (fried, mashed, with honey/molasses), marketed wild fruit, traditional trade, nutritional use	Fruit	Ethnobotanical / Nutritional	Anatolia, Mediterranean	Ertuğ (2014), Ertuğ et al. (2004), Yeşil et al. (2019), Kızıl & Tonçer (2014), Abah (2018), Yıldırım et al. (2017), Vidal-Cascales (2021)"
Medicinal	Treatment of diabetes, gastrointestinal disorders, respiratory diseases, kidney stones, wounds; sedative, digestive, antimicrobial, antioxidant, anticancer, hepatoprotective effects	Fruit, leaf, seed	Ethnobotanical / Pharmacological	Türkiye and global	Geçibesler et al. (2017), Polat et al. (2013), Çakılcıoğlu et al. (2007), Akan et al. (2013), Arasan (2014), Temiz et al. (2021), Yılmaz et al. (2021), Touhtouh et al. (2025), Keser et al. (2017), İkinci et al. (2018), Ota et al. (2017), Samadd et al. (2024), Chevallier (1996), Simchoni & Kislev (2011)
Energy	Firewood production	Wood, branches	Ethnobotanical	Rural Türkiye	Demirbağ (2023)
Construction & Handicraft	Tool handles, rural structures, cradle and sieve production	Wood	Ethnobotanical	Türkiye	Karahan (2015), Özkan & Tırak Hızal (2023)
Cultural	Toys (seed-based games), amulets, spiritual protection, symbolic/sacred tree	Seed, wood, whole tree	Ethnobotanical	Türkiye	Kılıç (2019), Olgun (2019), Aslan (2025), Ertuğ et al. (2004), Demirbağ (2023), Schiller (1996)
Archaeobotanical (Food Use)	Wild fruit collection, storage, and consumption from Pleistocene to Neolithic periods	Fruit (seed/endocarp)	Archaeobotanical	Anatolia, Near East, Mediterranean	Mellaart (1963), Atalay & Hastorf (2006), Martinoli & Nesbitt (2003), Duru & Umurtak (2008), Allué et al. (2015), Martínez-Varea (2023), Michael et al. (2019)
Archaeobotanical (Presence)	Seed and endocarp remains in settlements; long-term ecological presence	Fruit (seed)	Archaeobotanical	Aşıklı Höyük, Büklükale, Çemialo Sırtı	Van Zeist & de Roller (1995), Ergun (2016, 2018), Kutlu et al. (2018), Fairbairn et al. (2019)

Conclusion

Oriental hackberry is an important species that has persisted across a wide geographical range, particularly in Anatolia, and has left deep traces in cultural memory. Archaeobotanical evidence clearly indicates that the tree has been known to human communities since prehistoric times and that its fruits were collected and utilized for various purposes. In different regions of Anatolia, Oriental hackberry has supported survival during periods of scarcity and hardship and has been used by local communities both as a food source and in simple medicinal applications. At the same time, its hard and durable wood has been utilized in agricultural tools and small-scale construction materials.

Today, *C. tournefortii* is a species that warrants multifaceted utilization due to its antioxidant compounds and high nutritional value. Its suitability for evaluation in modern phytotherapeutic research offers new opportunities for both dietary supplements and natural health products. Furthermore, the high resilience it exhibits against climate change renders the species a strategic tree for the conservation of biodiversity, particularly in regions under the threat of drought.

Oriental hackberry is a species that has attracted attention in Anatolia from the Neolithic period to the present day in terms of both its natural distribution and its interaction with human communities. Archaeobotanical data indicate that the species was widely present in Neolithic settlements such as Aşıklı Höyük, Çatalhöyük, Can Hasan III, and Bademağacı. In particular, hackberry seeds encountered in refuse deposits at Aşıklı Höyük suggest that its fruits were systematically collected and consumed. These findings indicate that the species was not only a food source but also held an important place within the plant utilization repertoire of early agricultural societies. The fact that its fruits are still consumed as a snack in some regions today emphasizes the cultural continuity of the species.

The species is particularly recognized by individuals belonging to the middle and older age groups in areas where it occurs. Today, the fact that some individuals have reached monumental tree characteristics indicates that Oriental hackberry is one of the rare species that establishes a connection not only with the past but also with the future. In this context, the conservation of Oriental hackberry is necessary not only for the continuity of biological diversity but also for the preservation of cultural heritage. Considering the ecological, historical, and cultural values possessed by the species, broader conservation and awareness strategies should be developed at both local and national levels.

Local communities generally display a tendency toward the conservation of the species. In order to strengthen this tendency, awareness activities highlighting the historical and ecological significance of the species should be carried out, and field studies on Oriental hackberry should be expanded. Through a comprehensive inventory study, the locations, ages, and health conditions of existing individuals should be documented. Individuals identified as possessing monumental characteristics should be granted official protection status.

Oriental hackberry individuals are generally located within privately owned agricultural lands and are therefore under constant risk of removal. In order to ensure the continuity of the species within agricultural landscapes, its cultivation along field boundaries-similar to existing practices in certain areas-should be encouraged.

Oriental hackberry is a valuable natural genetic resource for Turkey due to its ecological resilience, cultural and historical heritage, and its role as a food source for humans and wildlife. Some suitable populations where the species occurs in groups, such as in the Alaylar Bir neighborhood of Seydişehir, should be recorded and preserved to evaluate the species' genetic resources.

Declarations

List of abbreviations: TEK - Traditional ecological knowledge, BC - Before christ.
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