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## From knowledge to conservation: Distribution-wide insights into the ethnobotany, population status and threats of *Eriolobus trilobatus*

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**Abstract:** *Eriolobus trilobatus* (Poir.) M. Roem. is a rare and endangered forest tree species which has ecological and economic significance. The species has traditionally been used for food, medicinal and ornamental purposes and it also provides food and habitat for wildlife in its natural ecosystems. This study comprehensively assesses the distribution, local uses, population status, and threats of *E. trilobatus* across Türkiye. Additionally, it examines the species' conservation, the transmission of local knowledge and generational differences in its use. To this end, the study employs the combination of site surveys and structured interviews. Site surveys were carried out across nine provinces covering the entire distribution range in Türkiye. Besides, online structured interviews were performed with 36 participants including local residents and forestry staff. Then, the collected data were analysed using SPSS software. 33 out of 36 participants recognized *E. trilobatus* mainly based on its fruit and morphological characteristics. Fruits were the main part of the plant used mostly for food while leaves, flowers and wood were rarely utilized. *E. trilobatus* is highly recognized in Turkish culture but it is vulnerable to region-specific anthropogenic pressures (such as mining, grazing and agricultural expansion), taxonomic confusion, population aging, limited natural regeneration and habitat degradation. Age-related differences in species knowledge and use were evident, with older generations showing higher recognition and utilization. This emphasizes the importance of family-based knowledge transmission for conservation. Effective conservation necessitates integrated strategies that combine *in situ* protection, *ex situ* propagation, community engagement and sustainable use practices.

**Keywords:** erect apple, edible plant, agroforestry, local knowledge, geographic distribution

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## Introduction

Wild fruit tree species are of great ecological and economic potential within natural forest ecosystems. Türkiye is home to rich diversity of these species (Yılmaz et al., 2019). Wild fruit trees are an important source of food and essential habitat for wildlife and also contribute to the complexity of mixed forests. Beyond their ecological roles, wild fruit trees occupy a critical position at the interface of biodiversity conservation and biocultural diversity with ecological processes and local knowledge systems jointly shaping species persistence (Lukawiecki et al., 2024; Kumar et al., 2025). Among these valuable resources is the deciduous tree, *Eriolobus trilobatus* (Poir.) M. Roem., which is known as one of the rare forest tree species in Türkiye (Yılmaz & Yüksel, 2016).

*E. trilobatus* belongs to the Rosaceae family (Gültekin et al., 2007). It was firstly described as *Crataegus trilobata* (Poiret, 1810). Later it was placed in the monotypic genus *Eriolobus* by Roemer in 1847 (Yılmaz & Yüksel, 2016; Demircan et al., 2022a). Considering the related literature, it is often named as *Malus trilobata* (Yılmaz & Yüksel, 2016; Boyacı et al., 2021), which emphasizes taxonomic ambiguity (Browicz, 1969). However, morphological characteristics and distinctive phytochemicals such as trilobatin support its classification as a distinct genus (Ak, 2019; Campbell et al., 2007). Phylogenetic analyses further confirm its distinction from other *Malus* species (Sun et al., 2024). Such taxonomic complexity also highlights the broader issue that classification systems – whether scientific or local – are shaped by different knowledge frameworks.

The species is distributed across the Eastern Mediterranean which includes countries such as Greece, Bulgaria, Türkiye, Syria, Palestine and Israel (Boratyński et al., 1992; Korakis et al., 2006; Yılmaz & Yüksel, 2016). As for its distribution in Türkiye, it is mainly found across the Mediterranean, Aegean and Central Anatolia regions. It naturally grows in sunny, rocky and calcareous soils and at altitudes between 250 and 1500 m (Yılmaz, 2008; Yılmaz et al., 2019). Regarding its conservation status, *E. trilobatus* is listed as vulnerable in Greece (Korakis et al., 2006). Nonetheless, it is classified as near threatened at the global level (Wilson & Stephan, 2018). As of 2025, two seed plantations of the species have been established in Isparta–Eğirdir and Balıkesir–Ilıca in Türkiye as conservation effort (OGM, 2025). Despite these initiatives, effective conservation requires not only ecological data but also an understanding of how species are perceived, classified and used by local communities.

Ethnobotanically, the species is considered highly valuable due to its richness in phenolic compounds

including chlorogenic acid, epicatechin, rutin and quercetin, which are often present in higher concentrations than those found in cultivated apples (Demircan et al., 2022b). Additionally, in Adana and Osmaniye provinces in Türkiye, local communities traditionally use the branches with leaves of this species to extract natural dye (Türkmen et al., 2004). Also, it acts as a rootstock for cultivated apple varieties (Yılmaz & Yüksel, 2016). Furthermore, it is seen as suitable for the use of ornamental plantings because of its leaves, flowers and crown (Gültekin et al., 2007; Yılmaz & Yüksel, 2016; Yılmaz et al., 2019). However, ethnobotanical knowledge includes more than just practical characteristics; it also has culturally embedded understandings of plant identity, local classification systems and naming customs. These “emic” perspectives reflect cohesive and useful knowledge systems formed by long-term human-environment interactions, even though they may not clearly align with scientific taxonomy.

Environmental threats including habitat degradation, overharvesting as well as biological constraints such as low seed yield and dormancy limit the persistence of populations (Konopelko, 2021). In the light of the existing literature, some previous studies examined specific characteristics of *E. trilobatus*, such as ethnobotany (Yılmaz & Yüksel, 2016; Çınar & Göktürk, 2019), genetics (Balaska et al., 2021), germination biology (Gültekin et al., 2007; Petkova and Tashev, 2007; Yılmaz, 2008) and wood traits (Şen et al., 2025). Despite this, there is a notable gap in distribution-wide research that combines ecological data with ethnobotanical insights within a stable analytical framework. Furthermore, the impact of differences between local and scientific knowledge systems on species recognition and conservation outcomes has been mainly overlooked in previous studies. In this regard, to bridge this gap, this study incorporates ethnobotanical knowledge, population status and threat assessment within the entire distribution of the species in Türkiye. By bridging ecological and ethnobotanical approaches, this study aims to contribute to both species-level conservation and broader discussions on the role of local knowledge in biodiversity management. The objectives of this study are (i) to assess the local recognition of *E. trilobatus*, the diversity of its local names and its habitat distribution, (ii) to look into its traditional uses in study sites, (iii) to evaluate its population trends, age structure and regeneration capacity, (iv) to identify the threats and conservation measures, (v) to examine the knowledge transmission pathways and (vi) to analyse generational differences in the recognition, use and user familiarity.

## Material and Methods

This study adopts a mixed methods research design to comprehensively assess the distribution, local uses, population status, and perceived threats of *E. trilobatus* in Türkiye. Data were collected using both site surveys and structured interviews in order to document ecological characteristics and ethnobotanical knowledge systematically. This combined method made it easier to cross-validate field observations and participant responses by reducing potential bias in species identification and use reporting. The collected data were then analysed using descriptive and inferential statistical methods.

### Study Site

The study was conducted at 24 locations across nine provinces (Antalya, Balıkesir, Burdur, Denizli, Isparta, İzmir, Manisa, Mersin, Muğla) in the Mediterranean, Aegean and Southern Marmara regions (Fig. 1). They were selected based on previous studies (Yılmaz & Yüksel, 2016; Çınar, 2019; Yılmaz et al., 2019) and new field observations. These sites within the Mediterranean phytogeographical region are characterized by a transitional climate between

temperate and arid zones with projected warming and precipitation changes (Çetinkaya, 2020).

### Site Survey

Site surveys were conducted using systematic non-participant observations (Zeisel, 1984). Data including the habitat distribution, population structure, regeneration capacity and anthropogenic pressures on *E. trilobatus* were documented through photographs and site observations.

### Structured Interview

Participants were purposively sampled based on their familiarity with local forests, experience with wild fruit trees and residence in the distributional areas of *E. trilobatus*. Purposive sampling is widely used because it requires fewer resources than traditional methods and allows researchers to focus on participants most relevant to study objectives. It is useful for comparisons between subgroups, e.g., by age or gender, to identify variations in knowledge or perception (Suri, 2011).

Online questionnaires were used to ease the access to participants in remote villages across the

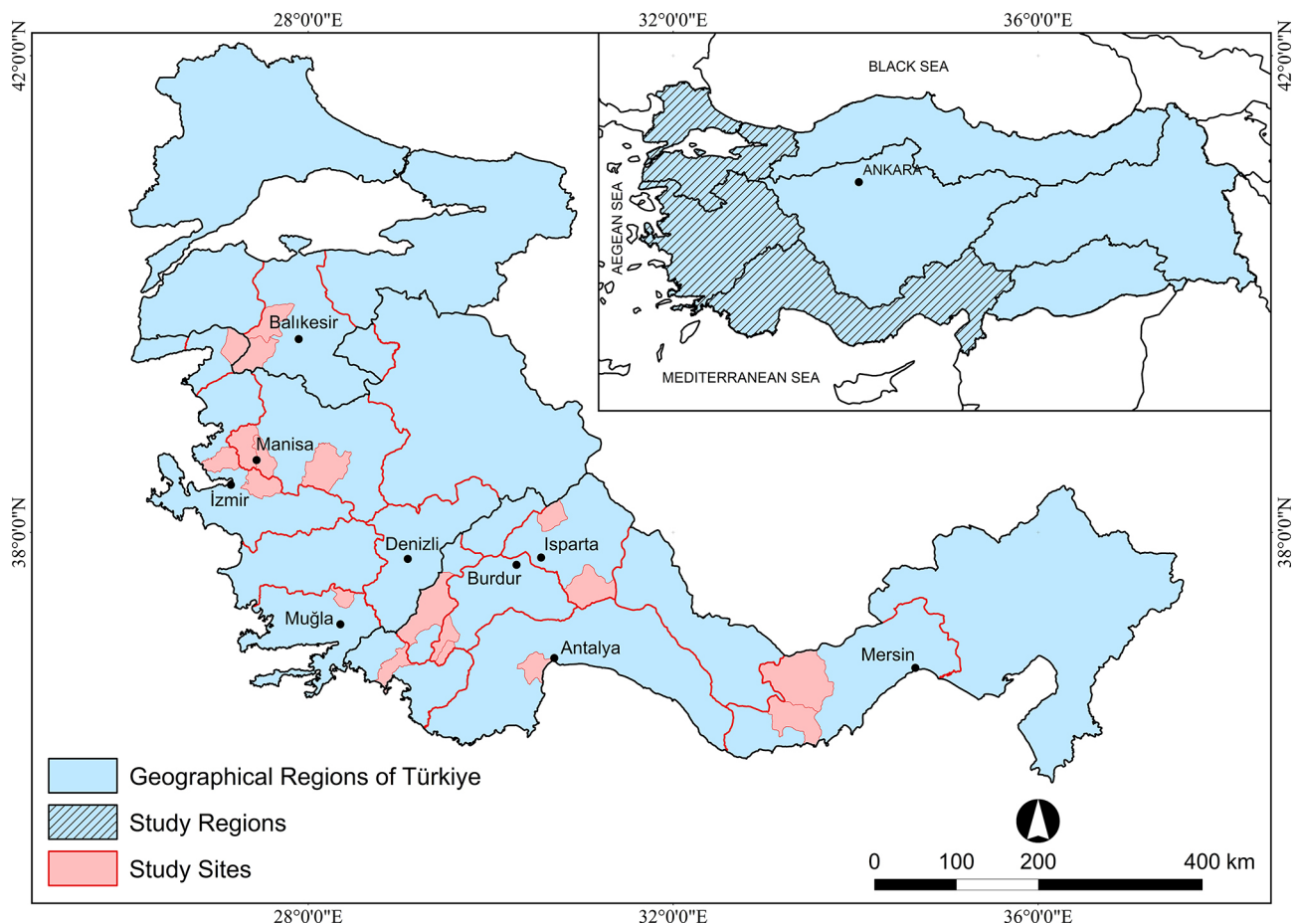


Fig. 1. Location of study sites

Table 1. Demographic characteristics of the participants

Variables	Frequency	Variables	Frequency
Age/Generation		Job	
z (1997–2012)	4	Farmer	5
y (1981–1996)	12	Retired	6
x (1965–1980)	14	Worker	1
Baby boomers (1946–1964)	6	Officer	2
Education		Village/Neighbourhood Headman	5
Primary School	7	Forest Ranger	6
Secondary School	3	Forest Engineer	8
High School	6	Forest Engineer (MSc)	1
Vocational School	8	Vocational School Secretary	1
Bachelor	10	Agricultural Technician	1
Graduate	2		

nine provinces, enabling efficient data collection. Participants were contacted via local forestry offices, community leaders and agricultural cooperatives, ensuring knowledgeable. Of 60 contacted, 36 participated (33 male, 3 female). The gender distribution of participants was not balanced, which shows the socio-cultural structure of the study sites, where forestry-related activities and interactions with formal institutions are predominantly undertaken by men. Participants were informed about study aims and consent was obtained. To reduce misidentification, participants were asked to identify the species using photos, local names and descriptions which were before validated through site surveys. This triangulation approach addressed potential biases in ethnobotanical reporting.

According to Table 1, most participants are middle-aged or older with generations X ( $f = 14$ ) and Y ( $f = 12$ ). Most of them completed vocational school ( $f = 8$ ) or a bachelor's degree ( $f = 10$ ). The participants are dominated by rural and forestry-related occupations, notably forest engineers ( $f = 8$ ), forest rangers ( $f = 6$ ), farmers ( $f = 5$ ) and village/neighbourhood headmen ( $f = 5$ ).

The online structured interview was performed from August to October 2025 through open-ended survey questions developed by the authors (Supplementary 1). An open-ended format was preferred as it allows participants to express their own responses freely (Jackson, 2008). Participants were asked a set of open-ended questions to assess their knowledge and perceptions of *E. trilobatus*, its local uses, habitat characteristics, population trends, perceived pressures, conservation needs and the sources of their knowledge about the species.

## Data analysis

The data were initially divided into manageable units and then examined for recurring themes, key terms and expressions that effectively represented participants' knowledge and perceptions of *E.*

*trilobatus* regarding its local uses, habitat characteristics, population dynamics, perceived pressures, conservation needs and the sources of their knowledge. For this purpose, the data were subjected to content analysis for classification, summarization and tabulation. Following a thorough reading of the data, the most frequent themes were identified for each question and illustrated through the quotations from the participants. The results were first presented descriptively using representative quotations, then quantified through descriptive content analysis (e.g., frequency counts) using Microsoft Excel and finally cross-tabulated in order to provide more detailed examination of the responses. In this way, it was also tested whether the responses to certain questions differed according to the categorical variables of city, age/generation, education and job using chi-square tests ( $\chi^2$ ,  $p < 0.05$ ). Although gender may influence ethnobotanical knowledge, the limited number of female participants ( $f = 3$ ) did not allow for statistically meaningful comparisons. Therefore, gender was not included as a categorical variable in the analysis, and this is acknowledged as a limitation of the study. Statistical analyses were performed using SPSS Statistics software version 25 (Corp IBM, 2017).

## Results

In this section, results from the site surveys and interviews are jointly reported to offer a comprehensive and cohesive understanding of *E. trilobatus*.

### Recognition, local knowledge and habitat

Thirty-three participants stated that they recognized the species. 19 participants described the species based on its fruit and its edibility as a food source. Furthermore, it is also noteworthy that the species was frequently described in terms of its

morphological characteristics (leaves and general appearance) (Fig. 2a–d). Although most of the participants stated that they recognized the species, site surveys revealed that the local communities often confused the species they referred to as *E. trilobatus* with other species, particularly due to similarities in leaf and fruit characteristics (Table 2).

The species was most commonly referred to as “Geyik Elması” with this name being reported from several provinces, particularly Isparta, Mersin, and Muğla. In addition to this dominant local name, a wide range of regional names was reported (Fig. 3). Moreover, it was experienced in Balıkesir and İzmir that the trees identified by local people as “Geyik

Elması” were in fact of one of the *Sorbus* or *Crataegus* species, respectively.

Exploring the responses of participants on the distribution of environmental characteristics of *E. trilobatus* sites, Antalya is linked to a variety of conditions including cool environments, north exposure, humid areas, steep slopes and streamside locations, indicating diverse terrains and microclimates. Mersin predominantly corresponds to high-altitude and humid areas while İzmir is associated with a cool environment. Balıkesir and Isparta showed connections to high altitudes, steep slopes and streamside areas, highlighting their varied topography. Burdur and Denizli are mostly linked to inside forest regions

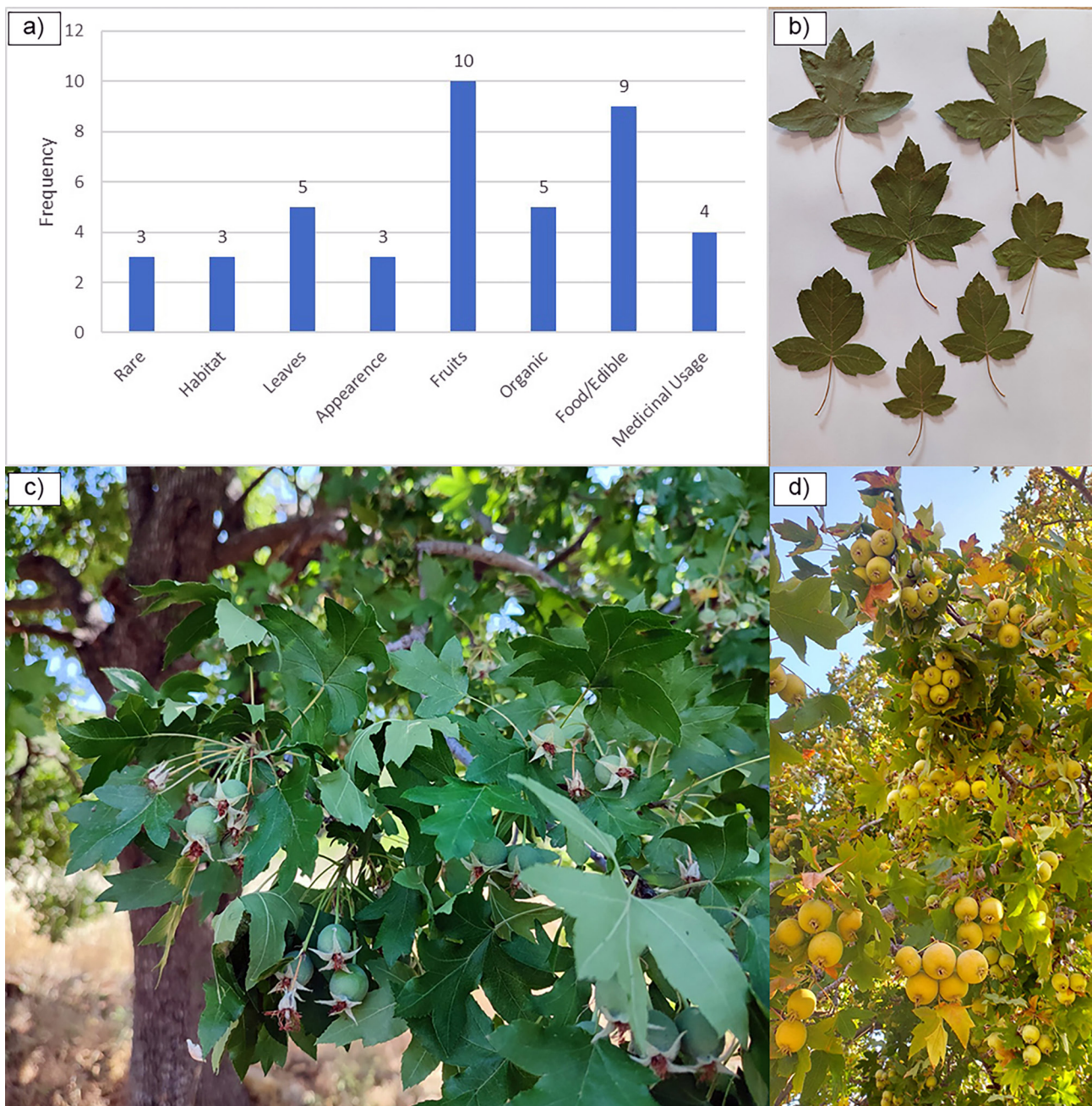


Fig. 2. (a) Frequencies of participants' descriptions, (b) leaves, (c) immature and (d) mature fruits of the studied species

and mid-altitude areas. It was found that high altitude, sloped terrain and forested areas were the most common habitat characteristics for *E. trilobatus* (see Table 2). According to the site survey, high altitude and steep slopes were observed in the provinces of Burdur, Denizli, Isparta, Mersin and Muğla. Additionally, the species was found within *Pinus brutia* forests in Balıkesir, Burdur, İzmir, Manisa and Muğla,

and *P. nigra* forests in Burdur and Muğla, in a *P. pinea* afforestation in Balıkesir, and in association with various maquis elements in Mersin and Isparta (Fig. 4a–b). In Antalya, it was also observed both in open areas and in the forest. The most frequently observed species in its habitats was *Cotinus coggygria*.

The reported occurrence of *E. trilobatus* varied among provinces and habitats. The species was

Table 2. Representative quotations of participants for various contexts

Context	Representative quotations	Participant
Recognition and local knowledge	It is a late-spoiling fruit that serves as an important food source for both wild animals and humans, especially in winter	P2
	Its leaves are small and have 3–4 lobes, resembling those of a wild pear	P15
	It is like a small apple, and its leaves have an indented (lobed) shape	P16
Habitat	It grows in forested areas at elevations between 900 and 1200 m	P8
	The species is found on the southern slopes of the Taurus Mountains at elevations of around 1400 m	P20
	It grows in high and sloping areas	P27
Multiple uses	In our region, the fruit is harvested and it is believed to be beneficial for blood pressure, diabetes, and cholesterol. It is also consumed as vinegar and molasses, and is said to help with shortness of breath	P3
	We make pickles, vinegar, and medicine	P8
	The fruit is used for health purposes (as a blood thinner), while the flowers and leaves are consumed as tea for lowering cholesterol and promoting relaxation	P14
Conservation perspectives	Yes, it needs to be protected. It is a medicinal plant that naturally adapts to its environment, grows in various regions of Türkiye without requiring fertilizers or chemicals, and serves as an important source of healing	P3
	It should be protected due to its widespread use in traditional medicine	P7
	Yes, it should be protected because it is essential for wildlife	P31



Fig. 3. Provincial distribution of the reported local names used for *E. trilobatus* with regions shown on the left and local names on the right

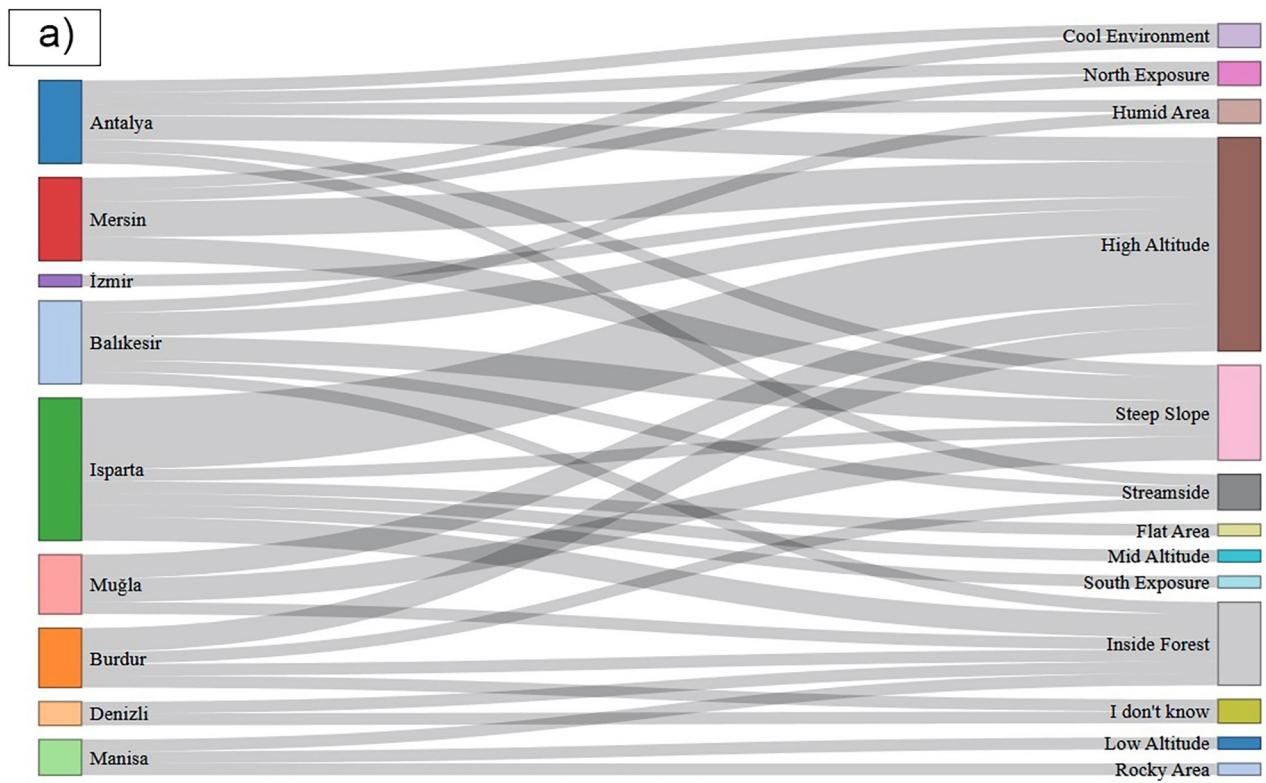


Fig. 4. (a) Provincial distribution of the reported habitat characteristics for *E. trilobatus* with regions shown on the left and habitat characteristics on the right and (b) one individual within a *P. nigra* forest in Muğla

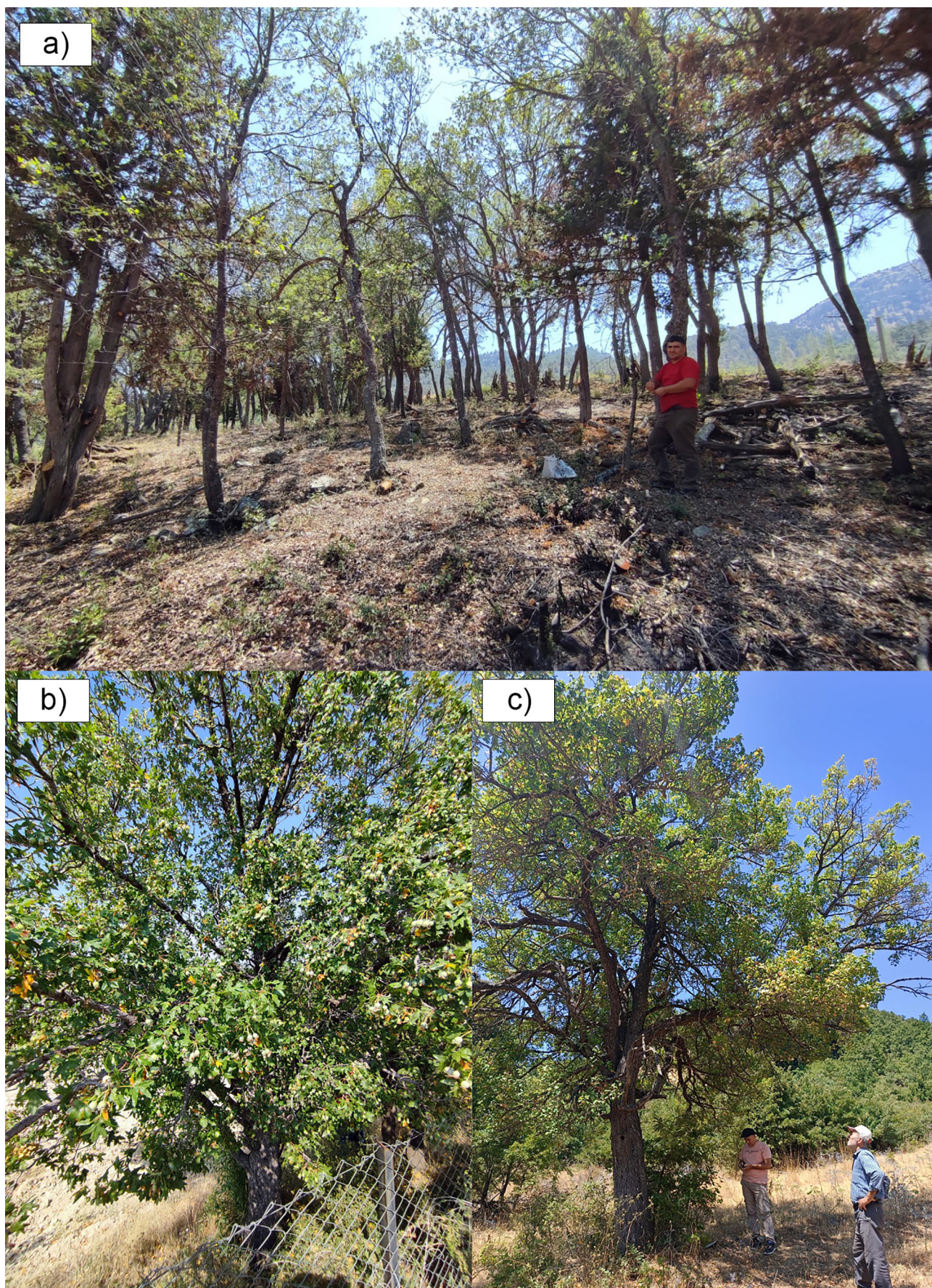


Fig. 5. Views of *E. trilobatus* (a) in a cemetery (Mersin), (b) in cultivated (Mersin) and (c) agricultural fields (Balikesir)

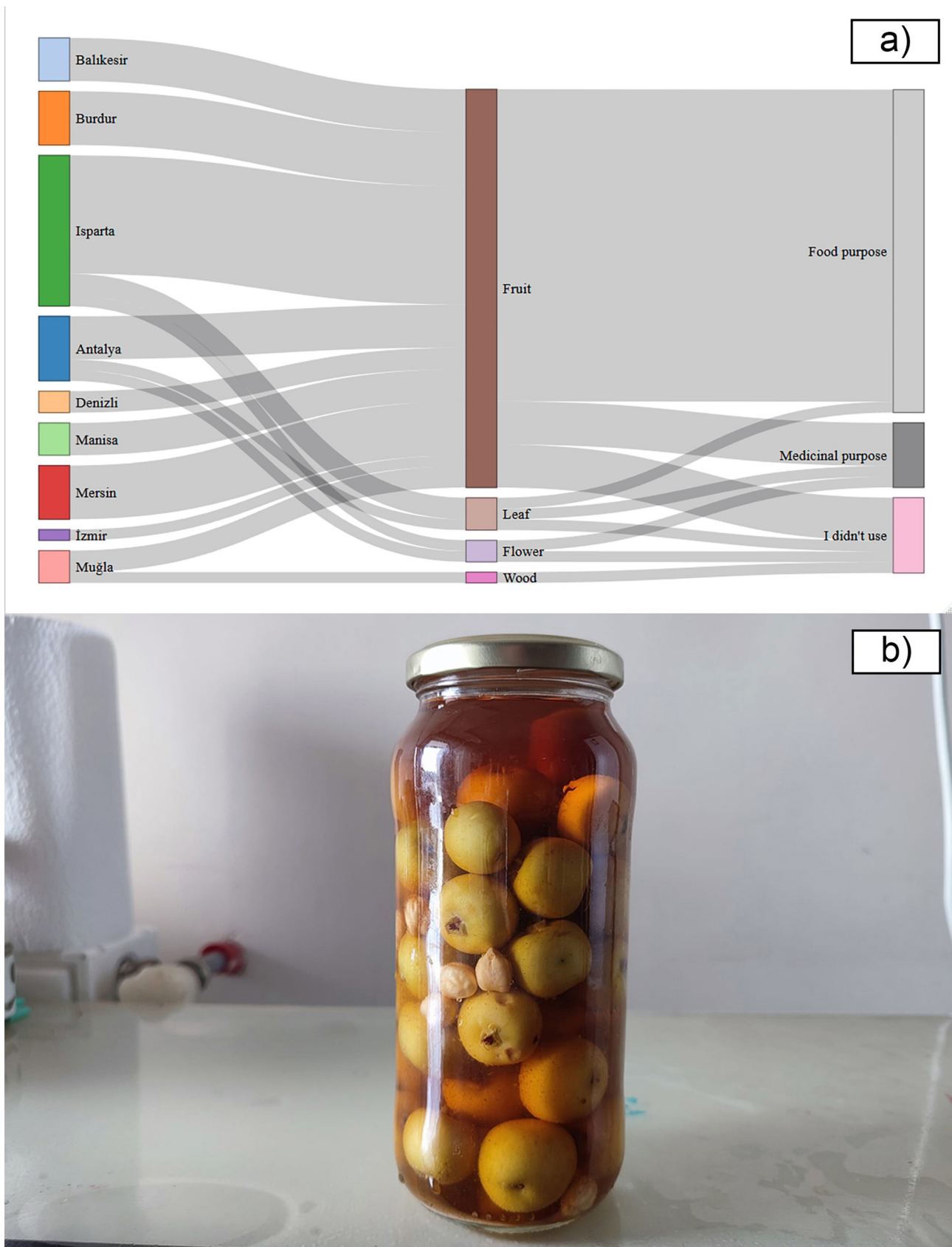


Fig. 6. (a) Provincial distribution of the used parts and usage purposes of *E. trilobatus* with regions shown on the left, used parts in the middle and usage purposes on the right and (b) pickled fruits

predominantly associated with mountainous and highland pasture areas, with particularly strong concentration in Balikesir and Isparta. In Burdur and Manisa, it was also frequently reported in agricultural fields. Participants' reports from Denizli were limited to village surroundings while those from İzmir largely reported no knowledge of the species. The results indicated a habitat preference mainly toward mountainous ecosystems, with region-specific occurrences in agricultural and rural environments. Furthermore, site surveys generally confirmed the results of the interview. In addition, the species was observed in cemeteries and agricultural fields in Mersin, and in cultivated fields in Antalya, Balikesir and Isparta (Fig. 5a–c).

### The multiple uses of *E. trilobatus*

Twenty-eight participants reported that they used the plant for different purposes. Among all plant parts of *E. trilobatus*, fruits were by far the most frequently utilized, notably exceeding the use of leaves, flowers and wood. The overwhelming majority of fruit-based uses ( $f = 19$ ) fell within the category of food related uses. Provinces such as Isparta ( $f = 5$ ) and Burdur ( $f = 4$ ) had higher contributions to this pattern compared to other regions as shown in the diagram (Fig. 6a; see Table 2). The photograph displayed at the bottom of the figure (Fig. 6b) further illustrated this use, depicting fruits stored in a large glass jar, visually supporting their preservation and consumption in form such as pickles. Moreover, site surveys showed that local people in Mersin and İzmir made molasses from the fruits of the species. On the other hand, the use of flowers and wood was minimal, remaining marginal compared with other principal use categories (Fig. 6a). The utilization pattern of *E. trilobatus* resembles a river system in which numerous tributaries converge: fruits collected across a broad geographical range flow predominantly into a single principal purpose such as food while smaller side streams represent limited medicinal applications.

### Population status and regeneration patterns of *E. trilobatus*

Twenty-five participants stated that *E. trilobatus* was more widespread in their regions in the past while 26 participants reported that the individuals of this species were aging. According to site surveys, the populations with the oldest individuals (aged between 350 and 450 years) were observed in Isparta and Antalya. In these places where these old populations occur, natural regeneration was not observed (Fig. 7). The site survey revealed that there were



Fig. 7. View of an old individual from Antalya

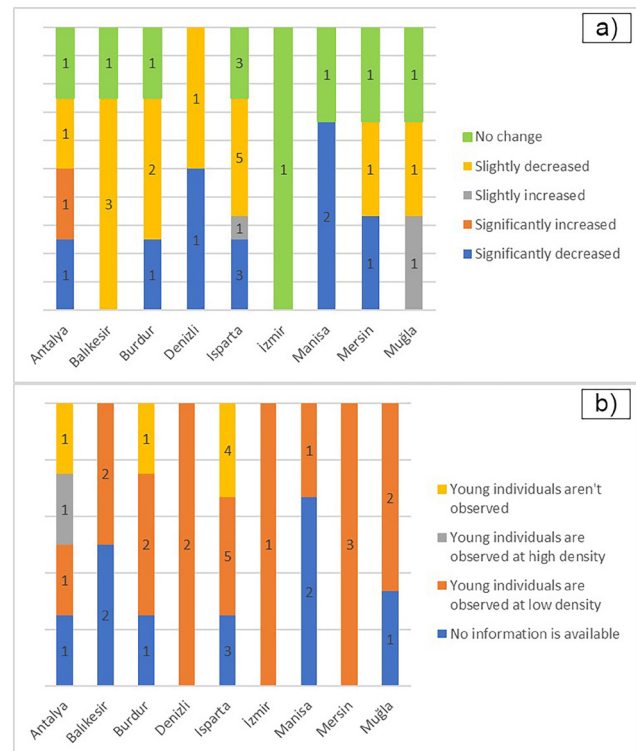


Fig. 8. Perceived (a) temporal changes and (b) patterns of young individuals in *E. trilobatus* populations

large numbers of individuals in all study sites except Muğla.

Perceived temporal changes in *E. trilobatus* population size varied considerably among study sites. Responses indicating “slightly decreased” and “significantly decreased” were reported in Antalya (f = 2), Burdur (f = 3), Denizli (f = 2), Isparta (f = 8), Manisa (f = 2) and Mersin (f = 2). In İzmir, respondents reported “no change”. Balıkesir and Muğla exhibited both declining and stable responses, while a minor proportion of respondents in Antalya and Balıkesir indicated increases in population size (Fig. 8a).

In most provinces, young individuals were either observed at low density or not observed at all based on the interviews. High juvenile density was reported only sporadically in Antalya. A substantial proportion of respondents, particularly in Balıkesir and

Manisa, reported a lack of natural regeneration. Denizli and İzmir had no records of young individuals. Site surveys showed that individuals of *E. trilobatus* were also observed to be cut in the regeneration areas of *P. brutia* in Manisa and Balıkesir but regenerated through root suckers. In addition, individuals originating from root suckers of a single tree were observed in Antalya, Isparta, and Burdur. Furthermore, it was observed that the species was preserved in the regeneration areas of *P. brutia* in Burdur (Fig. 8b).

### Perceived threats and conservation perspectives of *E. trilobatus*

Participants’ views on the uses of the species indicated that its use was predominantly focused on

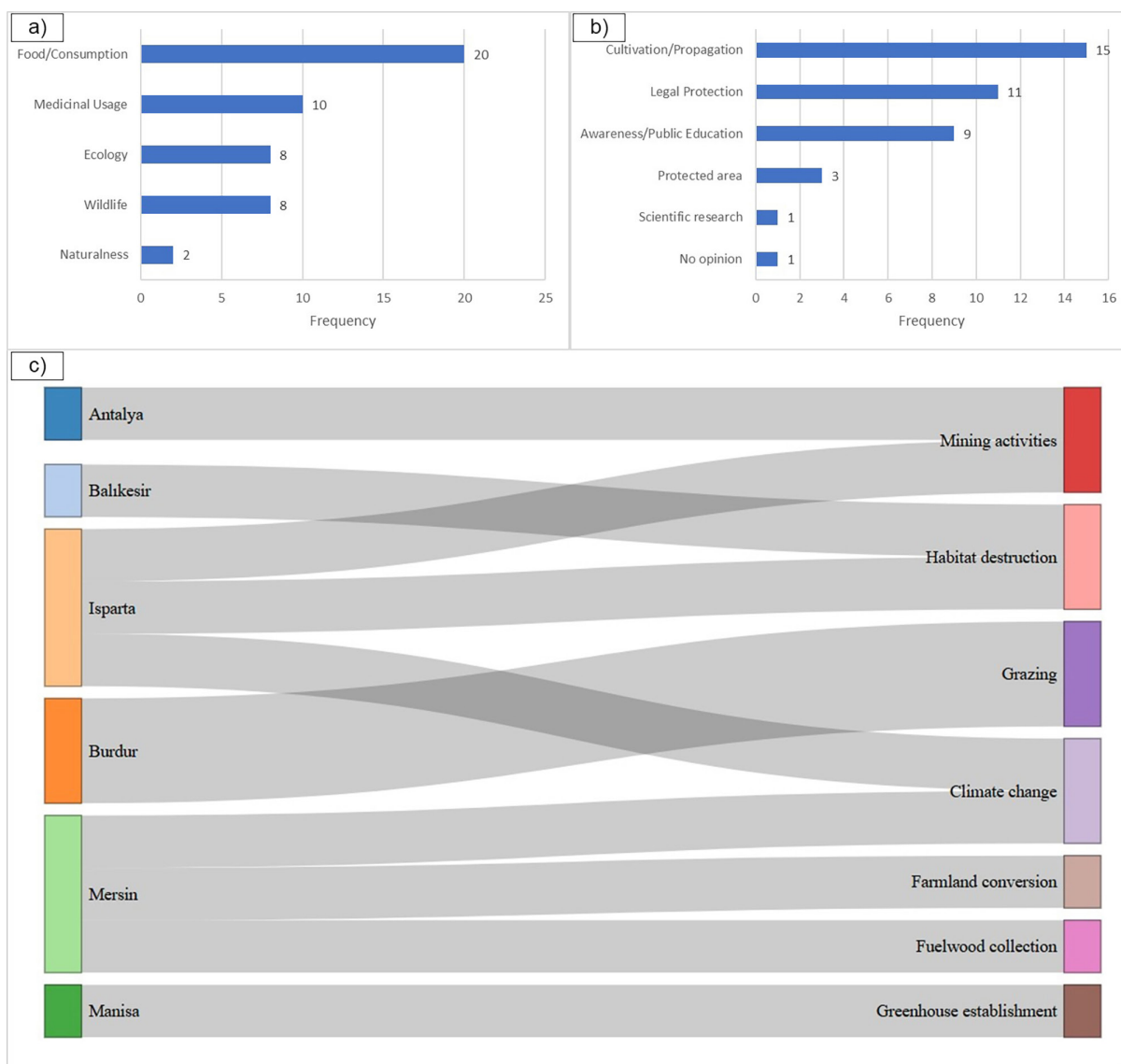


Fig. 9. (a) Participants’ conservation motivations and (b) proposed protection measures for *E. trilobatus*, and (c) the provincial distribution of reported threat factors for the species with regions shown on the left and threat factors on the right

food/consumption (f = 20) and medicinal/therapeutic purposes (f = 10) (Fig. 9). Uses related to ecosystem services and wildlife interactions were reported to a more limited extent (each f = 8) while the perception of the species as an indicator of naturalness was very low (f = 2). These findings suggest that the species is mainly appreciated for its direct and practical benefits.

Regarding conservation recommendations, cultivation/propagation (f = 15) emerged as the most common approach, followed by legal protection (f = 11) and awareness-raising and public education (f = 9) (Fig. 9a). The inclusion of the species in protected areas (f = 3) and the promotion of scientific research (f = 1) were mentioned less frequently (Fig. 9b; see Table 2). The results indicated a general awareness among participants of the need for conservation.

The spatial distribution of threats varies among provinces (Fig. 9c). According to interview responses, mining activities were the main threat in Antalya; habitat destruction and grazing in Balıkesir and Isparta; climate change in Burdur; conversion to agricultural land and fuelwood collection in Mersin; and greenhouse cultivation in Manisa. Site surveys confirmed region-specific pressures: Antalya is particularly affected by greenhouse facilities, Mersin by land clearing for agriculture, Balıkesir by grazing, and Muğla by mining activities and forest fires.

### Sources and transmission pathways of species-related knowledge

An examination of participants' sources of knowledge about the species shows that information was predominantly transmitted within the family across generations (f = 18). This result clearly demonstrated that traditional ecological knowledge was maintained through oral transmission. After the family, the most important source of information was professional experience (f = 8), indicating that knowledge of the species is also acquired through institutional

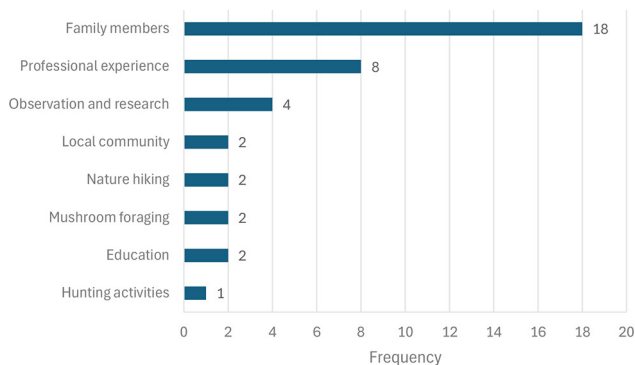


Fig. 10. Distribution of participants' sources of knowledge about the species

and practical processes. Knowledge gained through individual observation and personal research was more limited (f = 4). Other sources including local communities, nature walks, mushroom foraging, and education were reported at low and equal rates (each f = 2) while hunting activities contributed the least (f = 1) (Fig. 10). Family-based transmission and professional experience played a dominant role in the transfer of species-related knowledge whereas the other sources served a complementary function.

### Effects of age on species recognition, usage and user acquaintance

Only the age of interviewees was found to have a significant effect on species recognition, usage and user acquaintance while the other categorical variables (city, education, and job) were not significant (p > 0.05). Species recognition was high across all generations, with the highest contribution from generation X (f = 14) and the lowest from generation Z (f = 2). A similar trend was observed for species use, with the highest usage reported in generation X (f = 13) and generation Y (f = 9) while no usage was reported in generation Z (f = 0). Regarding user familiarity, "Yes" responses were predominantly concentrated in generation X (f = 11) whereas "No" responses were particularly prominent in generation Y (f = 6) (Fig. 11). The results indicated a clear trend of increasing species recognition, use and social interaction with increasing age.

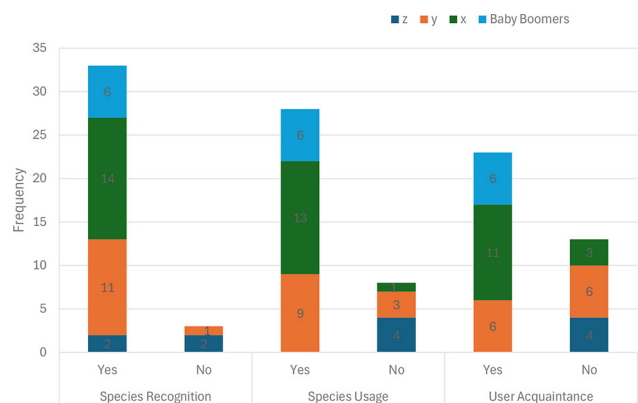


Fig. 11. Intergenerational variation in species recognition ( $\chi^2 = 10.909$ , p = 0.012), usage ( $\chi^2 = 17.610$ , p = 0.001) and user acquaintance ( $\chi^2 = 12.780$ , p = 0.005). Generational ranges are defined as: X (1965–1980), Y (1981–1996), Z (1997–2012), and Baby Boomers (1946–1964)

## Discussion

The current study revealed that participants generally recognized *E. trilobatus* but frequently confused it with *Sorbus* and *Crataegus* genera. These results are largely consistent with earlier studies reporting cross-genus misidentification in local knowledge (Yılmaz & Yüksel, 2016; Ak, 2019; Çınar, 2019), although our data indicate that younger generations exhibit lower taxonomic accuracy despite maintaining high cultural familiarity. This decline may reflect degradation of juvenile ethnobotanical knowledge possibly linked to dietary changes, increased urbanization, and decreased exposure to natural habitats. Therefore, the reliability of the results derived from traditional ecological knowledge is strengthened when surveys and interview data are combined as ethnobotanical recognition alone may overstate actual species knowledge. The high number of alternative local names indicates that *E. trilobatus* is widely known in local cultures. This variation in naming appears both across different regions and within the single districts, which indicates that multiple local names are commonly used at both intra-regional and regional levels. This variety of names reflects the flexibility and context-dependence of local classification systems, where naming is not only determined by scientific taxonomy but also by morphological similarity, practical use, and cultural traditions. This diversity may lead to confusion with morphologically similar species at the local level, but it also emphasizes the richness of local ethnobotanical knowledge.

Site surveys showed that *E. trilobatus* predominantly grows in mountainous and semi-natural forested areas, especially within *Pinus brutia* and *P. nigra* forests and their associated maquis vegetation. Interestingly, its presence in agricultural fields, cemeteries and open areas suggests a wider ecological tolerance than previously documented (Çınar, 2019; Demircan et al., 2022b). These results indicate that while core populations persist in less disturbed montane forests, the species can tolerate moderate anthropogenic disturbance. This implies that the species is resilient to certain habitat changes but vulnerable to extensive land use conversion or environmental stress. The observed decline in ethnobotanical knowledge and usage, particularly among younger generations, may have an indirect impact on the occurrence of species by reducing awareness of sustainable harvesting and conservation practices in certain regions of Türkiye. Local communities contribute to the conservation of *E. trilobatus* in different regions by participating in propagation, cultivation, and protection of core populations as well as by adapting harvesting practices to local ecological conditions.

Fruits were the most commonly used plant part, mostly for food preparation such as vinegar, pickles,

molasses and compote. This shows that local harvesting pressures are driven mainly by food use rather than medicinal applications, which were reported less frequently (Çınar, 2019; Çınar et al., 2020; Demircan et al., 2022b). Interestingly, despite the species' widespread use as food, participants iterated the species' medicinal properties in interviews, highlighting a discrepancy between perceived value and actual practice. This suggests that traditional medicinal knowledge persists culturally even when daily consumption is largely nutritional. This is probably because ethnobotanical knowledge has been passed down through generations and the species has historically been important as a medicinal plant. This pattern highlights the need to integrate cultural use into conservation planning to prevent overexploitation while acknowledging traditional practices.

Besides, the current study revealed that most populations were made up of older individuals with juveniles rarely observed, especially in Isparta and Antalya. This supports the previous results that the species has low seed production and strong seed dormancy (Gültekin et al., 2007; Yılmaz, 2008), and limited contribution of vegetative sprouting to population sustainability. Targeted conservation interventions are necessary in susceptible locations because observed regeneration failures may be triggered by environmental disturbances, competition with other species and even stress associated with climate change.

Perceptions of the participants and site surveys show that threats to the species are highly region-specific. The main pressures that reflect local anthropogenic activities are overgrazing in Balıkesir, mining and forest fires in Muğla, increase in the number of greenhouses in Antalya and agricultural conversion in Mersin (Yılmaz & Yüksel, 2016; Ak, 2019). Although climate change was mentioned, no direct evidence links it to population decline, so causal claims were avoided. These results show how socio-ecological factors interact to influence species' vulnerability and underscore the importance of developing conservation strategies that take into account both ecological and cultural contexts.

Strong local understanding of the species' ecological and cultural significance is reflected in the participants' emphasis on cultivation and propagation as effective conservation strategies. Given the regional limitations and social behaviours, combining traditional ecological knowledge with formal conversation practices such as in-situ protection of old populations, ex-situ propagation through containerized seedlings, reinforcement planting, and community-based management seems to be the most practical strategy.

## Conclusion

*E. trilobatus* is still widely recognized in culture but it faces some challenges including taxonomic confusion, limited natural regeneration and aging populations. Local knowledge is primarily handed down within families and fruit-based applications are prevalent. Thus, conservation necessitates focused in-situ protection, ex-situ propagation and community engagement strategies tailored to region-specific threats. The long-term survival of the species depends heavily on the integration of traditional knowledge and scientific management.

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