



Traditional uses, ethnobotanical significance, and resource potential of *Ephedra equisetina* Bunge in the Kurshab River Basin, Kyrgyzstan

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Research

Abstract

Background: The Kurshab River Basin (Osh Region, Kyrgyzstan) is an area where traditional knowledge related to the use of wild plants has been preserved for generations. Among the species of particular cultural importance is *Ephedra equisetina* Bunge, which is widely known and used by local communities. However, information on local harvesting practices, processing methods, and traditional applications of this species remains insufficiently documented.

Methods: Field studies were conducted during 2023-2025 in the villages of Bulolu, Askaly-Chaty, and Kyzyl-Korgon within the Kurshab River Basin. Botanical surveys, herbarium collection, and ethnobotanical investigations were carried out. Semi-structured interviews were conducted with 57 informants to document local knowledge regarding the harvesting, processing, and use of *Ephedra equisetina*. Historical sources, including the works of Theophrastus and Ibn Sina's Canon of Medicine, were used for comparative analysis.

Results: A total of 57 informants (32 women and 25 men) participated in the study. Fifty-two respondents were familiar with *Ephedra equisetina*, whereas five younger informants reported no knowledge of the species. The most common forms of use included the traditional fruit jam "shirne", mixtures of fruits with clarified butter, and preparations made from young shoots. Harvesting practices showed clear seasonality, with shoots collected mainly in spring and fruits harvested during late

summer and autumn. Comparison with historical sources revealed similarities between contemporary and historical perceptions of the genus *Ephedra*. Resource assessments indicated that *E. equisetina* occupies approximately 450-500 ha within the study area, with a biological stock estimated at about 125 t.

Conclusions: *Ephedra equisetina* remains an important component of traditional plant use in the Kurshab River Basin. Differences in knowledge among age groups suggest a gradual decline in the transmission of traditional ethnobotanical knowledge. Documentation of local practices contributes to the preservation of biocultural heritage and provides a basis for the sustainable use and conservation of plant resources in Eastern Alay.

Keywords: *Ephedra equisetina*, ethnobotany, traditional knowledge, medicinal plants, biocultural heritage, Eastern Alay.

Background

Medicinal plants have played an important role in the traditional healthcare systems of Central Asian peoples for centuries. Kyrgyzstan is characterized by a rich floristic diversity comprising more than 4,100 species of vascular plants, a considerable proportion of which are used in traditional medicine. Mountain regions in the southern part of the country are particularly rich in medicinal plant resources and continue to preserve traditional knowledge related to the harvesting, processing, and use of wild plant species (Shalpykov 2015; Aizenman *et al.* 2012).

One such species is *Ephedra equisetina* Bunge, a shrub species widely distributed on the rocky slopes of Eastern Alay. The species is well known among local communities as both a food and medicinal resource. Its fruits are used to prepare the traditional jam known as “**shirne**” as well as mixtures with clarified butter. These products are traditionally consumed during the winter period and are locally perceived as supporting general well-being. Traditional knowledge associated with the use of this species remains preserved in rural communities of the Kurshab River Basin and is transmitted primarily through oral traditions from one generation to the next (Karimova & Dursunbaeva 2002).

Historical sources indicate the long-standing use of species belonging to the genus *Ephedra*. References to these plants can be found in the works of Theophrastus and in Ibn Sina’s Canon of Medicine, where representatives of the genus were described as plants used to maintain vitality and alleviate various ailments. These records suggest that contemporary knowledge held by local communities in southern Kyrgyzstan represents part of a broader historical and ethnobotanical tradition extending across Eurasia.

During recent decades, numerous studies have investigated medicinal plants, their resource potential, and their traditional uses in Kyrgyzstan (Taizhanov *et al.* 2004; Pawera *et al.* 2016; Karimov *et al.* 2024; Omurova *et al.* 2024). Nevertheless, information on the traditional use of *Ephedra equisetina* in southern regions of the country remains fragmented. Local names, harvesting and processing practices, forms of utilization of fruits and shoots, and the degree of preservation of traditional knowledge among different age groups remain insufficiently documented.

Although *Ephedra equisetina* is widely distributed throughout Central Asia, detailed field-based information on local fruit-processing techniques, harvesting seasonality, transmission of traditional knowledge, and the cultural significance of the species among communities of southern Kyrgyzstan remains limited. The novelty of the present study lies in the comprehensive documentation of contemporary ethnobotanical knowledge associated with *E. equisetina* in the Kurshab River Basin, including traditional food products, harvesting practices, and the resource potential of the species.

Particular attention was given to the transmission of ethnobotanical knowledge among generations. Under current socio-economic conditions, elements of traditional knowledge are gradually being lost, making their documentation and preservation increasingly important as components of the region’s biocultural heritage.

The aim of this study was to document and systematize traditional knowledge related to *Ephedra equisetina* among communities of the Kurshab River Basin in southern Kyrgyzstan and to assess the role of the species in local culture and traditional plant-use practices.

The specific objectives of the study were to:

- document local methods of harvesting, processing, and using *Ephedra equisetina*;
- investigate patterns of traditional knowledge transmission among different age groups;
- characterize the role of the species within local systems of traditional natural resource use;

- compare contemporary ethnobotanical information with historical literary sources.

The results contribute to the preservation of traditional knowledge concerning medicinal plants and provide new insights into the role of *Ephedra equisetina* within the biocultural heritage of Eastern Alay.

Materials and Methods

Study area

Field studies were conducted between 2023 and 2025 in the Kurshab River Basin, located in Osh Region, southern Kyrgyzstan. The study area belongs to the Eastern Alay and comprises mountain and foothill ecosystems represented by rocky slopes, river valleys, steppe habitats, and shrub communities. Particular attention was paid to the villages of Bulolu, Askaly-Chaty, and Kyzyl-Korgon, where traditional knowledge related to wild medicinal plants continues to be maintained and transmitted between generations.

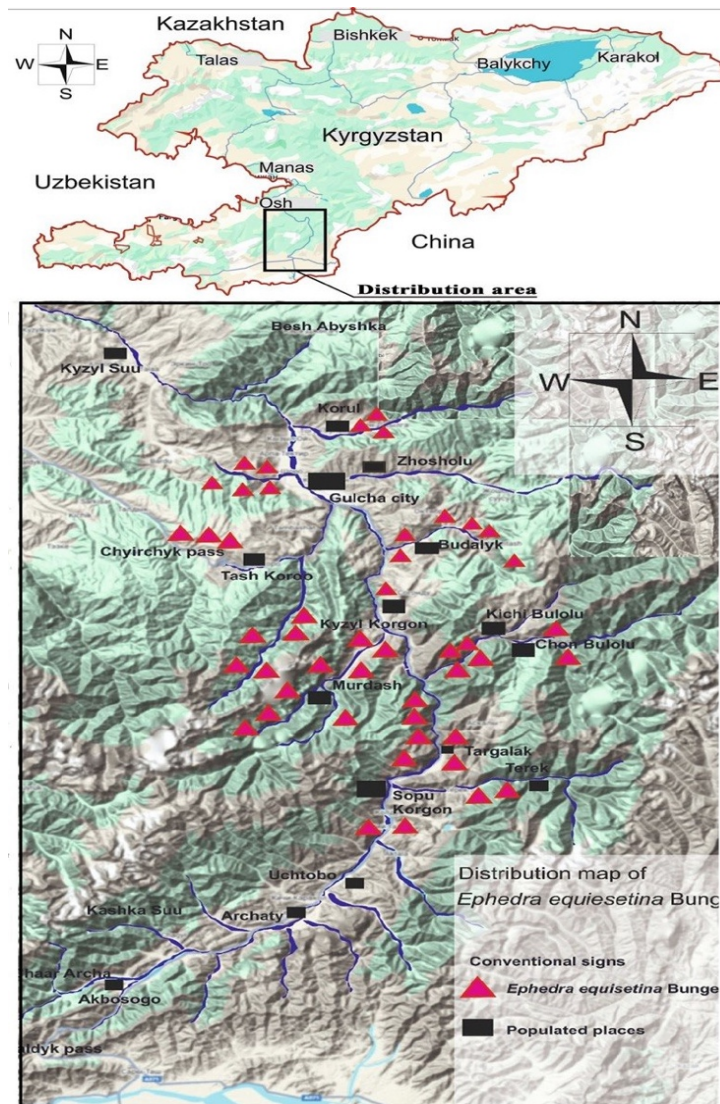


Figure 1. Study area in the Kurshab River Basin (Osh Region, Kyrgyzstan)

The focus of the study was *Ephedra equisetina* Bunge (Ephedraceae), a species naturally occurring within the Kurshab River Basin. The research combined botanical and ethnobotanical approaches and addressed the distribution of the species, its use by local communities, and traditional harvesting and processing practices.

Botanical studies

The nomenclature and taxonomic treatment of the species followed the Cadastre of the Flora of Kyrgyzstan (Lazkov & Sultanova 2014).

Field expeditions included surveys of *Ephedra equisetina* populations and associated vegetation communities. Photographic documentation was carried out for plants, habitats, and individual plant organs, including shoots and fruits.

Voucher specimens of *Ephedra equisetina* were collected during fieldwork, identified by B. Karimov using regional floras and specialized botanical literature, and deposited in the Herbarium of Osh State University (OshSU) under voucher number OshSU-EQ-001.

Ethnobotanical studies

Ethnobotanical data were collected through semi-structured interviews conducted between 2023 and 2025. A total of 57 informants participated in the study, including 32 women and 25 men.

To assess the preservation of traditional knowledge, informants were grouped into three age categories:

- 14-30 years: 17 informants (10 women, 7 men);
- 31-50 years: 22 informants (12 women, 10 men);
- 51-80 years: 18 informants (10 women, 8 men).

All interviews were conducted in the Kyrgyz language. Informants were selected using purposive sampling based on their experience with medicinal plants and their knowledge of local plant-use traditions.

Information recorded during interviews included:

- local plant names;
- plant parts used;
- harvesting periods;
- processing and storage methods;
- traditional forms of use;
- local perceptions of beneficial properties;
- observations regarding changes in plant availability.

Particular attention was paid to knowledge related to *Ephedra equisetina*. Of the 57 respondents interviewed, 52 were familiar with the species and were able to describe its uses. Five younger informants (three females and two males) reported no knowledge of the plant.

Prior informed consent was obtained orally from all participants before each interview. Informants were informed about the aims of the study, the voluntary nature of participation, and their right to withdraw at any time. No personal identifying information is disclosed in this manuscript.

Documentation of traditional products

Special attention was given to documenting local methods of processing the fruits of *Ephedra equisetina*. Information was collected on the preparation of the traditional fruit jam known as “*shirne*” and on the preparation of boiled fruits mixed with clarified butter in a 1:1 ratio. Informants’ perceptions regarding the purpose and consumption of these products were also recorded.

Comparative analysis

Ethnobotanical information obtained during fieldwork was compared with historical literary sources, including the works of Theophrastus and Ibn Sina’s Canon of Medicine. The analysis aimed to identify similarities and differences between contemporary uses of the species and historical descriptions of representatives of the genus *Ephedra*.

Resource assessment

Resource assessments of *Ephedra equisetina* populations were conducted according to standard methodologies for medicinal plant resource evaluation (Borisova & Shreter 1966; Krylov & Shreter 1971; Methodology for Determining Reserves of Medicinal Plants 1986). Field surveys were carried out in the principal habitats of the species within the Kurshab River Basin. The area occupied by populations was estimated through route surveys and mapping of population boundaries. Mean yield of air-dried plant material (kg/ha) was assessed using sample plots established within the studied populations. Biological stock was calculated based on mean yield and the total area occupied by the species. Exploitable stock and

potential annual harvest were estimated according to recommendations for the sustainable use of wild medicinal plant resources.

Data analysis

The collected questionnaires were analyzed, and the Fidelity Level (FL) was calculated as a quantitative ethnobotanical parameter. FL is an index used to measure the importance of a specific plant usage within a certain category. The index values range from 0% to 100%, calculated using the following formula:

$$FL = \left(\frac{N_i}{N} \right) \times 100$$

where:

- N_i = the number of informants who mentioned a specific use;
- N = the total number of informants (Friedman *et al.* 1986).

Results

Informant characteristics and preservation of traditional knowledge

A total of 57 informants participated in the study, including 32 women (56.1%) and 25 men (43.9%). All interviews were conducted in the Kyrgyz language in the villages of Bulolu, Askaly-Chaty, and Kyzyl-Korgon.

Informants were divided into three age groups: 14-30 years (17 individuals), 31-50 years (22 individuals), and 51-80 years (18 individuals). The demographic structure of the informants is presented in Table 1.

Table 1. Age and gender structure of informants

Age group	Men	Women	Total
14-30 years	7	10	17
31-50 years	10	12	22
51-80 years	8	10	18
Total	25	32	57

Of the 57 respondents interviewed, 52 were familiar with *Ephedra equisetina* and were able to describe its uses. Five younger respondents (three females and two males) reported no knowledge of the species. The distribution of knowledge among age groups is presented in Table 2.

Table 2. Knowledge of *Ephedra equisetina* among different age groups

Age group	Familiar with the species	Not familiar with the species
14-30 years	12	5
31-50 years	22	0
51-80 years	18	0
Total	52	5

The results indicate differences in the level of traditional knowledge among age groups. Informants belonging to the oldest age group possessed the most detailed knowledge regarding the harvesting, processing, and use of the species.

Local names and forms of use of *Ephedra equisetina*

Ephedra equisetina is a well-known species among residents of the Kurshab River Basin. Interviews documented several traditional uses of the fruits and young shoots.

The most commonly reported forms of use were:

- preparation of the traditional fruit jam “shirne” from ripe fruits;
- preparation of a mixture of boiled fruits and clarified butter in a 1:1 ratio;
- use of dried shoots for preparing decoctions and herbal drinks.

Fruit-based products were the most frequently reported forms of use among informants.

Harvesting seasonality and storage practices

The harvesting period depended on the plant part used. Young shoots were collected mainly during spring, whereas fruits were harvested at full maturity during August-September. Seasonal harvesting patterns are illustrated in Figure 2.

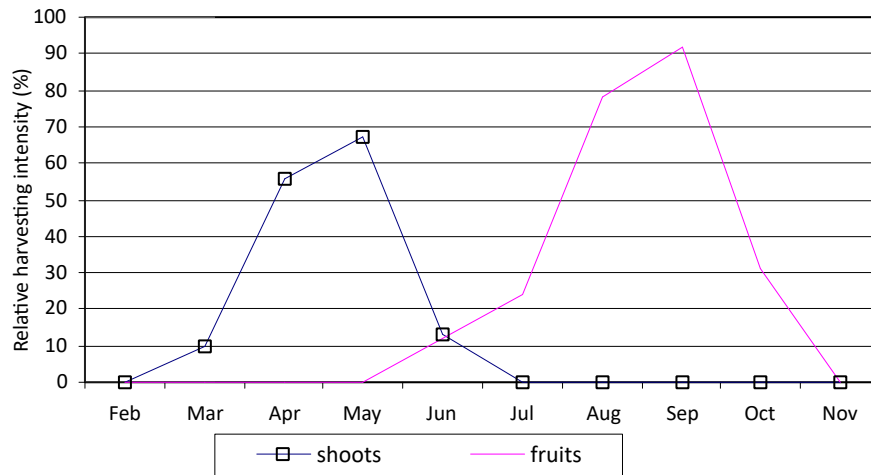


Figure 2. Seasonal harvesting pattern of *Ephedra equisetina* shoots and fruits based on informant reports and field observations

Harvesting was performed manually. Informants emphasized the importance of leaving part of the shoots on the plant to facilitate natural regeneration. Air-drying followed by storage in dry indoor conditions was the most common preservation method.

Ethnobotanical uses of the species

A total of 62% of informants associated the use of the species with respiratory complaints, including cough, breathing difficulties, and cold-related symptoms. Another 24% mentioned its use as a seasonal preventive product during the cold season, while 14% reported its use as a general tonic. According to informants, products prepared from the fruits of *Ephedra equisetina* are traditionally consumed during winter and are locally regarded as general tonic food products that support overall well-being.

The most frequently mentioned preparation methods included decoctions, infusions, the traditional fruit jam “shirne” and mixtures of fruits with clarified butter. The principal traditional uses of *Ephedra equisetina* are summarized in Table 3.

Table 3. Traditional uses of *Ephedra equisetina* in the Kurshab River Basin

Traditional use / purpose	No. of informants	Part used	Preparation method	Harvest season	FL (%)
Traditional food product	38	Fruits	“Shirne” jam	August-September	73.1
General tonic food product	26	Fruits	Mixture with clarified butter (1:1)	August-September	50.0
Traditional use for seasonal ailments	21	Shoots	Decoction	Spring	40.4
Traditional herbal infusion	17	Shoots	Infusion	Spring	32.7
Traditional use / purpose	No. of informants	Part used	Preparation method	Harvest season	FL (%)

Based on the ethnobotanical analysis, *Ephedra equisetina* was reported to be used in four main traditional forms in the Kurshab River Basin: as a traditional food product, a general tonic food product, a decoction prepared from shoots, and a herbal infusion. The most frequently reported use was the preparation of the traditional fruit product known locally as “shirne” jam, which was cited by 38 informants and had the highest Fidelity Level (FL) of 73.1%. The fruits were also

traditionally mixed with clarified butter at a 1:1 ratio and consumed as a general tonic food product, as reported by 26 informants (FL = 50.0%).

The young shoots of *E. equisetina* were traditionally harvested in spring and used to prepare decoctions and infusions. Decoctions were reported by 21 informants (FL = 40.4%), whereas herbal infusions were mentioned by 17 informants (FL = 32.7%). Thus, fruit-based preparations, particularly “shirne” jam, represented the most frequently documented traditional use of *E. equisetina* in the study area. The relatively high frequency of fruit use may be associated with the seasonal availability of the fruits in August-September and their subsequent consumption during the winter period. Overall, the findings indicate that *E. equisetina* plays an important role in the traditional food practices and seasonal ethnobotanical knowledge of local communities in the Kurshab River Basin.

Resource characteristics of the species

Resource assessments conducted according to standard methodologies for medicinal plant evaluation showed that *Ephedra equisetina* populations occupy approximately 450-500 ha within the Kurshab River Basin.

The mean yield of air-dried plant material was estimated at approximately 250 kg/ha. The biological stock was estimated at about 125 t, whereas the exploitable stock was approximately 60 t. The potential sustainable annual harvest was estimated at 30-40 t of raw material. Resource assessment results are presented in Table 4.

Table 4. Resource indicators of *Ephedra equisetina* in the Kurshab River Basin

Indicator	Value
Population area	450-500 ha
Mean yield	250 kg/ha
Biological stock	125 t
Exploitable stock	60 t
Sustainable annual harvest	30-40 t

In areas subjected to intensive harvesting, informants reported a decline in population density, indicating the need for monitoring and conservation of natural populations.

Comparison with historical sources

Comparison of contemporary ethnobotanical data with historical literary sources revealed several similarities between present-day traditions associated with *Ephedra equisetina* and descriptions found in the works of Theophrastus and Ibn Sina.

Comparative analysis showed that 52 medicinal plant species recorded in the Kurshab River Basin are mentioned in Ibn Sina’s Canon of Medicine, whereas 75 species have parallels in the works of Theophrastus.

For *Ephedra*, similarities were observed in perceptions of the species as a traditionally valued plant associated with maintaining general well-being and its use in conditions related to fatigue, weakness, and seasonal ailments.

Discussion

The results obtained confirm the important role of *Ephedra equisetina* in the traditional plant-use system of communities inhabiting the Kurshab River Basin. Despite ongoing socio-economic changes, the species continues to be used by local residents as a culturally significant food and ethnobotanical resource.

One of the most important findings of the present study is the identification of differences in ethnobotanical knowledge among age groups. All middle-aged and elderly informants were familiar with *Ephedra equisetina* and were able to describe in detail its harvesting practices and traditional uses. In contrast, several representatives of the younger generation lacked knowledge of the species. These findings suggest a gradual decline in traditional knowledge and are consistent with other ethnobotanical studies from Central Asia that have reported the loss of elements of biocultural heritage due to urbanization, migration, and changing lifestyles.

Similar trends have been documented in other ethnobotanical investigations throughout Central Asia, where urbanization, migration processes, and transformations of traditional ways of life are considered major drivers of the gradual erosion of medicinal plant knowledge (Pawera *et al.* 2016; Khojimatov *et al.* 2023; Makhkamov *et al.* 2024).

The recorded uses of *Ephedra equisetina* indicate the persistence of certain elements of local ethnobotanical traditions. Comparable findings have been reported in other Central Asian ethnobotanical studies focused on documenting traditional medicinal plant knowledge and ethnomedicinal practices (Boboev *et al.* 2023; Gafforov *et al.* 2024). The most common forms of preparation include the traditional fruit jam known as “shirne”, mixtures of fruits with clarified butter, and decoctions prepared from young shoots. These practices reflect a long-term adaptation of local communities to regional environmental conditions and the rational use of available plant resources.

Comparison of contemporary ethnobotanical information with historical sources revealed continuity in perceptions regarding the properties of species belonging to the genus *Ephedra*. The uses reported by informants show certain parallels with descriptions of tonic and restorative plants found in the works of Theophrastus and Ibn Sina. Nevertheless, direct comparisons between contemporary practices and historical accounts should be interpreted with caution, as methods of preparation and contexts of use may have changed over time. These observations suggest the presence of elements of historical and cultural continuity in the use of medicinal plants among the population of southern Kyrgyzstan.

Comparison of the present findings with studies conducted in other Central Asian countries reveals both common features and regional differences in the use of *Ephedra equisetina*. In Kyrgyzstan, medicinal plants of the Kurshab River Basin and the flora of southern regions have previously been investigated; however, detailed ethnobotanical information on the processing and use of *E. equisetina* has remained limited (Aizenman *et al.* 2012; Karimov *et al.* 2024; Omurova *et al.* 2024). In neighboring Central Asian countries, studies of *Ephedra* species have focused primarily on taxonomy, distribution, ecology, and resource assessments, whereas ethnobotanical aspects have received considerably less attention (Pimenov *et al.* 2021; Tayjanov *et al.* 2021). In Kazakhstan, research has emphasized useful and medicinal plants of the native flora, including species of economic and medicinal importance (Aidarbayeva *et al.* 2025), while studies in Turkmenistan have focused on the chemical composition and biological activity of medicinal plant extracts, including species of the genus *Ephedra* (Korpayev *et al.* 2025).

Despite the widespread traditional use of *E. equisetina*, the findings should be interpreted with caution. Species of the genus *Ephedra* contain biologically active alkaloids whose concentrations may vary depending on plant organ, harvesting season, and habitat conditions (González-Juárez *et al.* 2020; Zheng *et al.* 2023). Similar patterns of variation in the chemical composition of medicinal plants according to source material and environmental conditions have also been reported in studies of plant-derived preparations from East Asia (Zhang *et al.* 2024). During interviews, several informants reported undesirable effects associated with excessive consumption of plant-based preparations, including headaches and unpleasant cardiac sensations. Furthermore, the traditional preparations documented in the present study lack standardized dosages and have not undergone clinical safety evaluation. Alkaloid content may also vary considerably according to environmental conditions and the plant parts used. Therefore, preparations derived from *Ephedra* should be used with caution, particularly by individuals with cardiovascular disorders. The documented uses should be regarded as elements of local traditional knowledge rather than medically validated recommendations. This approach is widely adopted in contemporary ethnobotanical research, where traditional reports of medicinal use are distinguished from clinically verified medical evidence (Hussain *et al.* 2022). Further phytochemical, pharmacological, and toxicological studies are required to evaluate the safety and potential efficacy of local preparations.

Against this background, the present study contributes new information on local traditions associated with the use of *Ephedra equisetina* in southern Kyrgyzstan. Of particular interest are the documented methods for preparing traditional “shirne” jam, mixtures of fruits with clarified butter, as well as information on harvesting seasonality and the transmission of knowledge between generations. The findings broaden current understanding of the biocultural significance of *E. equisetina* in Central Asia and highlight the importance of further documenting traditional knowledge related to medicinal plant use in the region.

The results also emphasize the need for conservation of natural populations of *Ephedra equisetina*. According to informants, some localities have experienced a reduction in stand density due to intensive harvesting and anthropogenic impacts. Regular monitoring of natural populations and the development of sustainable harvesting guidelines are therefore recommended. Previous studies have demonstrated that anthropogenic pressures can significantly affect the recovery of medicinal plant populations, highlighting the importance of incorporating conservation considerations into harvesting management strategies (Krylova 1994). Similar conclusions were reached in studies of medicinal plant resources on the

northern slopes of the Alay Range, where the need for rational use and conservation of medicinal plant resources was likewise emphasized (Dolonova *et al.* 2024).

It should be noted that the present study was primarily focused on documenting traditional knowledge and local practices associated with the use of *E. equisetina*. Future research should therefore include more detailed assessments of population resources as well as investigations of biologically active compounds present in different plant organs.

In conclusion, *Ephedra equisetina* represents an important component of the biocultural heritage of the Kurshab River Basin. The findings highlight the need for continued documentation of traditional knowledge, conservation of natural populations, and further phytochemical, pharmacological, and conservation-oriented research. The preservation and documentation of traditional knowledge associated with this species are essential for understanding human-plant interactions and for safeguarding the biocultural heritage of the region.

Conclusions

The present study demonstrated that *Ephedra equisetina* Bunge remains an important component of traditional plant use and biocultural heritage among communities of the Kurshab River Basin in southern Kyrgyzstan. Most informants were familiar with the species and were able to describe its harvesting, processing, and traditional uses.

The most commonly reported forms of use included the preparation of traditional “shirne” jam, mixtures of fruits with clarified butter, and decoctions prepared from young shoots. These practices continue to be maintained within local communities and are transmitted primarily through oral tradition.

Differences in ethnobotanical knowledge were observed among age groups. Elderly informants possessed the most detailed knowledge of the species, whereas some younger participants were unfamiliar with *E. equisetina*. This finding suggests a gradual decline in the transmission of traditional knowledge and highlights the importance of its documentation and preservation.

Comparison of contemporary ethnobotanical information with historical sources revealed similarities in perceptions of the cultural importance and traditional uses of representatives of the genus *Ephedra*. Although direct continuity between historical and present-day practices cannot be fully established, the results indicate the persistence of certain traditional concepts associated with the species.

Overall, *Ephedra equisetina* represents not only a characteristic component of the vegetation of Eastern Alay but also an important element of the region’s biocultural heritage. The documentation and preservation of traditional knowledge related to this species may contribute to future ethnobotanical, phytochemical, conservation-oriented, and resource-management studies. Further investigations are needed to evaluate the safety, biological activity, and sustainable utilization of local *E. equisetina* preparations before any broader medicinal applications can be considered.

Declarations

List of abbreviations: Not applicable.

Ethics approval and consent to participate: The study was conducted in accordance with internationally accepted ethical standards for ethnobotanical research. Prior informed consent was obtained orally from all participants before each interview. Informants were informed about the objectives of the study, the voluntary nature of participation, and their right to withdraw at any time. No personal identifying information is disclosed in this publication. According to the regulations of Osh State University and the legislation of the Kyrgyz Republic, formal ethical committee approval was not required for this type of non-invasive ethnobotanical research.

Consent for publication: Not applicable.

Availability of data and materials: All data generated or analyzed during this study are included in this published article. Additional information is available from the corresponding author upon reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors’ contributions: B.K. and M.T. designed and supervised the study. Z.A., B.K., A.D., and A.B. conducted field surveys and collected ethnobotanical data. T.M., R.B., M.T., M.E. and M.B. contributed to data organization, analysis, and

interpretation. K.O., G.D., A.B., M.E. and M.T. participated in data processing and statistical interpretation. A.D., B.K., and T.M. prepared the first draft of the manuscript. All authors reviewed, revised, and approved the final manuscript.

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Literature Cited

- Aidarbayeva D, Tal'dybay A, Bashenova M. 2025. Beneficial flora of northwestern Zhetysay Alatau region, Kazakhstan. *Sabrao Journal of Breeding and Genetics* 57(1):171-182.
- Aizenman S, Zurov DE, Shalpykov KT, Struve L. 2012. *Medicinal Plants of Central Asia: Uzbekistan and Kyrgyzstan*. Springer, New York, USA. 431 pp.
- Boboev S, Makhkamov T, Bussmann RW, Zafar M, Yuldashev A. 2023. Anatomical and phytochemical studies and ethnomedicinal uses of *Colchicum autumnale* L. *Ethnobotany Research and Applications* 25:1-9.
- Borisova NA, Shreter AI. 1966. On the methodology for determining reserves and mapping resources of medicinal raw materials. *Plant Resources* 2(2):271-277. (In Russian)
- Dolonova GM, Omurova KO, Burkanov NR, Sodobekov IS. 2024. Phytocenotic characteristics and reserves of the main medicinal plants of the northern slopes of the Alay Range (Kyrgyzstan). *E3S Web of Conferences* 537:07003.
- Gafforov Y, Rašeta M, Zafar M, Makhkamov T, Yarasheva M, Chen JJ, Rapior S. 2024. Exploring biodiversity and ethnobotanical significance of *Solanum* species in Uzbekistan: unveiling the cultural wealth and ethnopharmacological uses. *Frontiers in Pharmacology* 14:1287793.
- González-Juárez DE, Escobedo-Moratilla A, Flores J, Hidalgo-Figueroa S, Martínez-Tagüeña N, Morales-Jiménez J, Muñiz-Ramírez A, Pastor-Palacios G, Pérez-Hernández N. 2020. A review of the *Ephedra* genus: distribution, ecology, ethnobotany, phytochemistry and pharmacological properties. *Molecules* 25(14):3283.
- Hussain S, Hussain W, Nawaz A, Badshah L, Ali A, Ullah S, Ali M, Hussain H, Bussmann RW. 2022. Quantitative ethnomedicinal study of indigenous knowledge on medicinal plants used by the tribal communities of Central Kurram, Khyber Pakhtunkhwa, Pakistan. *Ethnobotany Research and Applications* 23:1-31.
- Ibn Sina (Avicenna). 1996. *Canon of Medicine*. Volume 2. Tashkent, Uzbekistan. 336 pp.
- Karimov B, Dursunbaeva A, Babekov A, Umetaliyev M, Abzhaparova A. 2024. Analysis of the medicinal flora of the Kurshab River Basin in Eastern Alay to preserve biodiversity. *E3S Web of Conferences* 537:05009.
- Karimova BK, Dursunbaeva AZh. 2002. History of research and some information on medicinal plants of the Gulcha River Basin (Kurshab), Alay Range. *Vestnik Osh State University, Natural Sciences Series*: 109-112. (In Russian)
- Khojimatov OK, Gafforov Y, Bussmann RW (eds). 2023. *Ethnobiology of Uzbekistan: Ethnomedicinal Knowledge of Mountain Communities*. Springer, Cham, Switzerland.
- Korpayev S, Zengin G, Glamočlija J, Soković M, Aničić N, Gašić U, Stojković D, Agamuradov M, Agamyradova G. 2025. Studies on the bioactivity (antioxidant, enzyme inhibitory, antimicrobial and cytotoxic) and chemical composition of aqueous extracts of some plant species collected from Turkmenistan. *Chemistry and Biodiversity* 22(1): e202401493.
- Krylov IL, Shreter AM. 1971. *Methodological Guidelines for the Study of Reserves of Wild Medicinal Plants*. Moscow, USSR. 24 pp. (In Russian)
- Krylova IL. 1994. The influence of some anthropogenic factors on the restoration of medicinal plant coenopopulations. *Plant Resources* 4:15-21. (In Russian).
- Lazkov GA, Sultanova BA. 2014. *Cadastre of the Flora of Kyrgyzstan*. Vascular Plants. National Academy of Sciences of the Kyrgyz Republic, Bishkek, Kyrgyzstan. 126 pp. (In Russian)
- Makhkamov T, Eshonkulov A, Bussmann RW, Khojimatov O, Zafar M, Ahmad M, Ruzmetov U, Yuldashev A, Islomov S, Khakimova D, Xojimatova D. 2024. Ethnobotanical knowledge of medicinal plants from Bukhara Region of Uzbekistan. *Ethnobotany Research and Applications* 27:1-46.
- Methodology for Determining Reserves of Medicinal Plants. 1986. VILR, Moscow, USSR. 51 pp. (In Russian)

- Omurova KO, Dolonova GM, Burkanov NR, Sodombekov IS, Dursunbaeva A. 2024. Resource characteristics of the natural distribution of medicinal plants *Ziziphora clinopodioides* Lam. in the Naryn Region of the Inner Tien Shan. E3S Web of Conferences 537:09001.
- Pawera L, Verner V, Termote C, Sodombekov I, Kandakov A, Karabaev N, Skalicky M, Polesny Z. 2016. Medical ethnobotany of herbal practitioners in the Turkestan Range, southwestern Kyrgyzstan. Acta Societatis Botanicorum Poloniae 85(1):3483. doi: 10.5586/asbp.3483.
- Pimenov MG, Nasyrova F, Akhmedov K, Tojibaev KS, Degtjareva GV. 2021. Field survey of *Ephedra* plants in Central Asia: characterization of *Ephedra equisetina*, *Ephedra intermedia* and their putative hybrids. Biological and Pharmaceutical Bulletin 44(3):289-297.
- Shalpykov KT. 2015. Medicinal and aromatic plants in Kyrgyzstan. In: Protection and Sustainable Use of Medicinal Plant Resources. Proceedings of the Third International Scientific-Practical Conference. Bishkek, Kyrgyzstan. Pp. 122-127. (In Russian)
- Taizhanov K, Karimova B, Dursunbaeva AZh. 2004. On wild medicinal plants of the Kurshab River Basin (Alay Range). Uzbek Biological Journal 6:29-35. (In Russian)
- Tayjanov K, Khojimatov O, Gafforov Y, Makhkamov T, Normakhamatov N, Bussmann RW. 2021. Plants and fungi in the ethnomedicine of the medieval East: a review. Ethnobotany Research and Applications 22:1-20.
- Theophrastus. 1916. De Historia Plantarum. Harvard University Press, Cambridge, Massachusetts, USA.
- Zhang Y, Wang X, Tang F. 2024. Equality evaluation on a multi-sources traditional Chinese medicine, *Ephedra sinica* and Tinglizi. Pharmaceutical Chemistry Journal 58(9):1422-1430.
- Zheng Q, Mu X, Pan S, Luan R, Zhao P. 2023. Ephedrae herba: a comprehensive review of its traditional uses, phytochemistry, pharmacology, and toxicology. Journal of Ethnopharmacology 307:116153.