Торайғыров университетінің
ҒЫЛЫМИ ЖУРНАЛЫ

НАУЧНЫЙ ЖУРНАЛ
Торайгыров университета

ТОРАЙҒЫРОВ УНИВЕРСИТЕТІНІҢ ХАБАРШЫСЫ

Химия-биологиялық сериясы

1997 жылдан бастап шығады

ВЕСТНИК ТОРАЙГЫРОВ УНИВЕРСИТЕТА

Химико-биологическая серия

Издается с 1997 года

ISSN 2710-3544

№ 2 (2025)

Павлодар

НАУЧНЫЙ ЖУРНАЛ
Торайгыров университета

Химико-биологическая серия
выходит 4 раза в год

СВИДЕТЕЛЬСТВО
о постановке на переучет периодического печатного издания,
информационного агентства и сетевого издания
№ KZ84VPY00029266

выдано
Министерством информации и коммуникаций Республики Казахстан

Тематическая направленность
публикация материалов в области химии, биологии, экологии,
сельскохозяйственных наук, медицины

Подписной индекс – 76134

https://doi.org/10.48081/PGFX4116

SRSTI 31.21:31.23:34.45.15

https://doi.org/10.48081/PYUZ1750

R. I. Jalmakhanbetova[1], M. N. Babakhanova[2], G. K. Mukusheva[3]

[1,2]L. N. Gumilyov Eurasian National University,
Republic of Kazakhstan, Astana;
[3]Karaganda Buketov University,
Republic of Kazakhstan, Karaganda.
[1]ORCID: https://orcid.org/0000-0001-9937-275X
[2]ORCID: https://orcid.org/0009-0009-7471-9054
[3]ORCID: https://orcid.org/0000-0001-6706-4816
*e-mail: rjalmakhanbetova@gmail.com

THE GENUS EPHEDRA: BIODIVERSITY, PHYTOCHEMISTRY AND PHARMACOLOGICAL POTENTIAL

This review article provides a comprehensive analysis of both domestic and international scientific studies on the phytochemical composition and biological activity of plants belonging to the Ephedra genus. Although Ephedra species have long been used in traditional medicine, their biologically active compounds and pharmacological effects have only recently begun to be systematically studied from a scientific standpoint. The article describes the major phytochemical constituents commonly found in Ephedra species, including alkaloids, flavonoids, phenolic compounds, and other secondary metabolites. A comparative analysis is conducted on the antioxidant, anti-inflammatory, antimicrobial, immunomodulatory, and other biological activities of these compounds. Additionally, the chemical composition of various Ephedra species is examined, highlighting both the similarities and differences among them. The authors emphasize the therapeutic potential of Ephedra species and explore their possible applications in the development of new pharmaceutical products. Overall, the article aims to establish a scientific foundation for future applied and clinical research based on the biologically active compounds of plants from the Ephedraceae family.

Keywords: Ephedraceae, Ephedra species, biodiversity, chemical composition, pharmacological properties.

Introduction

The genus *Ephedra*, belonging to the family *Ephedraceae*, comprises approximately 70 species distributed across various climatic zones, primarily in the dry and semi-arid ecosystems of Asia, Europe, Africa, and America. Their natural habitats include Western and Central Asia, southern and southeastern regions of Europe, the Sahara-adjacent deserts of North Africa, and the arid landscapes of the Americas. The average height of the *Ephedra* plant, which grows mainly as a shrub, does not exceed 1.5 meters, although some species can reach even higher under favorable conditions; the deep and widespread root system allows these plants to survive in areas where water shortages are common [1].

In Kazakhstan, eight species of the Ephedra genus are found: *E. equisetina* Bunge, *E. intermedia* Schrenk, *E. regeliana* Florin, *E. fedtschenkoi* Florin, / *E. lomatolepis* Schrenk, *E. monosperma* C. A. Mey., *E. distachya* Linn., and *E. strobilacea* Linn. These species are distinguished by their high adaptability to the diverse environmental conditions across the country. The Kazakh representatives of *Ephedra* predominantly grow in arid and semi-arid zones. In particular, species such as *E. lomatolepis, E. equisetina, E. intermedia,* and *E. major* are commonly found at the foothills of the Dzungarian Alatau, thriving in rocky and sandy landscapes. The ecological adaptability of these species places them among the resilient plants capable of surviving in dry climates [2].

Overall, plants of the *Ephedra* genus are characterized by their drought resistance, morphological flexibility, and high ecological adaptability. Their wide distribution across various climate zones underscores their environmental resilience and biological significance. Within the flora of Kazakhstan, these plants play a vital role in maintaining the stability of desert and semi-desert ecosystems, particularly in preventing soil erosion and preserving biodiversity. Moreover, the presence of biologically active compounds in *Ephedra* species highlights their significant pharmacological potential. Therefore, comprehensive research on these plants remains a relevant issue for the development of novel medicinal products and for ensuring ecological sustainability in the future.

Materials and methods

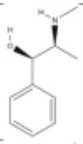
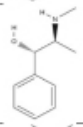
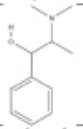
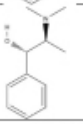
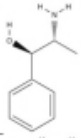
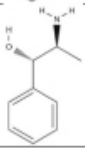
This review is based on a comprehensive analysis of contemporary scientific literature addressing the morphological, phytochemical, and pharmacological characteristics of *Ephedra* species. The sources include peer-reviewed articles published within the last decade, identified through reputable international and national databases such as Scopus, Web of Science, and Google Scholar. The selection prioritized high-quality studies that offer relevant insights into the genus *Ephedra.* In processing the literature, both comparative and descriptive analytical methods were employed to synthesize and interpret the collected information.

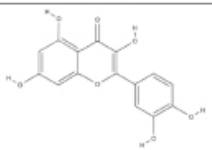
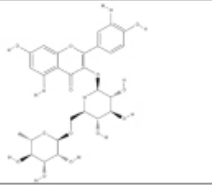
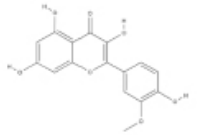
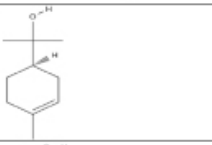
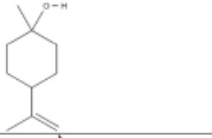
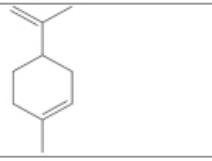
Results and Discussion

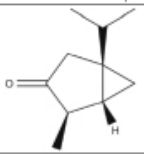
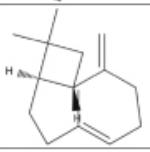
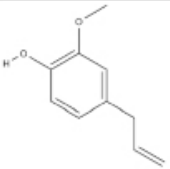
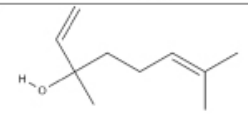
Main Biologically Active Compounds in *Ephedra* Species.

Various primary and secondary metabolites have been identified in plants of the genus *Ephedra.* Phytochemical compounds include alkaloids, flavonoids, phenolic compounds, terpenoids, essential oils, tannins, carbohydrates, amino acids, lipids, minerals, vitamins, steroids, lignans, coumarins, saponins, glycosides, organic acids, pectins, phytoncides and proanthocyanidins [3]; [4]; [5]; [6]. The table (Table 1) below lists some secondary metabolites.

Table 1 – Main Compounds Found in *Ephedra* Species

Metabolites	Main compounds	Chemical structure
1	2	3
Alkaloids	(-)-Ephedrine	
	(+)-Pseudoephedrine	
	(-)-(N)-Methylephedrine	
	(+)-(N)-Methylpseudoephedrine	
	(-)-Norpseudoephedrine	
	(+)-Norpseudoephedrine	

1	2	3
Flavonoids	Quercetin	
	Rutin	
	Isorhamnetin	
Terpenoids	α-Terpineol	
	β-Terpineol	
	Pinene	
	Limonene	

1	2	3
	Camphor	
	Thujone	
	Caryophyllene	
	Eugenol	
	Linalool	

The primary alkaloids of Ephedra plants are ephedrine-type compounds. Among them, ephedrine and pseudoephedrine are the most widespread. In addition, some Ephedra species contain macrocyclic spermine alkaloids and ephedradines. By synthesizing various alkaloids, Ephedra plants demonstrate a diverse chemical profile [7]; [8]; [9].

The flavonoids in *Ephedra* include compounds such as rutin, quercetin, and isorhamnetin, which are of particular importance. These flavonoids are known for their structural diversity and are commonly found in various plant species, contributing to the overall chemical profile of *Ephedra* [10].

Certain *Ephedra* species are rich in terpenoids. For example, *E. sinica, E. equisetina,* and *E. distachya* contain monoterpenes such as α-terpineol and β-terpineol, which contribute to the plant's overall chemical composition [11].

In species like *E. sinica* and *E. equisetina*, terpenoids are especially found in essential oils. Additionally, *E. distachya* contains other terpenes such as pinene, limonene, camphor, and thujone. The essential oil composition of *E. sinica, E. distachya,* and *E. alata* has been studied. These oils mainly consist of monoterpenes and sesquiterpenes. The main identified components include limonene, terpineol, caryophyllene, eugenol, and linalool. Some studies have also reported the presence of phenylpropanoids and volatile phenolic compounds [12]; [13]. Thus, the chemical composition of *Ephedra* is characterized by a variety of compounds. This structural diversity reflects the plant's complex biochemical profile.

The chemical composition of *Ephedra* species includes a wide range of biologically active substances such as alkaloids, flavonoids, terpenoids, and essential oil components. These compounds exhibit considerable structural diversity, reflecting the plant's complex phytochemical nature. The presence of various compound classes indicates the biochemical richness of *Ephedra* and provides a basis for further phytochemical investigations. This diversity in chemical structure is an important feature that distinguishes *Ephedra* among medicinal plants.

Ethnomedicinal and Pharmacological Significance.

Plants of the *Ephedra* genus have long been used in traditional medicine, particularly in Central Asia, China, India, and the Middle East [14]; [15]. In Kazakh folk medicine, certain species, known as *qylsha*, have traditionally been used to treat respiratory conditions, reduce fever, and induce sweating. Additionally, they have been employed for managing joint diseases, internal inflammatory processes, and for strengthening a weakened body.

In Pakistan and the Middle East, *Ephedra* is used for managing asthma, bronchitis, and cough. Species like *E. gerardiana* are used, the active compounds of which have antimicrobial and antioxidant activity. In addition, this plant has antitumor and antimalarial effects [16].

The pharmacological properties of the *Ephedra* plant (Fig. 1) have led to its use in traditional medicine [17]; [18]. Therefore, further research on *Ephedra* species and their chemical constituents – especially from a safety and toxicological perspective – remains essential.

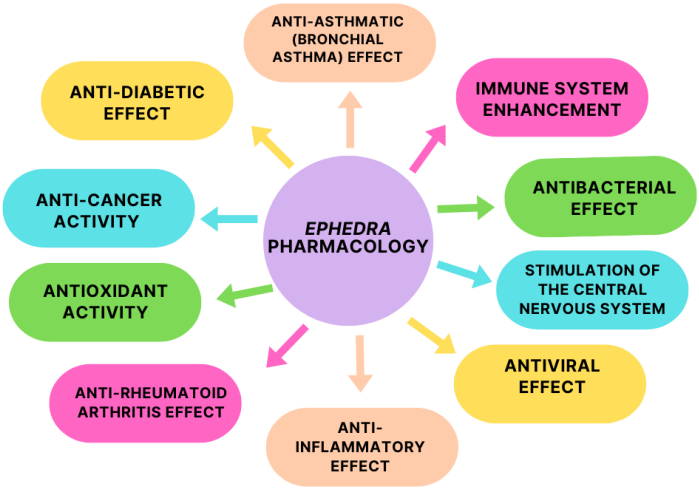


Figure 1 – Pharmacological properties of *Ephedra* plants

Ephedra species are rich in naturally occurring bioactive compounds, with ephedrine-type alkaloids, flavonoids, essential oils, and endophytic metabolites being particularly significant. Among these, flavonoids play a key role due to their antioxidant, anti-inflammatory, and immune-enhancing properties, making *Ephedra* a subject of growing scientific interest. In-depth investigation of these constituents may provide a foundation for developing new pharmaceutical and cosmetic products.

The primary alkaloids of *Ephedra*, such as ephedrine and pseudoephedrine, stimulate β-adrenergic receptors, producing bronchodilator, central nervous system stimulant, and vasoconstrictor effects [19]. These actions help widen airways, increase heart rate, and reduce nasal mucosal swelling, making these compounds effective for respiratory disorders.

Essential oils of *Ephedra*, primarily composed of terpenes and their derivatives, exhibit antioxidant property [20]. These oils are effective against skin infections and wounds and are also used in cosmetics as natural antibacterial agents.

Overall, the diverse bioactive compounds in *Ephedra* underline its importance in pharmaceutical, cosmetic, and medical applications. Continued research on these constituents may lead to the development of new, natural-based therapeutic agents.

Conclusions

Plants of the *Ephedra* genus grow in arid and semi-arid climatic regions and have become widespread due to their ecological and physiological adaptability. In Kazakhstan's desert and semi-desert areas, these plants are a vital component of the native flora. *Ephedra* species, in particular, have long been used in traditional medicine for their therapeutic properties. The main biologically active compounds in these plants – such as ephedrine, pseudoephedrine, flavonoids, and essential oils – demonstrate significant medicinal effects.

In conclusion, *Ephedra* species stand out for their ecological adaptability and significant pharmacological and medicinal potential. In-depth study of the bioactive compounds they contain will pave the way for the development of new medicinal and cosmetic products, further expanding the therapeutic potential of these plants. Future scientific studies and innovations will allow the full realization of the medicinal and biological potential of the *Ephedra* genus.

References

1 **González-Juárez, D. E., Escobedo-Moratilla, A., Flores, J., Hidalgo-Figueroa, S., Martínez-Tagüeña, N., Morales-Jiménez, J., Muñiz-Ramírez, A., Pastor-Palacios, G., Pérez-Miranda, S., Ramírez-Hernández, A., Trujillo, J., Bautista, E.** A review of the Ephedra genus : Distribution, ecology, ethnobotany, phytochemistry, and pharmacological properties // Molecules. – 2020. – Vol. 25. – P. 3–37.

2 **Иващенко, А. А.** Сокровища растительного мира Казахстана. – Алматы: Алматы кітап, 2007. – 127 с.

3 **Ibragic, S., Sofić, E.** Chemical composition of various Ephedra species // Bosnian Journal of Basic Medical Sciences. – 2015. – Vol. 15. – No. 3. – P. 21–27. – https://doi.org/10.17305/bjbms.2015.539

4 **Harisaranraj, R., Suresh, K., Saravanababu, S.** Evaluation of the chemical composition of Rauvolfia serpentina and Ephedra vulgaris // Advances in Biological Research. – 2009. – Vol. 3(5–6). – P. 174–178.

5 **Cottiglia, F., Bonsignore, L., Casu, L., Delia Deidda, D., Pompei, R., Casu, M., Floris, C.** Phenolic constituents from Ephedra nebrodensis // Natural Product Research. – 2005. – Vol. 19(2). – P. 117–123. – https://doi.org/10.1080/14786410410001704714

6 **Hong, H., Chen, H. B., Yang, D. H., Shang, M.Y., Wang, X., Cai, Sh.-Q., Mikage, M.** Comparison of contents of five ephedrine alkaloids in three official origins of Ephedra herb in China by HPLC // Journal of Natural Medicines. – 2011. – Vol. 65(3–4). – P. 623–628. – https://doi.org/10.1007/s11418-011-0528-8

7 **Zhu, D. H., Zhang, J. K., Jia, J. F., Liu, J.-J., Wei, J.-J., Yang, M., Yang, Y., Li, M., Hao, Zh.-Y., Zheng, X.-K., Feng, W.-Sh.** Alkaloids from the stem of Ephedra equisetina // Journal of Asian Natural Products Research. – 2022. – Vol. 24. – P. 238–244.

8 **Abourashed, E. A., El-Alfy, A. T., Khan, I. A., Walker, L.** Ephedra in perspective – a current review // Phytotherapy Research. – 2003. – Vol. 17(7). – P. 703–712. – https://doi.org/10.1002/ptr.1337

9 **Krizevski, R., Bar, E., Shalit, O., Sitrit, Y., Ben-Shabat, Sh., Lewinsohn, E.** Composition and stereochemistry of ephedrine alkaloids in Ephedra sinica // Phytochemistry. – 2010. – Vol. 71(8–9). – P. 895–903.

10 **Niu, Y., Cao, Y. G., Liu, Y. L., Xu Chen, X., Li, X.-D., Ma, X.-Y., Lu, D., Zheng, X.-K., Feng, W.-Sh.** Three new flavonoid glycosides from the herbaceous stems of Ephedra intermedia // Natural Product Research. – 2024. – P. 1–7. – https://doi.org/10.1080/14786419.2024.2405993

11 **He, M., Yan, J., Cao, D., Liu, Sh., Zhao, Ch., Liang, Y., Li, Y., Zhang, Zh.** Identification of terpenoids from Ephedra combining with accurate mass and in-silico retention indices // Talanta. – 2013. – Vol. 103. – P. 116–122. – https://doi.org/10.1016/j.talanta.2012.10.018

12 **Liu, B., Akobirshoeva, A., Ghorbani, A., Boer, H.J de.** Ephedra equisetina, Ephedra intermedia, Ephedra sinica (Ephedraceae) // Ethnobotany of the Mountain Regions of Central Asia and Altai. – 2020. – Vol. 35. – P. 3–24. – https://doi.org/10.1007/978-3-030-28947-8_53.

13 **Mahmoudi, M., Boughalleb, F., Maaloul, S., Mabrouk, M., Abdellaoui, R.** Phytochemical screening and LC–ESI–MS profiling of Ephedra seeds in Tunisia // Applied Biochemistry and Biotechnology. – 2023. – Vol. 195. – P. 5903–5915. – https://doi.org/10.1007/s12010-023-04370-8

14 **Gul, R., Jan, S. U., Faridullah, S., Sherani, S., Jahan, N.** Preliminary Phytochemical Screening, Quantitative Analysis of Alkaloids, and Antioxidant Activity of Crude Plant Extracts from Ephedra intermedia Indigenous to Balochistan // The Scientific World Journal. – 2017. – https://doi.org/10.1155/2017/5873648.

15 **Zhang, B.-M., Wang, Zh.-B., Xin, P., Wang, Q.-H., Bu, H., Kuang, H.-X.** Phytochemistry and pharmacology of Ephedra // Chinese Journal of Natural Medicines. – 2018. – Vol. 16(11). – P. 811–828.

16 **Khan, A., Jan, G., Khan, A., Jan, F.G., Bahadur, A., Danish, M.** In vitro antioxidant and antimicrobial activities of Ephedra gerardiana crude extract and fractions // Evidence-Based Complementary and Alternative Medicine. – 2017. – Article ID 4040254. – 6 p. – https://doi.org/10.1155/2017/4040254

17 **Ben Lamine, J., Boujbiha, M. A., Dahane, S., Cherifa, A.B., Khlifi, A., Chahdoura, H., Yakoubi, M.T., Ferchichi, S., Ayeb, N.E., Achour, L.** Alpha-

amylase and alpha-glucosidase inhibitor effects and pancreatic response of Ephedra alata decoction on Wistar rats // Environmental Science and Pollution Research International. – 2019. – Vol. 26. – P. 9739–9754. – https://doi.org/10.1007/s11356-019-04339-3

18 **Fan, Y., Li, J., Yin, Q., Zhang, Y., Xu, H., Shi, X., Li, Ch., Zhou, Y., Zhou, C.** Effect of extractions from Ephedra sinica on hyperlipidemia in mice // Experimental and Therapeutic Medicine. – 2015. – Vol. 9(2). – P. 619–625. – https://doi.org/10.3892/etm.2014.2117

19 **Andraws, R., Chawla, P., Brown, D. L.** Cardiovascular effects of Ephedra alkaloids : A comprehensive review // Progress in Cardiovascular Diseases. – 2005. – Vol. 47(4). – P. 217–225. – https://doi.org/10.1016/j.pcad.2004.07.006

20 **Wang, L., Zhao, D., Liu, Y.** GC-MS analysis of Ephedra sinica // Chemistry of Natural Compounds. – 2009. – Vol. 45(4). – P. 434–436.

References

1 **González-Juárez, D. E., Escobedo-Moratilla, A., Flores, J., Hidalgo-Figueroa, S., Martínez-Tagüeña, N., Morales-Jiménez, J., Muñiz-Ramírez, A., Pastor-Palacios, G., Pérez-Miranda, S., Ramírez-Hernández, A., Trujillo, J., Bautista, E.** A review of the Ephedra genus : Distribution, ecology, ethnobotany, phytochemistry, and pharmacological properties // Molecules. – 2020. – Vol. 25. – P. 3–37.

2 **Ivashchenko A. A.** Sokrovishcha rastitel'nogo mira Kazakhstana [Treasures of the plant world of Kazakhstan]. – Almaty : Almaty kitap, 2007. – 127 p.

3 **Ibragic, S., Sofić, E.** Chemical composition of various Ephedra species // Bosnian Journal of Basic Medical Sciences. – 2015. – Vol. 15. – No. 3. – P. 21–27. – https://doi.org/10.17305/bjbms.2015.539

4 **Harisaranraj, R., Suresh, K., Saravanababu, S.** Evaluation of the chemical composition of Rauvolfia serpentina and Ephedra vulgaris // Advances in Biological Research. – 2009. – Vol. 3(5–6). – P. 174–178.

5 **Cottiglia, F., Bonsignore, L., Casu, L., Delia Deidda, D., Pompei, R., Casu, M., Floris, C.** Phenolic constituents from Ephedra nebrodensis // Natural Product Research. – 2005. – Vol. 19(2). – P. 117–123. – https://doi.org/10.1080/14786410410001704714

6 **Hong, H., Chen, H. B., Yang, D. H., Shang, M.Y., Wang, X., Cai, Sh.-Q., Mikage, M.** Comparison of contents of five ephedrine alkaloids in three official origins of Ephedra herb in China by HPLC // Journal of Natural Medicines. – 2011. – Vol. 65(3–4). – P. 623–628. – https://doi.org/10.1007/s11418-011-0528-8

7 **Zhu, D. H., Zhang, J. K., Jia, J. F., Liu, J.-J., Wei, J.-J., Yang, M., Yang, Y., Li, M., Hao, Zh.-Y., Zheng, X.-K., Feng, W.-Sh.** Alkaloids from the stem of Ephedra equisetina // Journal of Asian Natural Products Research. – 2022. – Vol. 24. – P. 238–244.

8 **Abourashed, E. A., El-Alfy, A. T., Khan, I. A., Walker, L.** Ephedra in perspective – a current review // Phytotherapy Research. – 2003. – Vol. 17(7). – P. 703–712. – https://doi.org/10.1002/ptr.1337

9 **Krizevski, R., Bar, E., Shalit, O., Sitrit, Y., Ben-Shabat, Sh., Lewinsohn, E.** Composition and stereochemistry of ephedrine alkaloids in Ephedra sinica // Phytochemistry. – 2010. – Vol. 71(8–9). – P. 895–903.

10 **Niu, Y., Cao, Y. G., Liu, Y. L., Xu Chen, X., Li, X.-D., Ma, X.-Y., Lu, D., Zheng, X.-K., Feng, W.-Sh.** Three new flavonoid glycosides from the herbaceous stems of Ephedra intermedia // Natural Product Research. – 2024. – P. 1–7. – https://doi.org/10.1080/14786419.2024.2405993

11 **He, M., Yan, J., Cao, D., Liu, Sh., Zhao, Ch., Liang, Y., Li, Y., Zhang, Zh.** Identification of terpenoids from Ephedra combining with accurate mass and in-silico retention indices // Talanta. – 2013. – Vol. 103. – P. 116–122. – https://doi.org/10.1016/j.talanta.2012.10.018

12 **Liu, B., Akobirshoeva, A., Ghorbani, A., Boer, H.J de.** Ephedra equisetina, Ephedra intermedia, Ephedra sinica (Ephedraceae) // Ethnobotany of the Mountain Regions of Central Asia and Altai. – 2020. – Vol. 35. – P. 3–24. – https://doi.org/10.1007/978-3-030-28947-8_53.

13 **Mahmoudi, M., Boughalleb, F., Maaloul, S., Mabrouk, M., Abdellaoui, R.** Phytochemical screening and LC–ESI–MS profiling of Ephedra seeds in Tunisia // Applied Biochemistry and Biotechnology. – 2023. – Vol. 195. – P. 5903–5915. – https://doi.org/10.1007/s12010-023-04370-8

14 **Gul, R., Jan, S. U., Faridullah, S., Sherani, S., Jahan, N.** Preliminary Phytochemical Screening, Quantitative Analysis of Alkaloids, and Antioxidant Activity of Crude Plant Extracts from Ephedra intermedia Indigenous to Balochistan // The Scientific World Journal. – 2017. – https://doi.org/10.1155/2017/5873648.

15 **Zhang, B.-M., Wang, Zh.-B., Xin, P., Wang, Q.-H., Bu, H., Kuang, H.-X.** Phytochemistry and pharmacology of Ephedra // Chinese Journal of Natural Medicines. – 2018. – Vol. 16(11). – P. 811–828.

16 **Khan, A., Jan, G., Khan, A., Jan, F.G., Bahadur, A., Danish, M.** In vitro antioxidant and antimicrobial activities of Ephedra gerardiana crude extract and fractions // Evidence-Based Complementary and Alternative Medicine. – 2017. – Article ID 4040254. – 6 p. – https://doi.org/10.1155/2017/4040254

17 **Ben Lamine, J., Boujbiha, M. A., Dahane, S., Cherifa, A.B., Khlifi, A., Chahdoura, H., Yakoubi, M.T., Ferchichi, S., Ayeb, N.E., Achour, L.** Alpha-

amylase and alpha-glucosidase inhibitor effects and pancreatic response of Ephedra alata decoction on Wistar rats // Environmental Science and Pollution Research International. – 2019. – Vol. 26. – P. 9739–9754. – https://doi.org/10.1007/s11356-019-04339-3

18 **Fan, Y., Li, J., Yin, Q., Zhang, Y., Xu, H., Shi, X., Li, Ch., Zhou, Y., Zhou, C.** Effect of extractions from Ephedra sinica on hyperlipidemia in mice // Experimental and Therapeutic Medicine. – 2015. – Vol. 9(2). – P. 619–625. – https://doi.org/10.3892/etm.2014.2117

19 **Andraws, R., Chawla, P., Brown, D. L.** Cardiovascular effects of Ephedra alkaloids : A comprehensive review // Progress in Cardiovascular Diseases. – 2005. – Vol. 47(4). – P. 217–225. – https://doi.org/10.1016/j.pcad.2004.07.006

20 **Wang, L., Zhao, D., Liu, Y.** GC-MS analysis of Ephedra sinica // Chemistry of Natural Compounds. – 2009. – Vol. 45(4). – P. 434–436.

Received 13.06.25.
Received in revised form 18.06.25.
Accepted for publication 25.06.25.

**Р. И. Джалмаханбетова[1], М. Н. Бабаханова[2], Г. К. Мукушева[3]*
[1,2]Л. Н. Гумилев атындағы Еуразия ұлттық университеті,
Қазақстан Республикасы, Астана қ.;
[3]Е. А. Бөкетов атындағы Қарағанды университеті,
Қазақстан Республикасы, Қарағанды қ.
13.06.25 ж. баспаға түсті.
18.06.25 ж. түзетулерімен түсті.
25.06.25 ж. басып шығаруға қабылданды.

EPHEDRA ТУЫСЫ: БИОӘРТҮРЛІЛІК, ФИТОХИМИЯ ЖӘНЕ ФАРМАКОЛОГИЯЛЫҚ ПОТЕНЦИАЛ

Бұл шолу мақаласы Ephedra тұқымдасына жататын өсімдіктердің фитохимиялық құрамы мен биологиялық белсенділігіне қатысты отандық және шетелдік ғылыми зерттеулерді кешенді түрде талдайды. Ephedra өсімдіктері халық медицинасында ежелден қолданылып келе жатқанына қарамастан, олардың құрамындағы биологиялық белсенді қосылыстар мен фармакологиялық әсерлері ғылыми тұрғыдан тек соңғы жылдары ғана жүйелі зерттеле бастады. Мақалада Ephedra түрлерінде жиі кездесетін негізгі фитохимиялық заттар – алкалоидтар, флавоноидтар, фенолдық

қосылыстар және басқа да екінші реттік метаболиттер жан-жақты сипатталады. Бұл қосылыстардың антиоксиданттық, қабынуға қарсы, антимикробтық, иммуномодуляциялық және өзге де биологиялық белсенділіктеріне салыстырмалы талдау жүргізілген. Сонымен қатар, әртүрлі Ephedra түрлерінің химиялық құрамына талдау жасалып, олардың арасындағы ұқсастықтар мен ерекшеліктер көрсетілген. Мақала авторлары бұл өсімдіктердің табиғи терапиялық қасиеттерін атап көрсетіп, оларды жаңа фармацевтикалық өнімдерді жасау үшін болашақта қолдану мүмкіндіктерін қарастырады. Жалпы алғанда, мақала Ephedraceae тұқымдасына жататын өсімдіктердің биологиялық белсенді заттарына негізделген қолданбалы және клиникалық зерттеулер үшін ғылыми база құруды мақсат етеді.

Кілтті сөздер: Ephedraceae, Ephedra түрлері, биоәртүрлілік, химиялық құрамы, фармакологиялық қасиеттері.

**Р. И. Джалмаханбетова[1], М. Н. Бабаханова[2], Г. К. Мукушева[3]*
[1,2]Евразийский национальный университет имени Л. Н. Гумилёва,
Республика Казахстан, г. Астана;
[3]Карагандинский университет имени Е. А. Букетова,
Республика Казахстан, г. Караганда.
Поступило в редакцию 13.06.25.
Поступило с исправлениями 018.06.25.
Принято в печать 25.06.25.

РОД EPHEDRA: БИОРАЗНООБРАЗИЕ, ФИТОХИМИЯ И ФАРМАКОЛОГИЧЕСКИЙ ПОТЕНЦИАЛ

Данная обзорная статья представляет собой всесторонний анализ отечественных и зарубежных научных исследований, посвящённых фитохимическому составу и биологической активности растений рода Ephedra. Несмотря на то, что растения Ephedra издавна применяются в народной медицине, их биологически активные соединения и фармакологические эффекты начали систематически изучаться с научной точки зрения лишь в последние годы. В статье подробно рассматриваются основные фитохимические вещества, характерные для различных видов Ephedra, включая алкалоиды, флавоноиды, фенольные соединения и другие вторичные метаболиты. Проведён сравнительный анализ

антиоксидантной, противовоспалительной, антимикробной, иммуномодулирующей и другой биологической активности этих соединений. Также рассматривается химический состав различных видов Ephedra, подчёркиваются их общие черты и уникальные особенности. Авторы статьи акцентируют внимание на природном терапевтическом потенциале растений Ephedra и рассматривают перспективы их использования для создания новых фармацевтических препаратов. В целом, статья направлена на формирование научной базы для будущих прикладных и клинических исследований, основанных на биологически активных соединениях растений семейства Ephedraceae.

Ключевые слова: Ephedraceae, виды Ephedra, биоразнообразие, химический состав, фармакологические свойства.

Теруге 25.06.2025 ж. жіберілді. Басуға 30.06.2025 ж. қол қойылды.
Электронды баспа
2,57 МБ RAM
Шартты баспа табағы 10,13.
Таралымы 300 дана. Бағасы келісім бойынша.
Компьютерде беттеген А. К. Темиргалинова
Корректорлар: А. Р. Омарова, Д. А. Кожас
Тапсырыс № 4428

Сдано в набор 25.06.2025 г. Подписано в печать 30.06.2025 г.
Электронное издание
2,57 МБ RAM
Усл. п. л. 10,13. Тираж 300 экз. Цена договорная.
Компьютерная верстка А. К. Темиргалинова
Корректоры: А. Р. Омарова, Д. А. Кожас
Заказ № 4428

«Toraighyrov University» баспасынан басылып шығарылған
Торайғыров университеті
Павлодар мемлекеттік университеті
140008, Павлодар қ., Ломов к., 64, 137 каб.

«Toraighyrov University» баспасы
Торайғыров университеті
140008, Павлодар қ., Ломов к., 64, 137 каб.
8 (7182) 67-36-69
e-mail: kereku@tou.edu.kz
www.vestnik-cb.tou.edu.kz