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BIOLOGICALLY ACTIVE COMPOUNDS OF KHIVA MILKVETCH (ASTRAGALUS CHIVENSIS) GROWING IN KARAKALPAKSTAN

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Abstract

This article examines the potential biologically active compounds of Khiva milkvetch (Astragalus chivensis), a representative of the genus Astragalus L. associated with the flora of Central Asia. Particular attention is given to the phytochemical characteristics of the genus, including flavonoids, saponins, polysaccharides, phenolic compounds, and other secondary metabolites. The study also considers the ecological conditions of Karakalpakstan and their possible influence on the accumulation of biologically active substances in plant tissues. A comparative literature-based approach is used to identify the main research directions for the phytochemical investigation of A. chivensis. The article emphasizes that the chemical composition of this particular species requires experimental verification through chromatographic, spectrophotometric, and other analytical methods. The findings provide a scientific basis for further botanical and phytochemical research into the plant resources of the Aral Sea region.

Keywords: Astragalus chivensis, Khiva milkvetch, biologically active compounds, flavonoids, saponins, polysaccharides, phytochemistry, medicinal plants, Karakalpakstan, plant extracts.

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Introduction

The study of medicinal plants and their biologically active compounds is an important direction in modern botanical, pharmaceutical, and biochemical research. Natural plant resources contain various groups of secondary metabolites that participate in physiological processes, environmental adaptation, and interactions with other organisms. Among these plants, representatives of the genus Astragalus L. (Fabaceae) attract considerable scientific attention due to their taxonomic diversity and wide range of phytochemical characteristics.

The genus Astragalus is one of the largest genera of flowering plants and includes numerous annual and perennial species distributed across different climatic and geographical regions. Representatives of this genus are known to contain flavonoids, triterpenoid saponins, polysaccharides, amino acids, and phenolic compounds. These substances are of interest for pharmacognosy, phytochemistry, and the development of plant-derived preparations [1; 2].

Karakalpakstan represents a distinctive geographical region of Central Asia characterized by arid climatic conditions, high summer temperatures, limited precipitation, and considerable variation in soil salinity. These environmental factors create specific conditions for the growth and development of native plant species. The study of plants growing in this region is particularly important for understanding the relationship between environmental conditions and the formation of secondary metabolites.

Khiva milkvetch, referred to in this article as Astragalus chivensis, is considered in the context of regional botanical and phytochemical research. However, species-specific chemical information must be distinguished from the broader phytochemical knowledge available for the genus Astragalus. Therefore, the identification and quantitative determination of compounds in A. chivensis growing in Karakalpakstan remain important research tasks.

The purpose of this study is to examine the potential biologically active compound groups associated with Khiva milkvetch and to identify the main methodological and practical directions for its phytochemical investigation under the ecological conditions of Karakalpakstan.

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Literature Review

The phytochemical composition of medicinal plants belonging to the family Fabaceae has been widely studied in botanical and pharmaceutical literature. Particular attention has been devoted to the genus Astragalus because of its diversity of secondary metabolites and the potential biological properties of individual species.

Bedir et al. [3] investigated cycloartane-type triterpene glycosides isolated from species of the genus Astragalus. Their research contributed to the understanding of the chemical diversity of saponins within this botanical group. Triterpenoid saponins are considered important characteristic compounds in the phytochemical investigation of certain Astragalus species.

Flavonoids represent another important group of compounds identified in various representatives of the genus. These substances are widely studied due to their antioxidant properties and their participation in plant protection mechanisms. According to Harborne [4], flavonoids are among the major classes of plant secondary metabolites and play an important role in plant physiology and chemical ecology.

Research by Gülcemal et al. [5] and other phytochemical investigators has demonstrated the diversity of cycloartane-type saponins in selected Astragalus species. These findings highlight the importance of species-specific chemical analysis rather than assuming that all plants belonging to the same genus possess identical chemical profiles.

Polysaccharides are also considered significant components of certain Astragalus species. Their structural diversity and biological characteristics have attracted attention in pharmacological and biochemical studies [6].

Despite the available research on the genus, the phytochemical profile of Astragalus chivensis growing in Karakalpakstan requires further investigation. In particular, the identification of individual compounds, their concentrations, and their relationship with ecological conditions remain relevant scientific questions.

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Research Methodology

The research methodology is based on a comparative analysis of scientific literature concerning the phytochemical composition of the genus Astragalus L., botanical characteristics of Central Asian milkvetch species, and the ecological conditions of Karakalpakstan.

The following research methods are proposed:

1. Botanical identification: determination of the taxonomic identity of Astragalus chivensis using botanical identification keys and herbarium specimens.
2. Phytochemical screening: preliminary identification of flavonoids, saponins, phenolic compounds, and other secondary metabolites.
3. Spectrophotometric analysis: determination of total phenolic and flavonoid contents in plant extracts.
4. Chromatographic analysis: identification and separation of individual compounds using high-performance liquid chromatography (HPLC) and liquid chromatography–mass spectrometry (LC-MS).
5. Comparative analysis: evaluation of possible differences in phytochemical composition between plant samples collected from different ecological locations.

For a comprehensive investigation, plant samples should be collected separately from leaves, stems, flowers, and roots. The samples should be dried under controlled conditions and prepared for laboratory extraction.

Results and Discussion

The genus Astragalus is characterized by a diverse range of secondary metabolites. The principal compound groups of interest include flavonoids, triterpenoid saponins, phenolic acids, polysaccharides, and amino acids.

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Table 1. Major groups of biologically active compounds associated with the genus Astragalus

No.	Compound group	Representative compounds	Scientific significance
1	Flavonoids	Quercetin, kaempferol, isorhamnetin derivatives	Antioxidant activity and plant protection
2	Triterpenoid saponins	Cycloastragenol derivatives, astragalosides	Important phytochemical markers
3	Phenolic compounds	Phenolic acids and their derivatives	Antioxidant potential
4	Polysaccharides	Heteropolysaccharides and plant polysaccharide fractions	Biochemical and structural properties
5	Amino acids	Essential and non-essential amino acids	Nitrogen metabolism and plant physiology

Flavonoids are among the most important groups of plant secondary metabolites. Their chemical structures contain aromatic rings and hydroxyl groups, which contribute to their ability to participate in oxidation-reduction processes. In phytochemical research, quercetin and kaempferol derivatives are frequently investigated as markers of plant extract composition.

Triterpenoid saponins are another important group. Some species of Astragalus contain cycloartane-type saponins, which are particularly relevant in the study of the chemical diversity of this genus. The identification of such substances in A. chivensis would require chromatographic separation and structural confirmation.

Phenolic compounds are also important indicators of plant biochemical characteristics. Their concentrations may vary depending on environmental conditions, plant developmental stages, and the methods used for extraction.

Polysaccharides represent a separate area of interest because of their structural diversity. Their composition and molecular characteristics can be examined using biochemical and instrumental methods.

Influence of ecological conditions on phytochemical composition

The environmental conditions of Karakalpakstan may influence the growth, development, and biochemical characteristics of native plants. The region is

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characterized by arid climatic conditions, irregular precipitation, high summer temperatures, and varying degrees of soil salinity.

These factors can affect plant metabolism and the accumulation of secondary metabolites. For example, water availability, temperature fluctuations, and soil characteristics may influence the synthesis of phenolic compounds and flavonoids in certain plant species.

The ecological conditions of different geographical locations should therefore be considered when investigating Astragalus chivensis. Samples collected from different habitats may demonstrate variations in chemical composition, even when they belong to the same species.

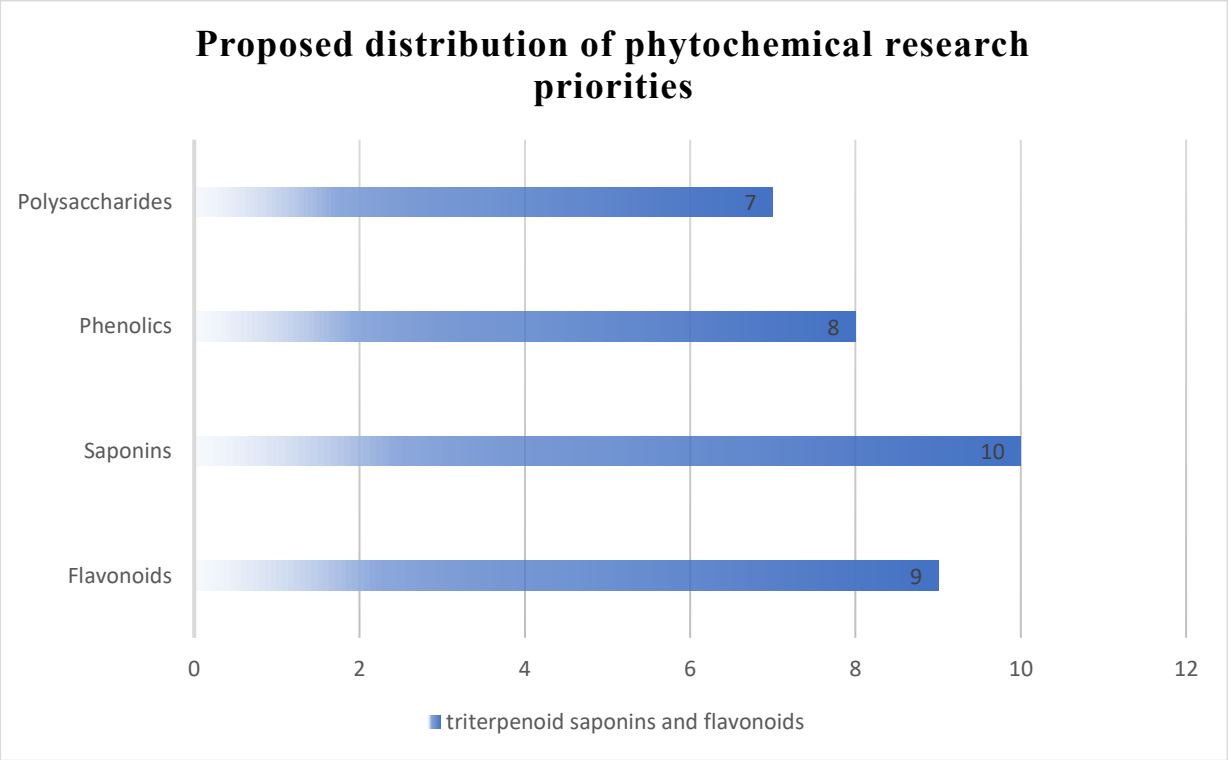


Figure 1. Proposed distribution of phytochemical research priorities

The diagram indicates that triterpenoid saponins and flavonoids deserve particular attention in the proposed phytochemical investigation. This prioritization is based on their relevance to existing research on the genus Astragalus, rather than on confirmed concentrations in Khiva milkvetch.

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Identification of specific compounds in Khiva milkvetch

An important contribution to the phytochemical study of Khiva milkvetch was made by Naubeev, Uteniyazov, Isaev and their co-authors. Their research identified the structure of cycloquivinoside A isolated from the aerial parts of Astragalus chivensis [7].

Earlier investigations also examined cyclochivinosides B, C and D from this plant. These studies demonstrate that the aerial parts of Khiva milkvetch contain structurally specific triterpenoid glycosides belonging to the cycloartane group [8; 9].

Additional evidence was provided by a 2021 study using gas chromatography–mass spectrometry (GC-MS). Researchers investigated the volatile components of six Astragalus species from Uzbekistan, including Astragalus chiwensis. The analysis identified 97 metabolites across the six species. In the volatile fraction of A. chiwensis, identified compounds accounted for 87.03% of the total composition, while (E)-2-hexenal represented 10.1% [10].

These findings provide a more specific scientific foundation for investigating Khiva milkvetch. However, volatile compounds and triterpenoid glycosides represent different chemical fractions and should be studied using appropriate analytical methods.

Table 2. Selected phytochemical findings reported for Astragalus chiwensis

No.	Compound or indicator	Reported finding	Research method
1	Cycloquivinoside A	Structure established	Structural and spectral analysis
2	Cyclochivinoside B	Previously investigated glycoside	Phytochemical isolation
3	Cyclochivinoside C	Previously investigated glycoside	Structural analysis
4	Cyclochivinoside D	Previously investigated glycoside	Structural analysis
5	(E)-2-Hexenal	10.1% of volatile fraction	GC-MS
6	Total identified volatile components	87.03%	GC-MS

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The results indicate that Khiva milkvetch is a promising subject for further chemical investigation. In particular, cycloartane glycosides deserve attention because their structures have already been investigated in this species.

The GC-MS study provides an opportunity to compare the proportion of identified volatile components in six Astragalus species growing in Uzbekistan.

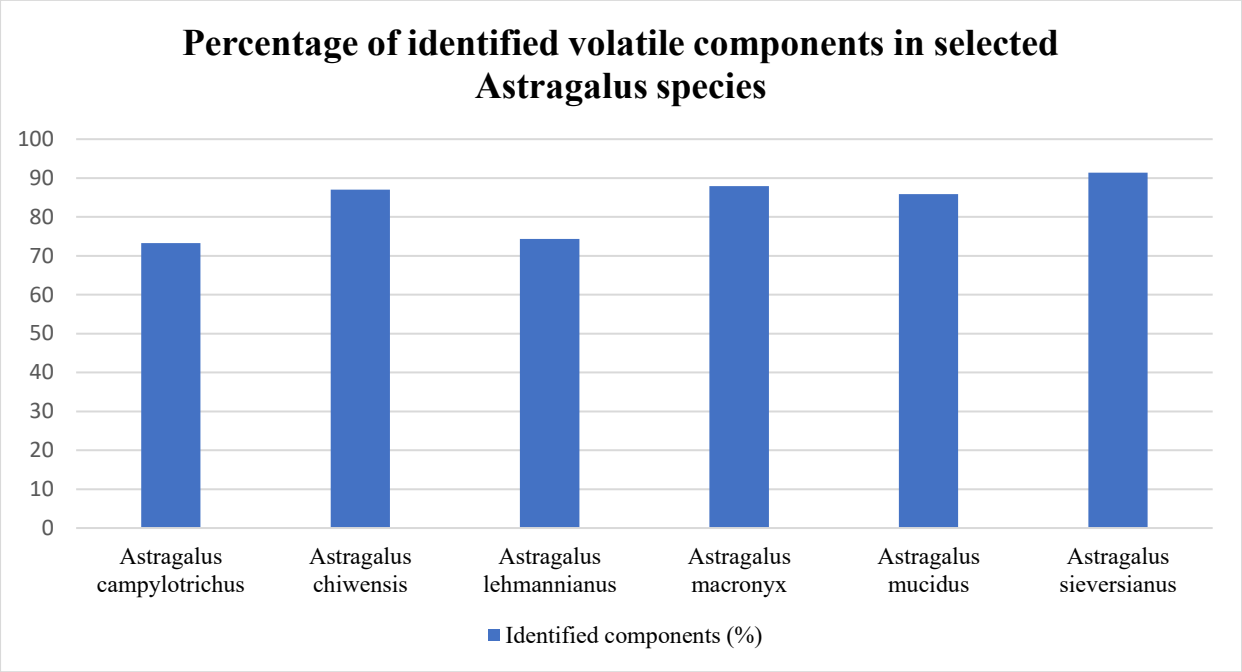


Figure 2. Percentage of identified volatile components in selected Astragalus species

The comparative results demonstrate that the identified volatile components of A. chiwensis account for 87.03% of its analyzed volatile fraction. This value is higher than the corresponding figures for A. campylotrichus and A. lehmannianus, but lower than those reported for A. macronyx, A. mucidus, and A. sieversianus.

These differences demonstrate the chemical variability of the genus and emphasize the importance of species-specific investigations.

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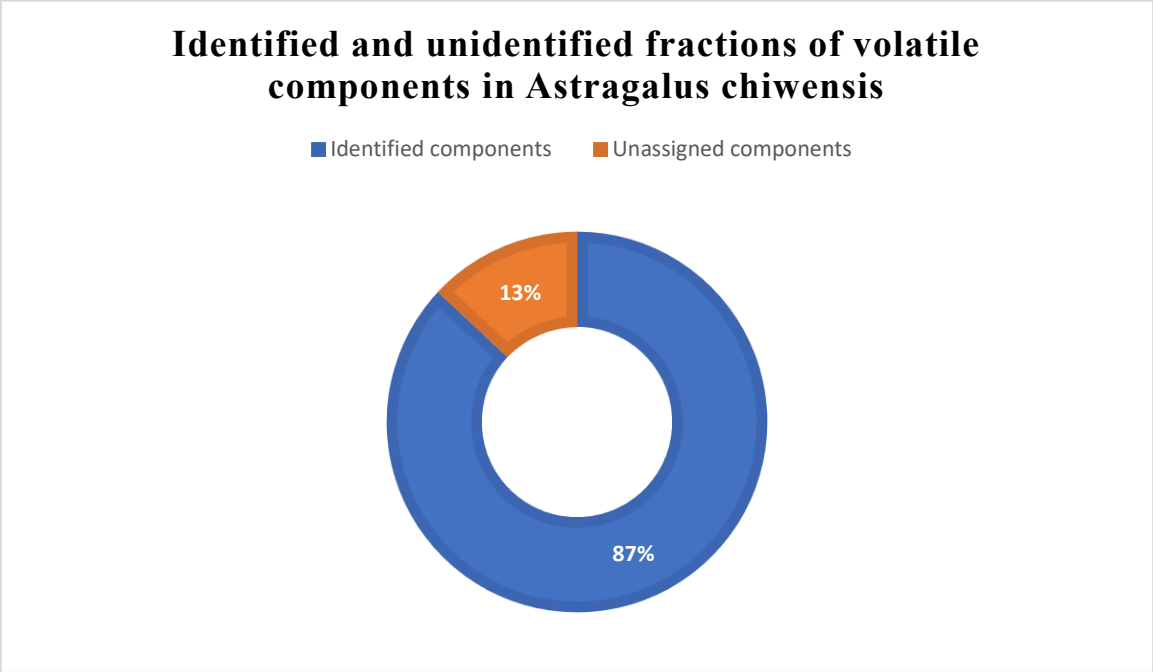


Figure 3. Identified and unidentified fractions of volatile components in Astragalus chiwensis

The pie chart demonstrates that 87.03% of the analyzed volatile fraction was attributed to identified components, while 12.97% remained unassigned in the reported analysis. This indicates the importance of further analytical research to obtain a more complete understanding of the volatile chemical composition of Khiva milkvetch.

Scientific and practical significance of the research

The phytochemical investigation of Astragalus chiwensis has scientific importance for several reasons.

First, the identification of cycloartane glycosides contributes to the understanding of the chemical diversity of the genus Astragalus. These compounds can serve as important chemical markers in comparative phytochemical research.

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Second, the investigation of volatile compounds provides information about the chemical characteristics of the aerial parts of the plant. GC-MS analysis makes it possible to identify and compare individual volatile substances.

Third, the ecological conditions of Karakalpakstan provide an interesting background for studying possible relationships between environmental factors and plant metabolism. Differences in soil characteristics, temperature, and moisture availability may influence the chemical composition of plant tissues.
Further investigations should focus on:
- determining the complete chemical profile of different plant organs;
- comparing samples collected from different geographical locations;
- studying the seasonal dynamics of secondary metabolites;
- evaluating the antioxidant properties of properly characterized extracts in laboratory conditions;
- identifying the relationship between environmental conditions and the accumulation of individual compounds.

The practical application of the plant should be considered only after appropriate studies of chemical composition, biological activity, and safety have been completed.

Conclusion

The study of biologically active compounds in Khiva milkvetch (Astragalus chiwensis) is an important direction in the investigation of the medicinal and botanical resources of Karakalpakstan.
The analysis of scientific literature demonstrates that the species contains chemically interesting substances, particularly cycloartane-type triterpenoid glycosides. Previous investigations have established the structure of cycloquivinoside A and reported research on cyclochivinosides B, C and D.
The GC-MS analysis of six Astragalus species from Uzbekistan also revealed that identified volatile components accounted for 87.03% of the analyzed volatile fraction of A. chiwensis. The compound (E)-2-hexenal represented 10.1% of that fraction.

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The main scientific conclusion is that Khiva milkvetch represents a promising object for further phytochemical research due to the previously identified cycloartane glycosides and its characterized volatile chemical fraction.

Further research should concentrate on the quantitative determination of biologically active substances, comparison of plant organs, and investigation of ecological factors influencing chemical composition. Such studies may contribute to the scientific assessment of regional plant resources and the development of a reliable phytochemical database for the flora of Karakalpakstan.

References

1. Harborne J. B. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. — 3rd ed. — London: Chapman & Hall, 1998.
2. Bruneton J. Pharmacognosy, Phytochemistry, Medicinal Plants. — 2nd ed. — Paris: Lavoisier Publishing, 1999.
3. Khalmatov K. K., Primukhamedov I., Svechnikova A. N. Phytochemical Characteristics of Some Species of Milkvetch Grown in the Uzbek SSR // Rastitel'nye Resursy. — 1979. — Vol. 15, No. 3. — P. 384–389.
4. Harborne J. B., Williams C. A. Advances in Flavonoid Research Since 1992 // Phytochemistry. — 2000. — Vol. 55. — P. 481–504.
5. Bedir E., Calis I., Aquino R., Piacente S., Pizza C. Cycloartane Triterpene Glycosides from Astragalus Species. — Phytochemical investigations.
6. Naubeev T. Kh., Uteniyazov K. K. Structure of Cyclochivinoside C from Astragalus chivensis // Chemistry of Natural Compounds. — 2007. — No. 5.
7. Naubeev T. Kh., Uteniyazov K. K., Isaev M. I., Kachala V. V., Shashkov A. S. Structure of Cycloquivinoside A from the Aerial Part of Astragalus chivensis // Chemistry of Natural Compounds. — 2012. — Vol. 48, No. 5. — P. 810–812. — DOI: https://doi.org/10.1007/s10600-012-0389-8.
8. Naubeev T. Kh., Uteniyazov K. K., Tlegenov R. T., Uteniyazov K. U. Structure of Cyclochivinoside D from the Aerial Part of Astragalus chivensis // Uzbek Chemical Journal. — 2008. — No. 2.

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Volume 2, Issue 11, November 2026
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9. Naubeev T. Kh., Uteniyazov K. K., Kachala V. V., Shashkov A. S. Cyclochivinoside B from the Aerial Part of Astragalus chivensis // Chemistry of Natural Compounds. — 2007. — No. 2.
10. Gad H. A., Mamadalieva N. Z., Böhmdorfer S., Rosenau T., Zengin G., Mamadalieva R. Z., Al Musayeib N. M., Ashour M. L. GC-MS Based Identification of the Volatile Components of Six Astragalus Species from Uzbekistan and Their Biological Activity // Plants. — 2021. — Vol. 10, No. 1. — Article 124. — DOI: https://doi.org/10.3390/plants10010124.
11. Chamberlain D. F., Matthews V. A. Astragalus L. // Flora of Turkey and the East Aegean Islands. — Edinburgh: Edinburgh University Press.
12. Polhill R. M. Classification of the Leguminosae // Advances in Legume Systematics. — Kew: Royal Botanic Gardens, 1981.
13.World Flora Online. Astragalus chiwensis Bunge. URL: https://www.worldfloraonline.org/
14. Royal Botanic Gardens, Kew. Plants of the World Online: Astragalus chiwensis Bunge. URL: https://powo.science.kew.org/
15. National Center for Biotechnology Information. NCBI Taxonomy: Astragalus chiwensis. URL: https://www.ncbi.nlm.nih.gov/Taxonomy/