Aegopodium L. is a perennial plant of the Apiaceae family, growing in the mountainous regions of Europe, Siberia, the Caucasus, Kazakhstan and Central Asia. The genus Aegopodium L. includes seven species. Two species grow in Kazakhstan: Aegopodium podagraria L. and Aegopodium alpestre Ledeb. Goutweed (Aegopodium podagraria L.) as a medicinal plant for the treatment of podagra and rheumatism has been used since ancient times. But the biological and phytochemical characteristics of Aegopodium podagraria L. and Aegopodium alpestre Ledeb are very little studied.

Our article presents the results of a comparative study of the anatomical and morphological structures of the underground organs of the two above-mentioned medicinal plants, as well as the determination of the moisture, ash and extract content of their raw materials.

Plants were collected during the flowering period (in early July) 2017 in the big Almaty gorge (GPS coordinates of the initial point of the gorge: 43.136976, 76.903267. Height over sea level of 1500 – 2500 m).

As a result of morphological study of underground organs of Aegopodium podagraria L. and Aegopodium alpestre Ledeb. it is revealed that the roots in the form of lobes are formed on horizontal rhizomes. On the cross section of the anatomical root of both plants diarсh. In the primary bark, as well as between the xylem rays accumulate starch grains. Biometric measurements of the root showed that, the indicators of Aegopodium podagraria L. are higher than, Aegopodium alpestre Ledeb.

The humidity of underground organs of Aegopodium podagraria L. Aegopodium alpestre Ledeb. does not exceed the values of this indicator for pharmaceutical samples. The ash content of underground organs of Aegopodium podagraria L is 1.5 times lower than that of Aegopodium alpestre Ledeb., and the extractivity of both plants is high (25.37 ± 6.91% and 28.13 ± 4.95%, respectively).

Key words: goutweed (Aegopodium podagraria L.), Aegopodium alpestre Ledeb., medicinal plants, xylem, phloem, ash content, extractivity.

Aegopodium L. – Europa, Сибир, Кавказ, Қазақстан мен Орталық Азияның таулы аймақтарында кездесетін, Apiaceae туқымдасының жататын қалпыңдық қауіпсіздік есімдік. Бұл тұрғылы жатып тұратын бар, сондықтан ағымда Aegopodium podagraria L. және Aegopodium alpestre Ledeb. деген екі түрі орны.

Кәдімгі бежір (Aegopodium podagraria L.) подагра мен ревматизмді емдеуде колданылатын қалпыңдық есімдік ретінде антикалық кезеңиң бери бетілі. Дегенмен, Aegopodium podagraria L. және Aegopodium alpestre Ledeb. есімдіктерінің биологиялық және фитохимиялық әрекетеліктері туралы зерттеулердің жоқтығы қасы дәректе болады.

Біздің мақаламызда жатқан дәрілік есімдіктерінің жерасты мүшелерінің анатомо-морфологиялық зерттеулері, сондықтан қатар олардың қызілқатарлығын
Introduction

Plant materials are used throughout the developed and developing world as home remedies, in over-the-counter drug products, and as raw material for the pharmaceutical industry, and they represent a substantial proportion of the global drug market [1]. So for the formation of a stable raw material base of the domestic pharmaceutical industry and the creation of new phytopreparations, priority is given to the study of Pharmacopoeia, vicar (substituting) and promising plant species in the regions of Kazakhstan. One of the most promising medicinal plants are the genus Aegopodium L. On the territory of Kazakhstan the genus Aegopodium represented by two species  – *Aegopodium podagraria* L. and *Aegopodium alpestre* Ledeb. [2].

As a medicinal raw material from the field of view of official medicine, the dream fell out more than 150 years ago. Book about medicinal plant, it again began occasionally to appear only since the late 50-ys of the last century. In addition, all
this despite the fact that the excellent taste properties of ordinary goutweed connoisseurs of the green world valued at all times (the first mention of the goutweed is in the manuscript, dating from the XII century.). At the same time, folk medicine has never excluded this plant from its healing agents. But only biochemical and applied research of recent decades have been able to justify the biological effect of edible dreams (as it was called in the middle of the 19th century) [3].

_Aegopodium podagraria_ L. contains many vitamins and microelements, as well as umbelliferosis, glucose, fructose, cyclitol, essential oil, umbelliferone, choline, falcarinolone, falkarinone, falkarinol, falcarindiol, phenolcarboxylic acids and their derivatives, coumarins, higher aliphatic hydrocarbon pentadecane, beta-sitosterol, tereductra, flavonoids. The herb contains a lot of vitamin C, especially in autumn (65-100 mg%), [4, 5]. Gas chromatography-mass spectrometry identified more than 20 volatile organic compounds isolated from leaves ans flowers of _Aegopodium podagraria_ L. [6].

In studies of Tovchiga O. V. et al. it is shown that the extract and tincture goutweed normalize lipid composition of liver in rats with impaired lipid and carbohydrate metabolism, caused by protamine sulfate and atherogenic diet [7].

In the works of some authors [2] it is mentioned that _Aegopodium podagraria_ is a part of drugs for the prevention and treatment of oncological diseases.

_Aegopodium podagraria_ is used as a sedative in traditional medicine. The effect of its aerial part extract and tincture goutweed normalize lipids of liver in rats with impaired lipid and carbohydrate metabolism, caused by protamine sulfate and atherogenic diet [7].

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weighing of the raw material was carried out after 3 hours.

The method of determining the ash content is based on the determination of the incombustible residue of inorganic substances remaining after burning and piercing the raw material. To determine the total ash, a weight of 1 g was taken. Raw materials in the crucible were carefully charred over the weak flame of a gas burner. After the raw material was completely charred, the crucible was transferred to a muffle furnace for burning coal and completely calcining the residue at a temperature of 550°C. At the end of the calcinations, the crucible was cooled for 2 hours, then put into desiccators, at the bottom of which is anhydrous calcium chloride, cooled and weighed.

To determine the content of extractive substances, an analytical sample of the raw material was ground and sifted through a sieve with holes 1 mm in diameter, after which a weight of 1 g was selected.

A portion of the raw material is placed in a conical flask, 50 cm³ of 80% ethanol is poured in, the flask is closed with a stopper, weighed with an error of no more than 0.01 g, and left for 1 hour. Then the flask is connected to a reflux condenser, heated to boiling and maintain a weak boil for 2 hours. After cooling, the flask with the contents is again closed with the same stopper, weighed and the weight loss is supplemented with the same solvent (80% ethanol). The contents are thoroughly shaken and filtered through a dry paper filter into a dry wab with a capacity of 150-200 cm³. 25 cm³ of the filtrate is pipetted into a porcelain dish with a diameter of 7-9 cm, pre-dried on an analytical balance, evaporated in a water bath to dryness, dried at 105°C for 3 hours, then cooled for 30 minutes in a desiccator, at the bottom of which is anhydrous calcium chloride and weighed.

Results and discussion

*Aegopodium podagraria* L. and *Aegopodium alpestre* Ledeb. – perennial herbaceous plants of the Apiaceae family. In Kazakhstan, *Aegopodium podagraria* L. occurs in the middle mountains from Altai to the Western Tien Shan, the *Aegopodium alpestre* Ledeb. occurs along the northern slopes of the Altai Mountains to the Western Tien Shan. Roots formed on a horizontal rhizome as fibrous (1-figure).

Anatomical features of the underground organs of the plant *Aegopodium* L.

Adhering to the methodical instruction, the transverse sections of the underground organs were carried out in the flowering phase, since it is in this phase that the structural anatomical elements of the plant organs have the greatest integrity.

![Figure 1 – Aegopodium podagraria L. (A) and Aegopodium alpestre Ledeb. (B)](image-url)
Under the epiblema of the root is the primary cortex, which surrounds the central cylinder in the form of a wide ring. It consists of exoderm, mesoderm and endoderm. Multilayer mesoderm is represented by rounded cells with numerous intercellular spaces. The rounded parenchymal cells with slightly thickened walls are located more or less regular concentric layers. In the cells of Aegopodium podagraria L. a lot of starch grains. The endoderm consists of a single layer of densely closed cells with horseshoe-shaped thickenings. Outside, the central cylinder is surrounded by a pericycle (Figure 2).

As can be seen, the anatomical structure of the roots of Aegopodium plants is the same as in dicotyledons.

In dicotyledonous plants, the primary structure is replaced by the secondary. These changes occur as a result of the emergence of two educational tissues: cork cambium and cambium. Cork cambium forms periderm. The primary cortex is exfoliated. Cambium forms a secondary phloem and xylem, therefore the roots of dicotyledonous plants are able to grow in thickness.

As can be seen from the 2-figure, in both species of plants pitch passages are well expressed, their size in Aegopodium podagraria L. is larger than Aegopodium alpestre Ledeb.

As can be seen from table 1, the biometric indicators of the anatomical structure of the root of Aegopodium podagraria L. were higher than Aegopodium alpestre Ledeb. Thus, the thickness of the anatomical cross section of the root is 1.4 times thicker (1886.71 ± 1.95 μm and 1357.99 ± 4.73 μm, respectively), the diameter of the central cylinder is 1.7 times larger (483.62 ± 1.40 μm and 287.21 ± 1.56 μm, respectively), the thickness of the first crust is 1.3 times thicker (397.8 ± 1.02 μm and 307.04 ± 0.66 μm, respectively), the thickness of the periderm does not make a big difference observed (28.22 ± 0.22 μm and 26.94 ± 0.39 μm).

To obtain drugs can only be used benign raw materials. On this basis, quality indicators were established for the studied plant materials (table 2).

From the data given in the 2-table, it follows that the humidity of the underground organs of Aegopodium podagraria L. (5.36 ± 0.25%) and Aegopodium alpestre Ledeb. (5.2 ± 0.14%) does not exceed the values of this indicator for pharmaceutical-based samples, the tolerable limit of which is usually in the range of 12-15%. Humidity is one of the important numerical indicators of raw materials, which is understood as its loss in weight due to the removal of hygroscopic moisture and volatile substances. Determine the moisture content in the raw material by drying it to constant weight. Medicinal plant raw materials should not contain moisture above the permissible norms, since conditions for reducing its quality are created under high humidity during storage.
Table 1 – Biometric indicators of the anatomical structure of the root of plants of the genus Aegopodium L.

<table>
<thead>
<tr>
<th>Plant species</th>
<th>Root thickness, mkm</th>
<th>Central cylinder, mkm</th>
<th>The thickness of the primary cortex, mkm</th>
<th>Periderm thickness, mkm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aegopodium podagraria L.</td>
<td>1886,71±1,95</td>
<td>483,62±1,40</td>
<td>397,8±1,02</td>
<td>28,22±0,22</td>
</tr>
<tr>
<td>Aegopodium alpestre Ledeb.</td>
<td>1357,99±4,73</td>
<td>287,21±1,56</td>
<td>307,04±0,66</td>
<td>26,94±0,39</td>
</tr>
</tbody>
</table>

Table 2 – Indicators of the chemical properties of raw materials Aegopodium L.

<table>
<thead>
<tr>
<th>№</th>
<th>Indicators</th>
<th>Aegopodium podagraria L.</th>
<th>Aegopodium alpestre Ledeb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Humidity, %</td>
<td>5,36±0,25</td>
<td>5,2±0,14</td>
</tr>
<tr>
<td>2</td>
<td>Ash content, %</td>
<td>8,58±0,18</td>
<td>13,24±0,16</td>
</tr>
<tr>
<td>3</td>
<td>Extract, %</td>
<td>25,37±6,91</td>
<td>28,13±4,95</td>
</tr>
</tbody>
</table>

The next important indicator of the raw material is the determination of its ash content. The ashes of plant raw materials is called the residue of inorganic substances, obtained after burning and subsequent piercing of the residue to constant weight. The amount of ash in vegetable raw materials varies within certain limits and depends both on the specifics of the raw material itself, and on the method of its collection and drying conditions. As can be seen from figure 3, the ash content of the underground organs of Aegopodium podagraria L. (8.58 ± 0.18%) is 1.5 times lower than Aegopodium alpestre Ledeb. (13.24 ± 0.16%).

To carry out the extraction, we took a portion of the crushed raw material weighing 1 g with an accuracy of up to 0.0001 g. 80% ethyl alcohol was used as a solvent. From the analysis presented in table 2 of the data, it can be seen that the extract in the underground organs of Aegopodium podagraria L. and Aegopodium alpestre Ledeb. high: 25.37 ± 6.91% and 28.13 ± 4.95%, respectively.

Figure 3 – Comparative content of moisture, ash and extract content of raw materials of Aegopodium podagraria L. and Aegopodium alpestre Ledeb.
**Conclusion**

The ground elder (Aegopodium podagraria L.) is a perennial plant that has been known and used in folk medicine for centuries. The interest in herbs has increased in recent years [23]. Thus, the obtained results of the study of the underground organs of plants of the genus Aegopodium L. replenishing biological and phytochemical data, makes it possible to determine the pharmacological qualities of plants.

**Conflict of interest**

All authors have read and are familiar with the content of the article and do not have a conflict of interest.

**Acknowledgements**

The authors of the article are grateful to Azimbayeva Gulbayra and Kuzhantaeva Zheniskul for valuable recommendations on writing the article.
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