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NEW POSSIBILITIES OF USING *ACORUS CALAMUS* L. IN PHYTOTHERAPY AS A MEDICINAL PRODUCT

Actuality. *Analysis of the literature indicates that many recent studies have focused on investigating the sweet flag medicinal and remediative properties. Data have emerged regarding the sweet flag rhizomes antitumor activity (Sharma, 2024). Notably, a 2024 study demonstrated that certain components of sweet flag medicinal raw material act as inhibitors of SARS-CoV-2 virus proteases (Huang, 2024). Reports on the antibacterial and sedative properties of this plant also continue to appear.*

At the same time, there is a scarcity of data in the literature concerning the anxiolytic activity of sweet flag rhizomes, as well as its cytostatic, litholytic, hemagglutinating, and remediative activities. In this context, research into the medicinal and anxiolytic properties of this officinal plant remains a relevant direction in medical botany.

Aim. The study of the sweet flag rhizomes aqueous extract effects on reactive anxiety and such indicators well-being as feeling, activity, and mood of students during the educational process – as well as the investigation of the hemagglutinating, lytic, cytostatic, antibacterial, and remediative activities of sweet flag in relation to lead.

Material and methods. *The change in anxiety levels among students was recorded using the Spielberger-Khanin method, and the change in psycho-emotional background was assessed with the FAM questionnaire. Hemagglutinating activity was studied using the Antonyuk method, while litholytic activity was determined by observing changes in the mass of calculi placed in a lectin-containing medium in vitro. Cytostatic activity was assessed by observing the activity of the meristem of cucumber seedling pericycle. Antibacterial activity was studied using the disc-diffusion method. Remediator activity was investigated using the voltamperometric method.*

Research results. *Psychological test results classify calamus raw material as a calming agent that improves feeling and mood while significantly reducing anxiety on 12%. Experiments on the hemagglutinating activity of Acorus calamus lectin extract show low agglutination titers, indicating sweet flag rhizomes are non-toxic for ABO blood groups. The lectin-containing extract exhibited litholytic activity only*

against phosphates. The cytostatic activity of sweet flag rhizomes aqueous extracts depends on concentration: at ≤250 mg/ml, it acts as a proliferation stimulator; at higher concentrations, it becomes a proliferation inhibitor. This aligns with data from multiple authors proposing Acorus calamus as an antitumor agent. The Acorus calamus rhizomes aqueous extract demonstrated antibacterial activity against all tested bacteria, with Staphylococcus aureus (the braking zone was 13 mm) and Pseudomonas aeruginosa (the braking zone was 14 mm) being most sensitive. Experiments confirmed Acorus calamus absorbs 18,7% of lead from heavy metal-contaminated water.

Conclusion. *The conducted experiment allows for the characterization of sweet flag as a phytotherapeutic medicinal agent with anxiolytic activity that improves mood and well-being and reduces activity. It was demonstrated that the lectin-containing extract of sweet flag has low hemagglutinating activity and exhibits litholytic activity only with respect to phosphates. Sweet flag also possesses antibacterial, antitumor, and remediator activities.*

Key words: *Acorus calamus, hemagglutinating, lytholytic, cytostatic, antibacterial activity.*

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НОВІ МОЖЛИВОСТІ ВИКОРИСТАННЯ *ACORUS CALAMUS* L. ЯК ЛІКАРСЬКОГО ЗАСОБУ

Актуальність. *Аналіз літературних даних дозволяє зробити висновок, що багато досліджень останніх років присвячено вивченню лікарських і ремедіаторних властивостей лепехи звичайної. З'явилися дані щодо протипухлинної активності кореневищ лепехи (Sharma, 2024). Також привертає увагу робота 2024 року, де доведено, що деякі компоненти лікарської сировини лепехи виступають інгібіторами протеаз вірусу SARS-Cov-2 (Huang, 2024). Також продовжують з'являтися повідомлення щодо антибактеріальних і заспокійливих властивостей цієї рослини. Водночас у літературі обмаль даних щодо протитривожної активності кореневищ лепехи та щодо її цитостатичної, літолітичної, гемаглютинувальної та ремедіаторної активності. У зв'язку із цим актуальним напрямом медичної ботаніки залишаються дослідження лікарських і протитривожних властивостей офіцинальної рослини.*

Мета дослідження *– вивчення впливу водного екстракту з кореневищ лепехи звичайної на реактивну тривожність і показники – самопочуття, активність і настрій студентів під час навчального процесу, а також вивчення гемаглютинувальної, літолітичної, цитостатичної, антибактеріальної та ремедіаторної, щодо свинцю, активності лепехи.*

Матеріал і методи. *Зміна стану тривожності студентів фіксувалася методом Спілбергера – Ханіна, а зміна психоемоційного фону – за допомогою анкети САН. Гемаглютинувальна активність вивчалася за методикою Антонюка, а літолітична – шляхом спостереження за зміною маси конкрементів, які перебували в лектиновмісному середовищі in vitro. Цитостатична – шляхом спостереження за активністю меристеми перицклу проростків огірка. Антибактеріальна активність вивчалася диско-дифузійним методом. Ремедіаторна активність досліджувалася вольтамперометричним методом.*

Результати дослідження. *Результати психологічних тестів дозволяють класифікувати сировину лепехи як заспокійливий засіб, що зменшує тривожність та підвищує показники самопочуття і настрою, достовірно зменшує показники тривожності на 12%. Експеримент з вивчення гемаглютинувальної активності лектинової витяжки лепехи свідчить, що титри аглютинації не мають великих значень, що дозволяє розглядати кореневище лепехи звичайної як нетоксичний продукт для носіїв усіх груп крові. Лектиновмісний екстракт кореневищ лепехи звичайної виявив літолітичну активність лише щодо фосфатів. Цитостатична активність водних екстрактів лепехи звичайної залежить від концентрації останніх. За концентрації до 250 мг/мл лепеха виступає стимулятором проліферації, а в разі збільшення концентрації екстракту останній демонструє властивості інгібітора проліферації. Останній факт збігається з даними багатьох авторів, які пропонують використовувати лепеху звичайну як протипухлинний засіб. Водний екстракт кореневищ лепехи звичайної виявив антибактеріальну активність щодо всіх досліджуваних бактерій. Найбільш чутливими виявилися Staphylococcus aureus (зона гальмування – 13 мм) та Pseudomonas aeruginosa (зона гальмування – 14 мм). Експериментально показано, що лепеха звичайна поглинає 18,7% свинцю з води акваторії, забрудненої свинцем.*

Висновок. *Проведений експеримент дозволяє схарактеризувати лепеху звичайну як фітотерапевтичний лікарський засіб із протитривожною активністю, який покращує настрій і самопочуття, знижує активність. Було продемонстровано, що лектиновмісний екстракт лепехи звичайної має низьку гемаглютинувальну активність і проявляє літолітичну активність лише щодо фосфатів. Також лепеха звичайна має антибактеріальну, протипухлинну та ремедіаторну активність.*

Ключові слова: *Acorus calamus, гемаглютинувальна, літолітична, цитостатична, антибактеріальна активність.*

Introduction. Actuality. Although sweet flag (*Acorus calamus* L.) is an official medicinal plant, its therapeutic properties continue to be studied, as evidenced by the extensive emergence of new publications. The search for new medicinal plants for both phytopreparations and the production of food and biologically active supplements is a pressing issue today.

Sweet flag (*Acorus calamus*) is a plant with a wide range of medical applications. The sweet flag rhizome is used as a bitter tonic to improve digestion. The essential oil of sweet flag is an ingredient in the preparation Olimetin, which is used as a choleretic agent. The rhizome powder is a component of the preparation Vikair. A decoction of the rhizome enhances hydrochloric acid secretion in the stomach (Kongkham, 2024). In folk medicine, the rhizome is recommended for use in cases of anemia, diseases of the gallbladder and kidneys. In Tibetan medicine, the rhizome is used as a tonic.

Sweet flag rhizomes are also used as a food ingredient. According to Amrit Devi Hwaikham (Hwaikham, 2018), sweet flag raw material is used to treat neuralgia, diarrhea, dyspepsia, kidney and liver problems, eczema, sinusitis, fever, and bronchitis. Numerous reports confirm the nutritional and medicinal properties of common sweet flag. Huang Y. experimentally demonstrated that common sweet flag has antiviral activity against SARS-CoV-2. He studied eight active components of the plant material and concluded that sweet flag extracts contain compounds that inhibit the activity of viral proteases (Huang, 2024).

Several authors have demonstrated the cytotoxicity of sweet flag rhizome methanolic extracts using the *Allium cepa* root assay. The results of this study indicate that sweet flag may serve as a potential source for the development of antitumor drugs (Rajkumar, 2009).

Rahamooz Haghighi showed that extracts of *Acorus calamus* have antiproliferative and antiangiogenic effects on cancer cells (Haghighi, 2017).

The pharmacological action of sweet flag rhizome is classified by authors as sedative, central nervous system depressant, anticonvulsant, spasmolytic, hypolipidemic, immunosuppressive, anti-inflammatory, cryoprotective, antioxidant, antimicrobial, antitumor, and antidiabetic. At the same time, there are data regarding the genotoxicity and mutagenicity of beta- and alpha-asarone, which limits their use.

Pranav Haran and co-authors report that among the sweet flag biochemical components, the predominant bioactive substances are alpha- and beta-asarone. sweet flag rhizomes contain up to 5% essential oil, which includes: α-pinene, camphene, camphor, borneol, α-calamen, acorone, eugenol, asarone, caryophyllene, calarene, proazulene, guaiene, acorin, calamin, curcumin, neocaren, and tannins (Haran, 2024). The rhizomes contain glycoside acorin, terpenoids, aliphatic aldehydes, ketones, and alcohols. The leaves contain tannins and essential oil, while the plant material contains starch, choline, and the glycoside lucenin.

These same authors showed the antioxidant activity of sweet flag, which approached that of standard ascorbic acid. The rhizome extract in dimethyl sulfoxide demonstrated a significant inhibition zone for *Streptococcus mutans* and *Pseudomonas aeruginosa* (Joshi et al., 2016).

Bhuani Kongkham showed that asarone (asarone is component of *Acorus calamus*) provides antibacterial action against *Escherichia coli*, *Pseudomonas aeruginosa*, and *Bacillus cereus*. The research authors demonstrated that this disrupts membrane integrity and increases their permeability (Kongkham, 2024).

R. Joshi showed significant bactericidal and fungicidal activity of sweet flag essential oil against *Micrococcus luteus, Aspergillus niger,* and *Aspergillus fumigatus* (Joshi et al., 2016).

Vikas Sharma emphasized that sweet flag rhizome acts as a rejuvenating agent for the brain and nervous system, capable of improving memory and intellect. Sweet flag rhizomes are used in the treatment of epilepsy and mental disorders (Sharma et all, 2014).

Some authors have demonstrated the hepatoprotective properties of *Acorus calamus* (Samoilov, Hnatiuk, 2024; Derimedved et al., 2020).

Our previous works also investigated the medicinal properties of *Acorus calamus*, but some experimental results required additional elaboration (Мегалінська та ін., 2012, с. 101–106).

Thus, the medicinal properties of sweet flag require further scientific research.

The aim of the study was to study of the sweet flag rhizomes aqueous extract effects on reactive anxiety and such indicators well-being as feeling, activity, and mood of students during the educational process – as well as the investigation of the hemagglutinating, lytic, cytostatic, antibacterial, and remediative activities of sweet flag in relation to lead.

Materials and research methods. Raw materials of sweet flag rhizomes were harvested in late autumn on the Desna River (Kyiv region) in late autumn 2023. Ukraine is among the countries with significant reserves of sweet flag raw material, but a number of publications have raised concerns about the reduction of this plant's natural stocks. Meanwhile, the literature discusses the advisability of introducing sweet flag into cultivation (Яременко та ін., 2018).

To study the effect of sweet flag tea on situational anxiety, the Spielberger-Hanin anxiety scale was used. The level of anxiety was measured by points, according to the gradation of points: up to 30 points – low; 31–44 points – moderate; from 45 high. To study the effect of *Acorus calamus* rhizomes aqueous extract on feeling, activity and mood, the well-being test was used. (Lemak, Petriche, 2012). The control group received placebo in the form of 150 ml of boiled tap water. 20 students from Mykhailo Dragomanov Ukrainian State University participated in the experiment. The studies were conducted with the consent of the informed students and in accordance with the rules approved by the Ethics Committee.

Lectins were extracted using the Antonyuk method, yielding lectin-containing extracts (Antonyuk, 2005, p. 20–21). One volume of sweet flag crushed dry rhizome was poured with 9 volumes of 0,9% NaCl. After that, the mixture was shaken on a shaker (KJ-201BD) for 2 hours and filtered. The aqueous extract was obtained in concentration 50 mg/ml, accordance with the rules approved by the Ethics Committee.

Hemagglutinating activity was investigated according to the Jefferson Muniz de Lima method (de Lima et al., 2015, p. 1–6). Blood from carriers of ABO blood groups was centrifuged at 1 200–1 500 rpm 15 minutes. Then, a 2% solution of erythrocytes in phosphate buffer was obtained, which was broken into 50 µl wells of an immunological plate. Then 50 µl of lectin-containing substrate was added to the first well of the plate and mixed, then 50 µl from the first well to the second, from the second to the third, etc. So, the lectin was diluted 2, 4, 8, 16, 32, etc. times. After 2 hours of incubation, the titer was determined as the maximum diluted extract at which agglutination was observed. Experiment performed in three times.

Litholytic activity was studied according to Zheltovska's method (Zheltovskaya, 2018). According to Zheltovska's method, stones that were removed from the genitourinary system of people were placed in Acorus calamus aqueous and lectin extracts. The stones were dried and weighed weekly. The stones were kindly provided by the DU "Institute of Urology named after academic O.F. Vozianov". To determine the chemical composition of kidney stones, the infrared spectroscopy method was used on the UR-20 device (Carl Zeiss, Germany). This method allows studying the composition and quantitative ratios of complex components of kidney stones by the number, position, and intensity of light absorption bands on the spectrogram of the sample in the range of 4 000–400 cm-1. The control solution was 0,9% NaCl solution. The experiment was conducted in 3 mathematical and 3 biological replicates. The speed of dissolution was calculated according to the formula (Yachi et al., 2018).

A% = ((m initial (g) – m final (g))/m initial (g)) x 100%, where A% is the rate of stone dissolution before and after incubation with a plant substrate; m initial and m final are mass before and after incubation in lectins contained solution.

Cytostatic activity was studied by the method of V.B. Ivanov in the modification of G.P. Megalinska (Megalinska, 2020, p. 20–21). In this method, cucumber seedlings are used as a model of cancer cells. In plants of the Cucurbita-

ceae family, lateral roots arise as a result of mitotic divisions, so their number indicates the intensity of cell division.

First, 5 g crushed dry Acorus calamus rhizome was poured with 100 ml of boiling water. After cooling, the resulting infusion was filtered and a series of dilutions was prepared, in which the concentration of the substance ranged from 50 mg/ml to 500 mg/ml. 10 ml of a solution of a certain concentration and 10 seeds were placed in Petri dishes was added. Seeds grown in distillated water served as the control. All experimental variants were performed three times.

Sweet flag antibacterial activity of was studied by the disk-diffusion method, while the water fractions were investigated (Valgas, 2007). Disks (5 mm) moistened with the test substance were placed on a nutrient medium that was contaminated with microorganisms. The test microorganisms were: Escherichia coli Migula 1985, Staphylococcus aureus Castellani and Chalmers 1919, ATCC 25922, Proteus vulgaris Hauser 1885, ATCC 6896, Pseudomonas aeruginosa Schroeter 1872, ATCC 9027, Bacillus subtilis 1986, HU58, Bacillus cereus 1985, ATCC 4342 and yeast Candida albicans C.P. Robin, Berkhout 1923, ATCC 885-653. All microorganisms were obtained from the Ukrainian Collection of Microorganisms of the Institute of Microbiology and Virology named after D.K. Zabolotny of the National Academy of Sciences of Ukraine. The experiment was repeated in 5 mathematical and 3 biological replicates.

Remediation activity was determined by determining the lead concentration by voltammetry in model boxes.

A transdisciplinary approach was used to comprehensively study the properties of Sweet flag (Stryzhak, Dovgy, 2020).

Research results and their discussion. Since the pharmacological action of *Acorus calamus* is classified by several authors (Sharma et al., 2014) as a restorative agent for the nervous system, which can improve memory as well as have a calming and antispasmodic effect, we conducted an experiment to determine situational anxiety in a group of students before and after consuming tea made from *Acorus calamus* rhizomes during the educational process. The control group received a placebo in the form of 150 ml of water. The second measurement of situational anxiety was carried out one hour after taking the decoction.

The results of the situational anxiety study are presented in fig. 1.

According to the results of the study, before taking the placebo or *Acorus calamus* rhizome, about 10% of respondents in both groups had a low level of anxiety, about 60% of respondents had a moderate level of anxiety, and 30% of respondents had a high level of anxiety. After taking the placebo, the level of anxiety in the respondents did not change significantly. However, in the group that consumed *Acorus calamus* rhizomes aqueous extract, anxiety decreased by 12%. Thus, our data coincide with the findings of Sandip B. Rajput et al., who demonstrated that *Acorus calamus* rhizomes have a calming, central nervous system-suppressing effect (Rajput et al., 2024).

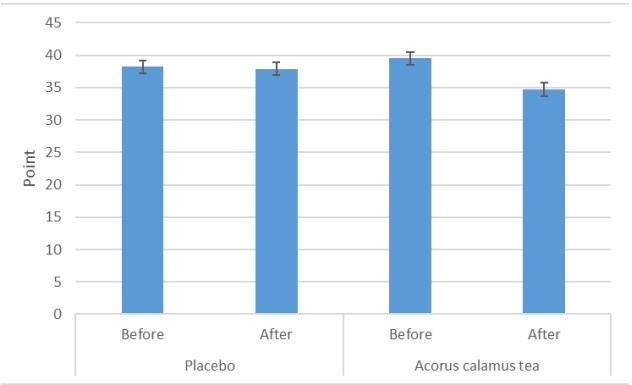

Fig. 1. The effect of *Acorus calamus* rhizomes aqueous extract on state (reactive) anxiety

* – the results are statistically significant at $p \leq 0,05$ (n = 20)

The study of the effect of sweet flag rhizomes aqueous extract was conducted in a control group (placebo) and an experimental group. In the control group, no significant changes in the indicators of feeling, activity, or mood were found. The results for the experimental group are presented in fig. 2.

The conducted experiment allows us to conclude that *Acorus calamus* rhizomes aqueous extract improves mood by 15,7%, feeling improved by 1,4%, while activity decreased by 12,8%. These data somewhat coincide with the findings of Vikas Sharma (Sharma et al., 2014), who recommends the use of sweet flag rhizomes for mental disorders, epilepsy, and hysteria. In the context of the educational process, consuming tea from *Acorus calamus* rhizomes may be advisable when relaxation and restoration of mental activity after intense work are needed.

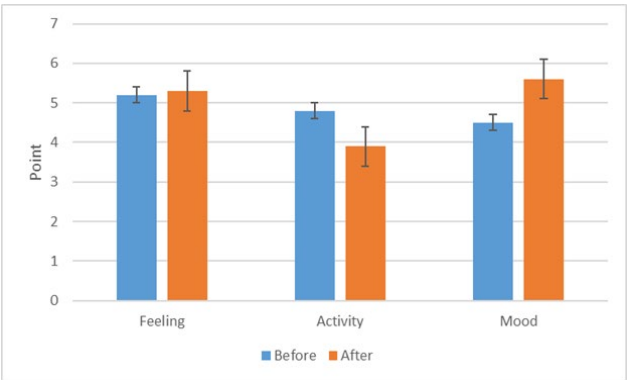

Fig. 2. The effect of *Acorus calamus* tea on feeling, activity, and mood

* – the results are statistically significant at $p \leq 0,05$ (n = 20)

Several authors (Bains et al., 2005) have demonstrated the presence of lectins in *Acorus calamus* rhizomes. The authors showed that the isolated lectins agglutinate erythrocytes of rabbit, rat, sheep, goat, and human after treatment with neuraminidase. Our experiments on the agglutination of erythrocytes of the four human blood groups by the lectin-containing extract of *Acorus calamus* rhizomes are presented in table 1.

Table 1

Sweet flag lectins hemagglutinating activity in relation to ABO human blood groups

Type of plant raw material	Agglutination titre			
	0	A	B	AB
Rhizome of sweet flag	2	4	32	16

The research results demonstrate the lowest hemagglutinating activity with respect to the O and A blood groups and the highest with respect to the B blood group. In our previous work (Мегалінська та ін., 2012), various hypotheses were proposed to explain the values of hemagglutinating activity in the "lectin-erythrocyte membrane" system. In our opinion, the reported agglutination titers indicate a minor agglutinating effect of the lectin-containing extract from sweet flag rhizomes on ABO blood groups, which allows for the widespread use of *Acorus calamus* as a medicinal and edible plant.

According to Sharma, 2014, *Acorus calamus* rhizomes are advisable to use in kidney diseases; therefore, the next stage of our experiments was to study the litholytic activity of lectin-containing extracts from Sweet flag rhizomes against three types of calculi. Our experimental data indicate that the *Acorus calamus* rhizomes lectin-containing extract actively dissolves only phosphates. The mass of struvite decreased by 15–20% after one month of exposure. The mass of oxalates and urates changed very little during this period. The rate of phosphate dissolution is shown in fig. 3.

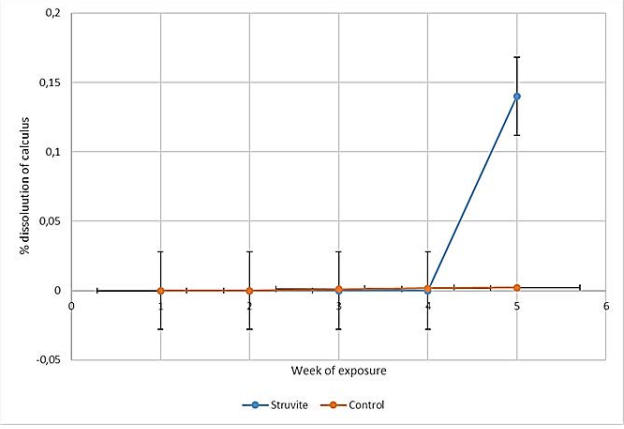

Fig. 3. The rate of phosphates dissolution in the *Acorus calamus* lectin-containing extract

* – the results are statistically significant at $p \leq 0,05$ ($n = 3$)

A large number of studies in the modern literature are devoted to investigating the cytotoxic effect of Sweet flag rhizomes.

In particular, the work by V. Rajkumar (2009) showed that the alcoholic extract has high cytostatic activity, while the sweet flag aqueous extract of the rhizomes, according to the same author, acts as a proliferation stimulator. Additionally, there is evidence of the mitogenic effect of *Acorus calamus* lectins (Bains, 2005). Therefore, the next stage of the experiment was devoted to studying the cytostatic activity of the sweet flag rhizomes aqueous extract, with cucumber seedlings used as the test object in this case. The results of this latest study are presented in fig. 4.

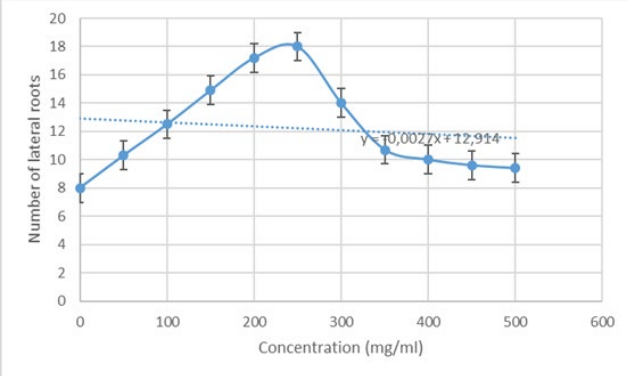

Fig. 4. Cytostatic effect of aqueous extract of Acorus calamus rhizome

* – results are significant at $p \leq 0,05$ ($n = 3$)

As shown by the data presented in fig. 4, the studied extract has a dual effect on mitotic division within the concentration range of 50–250 mg/ml, where the aqueous extract acts as a proliferation stimulator. At concentrations above 250 mg/ml, the *Acorus calamus* rhizome aqueous extract acts as a proliferation inhibitor. Our data correspond with those of Rajkumar, 2009, and Bains, 2005, although the test objects in those studies were *Allium cepa* roots, whereas in our work *Cucumis sativa* seedlings were used. The stimulatory effect on the length of the main root can be explained by the action of auxin-like substances.

The most sensitive to the action of the *Acorus calamus* rhizome aqueous extract in the table 2 were *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Bacillus cereus*. Among the listed microorganisms, most belong to the group of Gram-positive bacteria. Thus, the antibacterial effect is exhibited not only by the hexane and dimethyl sulfoxide (DMSO) extracts of sweet flag rhizomes but also by the aqueous extract (Shreelaxmi, 2018). The antibacterial activity of the aqueous extract from *Acorus calamus* rhizomes can

be explained both by the high content of essential oils, ascorbic acid, and flavonoids, and by the disruption of bacterial membrane structures (Kongkham, 2024).

Table 2

Antibacterial activity of sweet flag aqueous extract

Test microorganism	Lysis zone (in mm)
	Aqueous extracts
Escherichia coli	8,3 ± 0,3*
Staphylococcus aureus	13 ± 1,4*
Pseudomonas aeruginosa	14 ± 1,1*
Serratia marcescens	8,0 ± 0,5
Proteus vulgaris	9,0 ± 0,8*
Bacillus subtilis	11,0 ± 0,5*
Bacillus cereus	10,0 ± 1,0
Candida albicans	9,0 ± 0,4*

* – Mean values ± standard error of three independent experiments (n = 15);

* – $p \leq 0,05$ compared with control (disk with physiological solution), significantly by Student's Test.

In many literature sources sweet flag is considered a phytoremediator plant capable of purifying water bodies from heavy metals. Since the plant grows along the shorelines of lakes, rivers, and reservoirs, where highways often run nearby, lead contamination can enter the water, leading to pollution of the medicinal raw material of calamus. To assess the degree of contamination of the raw material depending on the pollution level of the water body, we conducted an experiment to study the lead absorption activity of *Acorus calamus* plants (Rajput et al., 2014).

For this, we created a model system – a water reservoir to which a certain concentration of lead acetate was added, and *Acorus common* calamus plants were introduced at a rate of 0,03 mg of lead salt per 1 g of *Acorus calamus* biomass. The lead concentration was measured by voltammetry. After one week of exposure of the sweet flag plants in the reservoir, the lead concentration in the water was measured again. The results of the study of lead concentration changes during the exposure of calamus plants are presented in the table 3.

After one week of exposure of sweet flag in the lead acetate solution, the lead content decreased by 18,7%, indicating the remediative properties of *Acorus calamus* and the necessity of monitoring heavy metal content in the aquatic environment where medicinal raw materials are collected.

Table 3

Change in Pb^{2+} concentration in the presence of Sweet flag

Control (Pb^{2+} concentration before sweet flag exposure, mg/dm³)	Pb^{2+} concentration after one week of exposure to common sweet flag, mg/dm³
17,7	14,4 ± 0,5*

* – Mean values ± standard error of three independent experiments (n = 3);

* – $p \leq 0,05$ compared with control (disk with physiological solution), significantly by Student's Test.

Conclusions

1. The results of studying the effect of *Acorus calamus* rhizomes aqueous extract on state anxiety indicate that the anxiety level in students decreases by 12%, characterizing sweet flag as a calming agent.

2. The study of sweet flag rhizomes aqueous extract effect on felling, activity, and mood allows us to conclude that mood improves by 15,7%, well-being by 1,4%, and activity decreases by 12,8%, relative to the scores of respondents from the same group before taking an sweet flag rhizomes aqueous extract.

3. During the educational process, consuming tea from calamus rhizomes may be advisable when relaxation or recovery after intense work is needed.

4. The study of hemagglutinating activity of the lectin-containing extract from calamus rhizomes shows the highest agglutination titer characteristic of individuals with the B blood group, while all other blood groups demonstrate a minor agglutinating activity effect.

5. Exposure of three types of calculi to the sweet flag lectin-containing extract allows us to conclude that *Acorus calamus* can dissolve phosphates while remaining indifferent to other types of calculi.

6. The study of the cytotoxic effect of the *Acorus calamus* aqueous extract indicates that the extract has a dual effect – at low concentrations, it acts as a proliferation stimulator, while at medium and high concentrations, it becomes a proliferation inhibitor.

7. The most sensitive to the action of the aqueous extract were *Staphylococcus aureus* (the braking zone was 13 mm), *Pseudomonas aeruginosa* (the braking zone was 14 mm), and *Bacillus subtilis* (the braking zone was 11 mm).

8. Sweet flag (*Acorus calamus*) absorbs 18.7% of lead from water bodies contaminated with heavy metals, which should be taken into account during the collection of medicinal raw materials.

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