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NATIOANAL UNIVERSITY OF PHARMACY

faculty for foreign citizens' education

department of chemistry of natural compounds and nutriciology

QUALIFICATION WORK

on the topic: "**PHYTOCHEMICAL STUDY OF SPATHIPHYLLUM FLORIBUNDUM LEAVES**"

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ANNOTATION

For the first time, BAC was identified and the quantitative content of the main BAC groups in Spathiphyllum floribundum leaves was determined. Technological parameters of raw materials are established. The results can be used as a basis for the project of quality control methods " *Spathiphylli floribundum Folia*".

It consists of an introduction, literature review, experimental part, general conclusions, list of used literature sources, set out on 46 pages, includes 9 tables, 8 figures, 36 sources of literature.

Key words: Spathiphyllum floribundum, leaves, chemical composition

АНОТАЦІЯ

Вперше проведено ідентифікацію БАР та визначення кількісного вмісту основних груп БАР у листі *Spathiphyllum floribundum* Встановлено технологічні параметри сировини. Результати можуть бути положені у основу проекту методів контролю якости «*Spathiphylli floribundum Folia*”.

Складається зі вступу, огляду літератури, експериментальної частини, загальних висновків, переліку використаних літературних джерел, викладена на 46 сторінках, включає 9 таблиць, 8 рисунків, 36 джерела літератури.

Ключові слова: спатифілум рясноквітучий, листя, хімічний склад

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LIST OF ABBREVIATIONS

BAC – biologically active compounds

MPM – Medicinal plant materials

SPhU – State Pharmacopoeia of Ukraine

USSR Ph. XI ed. – USSR Pharmacopoeia of XI edition

SPhS – standard pharmacopoeial samp

INTRODUCTION

Medicinal plant raw materials as an independent remedy are allowed for over-the-counter dispensing to patients from a pharmacy, and are also used as raw materials for obtaining medicinal preparations. During the last decades, much attention has been paid in medical practice to medicinal products of plant origin and their rational use. The ever-increasing flow of biologically active supplements using plant raw materials, as well as the problem of falsification of MPM and preparations of plant origin, require high competence from specialists, including those who create new means. That is why the search for new available sources of medicinal plant raw materials is the primary task of modern pharmacy.

Rationale. The search for new sources of medicinal plant raw materials is an urgent task today. Our attention was drawn to the raw material of *Spathiphyllum floribundum*. In the available literary sources there is not enough information on the chemical composition and use of raw materials of the plant.

Purpose. The purpose of the Master's thesis was the phytochemical study of *Spathiphyllum floribundum*.

Tasks of the research. The following tasks were set:

– analyze literature sources on botanical characteristics, chemical composition, use in folk medicine and contraindications to the use of *Spathiphyllum floribundum;*

– establish the main numerical indicators of the leaves of the plant raw material according to the SPhU requirements;

– carry out identification of BAC in the *Spathiphyllum floribundum* plant raw material;

– carry out quantitative analysis of BAC in the *Spathiphyllum floribundum* plant raw material;

– to establish the technological parameters of Spathiphyllum floribundum leaves.

The object of the research: phytochemical study of *Spathiphyllum floribundum* leaves.

The subject of the research: the study of the qualitative composition and the quantitative content of the main groups of biologically active compounds, determination of quality indicators in *Spathiphyllum floribundum* leaves.

Methods of the research: pharmacopoeial methods of determining the qualitative composition and quantitative content of BAC, using thin layer chromatography (TLC), paper chromatography (PC), titrimetry, spectrophotometry. The experiment results were processed by statistical methods according to the requirements of the State Pharmacopoeia of Ukraine.

The practical significance and scientific novelty of the results.The obtained results can be useful in the development of the project of quality control methods of "*Spathiphyllum floribundum Folia*".

Approbation of the research results.

Skrebtsova K.S., Semaan Ali, Popova N.V. Detection and quantitative analysis of polysaccharides in raw materials *Spathiphyllum floribundum.* Сучасні досягнення фармацевтичної науки в створенні та стандартизації лікарських засобів і дієтичних добавок, що містять компоненти природного походження: матеріали V Міжнародної науково-практичної інтернет-конференції (м. Харків, 14 квітня 2023 р.). – Електрон. дані. – Х. : НФаУ, 2023. – С. 49.

The structure and scope of the qualification work – consists of an introduction, a literature review, an experimental part, general conclusions, a list of used literary sources, laid out on 46 pages, including 9 tables, 8 figures, 36 literature sources.

CHAPTER 1
BOTANICAL CHARACTERISTICS, GEOGRAPHICAL DISTRIBUTION, CHEMICAL COMPOSITION, USES OF SPATHIPHYLLUM FLORIBUNDUM (LITERATURE REVIEW)

1.1. Short botanical description and features of *Spathiphyllum* genus plants

Spathiphyllum is a genus of perennial evergreen plants of the family *Araceae*. The name of the genus comes from two Greek words: σπάθη (spathe) - "covering" and φύλλον (phyllon) - "leaf" [18, 32].

The plant is popularly known as "white sail" and "female happiness". This is due to the non-standard appearance of the plant, it does not have a stem as such, and the leaves are basal, growing immediately from the ground in the form of a bundle. The inflorescence, outwardly resembling a cob, is surrounded by a white covering [33].

To date, the genus *Spathiphyllum* has about 45 species and many bred varieties of this plant. All of them differ among themselves both in the size of the plants, from small compact to gigantic, and in the color of the leaves and flowers. The rhizome is short, forms a leafy basal rosette, growing directly from the soil. The plant has non-withering leaves, independently forms a bush from 20 cm to 1.5 meters high, depending on the species. The leaves are deep green, smooth, glossy, there are species with rough, waxy leaf plates of medium density. The leaves are rounded or lanceolate in shape, oblong, pointed at the tips (fig. 1.1). Petioles are elongated, bifurcated to half. The stem is absent. The peduncles are long, at the top they form an inflorescence – a cob. The flowers are pale pink, pale yellow or cream. A cob (up to 5-6 cm long) is wrapped in a spacious white cloth-cover with a pointed end. The cover is called a flag leaf, it has an external resemblance to a developing sail or flag. The size of the canvas is 9-12 cm. The seeds are smooth, small, slightly bent in shape [33, 34].

Fig. 1.1. Spathiphyllum

1.2. Distribution of *Spathiphyllum* genus plants

Spathiphyllum grows in swampy forests, on the banks of rivers and streams, that is, in places where a stable climate with high humidity is maintained throughout the year. In these regions, there are no sharp temperature fluctuations (usually 23-29°C), no distinct seasons and seasons. At night, the air does not cool down, maintaining a mark of 18°C.

The homeland of "female happiness" is Central and South America. The genus includes more than 40 species, of which 3 came to us from the countries of East Asia and Polynesia [19].

The range of taxa includes the Gulf of Mexico, Guyana, Suriname, Guatemala, El Salvador, Panama, Nicaragua, Venezuela, Colombia, Brazil and Peru. The main distinguishing feature of the countries where the plant comes from is a huge variety of flora and fauna. The soil in these conditions is represented by a litter of decomposing leaves and branches, which is important to consider when breeding [21].

You can also meet "white sail" in the Philippines, Sulawesi and the Solomon Islands. The plant was first discovered in the Colombian and Ecuadorian jungles

and described by the German researcher G. Wallis (later one of the species was named after him). Breeders began to import the plant to England, from where it spread throughout Europe, as well as Russia.

In natural conditions, spathiphyllum occupies the lower tier of the tropical forest, therefore, despite the large amount of sun, it is satisfied with minor glare. Some representatives have adapted to an epiphytic existence, developing on tree trunks [35].

Despite its exotic origin, this indoor plant does not make special demands on the flower grower. The only and important point of plant maintenance is the creation of comfortable microclimatic conditions and maintaining them in an optimal balance.

1.3. Differences between morphologically similar species of the genus

1.3.1. Spathiphyllum Wallis (Spathiphyllum wallisii Regel.)

One of the most common and unpretentious species. Ideal for poorly lit rooms, as it feels good in partial shade. It has dwarf varieties that reach about 30 cm in height. Oblong dark green leaves are collected in a rosette. The flowers rise above the leaves, the peduncle is always longer than the leaves. The covering of the cob is white, then turns green (fig. 1.2). It blooms profusely, usually in spring, re-blooming may begin with the beginning of autumn [23, 23].

The homeland of the species is the tropical forests of Colombia. The height of the bush is about 0.3 m. The shape of the dark green leaves is oblong-lanceolate. The white cob is covered with a covering that is longer than it. The color of the blanket changes from white to green. Perfect for growing indoors, it is distinguished by lush and long-lasting flowering [23].

Fig. 1.2. *Spathiphyllum wallisii Regel*

1.3.2. *Spathiphyllum floribundum Linden*

Spathiphyllum floribundum Linden – up to 60 cm tall. It has oval, slightly elongated rough leaves up to 20 cm long and up to 10 cm wide. The cover of the inflorescence is white. It blooms abundantly and for a long time (fig. 1.3). The species comes from Colombia. The height of the bush is about half a meter. The shape of the leaves is oval-lanceolate, its width is about 12 centimeters, and its length is up to 25 cm. The head is covered with a white covering [25].

Fig. 1.3. Spathiphyllum floribundum Linden

1.3.3. *Spathiphyllum blandum*

The plant is larger than spathiphyllum profusely flowering. The dark green leaves are elongated, on long petioles. The flowers are collected in an elongated cob surrounded by a green, slightly bent cover (fig. 1.4). Flowering is abundant in April-May. Re-blooming may occur in autumn. Tolerates shade well, but grows more slowly.

Fig. 1.4. Spathiphyllum blandum

1.3.4. Spathiphyllum cochlearispathum

A tall plant, it can reach up to 1 meter in height, due to the fact that the dark green glossy, slightly wavy at the edges of the leaves are attached to high (up to 50-70 cm) petioles. The length of the leaves varies from 30 to 40 cm, the width is about 15 cm. The covering of the cob is white, oval-elongated, the upper edge is bent inward and slightly covers the inflorescence (fig. 1.5) [26, 28].

In nature, the species is found in Brazil. The height of the bush is about 100 cm. Shiny elongated-lanceolate leaf plates of dark green color are up to 0,4 m long and up to 0,2 m wide, their edges are wavy. The petiole is about 0,7 m long. The inflorescence is a white cob covered with a long oval covering [29].

Fig. 1.5. Spathiphyllum cochlearispathum

1.3.5. Spathiphyllum cannifolium

It is a rather rare plant as a houseplant. It is mainly used in hybridization to breed new varieties. The bright green egg-shaped leaves with a curved pointed edge are up to 50 cm long and often resemble canna leaves, which is why it got its name. The flowers are large and very fragrant, the cob is surrounded by a white covering that is bent back (fig. 1.6).

The homeland of the plant is Venezuela and Thailand. The color of the egg-shaped leaves is deep green. The fragrant yellow-green cob is covered with a greenish-white covering [35, 36].

Fig. 1.6. Spathiphyllum cannifolium

1.3.6. *Spathiphyllum heliconiifolium Schott*

In natural conditions, it is found in the humid tropical forests of Brazil. The height of the bush is about 100 cm.

The dark green shiny leaf plate is up to 25 cm wide and up to 50 cm long, the shape of the leaves is elongated-elliptical, slightly pointed at the top, the edge is wavy. The length of the petiole is slightly up to 80 cm. The inflorescence is 10 cm long, it is a cob, the color of which is from white to almost black. The width of the oval coverlet is about 10 cm, and the length is up to 15 cm. It grows quite well in room conditions (fig. 1.7) [15, 30].

Fig. 1.7. Spathiphyllum heliconiifolium Schott

1.3.7. Decorative varieties of *Spathiphyllum*

Some varieties of spathiphyllum are listed in table. 1.1 [18].

Table 1.1

Varieties of spathiphyllum

Appearance of the plant	Brief description
1	2
	"Domino" is a characteristic motley color of the leaves. The plant itself reaches 50 cm in height. The leaves are dense, leathery, wavy, with light spots.
	"Picasso" is a variety bred in Holland from Spathiphyllum Wallis. Leaves of an unusual color: alternating green and white spots in different variations can be found on the same plant. Nevertheless, this variety does not look variegated. This variety is more demanding on lighting: diffused light without direct sunlight
	"Sensation" is one of the largest varieties of spathiphyllum. The height of the plant reaches one and a half meters. The leaves are dark green, dense, ribbed, up to 80 cm long and about 40 cm wide. The inflorescence is also very large (up to 40 cm), the cover is white, as in most varieties - it turns green over time. Well suited for large dimly lit rooms, as a solitaire or floor plant.

Table. 1.1 (continued)

1	2
	"Chopin" - this compact variety of spathiphyllum reaches a height of 35 cm. The leaves are deep green, shiny, smooth, thin, slightly rounded. The veins are as if pressed into the middle of the leaves. The inflorescence is small, with a white cover, pointed to the edge.
	"Caiti" is a variety with decorative leaves decorated with yellow blotches or variegations. The height of this variety of spathiphyllum is about 70 cm. Inflorescences with a white covering.
Compact varieties of spathiphyllum – "Quatro", "Strauss", "Alfa" – their height is no more than 30-35 cm.	
"Mini" – the smallest variety in height, grows only 10-12 cm. This is a hybrid of spathiphyllum abundantly flowering.	

1.4. Chemical composition

The sap of plants of the genus *Spathiphyllum* is toxic, as well as in other members of the genus. The raw material contains calcium oxalate crystals that can irritate the mucous membrane. It is not recommended to place the plant in places accessible to children and pets [18,27].

When the raw materials come into contact with the mucous membranes, skin, or eyes, after 10-15 seconds there is a feeling of heating, irritation of the skin. There is no need for treatment – 20 minutes after poisoning, the symptoms disappear, otherwise - symptomatic treatment [31].

1.5. Use of the plant in folk medicine

Indoor plants that absorb dangerous and poisonous substances, reduce the number of microbes, and also moisturize the air, protecting people from seasonal diseases (flu, etc.) will help provide fresh air [1, 9, 10, 27].

It is common knowledge that the presence in a room with an area of 10 square meters of at least one plant guarantees a significant improvement in well-being and mood [12, 14].

Spathiphyllum removes dangerous substances such as ammonia, benzene, formaldehyde, trichlorethylene, xylene, toluene, phenol from the air.

Thus, the plant is widely cultivated in artificial conditions and can be an excellent detoxifier indoors [31].

CONCLUSIONS TO CHAPTER 1

After reviewing the literature data, it is obvious that the chemical composition of Spathiphyllum floribundum has not been sufficiently studied. The above makes the research of this plant and the creation of new medicines based on it a promising task today.

CHAPTER 2
DETERMINATION OF NUMERICAL INDICES OF SPATHIPHYLLUM FLORIBUNDUM LEAVES

2.1. Weight Loss on Drying

The term "Weight loss on drying" means the weight loss due to hygroscopic moisture and volatile substances determined in a substance after it is dried to a constant weight or for the period of time specified in the State Pharmacopoeia of Ukraine [3,4].

Determination of weight loss on drying was carried out according to the State Pharmacopoeia of Ukraine [4].

The results of the experiments are shown in Table 2.1.

Table 2.1

Results of the weight loss on drying determination of Spathiphyllum floribundum leaves

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	5,79 6,12 5,49 6,17 6,31	5,98	0,11	0,15	0,95	2,78	**5,98 ± 0,41**	3,91

As can be seen from the data given, the weight loss on drying of Spathiphyllum floribundum leaves was 5,98 ± 0,41 %.

2.2. Total Ash

Determination of total ash was carried out according to the State Pharmacopoeia of Ukraine (article 2.4.16) [3,4].

The results of the experiments are shown in Table 2.2.

Table 2.2

Results of the total ash determination of Spathiphyllum floribundum leaves

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	4,36 4,29 3,97 3,81 4,22	4,13	0,05	0,10	0,95	2,78	**4,13 ± 0,29**	3,97

As can be seen from the data given, the total ash of *Spathiphyllum cannofolia* leaves was 4,13 ± 0,29 %.

2.3. Extractable Matter

Determination of the extractable matter was carried out according to the State Pharmacopoeia of Ukraine (monograph "*Artemisia absinthium*") [3,4, 5].

To define the best solvent for the *Spathiphyllum cannofolia* leaves, the extraction of biologically active substances using different solvents (water, 30 %, 50 %, 70 % and 96 % ethanol) was conducted.

The results of the experiments are shown in Table 2.3 and Fig. 2.1.

Table 2.3

Results of the extractable matter in Spathiphyllum floribundum leaves

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
1	2	3	4	5	6	7	8	9	10
Water									
5	4	18,87	19,048	0,09	0,13	0,95	2,78	**19,05 ± 0,37**	1,95

Table. 2.3 (continued)

1	2	3	4	5	6	7	8	9	10
		19,27							
		19,06							
		19,39							
		18,65							
30 % ethanol									
5	4	14,67	15,11	0,14	0,17	0,95	2,78	**15,11 ± 0,47**	3,09
		15,54							
		14,81							
		15,42							
		15,11							
50 % ethanol									
5	4	20,67	20,16	0,57	0,34	0,95	2,78	**20,16 ± 0,94**	4,66
		20,98							
		19,34							
		20,43							
		19,38							
70 % ethanol									
5	4	24,65	24,572	0,210	0,21	0,95	2,78	**24,57 ± 0,57**	2,31
		24,32							
		25,17							
		23,96							
		24,76							
96 % ethanol									
5	4	11,45	11,166	0,26	0,23	0,95	2,78	**11,17 ± 0,63**	5,63
		10,67							
		11,78							
		11,31							
		10,62							

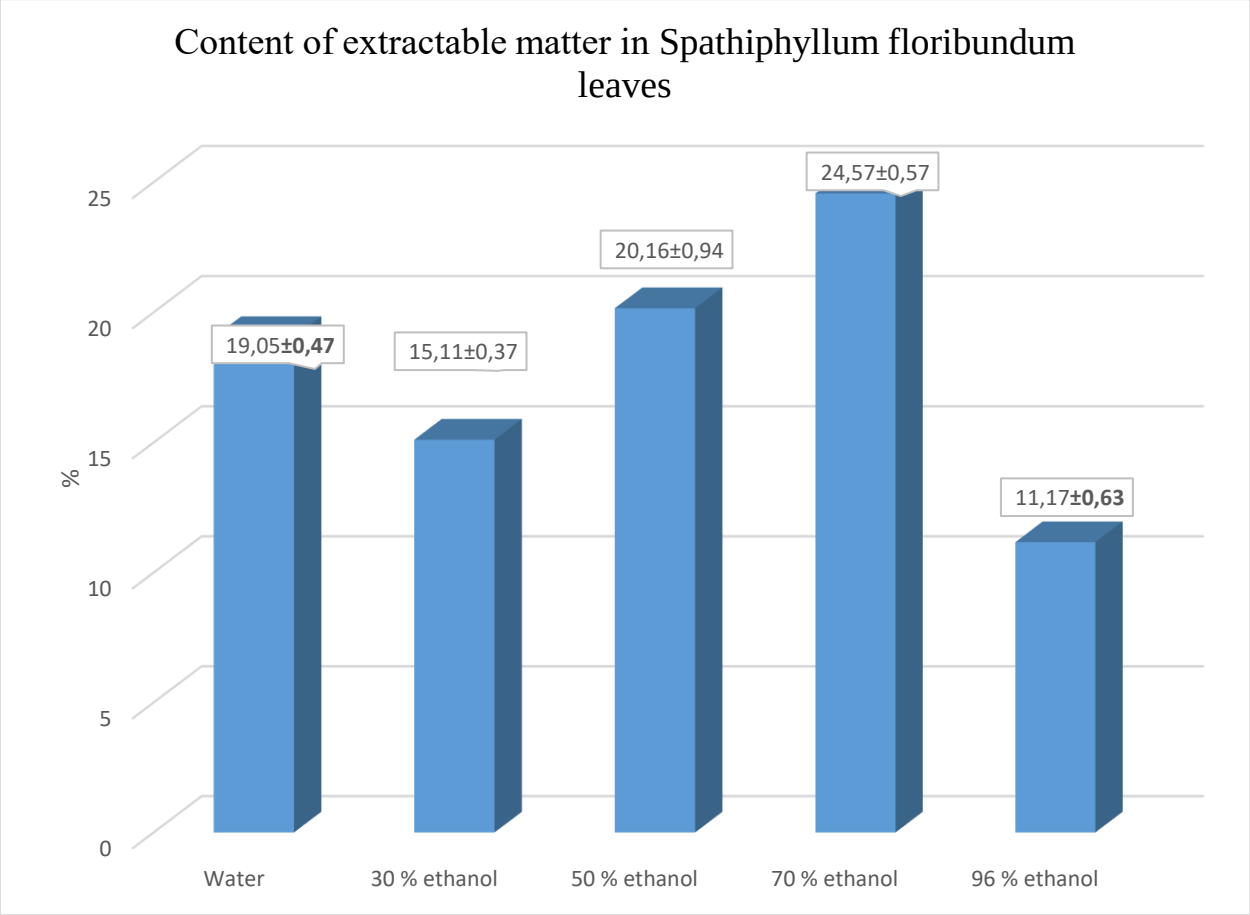


Fig. 2.1. Diagram of the content of extractable matter in *Spathiphyllum floribundum* leaves

As can be seen from the experimental data, the optimal solvent for the *Spathiphyllum cannofolia* leaves is 70% ethanol, because it extracts the largest amount of biologically active substances.

CONCLUSIONS TO CHAPTER 2

1. The numerical indices of Spathiphyllum floribundum leaves were determined.
2. The weight loss on drying is 5,98 ± 0,41 %.
3. The total ash content is 4,13 ± 0,29 %.
4. The maximal content of extractable matter in *Spathiphyllum floribundum* leaves is 24,57 ± 0,57 % when used 70% ethanol as solvent.

CHAPTER 3
PHYTOCHEMICAL ANALYSIS OF SPATHIPHYLLUM FLORIBUNDUM LEAVES

3.1. Study of the qualitative composition of BAR of Spathiphyllum floribundum leaves

3.1.1. Identification of polysaccharides

The water extract was obtained from *Spathiphyllum cannofolia* leaves; and then 20 ml of 96% alcohol were added in it for identification of polysaccharides [3, 5, 6].

The formation of brown precipitate in solution was observed in the test that was confirming the presence of polysaccharides in *Spathiphyllum cannofolia* leaves.

Reaction with α-naphthol. 2 ml of water extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, then a drop of α-naphthol alcohol solution and concentrated sulfuric acid were added in the test tube [3, 4, 5].

The formation of cherry-red ring at the boundary of the two layers confirmed the presence of carbohydrates in *Spathiphyllum cannofolia* leaves.

Reaction with carbazole solution. 6 ml of water extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, then 1 ml of 0,5% carbazole solution and 20 ml of concentrated sulfuric acid were added in the test tube, mixed,heated on a water bath for 10 minutes [6, 7].

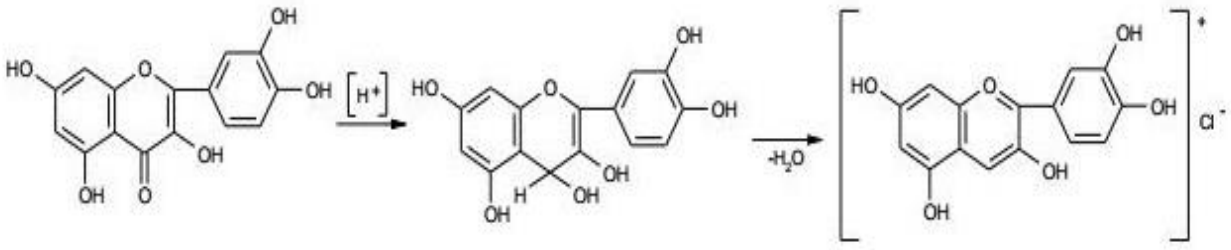
The formation of red-purple coloring confirmed the presence of pectins in *Spathiphyllum cannofolia* leaves.

3.1.2. Identification of flavonoids

The water-alcohol extract was obtained from *Spathiphyllum cannofolia* leaves for identification of flavonoids [3, 4, 5, 6, 7, 8].

Cyanidin test. 2 ml of water-alcohol extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, and then 5 drops of concentrated hydrochloric acid and metallic magnesium were added in the test tube [11, 16, 17].

The formation of pink coloring of the test extract was observed.



Bryant's modification of cyanidin test. 2 ml of water-alcohol extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, 5 drops of concentrated hydrochloric acid and metallic magnesium were added in the test tube. Then butanol were added in this solution

The formation of red coloring (the same in both layers) indicated the presence of equal ratio of aglycones and glycosides of flavonoids in *Spathiphyllum cannofolia* leaves.

Reaction with iron (III) chloride (for presence of phenolic hydroxyl). 2 ml of water-alcohol extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, and then 1 ml of 10 % iron (III) chloride was added in the test tube.

The formation of black-green coloring indicated the presence of phenolic compounds, including flavonoids in *Spathiphyllum cannofolia* leaves.

Reaction with 10% alcohol alkali solution. 2 ml of water-alcohol extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, then 1 ml of 10 % sodium hydroxide alcoholic solution was added in the test tube.

The formation of yellow-green coloring of the test extract was observed.

Reaction with 2 % aluminium (III) chloride alcoholic solution. 2 ml of water-alcohol extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, and then 2 ml of 2 % aluminium (III) chloride alcoholic solution were added in the test tube [11, 16].

The formation of green-yellow coloring of the test extract was observed.

The presence of flavonoids in *Spathiphyllum cannofolia* leaves was proven as a result of the experiments.

Chromatographic analysis. The presence of flavonoids in the leaves of *Spathiphyllum cannofolia* was determined using the paper chromatography method in solvent system: n-butanol – glacial acetic acid – water (4 : 1 : 2). The chromatogram was analyzed on the basis of fluorescence of substances under the UV-light before and after processing this chromatogram with 1 % aluminum (III) chloride alcoholic solution and was compared with standard samples of flavonoids [17].

The results of flavonoids chromatographic analysis in *Spathiphyllum cannofolia* leaves are shown in Fig. 3.1.

The presence of flavonoids (kaempferol, rutin and quercetin) was confirmed in *Spathiphyllum cannofolia* leaves as a result of the chromatographic analysis.

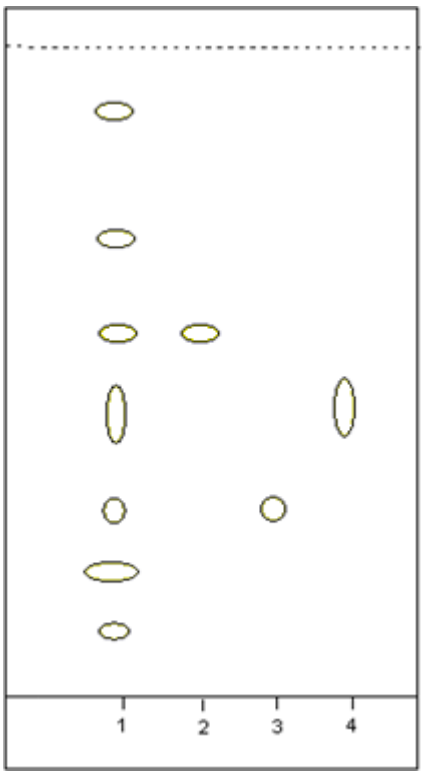


Fig. 3.1. Chromatogram of flavonoids in Spathiphyllum floribundum leaves:
1 – water-alcohol extract from *Spathiphyllum cannofolia* leaves; 2 – kaempferol;
3 – rutin; 4 – quercetin.

3.1.3. Identification of tanins

The water extract was obtained from *Spathiphyllum floribundum* leaves for identification of tannins [3, 4, 5, 8].

Reaction with 1 % quinine chloride solution. 2 ml of water extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, then some drops of 1 % quinine chloride solution were added in the test tube [3, 4, 13].

The formation of white precipitate was observed.

Reaction with 1 % gelatin solution. 2 ml of water extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, then some drops of 1 % gelatin solution were added in the test tube [32, 38, 39, 54].

The formation of light flocculent precipitate in solution was observed. This light flocculent precipitate disappeared while adding overage gelatin.

Reaction with iron (III) ammonium sulfate solution. 2 ml of water extract from *Spathiphyllum cannofolia* leaves were placed in a test tube, then 4 drops of iron (III) ammonium sulfate solution were added in the test tube [4, 6, 8].

The formation of black-green coloring indicated the presence of condensed group of tannins in *Spathiphyllum cannofolia* leaves.

The presence of condensed group of tannins in *Spathiphyllum cannofolia* leaves was confirmed as a result of experiments performed.

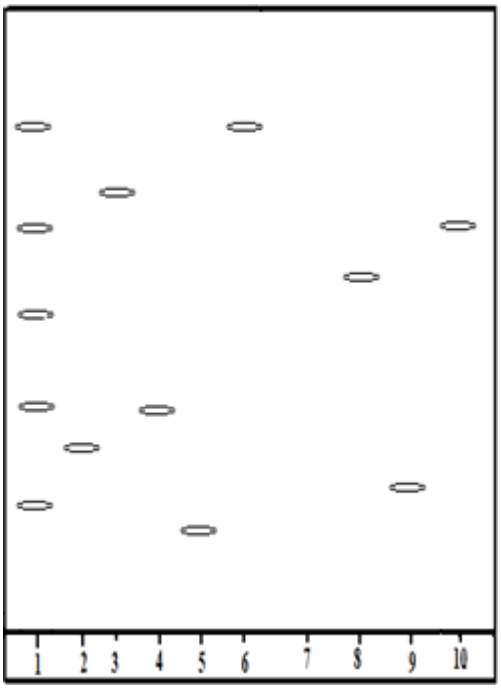
3.1.4. Identification of organic acids

Chromatographic analysis. The presence of organic acids in the leaves of *Spathiphyllum cannofolia* was determined using the paper chromatography method in solvent system: ethanol – chloroform – ammonia – water (70 : 40 : 20 : 2). The chromatogram was processed with solution of sodium 2,6-dichlorophenolindophenolate, then heated in the drying oven at 105 ºC. The chromatogram was analyzed in the day light.

The formation of spots with yellow colored on a dark-blue background indicated the presence of organic acids in *Spathiphyllum cannofolia* leaves. The formation of spots with pink colored, which disappeared with a time, indicated the presence of ascorbic acid [3, 4, 22].

The results of organic acids chromatographic analysis in *Spathiphyllum cannofolia* leaves are shown in Fig. 3.2.

The presence of organic acids (ascorbic, salicylic and gallic acids) was confirmed in *Spathiphyllum cannofolia* leaves as a result of the chromatographic analysis.



Pic. 3.2. Chromatogram of organic acids in *Spathiphyllum cannofolia* leaves: 1 – water extract from *Spathiphyllum cannofolia* leaves; 2 – Tartaric acid; 3 – Benzoic acid; 4 – Ascorbic acid; 5 – Oxalic acid; 6 – Salicylic acid; 7 – Malic acid; 8 – Succinic acid; 9 – Citric acid; 10 – Gallic acid

3.2. Quantitative analysis of biologically active compounds in leaves of *Spathiphyllum cannofolia*

3.2.1. Determination of polysaccharides

The quantitative determination of the polysaccharides content was carried out by the gravimetric method [3, 4, 6, 8].

This method based on three-time extraction of *Spathiphyllum cannofolia* leaves by water followed by precipitation with 96% ethyl alcohol. The obtained precipitate was filtered, the filter was washed with 96% ethanol and then with ethyl acetate. The filter with precipitate was weighed after drying [3, 4].

The results of the quantitative determination of polysaccharides in *Spathiphyllum floribundum* leaves are shown in Table 3.1.

Table 3.1

Results of the quantitative determination of polysaccharides in *Spathiphyllum floribundum* leaves

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	7,45 7,31 7,70 8,22 7,12	7,56	0,18	0,19	0,95	2,78	**7,56 ± 0,19**	3,99

Thus, the quantitative content of polysaccharides in *Spathiphyllum cannofolia* leaves was determined as 7,56 ± 0,19 %.

3.2.2. Determination of flavonoids

The quantitative determination of the flavonoids content was carried out by the spectrophotometric method [3, 4, 5, 6, 8].

First the alcohol-water extract was obtained from *Spathiphyllum cannofolia* leaves (extractant – 50% alcohol). Then 10 ml of 50% alcohol, 2 ml of 2% $AlCl_3$ solution and 2 ml of 5% acetic acid solution were added into the filtrate. The absorbance was measured with Mecasys Optizen POP spectrophotometer (407 nm wavelength) [3, 4, 7].

The results of the quantitative determination of flavonoids in *Spathiphyllum cannofolia* leaves are shown in Table 3.2.

Table 3.2

Results of the quantitative determination of flavonoidsin Spathiphyllum cannofolia leaves

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	3,32 3,19 2,95 3,11 3,09	3,132	0,02	0,06	0,95	2,78	**3,13 ± 0,17**	2,40

Thus, the quantitative content of flavonoids in *Spathiphyllum cannofolia* leaves was determined as 3,13 ± 0,17 %.

3.2.3. Determination of polyphenols

The quantitative determination of polyphenols content in *Spathiphyllum cannofolia* leaves was carried out by the spectrophotometric method [48, 49]. The absorbance was measured with the Mecasys Optizen POP spectrophotometer at 270 nm wavelength. The absorbance of the gallic acid reference solution (the pharmacopeia standard sample) was measured in parallel [3, 5, 17].

The obtained results of polyphenols content determination in *Spathiphyllum floribundum* leaves are shown in Table 3.3.

As can be seen from the data given, the quantitative content of polyphenols in *Spathiphyllum floribundum* leaves was 4,70 ± 0,21 %.

Table 3.3

Results of the quantitative determination of polyphenols in *Spathiphyllum floribundum* leaves

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	4,76 4,43 4,87 4,78 4,65	4,70	0,03	0,08	0,95	2,78	**4,70 ± 0,21**	4,47

3.2.4. Determination of organic acids

The quantitative determination of the organic acids content was carried out according to the famous method described in the State Pharmacopoeia of Ukraine (monograph "Dogrose fruits") [6, 7]. The quantitative determination of organic acids content in Spathiphyllum floribundum leaves was carried out by the titrimetric method [3, 4].

The obtained results of organic acids content determination in Spathiphyllum floribundum leaves are shown in Table 3.4.

Table 3.4

Results of the quantitative determination of organic acids in Spathiphyllum floribundum leaves

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	2,910 2,760 2,980 2,840 2,810	2,86	0,01	0,04	0,95	2,78	**2,86 ± 0,11**	3,75

Results of the quantitative determination of organic acids in Spathiphyllum floribundum leaves.

As can be seen from the data given, the quantitative content of organic acids in *Spathiphyllum floribundum* leaves was 2,86 ± 0,11 %.

3.2.5. Determination of ascorbic acid

The quantitative determination of ascorbic acid content in Spathiphyllum floribundum leaves was carried out by the titrimetric method [3, 4, 5].

The obtained results of vitamin C determination in Spathiphyllum floribundum leaves are shown in Table 3.5.

Table 3.5

Results of the quantitative determination of vitamin C

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
1	2		3	4	5	6	7	8	9
5	4	0,011 0,010 0,011 0,013 0,010	0,01	0,000002	0,001	0,95	2,78	**0,01 ± 0,002**	13,84

As can be seen from the data given, the quantitative content of vitamin C in *Spathiphyllum floribundum* leaves was 0,01 ± 0,002 %.

CONCLUSIONS TO CHAPTER 3

1. Presence of polysaccharides, polysaccharides, flavonoids and condensed group of tannins was identified by qualitative reactions in Spathiphyllum floribundum leaves.

2. Chromatograhic analysis was used in identification of three flavonoids (kaempferol, rutin and quercetin) and four organic acids (ascorbic, salicylic, malic and gallic acids) in the leaves of Spathiphyllum floribundum.

3. The quantitative content of polysaccharides (6,13 ± 0,45 %) was determined by the gravimetric method. The quantitative content of flavonoids (3,13 ± 0,17 %), and polyphenols (4,70 ± 0,21 %) were determined by the spectrophotometric method. The quantitative content of organic acids (2,86 ± 0,11 %) and ascorbic acid (0,01 ± 0,002%) were determined by the titrimetric method.

4. The results of the identification of BACs and the results of determining the quantitative content of the main groups of BACs can be used as a basis for the project of quality control methods for "*Spathiphylli floribundum Folia*".

CHAPTER 4
DETERMINATION OF TECHNOLOGICAL PARAMETERS OF THE SPATHIPHYLLUM FLORIBUNDUM LEAVES

4.1. Determination of average particle size

To determine the average size of the particles, a sieve analysis of the raw material was carried out [6, 7], based on the results of which the weighted average diameter of the size of the particles was determined according to the formula:

$$d = \frac{a_1 - d_1}{100},$$

a_1 – the capacity of each fraction, %;

d_1 – the average particle size of each fraction

, mm.

The average particle size of each fraction was determined as half the sum of the sizes of the sieves through which each fraction passed and on which it was retained, that is, as half the sum of the largest and smallest particle sizes:

$$d_1 = \frac{d_{max} + d_{min}}{2},$$

The results of determination of raw material pulverization are given in table. 4.1.

4.2. Determination specific gravity

About 5.0 g (exact weight) of crushed raw material was placed in a pycnometer with a capacity of 100 ml, filled with purified water to 2/3 of the volume and kept in a boiling water bath for 1.5-2 hours, periodically stirring in

order to completely remove air from the raw material. After that, the pycnometer was cooled to 20 ºC, the volume was brought up to the mark with purified water. Thus, the weight of the pycnometer with raw materials and water was determined [2, 6, 7].

The weight of the pycnometer with water was previously determined.

The specific mass was calculated according to the formula:

$$d_n = \frac{P * d_{æ}}{P + G - F},$$

P – the weight of completely dry crushed raw materials, g;

G – weight of the pycnometer with water, g;

F – the weight of the pycnometer with water and raw materials, g;

$d_{ж}$ – specific mass of water, g/ cm^3 ($d_{æ}$ =0,9982 g/ cm^3).

The results of determining the specific mass are given in the table. 4.1.

4.3. Determination volumetric mass

About 10.0 g (exact weight) of the crushed raw material was quickly immersed in a measuring cylinder with a liquid (purified water) and the volume was determined [2, 7]. The volume occupied by the raw material was determined by the volume difference in the measuring cylinder. The volumetric mass was calculated according to the formula:

$$d_0 = \frac{P_0}{V_0},$$

P_0 – the weight of crushed raw materials at a given humidity, g;

V_0 – the volume occupied by the raw material, cm^3.

The results of determining the volumetric mass are given in the table. 4.1.

4.4. Determination bulk mass

Crushed raw materials were loaded into the measuring cylinder, slightly shaken to level the raw materials, and the total volume occupied by it was determined. After that, the raw materials were weighed [2, 7].

The bulk mass was calculated according to the formula:

$$d_n = \frac{P_í}{V_í},$$

$P_н$ – the weight of crushed raw materials at a given humidity, g;

$V_н$ – the volume occupied by the raw material, cm^3.

The results of determination of bulk mass are given in table. 4.1.

Having determined the volumetric, specific and bulk mass, it is possible to calculate the porosity, porosity and free volume of the raw material layer, which makes it possible to determine the necessary ratio of raw materials and extractant [2, 7].

4.5. Determination porosity of raw materials

Porosity was calculated according to the formula:

$$П_c = \frac{d_n - d_0}{d_n},$$

d_n– Specific gravity of raw materials, g/cm^3;

d_0 – Volumetric mass of raw materials, g/cm^3.

The results of determining the porosity of raw materials are given in table. 4.1.

4.6. Determination layer difference

Layer difference was calculated according to the formula:

$$Ï = \frac{d_0 - d_í}{d_0},$$

де d_0 – Volumetric mass of raw materials, g/cm ^{3};

$d_н$ – Bulk mass сировини of raw materials, g/cm ^{3}.

The results of determining the layer difference of raw materials are given in table. 4.1.

4.7. Determination free volume of the layer

Free volume of the layer was calculated according to the formula:

$$V = \frac{d_п - d_н}{d_п},$$

де $d_п$ – Specific gravity of raw materials, g/cm ^{3};

$d_н$ – Bulk mass of raw materials, g/cm ^{3}.

The results of determining the free volume of the layer of raw materials are given in table. 4.1.

4.8. Calculation of water absorption coefficient

Water absorption coefficient is calculated based on the difference between the volume with which a known weight of raw material was poured and the volume obtained after draining and squeezing the meal [2, 8].

The absorption coefficient is calculated according to the formula:

$$K = \frac{V_п - V_ç}{Ð},$$

V_n – the volume with which raw materials are poured, ml;

$V_з$– the volume received after draining, ml;

P – the weight of completely dry crushed raw materials, g.

The results of determining the **w**ater absorption coefficient of raw materials are given in table. 4.1.

Table 4.1.

Results of determination of technological parameters

№	Name of technological parameters	Units of measurement	Determination results (n=3)
1.	Average particle size	mm	up to 3 mm
2.	Specific gravity	g/cm^3	1,46± 0,02
3.	Volumetric mass	g/cm^3	0,61 ± 0,01
4.	Bulk mass	g/cm^3	0,37 ± 0,02
5.	Porosity of raw materials	-	0,58 ± 0,01
6.	Layer difference	-	0,39 ± 0,01
7.	Free volume of the layer	-	0,75 ± 0,02
8.	Fluidity	g/sec	∞
9.	Water absorption coefficient	ml/g	4,43 ± 0,10
10.	Absorption coefficient of the extractant (ethanol 50%)	ml/g	3,34± 0,10

CONCLUSIONS TO CHAPTER 4

For the first time, the main technological parameters of spathiphyllum cannolifolia leaves were determined:

- average particle size (up to 3 mm);
- specific gravity питома маса – 1,46± 0,02 g/cm^3;
- volumetric mass – 0,61 ± 0,01 g/cm^3;
- bulk mass – 0,37± 0,02 g/cm^3;
- porosity of raw materials – 0,58± 0,01;
- layer difference – 0,39± 0,01;
- free volume of the layer – 0,75± 0,02;
- water absorption coefficient – 4,43 ± 0,10 ml/g
- absorption coefficient of the extractant (ethanol 50%) – 3,34± 0,10 ml/g.

GENERAL CONCLUSIONS

1. After reviewing the literature data, it is obvious that the chemical composition of Spathiphyllum floribundum has not been sufficiently studied. The above makes the research of this plant and the creation of new medicines based on it a promising task today.

2. The numerical indices of Spathiphyllum floribundum leaves were determined. The weight loss on drying is 5,98 ± 0,41 %; the total ash content is 4,13 ± 0,29 %; the maximal content of extractable matter in *Spathiphyllum floribundum* leaves is 24,57 ± 0,57 % when used 70% ethanol as solvent.

3. Presence of polysaccharides, polysaccharides, flavonoids and condensed group of tannins was identified by qualitative reactions in Spathiphyllum floribundum leaves. Chromatograhic analysis was used in identification of three flavonoids (kaempferol, rutin and quercetin) and four organic acids (ascorbic, salicylic, malic and gallic acids) in the leaves of Spathiphyllum floribundum.

4. The quantitative content of polysaccharides (6,13 ± 0,45 %) was determined by the gravimetric method. The quantitative content of flavonoids (3,13 ± 0,17 %), and polyphenols (4,70 ± 0,21 %) were determined by the spectrophotometric method. The quantitative content of organic acids (2,86 ± 0,11 %) and ascorbic acid (0,01 ± 0,002%) were determined by the titrimetric method.

5. For the first time, the main technological parameters of spathiphyllum cannolifolia leaves were determined:

- average particle size (up to 3 mm);
- specific gravity питома маса – 1,46± 0,02 g/cm^3;
- volumetric mass – 0,61 ± 0,01 g/cm^3;
- bulk mass – 0,37± 0,02 g/cm^3;
- porosity of raw materials – 0,58± 0,01;
- layer difference – 0,39± 0,01;
- free volume of the layer – 0,75± 0,02;

- water absorption coefficient – 4,43 ± 0,10 ml/g
- absorption coefficient of the extractant (ethanol 50%) – 3,34± 0,10 ml/g.

6. The obtained data can become the basis for the for the project of quality control methods for "*Spathiphylli floribundum Folia*".

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APPENDIX

СУЧАСНІ ДОСЯГНЕННЯ ФАРМАЦЕВТИЧНОЇ НАУКИ В СТВОРЕННІ ТА СТАНДАРТИЗАЦІЇ ЛІКАРСЬКИХ ЗАСОБІВ І ДІЄТИЧНИХ ДОБАВОК, ЩО МІСТЯТЬ КОМПОНЕНТИ ПРИРОДНОГО ПОХОДЖЕННЯ

Матеріали V Міжнародної науково-практичної інтернет-конференції

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МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНА АКАДЕМІЯ НАУК ВИЩОЇ ОСВІТИ УКРАЇНИ
НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ
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NATIONAL UNIVERSITY OF PHARMACY
DEPARTMENT OF CHEMISTRY OF NATURAL COMPOUNDS AND NUTRICIOLOGY

СУЧАСНІ ДОСЯГНЕННЯ ФАРМАЦЕВТИЧНОЇ НАУКИ В СТВОРЕННІ ТА СТАНДАРТИЗАЦІЇ ЛІКАРСЬКИХ ЗАСОБІВ І ДІЄТИЧНИХ ДОБАВОК, ЩО МІСТЯТЬ КОМПОНЕНТИ ПРИРОДНОГО ПОХОДЖЕННЯ

CURRENT APPROACHES OF PHARMACEUTICAL SCIENCE IN DEVELOPMENT AND STANDARDIZATION OF MEDICINES AND DIETARY SUPPLEMENTS THAT CONTAIN COMPONENTS OF NATURAL ORIGIN

Матеріали V Міжнародної науково-практичної інтернет-конференції

The Proceedings of the V International Scientific and Practical Internet-Conference

ХАРКІВ
KHARKIV
2023

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНА АКАДЕМІЯ НАУК ВИЩОЇ ОСВІТИ УКРАЇНИ
НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ
КАФЕДРА ХІМІЇ ПРИРОДНИХ СПОЛУК І НУТРИЦІОЛОГІЇ

СУЧАСНІ ДОСЯГНЕННЯ ФАРМАЦЕВТИЧНОЇ НАУКИ В СТВОРЕННІ ТА СТАНДАРТИЗАЦІЇ ЛІКАРСЬКИХ ЗАСОБІВ І ДІЄТИЧНИХ ДОБАВОК, ЩО МІСТЯТЬ КОМПОНЕНТИ ПРИРОДНОГО ПОХОДЖЕННЯ

Матеріали V Міжнародної науково-практичної інтернет-конференції

14 квітня 2023 року
м. Харків

Харків
2023

УДК 615.1 : 615.32 : 615.07
С 89

Електронне видання мережне

Конференція зареєстрована в Українському інституті науково-технічної і економічної інформації (УкрІНТЕІ), посвідчення № 546 від 19.12.2022 року

С 89 *Сучасні досягнення фармацевтичної науки в створенні та стандартизації лікарських засобів і дієтичних добавок, що містять компоненти природного походження* : матеріали V Міжнародної науково-практичної інтернет-конференції (м. Харків, 14 квітня 2023 р.). – Електрон. дані. – Х. : НФаУ, 2023. – 186 с. – Назва з тит. екрана.

У збірнику розглянуто теоретичні та практичні аспекти розробки, виробництва лікарських засобів рослинного походження і дієтичних добавок, контролю якості, стандартизації лікарських засобів рослинного походження та визначення безпечності дієтичних добавок, а також їх реалізації в умовах сучасного фармацевтичного ринку.

Для широкого кола науковців, магістрантів, аспірантів, докторантів, викладачів вищих фармацевтичних та медичних навчальних закладів, співробітників фармацевтичних підприємств, фармацевтичних фірм.

УДК 615.1 : 615.32 : 615.07

DETECTION AND QUANTITATIVE ANALYSIS OF POLYSACCHARIDES IN RAW MATERIALS *SPATHIPHHYLLUM FLORIBUNDUM*

Skrebtsova K.S., Semaan Ali, Popova N.V.
National University of Pharmacy, Kharkiv, Ukraine

Introduction. Spathiphyllum is a genus of perennial evergreen plants of the family *Araceae*. The genus *Spathiphyllum* has about 45 species and many bred varieties of this plant. *Spathiphyllum floribundum Linden* - up to 60 cm tall. It has oval, slightly elongated rough leaves up to 20 cm long and up to 10 cm wide. The cover of the inflorescence is white. It blooms abundantly and for a long time. The species comes from Colombia [3].

The height of the bush is about half a meter. The shape of the leaves is oval-lanceolate, its width is about 12 centimeters, and its length is up to 25 cm. The head is covered with a white covering.

The sap of plants of the genus *Spathiphyllum* is toxic, as well as in other members of the genus. The raw material contains calcium oxalate crystals that can irritate the mucous membrane.

Indoor plants that absorb dangerous and poisonous substances, reduce the number of microbes, and also moisturize the air, protecting people from seasonal diseases (SARS, flu, etc.) will help provide fresh air [2, 3].

Materials and methods. We selected leaves of *Spathiphyllum floribundum* for phytochemical studies harvested in the Kharkiv region in 2021. Detection of polysaccharides in *Spathiphyllum* leaves was carried out using a chemical reaction, using an aqueous extract from the studied raw material. As a result, a reaction was carried out with 96% ethanol. Determination of the quantitative content of polysaccharides was carried out by the gravimetric method in accordance with the requirements of the SPU, the article "Althaea roots" [1].

Results and their discussion. According to the results of the identification reaction, polysaccharides were found in leaf of *Spathiphyllum floribundum*. When determining the quantitative content of this class of BAC, the results were statistically processed in accordance with the requirements of the SPU and are 7,56 ± 0.19%.

The obtained results are one of the stages of a complex phytochemical study of Spathiphyllum floribundum. leaf.

References:

1. Державна Фармакопея України / Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». 2-е вид. Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. Т. 3. 732 с.
2. Britannica, The Editors of Encyclopaedia. "azalea". Encyclopedia Britannica, 25 Jan. 2023, https://www.britannica.com/plant/azalea. Accessed 1 March 2023.
3. Effects of different light-emitting diode qualities on the growth and photosynthetic characteristics of *Spathiphyllum floribundum* / Yinglong Song, Wenqian Shang, Zheng Wang et al. *Canadian J. of Plant Science*. 2022. Vol. 102, N 4. P. 911-925.

Наукове електронне видання мережне

СУЧАСНІ ДОСЯГНЕННЯ ФАРМАЦЕВТИЧНОЇ НАУКИ В СТВОРЕННІ ТА СТАНДАРТИЗАЦІЇ ЛІКАРСЬКИХ ЗАСОБІВ І ДІЄТИЧНИХ ДОБАВОК, ЩО МІСТЯТЬ КОМПОНЕНТИ ПРИРОДНОГО ПОХОДЖЕННЯ

Матеріали V Міжнародної науково-практичної інтернет-конференції

14 квітня 2023 року
м. Харків

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Процька Вікторія Василівна
Іосипенко Олена Олександрівна

Комп'ютерний набір та верстка
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MINISTRY OF HEALTH OF UKRAINE
MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL ACADEMY OF HIGHER EDUCATION OF SCIENCES OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
DEPARTMENT OF CHEMISTRY OF NATURAL COMPOUNDS AND NUTRICIOLOGY

CERTIFICATE

№ 53

This is to certify that

Semaan Ali

has participated in the V International Scientific and Practical Internet-Conference

"CURRENT APPROACHES OF PHARMACEUTICAL SCIENCE IN DEVELOPMENT AND STANDARDIZATION OF MEDICINES AND DIETARY SUPPLEMENTS THAT CONTAIN COMPONENTS OF NATURAL ORIGIN"

(Duration - 6 hours)
April, 14, 2023, Kharkiv, Ukraine

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ Національний фармацевтичний університет №02010936

Rector of the NUPh, prof. — **Alla KOTVITSKA**

Vice-Rector for scientific and pedagogical work of the NUPh, prof. — **Inna VLADIMIROVA**

Head of the department of chemistry of natural compounds and nutriciology of the NUPh, prof. — **Viktoriia KYSLYCHENKO**

Ф А 2.2.1–32-366

National University of Pharmacy

Faculty for foreign citizens' education
Department chemistry of natural compounds and nutritiology

Level of higher education master

Specialty 226 Pharmacy, industrial pharmacy
Educational program Pharmacy

APPROVED
The Head of Department
of chemistry of natural
compounds and nutritiology
Prof. Viktoria KYSLYCHENKO
"28" September 2022

ASSIGNMENT

FOR QUALIFICATION WORK

OF AN APPLICANT FOR HIGHER EDUCATION

Ali SEMAAN

1. Topic of qualification work: « Phytochemical study of *Spathiphyllum floribundum* leaves», supervisor of qualification work: Kateryna SKREBTSOVA., PhD,

approved by order of NUPh from "6th" of February 2023 № 35

2. Deadline for submission of qualification work by the applicant for higher education: April, 2023

3. Outgoing data for qualification work: Phytochemical study of *Spathiphyllum floribundum* leaves

4. Contents of the settlement and explanatory note (list of questions that need to be developed): Review of the literature on botanical description, chemical composition, use of *Spathiphyllum floribundum* leaves; determination of the qualitative composition and quantitative content of the main biologically active substances

5. List of graphic material (with exact indication of the required drawings):
Tables – 9, pictures – 8.

6. Consultants of chapters of qualification work

Chapters	Name, SURNAME, position of consultant	Signature, date	
		assignment was issued	assignment was received
1.	Kateryna SKREBTSOVA, assistent of the department of chemistry of natural compounds and nutriciology, PhD	03.10.2022	03.10.2022
2.	Kateryna SKREBTSOVA, assistent of the department of chemistry of natural compounds and nutriciology, PhD	07.11.2022	07.11.2022
3.	Kateryna SKREBTSOVA, assistent of the department of chemistry of natural compounds and nutriciology, PhD	05.12.2022	05.12.2022

7. Date of issue of the assignment: "28" _September_ 2022

CALENDAR PLAN

№ з/п	Name of stages of qualification work	Deadline for the stages of qualification work	Notes
1.	Botanical description, area of distribution, chemical composition, application in medicine and culinary, allergies and side effects	03.10.2022-21.10.2022	**done**
2.	Study of the qualitative composition of BAC of *Spathiphyllum floribundum* leaves	07.11.2022-28.11.2022	**done**
3.	Quantitative analysis of biologically active compounds in leaves of Spathiphyllum cannofolia	05.12.2022-07.02.2023	**done**

An applicant of higher education _____ Ali SEMAAN

Supervisor of qualification work _____ Kateryna SKREBTSOVA

ВИТЯГ З НАКАЗУ № 35
По Національному фармацевтичному університету
від 06 лютого 2023 року

нижченаведеним студентам 5-го курсу 2022-2023 навчального року, навчання за освітнім ступенем «магістр», галузь знань 22 охорона здоров'я, спеціальності 226 – фармація, промислова фармація, освітня програма – фармація, денна форма здобуття освіти (термін навчання 4 роки 10 місяців та 3 роки 10 місяців), які навчаються за контрактом, затвердити теми кваліфікаційних робіт:

Прізвище студента	Тема кваліфікаційної роботи		Посада, прізвище та ініціали керівника	Рецензент кваліфікаційної роботи
• **по кафедрі хімії природних сполук**				
Семаан Алі	Фітохімічне вивчення листя *Spathiphyllum floribundum*	Phytochemical study of *Spathiphyllum floribundum* leaves	ас. Скребцова К.С.	проф. Перехода Л.О.

Підстава: подання декана, згода ректора

Ректор

Вірно. Секретар

Ф А2.8-47-110

ВИСНОВОК

Комісії з академічної доброчесності про проведену експертизу щодо академічного плагіату у кваліфікаційній роботі здобувача вищої освіти

№ 112679 від « 28 » квітня 2023 р.

Проаналізувавши випускну кваліфікаційну роботу за магістерським рівнем здобувача вищої освіти денної форми навчання Семаан Алі, 5 курсу, _____ групи, спеціальності 226 Фармація, промислова фармація, на тему: «Фітохімічне вивчення листя *Spathiphyllum floribundum* / Phytochemical study of *Spathiphyllum floribundum* leaves», Комісія з академічної доброчесності дійшла висновку, що робота, представлена до Екзаменаційної комісії для захисту, виконана самостійно і не містить елементів академічного плагіату (компіляції).

Голова комісії,
професор **Інна ВЛАДИМИРОВА**

2%
29%

Ф А 2.2.1-32-353

REVIEW

of scientific supervisor for the qualification work of the level of higher education master of the specialty 226 Pharmacy, industrial pharmacy

Ali SEMAAN

on the topic: «Phytochemical study of *Spathiphyllum floribundum* leaves»

Relevance of the topic. The use of medicinal plants has deep roots in tropical countries. They are used for the prevention, supportment and treatment of various diseases. The search for new sources of medicinal plant raw materials is an urgent task today. Our attention was drawn to the raw material of *Spathiphyllum floribundum*. In the available literary sources there is not enough information on the chemical composition and use of raw materials of the plant.

Practical value of conclusions, recommendations and their validity. Analyzed and summarized the literature data on the botanical characteristics, chemical composition and pharmacological properties of plants of the genus *Spathiphyllum*. The presence of biological active compounds such as different types of organic acids, phenol carbonic acids, flavonoid aglycon and glycosides, content of BAC and quality indicators of herbal drugs were determined.

In the process of performing the qualification work, Ali SEMAAN mastered the methods of phytochemical analysis of medicinal plant raw materials.

Assessment of work. Ali SEMAAN qualification work was performed at a high scientific level. When conducting phytochemical analysis on the topic of the applicant's work, various methods of analysis were used.

Statistical processing of the results of quantitative determination of biological active compounds and quality indicators in accordance with the requirements of the State Pharmacopoeia of Ukraine

General conclusion and recommendations on admission to defend. Qualification work of Ali SEMAAN on the topic: "Phytochemical study of *Spathiphyllum floribundum* leaves" can be submitted for defense to the State Examination Commission.

Scientific supervisor _____ Kateryna SKREBTSOVA

«05» of April 2023

Ф А 2.2.1-32-356

REVIEW

for qualification work of the level of higher education master, specialty

226 Pharmacy, industrial pharmacy

Ali SEMAAN

on the topic: **«Phytochemical study of *Spathiphyllum floribundum* leaves»**

Relevance of the topic. Medicinal plants have long been used for the prevention and treatment of various diseases. Herbal remedies have a number of advantages over synthetic drugs: they are low toxic, have fewer side effects, the possibility of using in chronic diseases, greater bioavailability to the human body. The search for new promising medicinal plants and well known plants with a rich chemical composition and sufficient raw material base is relevant. Such plants include *Spathiphyllum floribundum*, which is widespread and cultivated not only in tropical region countries of the world and is used in folk medicine. Information on the chemical composition of leaves this species is fragmentary. Therefore, the topic of the work is relevant.

Theoretical level of work. The author of the qualification work analyzed the literature on botanical characteristics, distribution area, chemical composition and use of plants of the genus *Spathiphyllum* and make analysis of pharmacological activities and methods of determination of the quality of herbal drugs in many countries.

Author's suggestions on the research topic. The results of the research can be used in the development of draft pharmacopoeia's monograph of *Spathiphyllum floribundum* leaves (quality control methods).

Practical value of conclusions, recommendations and their validity. The author studied the qualitative composition of biologically active compounds in the studied herbal drugs. The content of the main groups of BAC and quality indicators of the studied raw materials.

Disadvantages of work. In the work there are bad expressions, spelling mistakes

General conclusion and assessment of the work. The proposed work is of practical importance and meets the requirements for qualification work. Qualification work of Ali SEMAAN on the topic: "Phytochemical study of *Spathiphyllum floribundum* leaves" can be submitted for defense to the Examination Commission

Reviewer _____ prof. Lina PEREKHODA

«11» of April 2023

Витяг
з протоколу засідання кафедри хімії природних сполук і нутриціології
Національного фармацевтичного університету
№ 4 від 18 квітня 2023 року

ПРИСУТНІ: Бурда Н.Є., Журавель І.О., Кисличенко В.С., Комісаренко А.М., Король В.В., Новосел О.М., Попик А.І., Попова Н.В., Процька В.В., Скребцова К.С., Тартинська Г.С., Хворост О.П.

Порядок денний:

1. Щодо допуску здобувачів вищої освіти до захисту кваліфікаційних робіт у Екзаменаційній комісії.

СЛУХАЛИ: про представлення до захисту в Екзаменаційній комісії кваліфікаційної роботи на тему «Фітохімічне вивчення листя *Spathiphyllum floribundum*» здобувачf вищої освіти випускного курсу Фм18(5,0д)англ-06 групи Алі СЕМААНА.
Науковий керівник: асистент Катерина СКРЕБЦОВА
Рецензент: професор Ліна ПЕРЕХОДА

УХВАЛИЛИ: рекомендувати до захисту в Екзаменаційній комісії кваліфікаційну роботу здобувача вищої освіти Фм18(5,0д)англ-06 групи Алі СЕМААНА. на тему «Фітохімічне вивчення листя *Spathiphyllum floribundum*».

Завідувачка кафедри хімії природних
сполук і нутриціології Вікторія КИСЛИЧЕНКО

Секретар кафедри ХПСіН Надія БУРДА

Ф А2.2.1-32-042

НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

ПОДАННЯ
ГОЛОВІ ЕКЗАМЕНАЦІЙНОЇ КОМІСІЇ
ЩОДО ЗАХИСТУ КВАЛІФІКАЦІЙНОЇ РОБОТИ

Направляється здобувач вищої освіти Алі СЕМААН до захисту кваліфікаційної роботи за галуззю знань 22 Охорона здоров'я
спеціальністю 226 Фармація, промислова фармація
освітньою програмою Фармація
на тему: «Фітохімічне вивчення листя *Spathiphyllum floribundum*».

Кваліфікаційна робота і рецензія додаються.

Декан факультету _____ / Світлана КАЛАЙЧЕВА /

Висновок керівника кваліфікаційної роботи

Здобувач вищої освіти Алі СЕМААН засвоїв основні методи фітохімічного аналізу, дана кваліфікаційна робота має практичне значення та відповідає вимогам, що висуваються до роботи певного рівня

Керівник кваліфікаційної роботи

_____ Катерина СКРЕБЦОВА

«05» квітня 2023 р.

Висновок кафедри про кваліфікаційну роботу

Кваліфікаційну роботу розглянуто. Здобувач вищої освіти Алі СЕМААН допускається до захисту даної кваліфікаційної роботи в Екзаменаційній комісії.

Завідувач(ка) кафедри хімії природних сполук і нутриціології

_____ Вікторія КИСЛИЧЕНКО

«18» квітня 2023 року

Qualification work was defended

of Examination commission on

« ___ » _____ 2023

With the grade _____

Head of the State Examination commission,

DPharmSc, Professor

_____ / Oleh SHPYCHAK /