Ф А 2.2.1-32-367

MINISTRY OF HEALTH OF UKRAINE

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 AZALIA INDICA FLOWERS**"

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Kharkiv – 2023 year

ANNOTATION

For the first time, BAC was identified and the quantitative content of the main BAS groups in *Azalea indica* flowers was determined. Technological parameters are established. The results can be used as a basis for the project of quality control methods "*Azaleae indicae Flores*".

It consists of an introduction, literature review, experimental part, general conclusions, list of used literature sources, set out on 42 pages, includes 10 tables, 12 figures, 64 sources of literature.

Key words: Azalea indica, flowers, chemical composition

АНОТАЦІЯ

Вперше проведено ідентифікацію БАР та визначення кількісного вмісту основних груп БАР у листі азалії індійської. Встановлено технологічні параметри сировини. Результати можуть бути положені у основу проекту методів контролю якості «*Azaleae indicae Flores*».

Складається зі вступу, огляду літератури, експериментальної частини, загальних висновків, переліку використаних літературних джерел, викладена на 42 сторінках, включає 10 таблиць, 12 рисунків, 64 джерела літератури.

Ключові слова: азалія індійська, квітки, 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

In the modern world, in connection with the rapid development of the pharmaceutical and chemical industry, the need to invent new sources of medicinal plant raw materials for the creation of therapeutic and preventive medicinal products of plant origin, the cultivation of plants and the expansion of the raw material base has significantly increased [19,20,29]. Another important issue is the pharmacognostic research of plant raw materials with the study of chemical composition and establishment of pharmacological properties of raw materials of new promising plant species [5,21,28,30].

Considering these facts, our attention was drawn to the raw material of Azalea indica [3,8,25,35].

Purpose. The purpose of the Master's thesis was the phytochemical study of Azalia indica flowers.

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 *Azalia indica*;
– establish the main numerical indicators of the flowers of the plant raw material according to the SPhU requirements;
– carry out identification of BAC in the *Azalia indica* plant raw material;
– carry out quantitative analysis of BAC in the *Azalia indica* plant raw material;
– to establish the technological parameters of *Azalia indica* flowers.

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 *Azalia indica* flowers.

The object of the research: phytochemical study of *Azalia indica* flowers.

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

[24]. The experiment results were processed by statistical methods according to the requirements of the State Pharmacopoeia of Ukraine [13-18].

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 "*Azaleae indicae Flores*".

The practical significance and scientific novelty of the results. For the first time, a pharmacognostic study of *Azalia indica* flowers was conducted. The presence of flavonoids, tannins, saponins, polysaccharides in the composition of raw materials was established, and the quantitative content of the following BAC groups was determined: phenolic compounds in terms of pyrogallol, coumarins, flavonoids, organic acids, ascorbic acid. For the first time, the quality indicators of *Azalia indica* flowers were determined, namely the loss in mass during drying, the content of total ash and extractive substances. Also, for the first time, the diagnostic features of the morphological structure were selected.

Elements of scientific research - for the first time, a systematic study of the chemical composition of plant raw materials - *Azalia indica* flowers - was carried out.

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 42 pages, including 10 tables, 12 figures, 64 literature sources.

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

1.2. Short botanical description and features of *Azalea* genus plants

Azalea is the trivial name of some flowering shrubs of the genus *Rhododendron* of the family *Ericaceae*. Previously, azaleas were separated into an independent genus, which included up to 37 species, but now belong to the rhododendron genus. Rhododendrons are shrubs from 1 m to 30 m tall. There are creeping shrubs. In culture, rhododendron exists for up to 50 years, in natural conditions - up to 100 years. The plant is early spring honeysuckle [4,7,37].

Rhododendrons are upright tall or slender low-growing shrubs. Height from 10-15 cm (*Rh.camtschaticum*) to 20-30 meters (*Rh.giganteum*). The leaves are alternate, large, oval, evergreen or deciduous, on short petioles, dark green above, lighter below. Shoots are dark brown, young - green, fully woody. The wood, as in all heathers, is very dense, resinous, reminiscent of coniferous wood. Flowers in umbrella-shaped shields. Petioles 0,5-1,5 cm long. The flowers are bisexual. The perianth is double. Calyx 5-incised, small. The corolla is funnel-shaped, the tube is cylindrical. Stamen 5. The color of the flowers is diverse: white, yellow, pink, red, purple, purple, and others (the color can be any, except pure blue). Blooms in spring, from April to mid-June. The ovary is upper. The fruit is an oblong-cylindrical, pod-like box, up to 2,5 cm long, which opens with longitudinal flaps. The seeds are very small, numerous, ripen in autumn. Freshly collected seeds germinate without stratification, those that were stored at room temperature need three-month stratification at a temperature of +2 ° - + 4 ° C [11]. The viability of seeds in different species is from 80% to 100%. The root system of rhododendrons is fibrous and consists of many small roots that densely intertwine the soil, lies

shallow (no deeper than 40-60 cm). A feature of the root system of rhododendrons, like other heathers, is that it does not have root hairs. Absorption of water and minerals is carried out by epiblema cells or mycorrhizal mycelium (symbiosis with fungi). The mycorrhiza of rhododendrons is endotrophic, that is, there are the simplest fungi that live entirely in the rhododendron root cells and are gradually digested by them. Mycorrhiza has a huge positive value in the life of heathers, providing plants with nutrients. In exchange, the mushrooms receive organic substances produced by the ericoid shrub. Mycorrhiza promotes the germination of heather seeds, as well as the active growth and development of plants on very acidic soils poor in mineral nutrients. An ordinary garden rhododendron has a bush height of about 2 m and blooms in May, but depending on the varietal characteristics, the height of the bush can vary from 30 cm to 3 m, and the flowering period should be in April – June [38,57,60].

Rhododendron and Azalea are undoubtedly well-known shrubs due to their bright and diverse flowers. Currently, botanists use the term "*Azalea*" only to refer to one subgenus in the genus "*Rhododendron*". Despite this, both names have been preserved in horticulture since the time of K. Linnaeus: deciduous species are called azaleas, and evergreen species are called rhododendrons. It can also be distinguished by the number of stamens. The name of the genus rhododendron is of Greek origin and consists of two words: "rhodon" means "rose" and "dendron" means "tree". Together it sounds like a rose tree or a rhododendron. Translated from Greek, the word "azaliya" literally means "dry". And indeed, before the rose-like flowers bloom, the plant is a dry shrub with small, rough, paper-like leaves. In Asian countries, the azalea flower is called the English rose, and in Germany it is called the Alpine rose. In Japan it is called "tsutsuji" [10,26,39,64].

Homeland: China, Japan, India. Representatives of the genus, growing in the cool mountain forests of the northern hemisphere, form whole thickets. In India, they grow into a miniature tree one and a half meters tall. In Japan, these beautiful flowers are especially popular in bonsai culture [40,54,59].

Widely distributed varieties based on two species that differ in terms of flowering and petal color:

Rhododendron simsii - Rhododendron Sims, or Azalea Sims, or indica azalea (Fig. 1.1). Dwarf shrub 30-50 cm tall.

Fig. 1.1. Azalea indica

Rhododendron obtusum - Stupid rhododendron, or Japanese azalea (Fig. 1.2). Dwarf shrub 30-40 cm tall.

Fig. 1.2. Rhododendron obtusum

Japanese azalea (*Satsuki azaleas*) is one of the most decorative garden species. The flowers are small, but this type of azalea has the advantage over the

Indica that it can continue to grow as an ornamental shrub if it is planted in open ground after flowering (Fig. 1.3). It is grown in the garden mainly in regions with a mild and humid climate.

Fig. 1.3. Satsuki azaleas

Japanese azalea is grown as an evergreen shrub, a perennial with a very slow growth rate. In nature, the height of this shrub can reach 3 m, but in the conditions of garden cultivation, the azalea reaches only 0,5 m -1,5 m, depending on the climate and care. The shoots of Japanese azalea are very fragile and delicate, covered with light gray bark. They are located very close to each other, which is due to strong branching. Japanese azalea bushes are very compact due to the location of the shoots, so they are perfect for creating unusual landscape compositions and hedges. The branches of the shrub are covered with very small leaves, 2-3 cm long. The shape of the leaves is oblong, lanceolate with a glossy surface. The lower part of the leaf plate is matte and has a little pubescence. The color of the leaves is dark green. Japanese azalea flowers are the main value and pride of this type of plant. The shape of the flowers is funnel-shaped, tubular or flat, depending on the variety. They can also be simple, small, very large and terry [31,33,34,36].

Garden or lake azalea (*Azalea indicum*) (fig. 1.4). Shades of Japanese azalea blossoms can also be varied: from white to bright red or pink, you can also find a

variegated color palette and two-color azalea flowers. Japanese azalea blooms from mid-May for 1,5-2 months, depending on the variety and climatic conditions. During flowering, the azalea bush is completely covered with beautiful and fragrant flowers, sometimes even the leaves and branches are not visible behind them. At this time, the plant looks like a big and bright ball. The winter hardiness of the Japanese azalea allows it to be grown on the territory of our country, as it can withstand a temperature of - 27°C degrees. This plant is widely used in landscape design to create original garden compositions and various hedges [49].

his is a fairly shade-tolerant hybrid shrub that prefers moderate watering. With high-quality care, it grows no more than a meter. This azalea starts blooming in late fall and blooms all winter. Large flowers look very beautiful against the background of dark leaves. At first, it was grown only in greenhouses, but later varieties were bred that can winter under the open sky. And naturally, then the flowering period changed - the garden azalea, growing on the street, began to bloom in the spring. The plant needs a winter temperature of no higher than 15 degrees. Otherwise, he simply will not survive. Therefore, it needs to be provided with a cold greenhouse or a bright basement, and then its magical flowering will delight those around it every year [52,53].

Fig. 1.4. Azalea indica

1.3. Botanical characteristics of Azalea indica

Azalea indica belongs to the genus *Rhododendron*. This decorative plant is a flowering evergreen shrub, its homeland is Southern Europe and North America. Today, there are about 350 varieties of this plant. Under the conditions of home cultivation, the plant reaches a height of no more than 50 cm. It is distinguished by dark green leaves, which are located on short petioles and are up to 3,5 cm long. In nature, the shrub prefers to grow in areas where cool temperatures and high humidity prevail. The plant has a lignified brown trunk. Green leathery type leaves. It has a funnel-shaped corolla. Garden forms of Azalea indica are extremely diverse. Its flowering period usually falls between the beginning of December and the end of January, while late varieties produce flowers in late February and early March. The flowers are large, bright, pink-red, up to 5 cm in diameter, usually 2-6 are located in the axils of the leaves (Fig. 1.5). There are other colors: white, yellow, red, cream, as well as decorative two-color, for example, pink with a white border around the edge of the petals (Inga variety) and white with a pink center (Osta variety). Azalea flowers can be double, non-double, with corrugated petals. Ampel and pyramidal forms have recently appeared. The plant is not afraid of low temperatures and blooms from November to June, depending on the variety. Fragrant azaleas with a delicate aroma are especially interesting: “*Mistral*”, “*Lara*”, “*Marie van Estvelde*”. One hundred years ago, varieties were bred in Europe that opened before Christmas, for example, the popular early variety "*Madame Petryk*" [41,50,55].

Fig. 1.5. Azalea indica

1.3.1. Varieties of Azalia indica

The main progenitor of varieties of indoor azaleas is a natural species of rhododendron indica, or Sims (*Rhododendron simsii*), which grows in humid mountain forests in an atmosphere of constant fog, rain and relative coolness. Numerous hybrids were obtained from it [48].

Azalea indica is represented by various varieties, each of which differs not only in decorative properties, but also in growing conditions. Therefore, before purchasing such a "beauty", it is important to know what will be required for its care. The most popular varieties of plants include: "*John Herens*", "*Niobe*", "*Concinna*", "*Albert Elizabeth*", "*Celestina*", "*Esmeralda*", "*Eggebrecht*", "*Verveniana Rosa*" and "*Fritz Saidor*". At the same time, several varieties are in great demand among flower growers:

Adventglocken variety. The variety is characterized by an early-mid flowering period, during which non-terry bells and red or crimson flowers appear on the bushes. The diameter of the buds is up to 6 cm (Fig. 1.6).

Fig. 1.6. Adventglocken variety

Weisse Schame variety. In this variety, the flowers have a wide funnel-shaped shape, their diameter is - 6,5 cm (Fig. 1.7). As for the color, it can be cream, white, or light pink.

Fig. 1.7. Adventglocken Weisse Schame

Doberlug variety. This plant is one of the most beautiful varieties of Azalea indica, the flowers of which differ in an irregular shape (Fig. 1.8). They are terry, medium in size (diameter up to 7,5 cm) and colored in dark pink color with a white border around.

Fig. 1.8. Сорт Doberlug

"Dresden +1936" variety. When the plant blooms, the bush is covered with medium-double flowers (their diameter is - 6,5 cm) of pink color, which are unusually shiny and iridescent (Fig. 1.9).

Fig. 1.9. "Dresden +1936" variety

1.3.2. Features of cultivation of Azalia indica

It is not easy to propagate Azalea indica in indoor culture - both by seeds and vegetatively, but experienced flower growers succeed in both ways. Seed

propagation, in which the characteristics of the original plants are mixed and split, is mainly used by specialist breeders who breed new luxury varieties. When propagating by cuttings, as well as when dividing a bush, the varietal qualities of the mother plant are preserved [12,26,63].

Reproduction by seeds. Sowing is carried out in an acidic soil mixture consisting of peat and partially rotted pine needles, sprinkling the seeds a little. After covering with polyethylene, they are placed in a bright place, since azalea seeds germinate only when they are illuminated. The temperature should be 18-24°C, it is also necessary to maintain the substrate and air in a moist state. Germination time varies greatly - from a week to two months. After most of the seeds have sprouted, they are gradually released from the greenhouse and the temperature is lowered. Watering is sufficient, but not excessive, otherwise the seedlings will be affected by black leg. If the daylight hours are short, it is necessary to organize additional education until 16-18 hours. When the first real leaves appear, the seedlings are planted [42,56,62].

Propagation by cuttings. The best time for cutting cuttings is spring and summer (March-June). They should be semi-woody, 5-8 cm long. They are treated with stimulators of root formation and growth, after which, buried by 2 cm, they are placed for rooting in acidic soil - soil with rotten needles or peat. Cover with polyethylene, ventilate, water and spray. The time during which the stem forms the first roots is from one to one and a half months, and the process of final rooting and formation of new shoots can take up to six months [58].

Propagation by division of the bush. A three- to four-year-old azalea bush can be divided and planted in separate containers. This operation requires extreme caution due to the increased vulnerability of the surface root system of Azaleas indica.

Azalea indica likes soil with a high level of acidity (pH from 4 to 4,5). Planting mixtures can be easily obtained by mixing coarse sand, coniferous soil and peat in proportions of 1:2:1.

Choosing the right pot plays a big role before planting a plant. The container should be small, shallow, wide and have holes for drainage. It is not recommended to use large containers, as the plant grows slowly and disease-causing bacteria can develop in unused soil. At the bottom of the pot, you need to place a drainage layer consisting of small pebbles or expanded clay [52,53,58,61].

1.3. Chemical composition

The chemical composition of the plant has not been sufficiently studied. There is information in the literature that the raw material contains an essential oil containing more than 80 compounds, most of which affect the smell of the oil. Alcohols (hexyl, heptyl, terpineol, linalool), sesquiterpenoids (caryophyllene, cadinene, neroledol, etc.), methyl esters of eugenol and isoeugenol, as well as benzyl esters of benzoic, salicylic, and anthranilic acids are found here (Fig. 1.10). Essential oil is a viscous mass of yellow-brown or greenish color with a persistent floral smell [32,43,61].

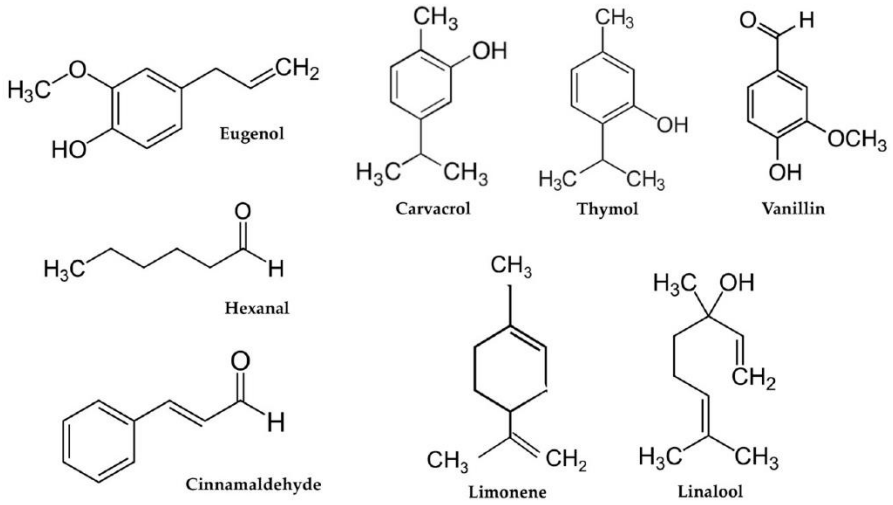

Fig. 1.10. Formulas of volatile compounds

The leaves contain vitamin C, polysaccharides, resins, and tannins.

1.4. Use of the plant in folk medicine plants of the genus *Azalea*

In the folk medicine of China, the leaves, fruits, and roots of *Rhododendron Sims* (Rh. Simsii Planch.) are widely used for medicinal purposes. The leaves are used exclusively externally as a disinfectant, pain reliever and antipyretic for bleeding of various etiologies, eczema, furunculosis and abscesses. Decoctions from the fruits of the plant purify the blood, regulate the menstrual cycle, and eliminate rheumatism. The roots are not poisonous. Decoction of roots helps with hemoptysis, nasal, uterine and intestinal bleeding, dysentery, rheumatism, congestion, mastitis [44,51,61].

It is also known to use azalea petals against leg cramps and to remove barley from the eyes and other eye diseases. According to some data, they have a calming and relaxing effect.

Essential oil can be used in perfume compositions and as a flavoring agent. Adds a piquant bitterness to the aroma of perfumes.

Perfectly cleans the air in the room from unpleasant odors.

Dark red azalea is used against domestic ants, moths, and bark beetles. Widely used in landscape design [45-47].

CONCLUSIONS TO CHAPTER 1

Azalia indica is an unpretentious plant that does not require special growing conditions and frequent transplants, easily tolerates direct sunlight and drought, and is frost-resistant. The only thing that must be remembered: azalea needs constant watering, has a negative attitude to dryness. In such conditions, it will quickly wither and die.

The chemical composition of the plant has not been sufficiently studied.

That is why the plant needs further pharmacognostic research. *Azalea indica* is a promising source of medicinal plant raw materials.

CHAPTER 2
DETERMINATION OF NUMERICAL INDICES OF AZALIA INDICA FLOWERS

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.

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

The results of the experiments are shown in Table 2.1.

Table 2.1

Results of the weight loss on drying determination of Azalia indica flowers

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	4,23 4,69 4,55 4,17 4,31	4,39	0,05	0,10	0,95	2,78	**4,39 ± 0,28**	3,27

As can be seen from the data given, the weight loss on drying of Spathiphyllum floribundum flowers was 4,39±0,28 %.

2.2. Total Ash

Five exact measurements (3,0 g) of Azalea indica flowers were taken to determine the total ash content. Determination of wire in porcelain crucibles. The

empty crucibles were dried to a constant mass and weighed. The raw material was placed in a crucible and burned on an electric stove, and then in a muffle furnace at a temperature of 600 °C to a constant mass. Crucibles were cooled in a desiccator and weighed [10].

The content of total ash (X, %) in the quantity of pleasant flowers was calculated according to the formula:

$$X = \frac{(m_2 - m_1) \times 100 \times 100}{m \times (100 - W)},$$

m – weight of raw materials, g;

m_1 – the mass of the crucible, g;

m_2 – mass of the crucible with ash, g;

W – loss in mass during drying of raw materials, % [7, 9].

The results of the experiments are shown in Table 2.2.

Table 2.2

Results of the total ash determination of Azalia indica flowers

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	2,76 2,95 2,87 3,03 2,89	2,9	0,01	0,05	0,95	2,78	**2,90 ± 0,12**	2,29

As can be seen from the data given, the total ash of *Spathiphyllum cannofolia* flowers was 2,90 ± 0,12 %.

2.3. Extractable Matter

Determination of the extractable matter was carried out according to the State Pharmacopoeia of Ukraine (monograph "*Artemisia absinthium*").

The content of extractive substances (X) as a percentage in terms of absolutely dry substance was calculated according to the formula:

$$X = \frac{m \cdot 200 \cdot 100}{m_1 \cdot (100 - W)}$$

m – mass of dry residue, g;

m_1 – mass of raw materials, g;

W – loss in mass during drying of raw materials, %.

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

Table 2.3

Results of the extractable matter in *Azalia indica* flowers

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	17,45 16,98 17,55 16,76 17,26	17,2	0,12	0,15	0,95	2,78	**17,20 ± 0,41**	2,37
30 % ethanol									
5	4	14,76 15,11 14,53 13,97 14,34	14,54	0,19	0,19	0,95	2,78	**14,54 ± 0,53**	3,67
50 % ethanol									
5	4	23,87 24,12 22,84 23,51	23,49	0,28	0,24	0,95	2,78	**23,49 ± 0,66**	2,79

Table. 2.3 (continued)

1	2	3	4	5	6	7	8	9	10
		23,11							
70 % ethanol									
5	4	20,12 19,85 21,43 20,79 21,51	20,74	0,56	0,34	0,95	2,78	**20,74 ± 0,93**	4,49
96 % ethanol									
5	4	11,39 10,74 10,91 10,46 10,81	10,86	0,12	0,15	0,95	2,78	**10,86 ± 0,42**	3,88

The content of extractive substances in Azalea indica flowers was determined, which amounted to 17,20 ±0,41% when using water, 30% ethanol – 14,54±0,53%, 50% ethanol – 23,49±0,66%, 70% ethanol – 20,74±0,93%, 96% ethanol – 10,86±0.42%. The obtained results showed that when 50% ethanol is used as an extractant, the largest amount of extractive substances is extracted - 23,49±0,66%. The lowest content of extractive substances was observed when using 96% ethanol – 10,86±0.42%.

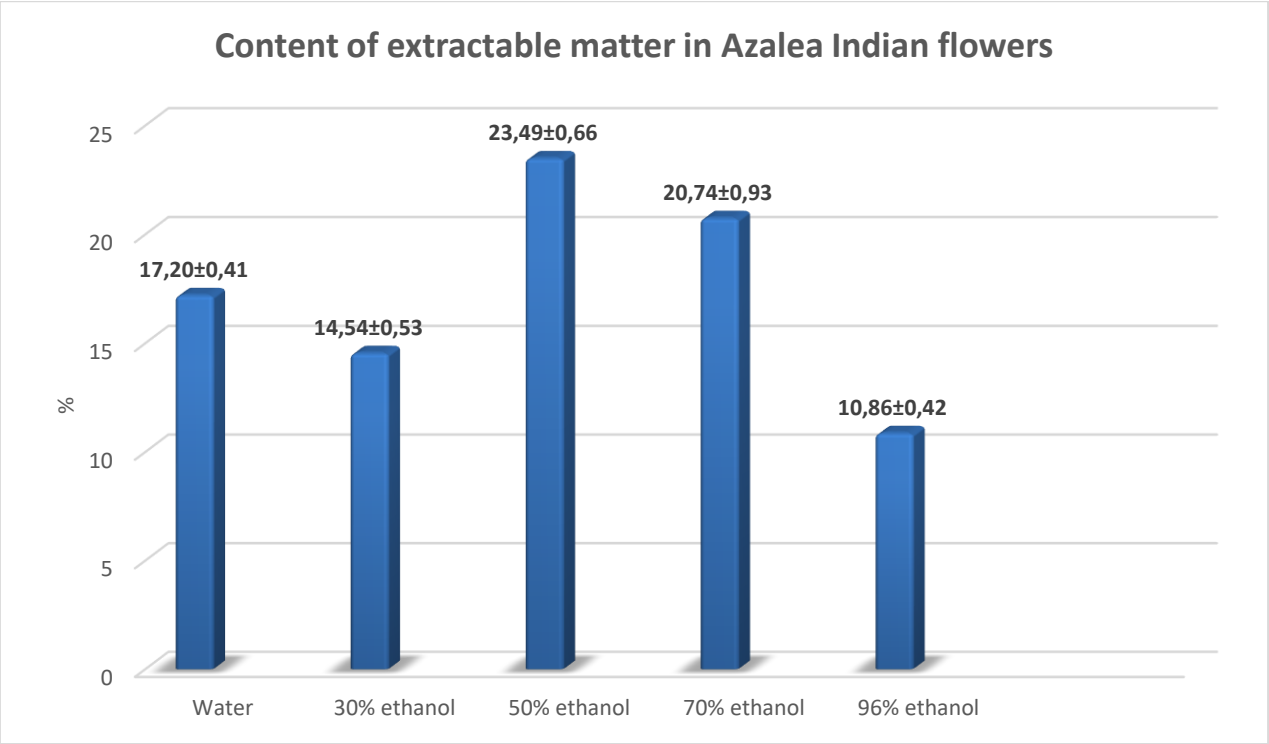

Fig. 2.1. Diagram of the content of extractable matter Azalea indica flowers

CONCLUSIONS TO CHAPTER 2

1. The numerical indices of Azalea indica flowers were determined.
2. The weight loss on drying is 4,39 ± 0,28 %.
3. The total ash content is 2,90 ± 0,12 %.
4. The maximal content of extractable matter in Azalia indica flowers is 23,49± 0,57 % when used 50% ethanol as solvent.

CHAPTER 3
PHYTOCHEMICAL ANALYSIS OF AZALIA INDICA FLOWERS

3.1. Study of the qualitative composition of BAR of Azalia indica flowers

3.1.1. Identification of polysaccharides

The presence of carbohydrates was determined in the aqueous extract of Azalea indica flowers using the following identification reactions.

1. Fehling's reagent was used to determine the presence of free and bound sugars. The reaction was carried out in two test tubes, which contained an aqueous extract of the studied raw material. Concentrated hydrochloric acid was added to one of them, and an equal amount of water was added to the second. Fehling's reagent was also added. The test tubes were heated in a water bath and left in the tripod for 10 min [20]. The results of the reaction are given in table. 3.1.

2. The second reaction was carried out with a solution of α-naphthol and concentrated sulfuric acid [20]. The results of the reaction are given in table 3.1.

3. The presence of polysaccharides was determined by reaction with 96% ethanol. For this purpose, 10 ml of the aqueous extract of the pleasant flowers of Colquitia was gradually added to 50 ml of 96% ethanol [20]. The results of the reaction are given in table. 3.1.

3.1.2. Identification of phenolic compounds

Reactions to coumarins.

To determine the presence of coumarins, a water-alcohol extract of Azalea indica flowers was used.

1. The lactone test is based on the peculiarity of α-lactones, under the influence of alkalis, the lactone ring opens, and when the solution is acidified, the ring closes again [20]. The results of the reaction are shown in the table. 3.1.

2. Reaction with diazotized sulfanilic acid. Sodium hydroxide solution and diazotized sulfanilic acid were added to the water-alcohol extract [20]. The results of the reaction are given in table. 3.1.

Reactions to flavonoids.

Detection of flavonoids was carried out in a water-alcohol extract using the following identification reactions.

1. The cyanidin reaction is based on the ability of flavonoids to be reduced under the action of atomic hydrogen, resulting in the formation of cyanidin chloride, which in an acidic environment has a pink or purple color of varying intensity [20]. The results of the reaction are given in table. 3.1.

2. Briant's cyanidin reaction allows you to preliminarily establish in which form (free or glycosidated) flavonoids are contained in plant raw materials. For this, octanol was added to the colored solution formed after the cyanide reaction was carried out [20]. The results of the reaction are given in table. 3.1.

3. Sodium hydroxide solution. A water-alcohol extract of the collquizia of pleasant flowers was placed in a test tube and a 10% alcohol solution of sodium hydroxide was added [20]. The results of the reaction are given in table. 3.1.

4. The presence of phenolic hydroxyl in the flavonoid molecule was determined using a reaction with a 10% solution of ferric (III) chloride. The results of the reaction are given in table. 3.1.

5. Reaction with aluminum(III) chloride solution. A water-alcohol extract of Azalea indica flowers and 2% solution of aluminum chloride [20] were placed in a test tube. The results of the reaction are given in table. 3.1.

6. Reaction with a solution of lead acetate. A positive result of the reaction is observed in the presence of two phenolic hydroxyls in ring B of the flavonoid

molecule, which are located next to each other [20]. The results of the reaction are given in table. 3.1.

Reactions to tannins.

Detection of tannins was carried out in water extraction using sedimentary and color reactions.

A 1% solution of quinine chloride and a 1% solution of gelatin were used for precipitation reactions [20]. The results of the reaction are given in table. 3.1.

To carry out the color reaction, a solution of ferrum (III) ammonium sulfate was added to the water extract of the collquizia of pleasant flowers. This reaction makes it possible to determine the group of tannins [20]. The results of the navedent reaction in table. 3.1.

3.1.3. Identification of iridoids

The analytical sample of the raw material was crushed to the size of particles that passed through a sieve with holes with a diameter of 1 mm. 0.5 g of crushed raw material was poured with 15 ml of 96% ethyl alcohol and heated for 20 minutes in a water bath at a temperature of 60°C. The obtained extract was filtered through a paper filter and evaporated to a volume of about 3-4 ml.

Reaction with Stahl's reagent.

1 ml of the extract was placed in a test tube, 0.5 ml of Stahl's reagent was added. The mixture was heated in a water bath for 1-2 minutes. Stahl's reagent: 5 ml of concentrated hydrochloric acid, 1.0 g of p-dimethylaminobenzaldehyde were dissolved in a 96% ethanol solution in a volumetric flask with a capacity of 100 ml.

The results of the reaction are given in table. 3.1.

Reaction with Trim-Hill's reagent.

1 ml of extract was placed in a test tube, 0.5 ml of Trim-Hill reagent was added. The mixture was heated in a water bath for 1-2 minutes. Trim-Hill's reagent: a mixture of glacial acetic acid, concentrated hydrogen chloride and 0.2% aqueous solution of copper sulfate (20:1:2).

The results of the reaction are given in table. 3.1.

Table 3.1

The results of studying the composition of BAC of Azalea indian flowers

BAC group	Reactant or reaction	Observation
1	2	3
Polysaccharides	Fehling's reagent	A brick-red precipitate was formed, which was larger in the test tube after acid hydrolysis
	Solution of α-naphthol and concentrated sulfuric acid	No changes
	96% ethanol	An amorphous precipitate was formed
Coumarins	Lactone test	No changes
	With diazotized sulfanilic acid	A red color appeared
Flavonoids	Cyanidin reaction	A dark pink color gradually appeared
	Briant's cyanidin reaction	The red color of the water layer is more intense than that of the organic layer (glycosides of flavonoids)
	Sodium hydroxide solution	A yellow-brown color appeared
	10% solution of ferric (III) chloride	A dark green color appeared

Table. 3.1 (continued)

1	2	3
	Aluminum(III) chloride solution	No changes
	Solution of lead acetate	No changes
Tanins	1% solution of quinine chloride	A white amorphous precipitate was formed
	1% solution of gelatin	A turbidity was forming
	Iolution of ferrum (III) ammonium sulfate	No changes
Iridoids	Stahl's reagent	No changes
	Trim-Hill's reagent	No changes

3.1.4. Identification of organic acids

Chromatographic study. The presence of organic acids was determined by the method of paper chromatography. Aqueous extract of Azalea indica flowers was applied to "Filtrak" FN 6 chromatographic paper with authentic samples of organic acids and chromatographed in a solvent system of ethyl acetate-acetic acid-formic acid-water (100:11:11:25). After that, the chromatograms were air-dried in a fume hood and treated with a solution of bromophenol blue and methyl red, followed by heating in a drying cabinet at a temperature of 105º C. Organic acids appeared as yellow spots on a blue background [20]. The scheme of the chromatogram is presented in fig. 3.1.

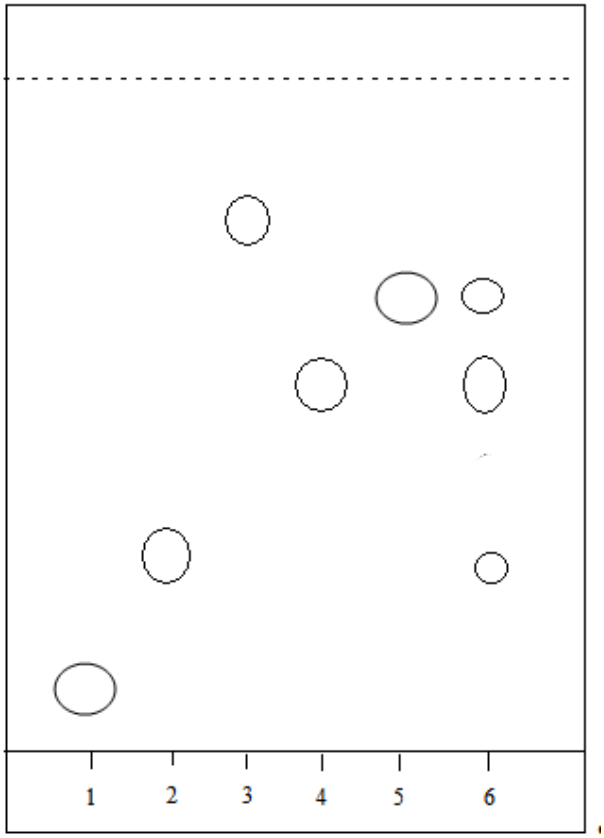

Fig. 3.1. Scheme of the chromatogram for the detection of organic acids in Azalia indica flowers (1 – oxalic; 2 – ascorbic; 3 – tartaric; 4 – malic; 5 – citric; 6 - water extract from Azalea indica flowers).

Solvent system: ethyl acetate-acetic acid-formic acid-water (100:11:11:25). Reagents for development: a solution of bromophenol blue and methyl red. Ascorbic, malic and citric acids were identified in the raw materials.

3.2. Quantitative analysis of biologically active compounds in flowers of *Azalia indica*

3.2.1. Determination of coumarins

Quantitative content of total coumarins in flowers of Azalea indica was determined by the photocolorimetric method [8].

The quantitative content of coumarins (X, %) in terms of absolutely dry raw materials was calculated according to the formula:

$$X = \frac{C \times V \times K \times 100 \times 100}{m \times 10000 \times (100 - W)},$$

C – concentration found from the calibration graph, mg/ml;

V – hood volume, ml;

K – dilution factor;

m – weight of raw materials, g;

W – loss in mass during drying of raw materials, % [17, 21].

The results of determining the quantitative content of the sum of coumarins in flowers of Azalea indica are presented in the table. 3.2.

Table 3.2

Results of the quantitative determination of coumarins in Azalia indica flowers (%, in terms of coumarin and dry raw materials)

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	0,24 0,22 0,23 0,23 0,24	0,23	0,0001	0,01	0,95	2,78	**0,23 ± 0,01**	2,48

As a result of photocolorimetric determination of the quantitative content of the sum of coumarins, it was established that their content was 0,23±0,01%.

3.2.2. Determination of flavonoids

The quantitative determination of the flavonoids content was carried out by the spectrophotometric method.

The quantitative content of the sum of flavonoids (X, %), in terms of luteolin-7-glucoside and dry raw materials, was calculated according to the formula:

$$X = \frac{A_1 \times m_0 \times P \times 1{,}63}{A_0 \times m \times (100 - W)},$$

A_1 – optical density of the tested solution at a wavelength of 410 nm;

A_0 – optical density of the reference solution at a wavelength of 410 nm;

m_0 – weight of luteolin, g;

m – the weight of the tested raw material, g;

1,63 – conversion factor of luteolin to luteolin-7-glucoside;

P – the content of luteolin of luteolin, %;

W – loss in mass during drying of raw materials, % [10].

The results of determining the quantitative content of flavonoids in flowers of Azalea indica are shown in table. 3.3.

Table 3.3

Results of the quantitative determination of flavonoids in Azalia indica flowers (%, in terms of luteolin-7-glucoside and dry raw materials)

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
5	4	3,11 2,92	2,97	0,01	0,05	0,95	2,78	**2,97 ± 0,14**	4,55

Table. 3.3 (continued)

1	2	3	4	5	6	7	8	9	10
		2,98							
		3,02							
		2,82							

The quantitative content of the sum of flavonoids in terms of luteolin-7-glucoside and completely dry raw materials was 2,97±0.14%.

Thus, the quantitative content of the sum of flavonoids in flowers of Azalea indica in terms of luteolin-7-glucoside and completely dry raw materials was at least 2.4%.

3.2.3. Determination of the quantitative content of the sum of phenolic compounds in terms of pyrogallol

Determination of the quantitative content of the sum of phenolic compounds in terms of pyrogallol was carried out according to the methodology outlined in SPU 2.0 [6].

The quantitative content of the sum of phenolic compounds in terms of pyrogallol (X, %), in terms of pyrogallol, was calculated according to the formula:

$$X = \frac{62,5 \times A_1 \times m_2}{A_2 \times m_1},$$

m_1 – mass of the tested sample, g;

m_2 – mass of pyrogallol, g.

The results of determining the quantitative content of the sum of phenolic compounds in terms of pyrogallol in flowers of Azalea indica are presented in the table. 3.4.

Table 3.4

Results of the quantitative determination of of the sum of phenolic compounds in Azalia indica flowers (%, in terms of pyrogallol and dry raw materials)

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	4,95 4,75 5,15 4,93 4,64	4,85	0,04	0,09	0,95	2,78	**4,88 ± 0,14**	2,96

The quantitative content of the sum of phenolic compounds in terms of pyrogallol in flowers of Azalea indica was 4,88±0,14%.

3.2.4. Determination of the quantitative content of ascorbic acid

Determination of the quantitative content of ascorbic acid was determined according to the method described in the monograph "Rosehip Fruits" SPU 2.0. The quantitative content of ascorbic acid was determined by the spectrophotometric method on a Lambda 25 Perbin Elmer spectrophotometer. [18].

The content of ascorbic acid, in percent, was calculated according to the formula:

$$X = \frac{2,5 \times A_1 \times m_2}{A_2 \times m_1},$$

A_1 — optical density of the tested solution;

A_2 — the optical density of the solution is comparable;

m_1 — weight of the tested raw material, g;

m_2 — weight of ascorbic acid, g.

The results of determining the content of ascorbic acid in flowers of Azalea indica are presented in the table. 3.5.

Table 3.5

Results of the quantitative determination of ascorbic acid in Azalia indica flowers (mg/%, in terms of ascorbic acid and dry raw materials)

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	11,43 10,87 10,58 10,88 11,31	11,01	0,12	0,16	0,95	2,78	**11,01 ± 0,43**	3,94

Azalea indica flowers contained 11,01±0.43 mg/% ascorbic acid.

3.2.6. Determination of organic acids

Determination of the quantitative content of the sum of organic acids was determined according to the method described in the monograph "Rosehip Fruits" SPU 2.0. titrimetric method [6,10].

The content of free organic acids (X) in terms of malic acid in absolutely dry raw materials was calculated according to the formula:

$$X = \frac{V \times 0{,}0067 \times 250 \times 100 \times 100}{m \times 10 \times (100 - W)},$$

V – volume of 0.1 M sodium hydroxide solution used for titration, ml;

0,0067 – the amount of malic acid corresponding to 1 ml of 0.1 M sodium hydroxide solution;

m – mass of raw materials, g;

W – loss in mass during drying, %.

The results of determining the quantitative content of the sum of organic acids in flowers of Azalea indica are presented in the table. 3.6.

Table 3.6

Results of the quantitative determination of organic acids in Azalia indica flowers (%, in terms of malic acid and dry raw materials)

m	n	X_i	X_{mean}	S^2	S_{mean}	P	t(P, n)	Confidence interval	ε, %
5	4	3,12 3,26 3,11 2,97 3,15	3,12	0,01	0,05	0,95	2,78	**3,12 ± 0,13**	4,13

The content of the sum of organic acids was 3,12±0,13% of Azalea indica flowers.

3.2.7. Determination of the macro- and microelement composition of Azalea indica flowers

Elemental analysis was carried out using the atomic emission spectrographic method with photographic registration on the DFS-8 device. Graduation graphs in the interval of measured concentrations of elements were built using standard samples of solutions of metal salts (ICOMP-23-27). Samples were evaporated from the craters of graphite electrodes in an alternating current arc discharge with a power of 16A at an exposure of 60 s; IVS-28 was used as a source of excitation of the spectra. Spectra were recorded on photographic film using a DFS-8 spectrograph with a three-lens slit illumination system and a diffraction grating of 600 pt/mm.

Spectral bands at a wavelength from 240 to 347 nm in the samples were photometered in comparison with state samples of a mixture of mineral elements,

using a MF-4 microphotometer. The relative standard deviation (for five parallel measurements) did not exceed 30% when determining the numerical values of element concentrations.

The results are given in the table. 3.7

Table 3.7

Elemental composition of Azalea indica flowers

№ з/п	Name of the element	The content of the element, mg/%
1	2	3
1.	Na	235,00
2.	Mg	505,00
3.	Al	29,00
4.	Si	715,00
5.	P	87,00
6.	K	2250,00
7.	Ca	910,00
8.	Mn	9,00
9.	Fe	70,00
10.	Ni	0,09
11.	Cu	1,30
12.	Zn	24,00
13.	Sr	3,20
14.	Mo	<0,20
15.	Pb	<0,20

At least 15 macro- and microelements were found in the studied raw materials. The predominant component is potassium (2250.00 mg%). The content of calcium and silicon compared to the content of potassium is 2.5 times lower (910.00 mg% and 715.00 mg%, respectively). Azalea flowers contained 505.00 mg% of magnesium. 87.00 mg% phosphorus and 235.00 mg% sodium were found in the flowers of Azalea indica. The ferrum content was equal to 70.00 mg%. The

flowers of common azalea contained 24.00 mg% of zinc. The content of nickel, molybdenum and lead is below 0.20 mg%.

CONCLUSIONS TO CHAPTER 3

1. The presence of carbohydrates (free and bound sugars, polysaccharides), phenolic compounds (coumarins, flavonoids, tannins) and organic acids (ascorbic, malic and citric) was established in flowers of Azalea indica with the help of qualitative chemical reactions and PC.

2. Using different methods of quantitative analysis, the BAC content in the flowers of Azalea indica was determined: the amount of coumarins – not less than 0,2%, the amount of flavonoids in terms of luteol-7-glucoside – not less than 2,9%, the amount of phenolic compounds in terms of on pyrogallol – not less than 4.8%, ascorbic acid – not less than 11,0 mg/%, the amount of organic acids in terms of malic acid – not less than 3,1%.

3. Determined macro- and microelement composition in flowers of Azalea indica. At least 15 macro- and microelements were found in the studied raw materials. The predominant component is potassium (2250.00 mg%).

GENERAL CONCLUSIONS

1. *Azalia indica* is an unpretentious plant that does not require special growing conditions and frequent transplants, easily tolerates direct sunlight and drought, and is frost-resistant. The only thing that must be remembered: azalea needs constant watering, has a negative attitude to dryness. In such conditions, it will quickly wither and die. The chemical composition of the plant has not been sufficiently studied. That is why the plant needs further pharmacognostic research. *Azalea indica* is a promising source of medicinal plant raw materials.
2. The numerical indices of Azalea indica flowers were determined. The weight loss on drying is 4,39 ± 0,28 %. The total ash content is 2,90 ± 0,12 %.
3. The content of extractive matter in Azalea indian flowers was determined. The maximal content of extractable matter in Azalia indica flowers is 23,49± 0,57 % when used 50% ethanol as solvent.
4. The presence of carbohydrates (free and bound sugars, polysaccharides), phenolic compounds (coumarins, flavonoids, tannins) and organic acids (ascorbic, malic and citric) was established in flowers of Azalea indica with the help of qualitative chemical reactions and PC.
5. Using different methods of quantitative analysis, the BAC content in the flowers of Azalea indica was determined: the amount of coumarins – not less than 0,2%, the amount of flavonoids in terms of luteol-7-glucoside – not less than 2,9%, the amount of phenolic compounds in terms of on pyrogallol – not less than 4.8%, ascorbic acid – not less than 11,0 mg/%, the amount of organic acids in terms of malic acid – not less than 3,1%.
6. Determined macro- and microelement composition in flowers of Azalea indica. At least 15 macro- and microelements were found in the studied raw materials. The predominant component is potassium (2250.00 mg%).
7. The obtained data can become the basis for the for the project of quality control methods for " *Azaleae indicae Flores*".

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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

Mustafa FADHIL ASKAR

1. Topic of qualification work: « Phytochemical study of Azalia indian flowers», 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 *Azalia indian* flowers

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 *Azalia indian* flowers; 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 – 10, pictures – 12.

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 *Azalia indian* flowers	07.11.2022-28.11.2022	**done**
3.	Quantitative analysis of biologically active compounds in flowers of *Azalia indian*	05.12.2022-07.02.2023	**done**

An applicant of higher education _____ Mustafa FADHIL ASKAR

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**				
Аль-Хаммуд Мустафа Фадхіл Аскар	Фітохімічне вивчення квіток азалії індійської	Phytochemical study of Azalia indian flowers	ас. Скребцова К.С.	проф. Перехода Л.О.

Підстава: подання декана, вказівка 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

№ 113083 від «8 » травня 2023 р.

Проаналізувавши випускну кваліфікаційну роботу за магістерським рівнем здобувача вищої освіти денної форми навчання Аль-Хаммуд Мустафа Фадхіл Аскар, 5 курсу, _____ групи, спеціальності 226 Фармація, промислова фармація, на тему: «Фітохімічне вивчення квіток азалії індійської / Phytochemical study of Azalia indian flowers», 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**

5%
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

Mustafa FADHIL ASKAR

on the topic: **«Phytochemical study of Azalia indian flowers»**

Relevance of the topic. Due to the wide spectrum of pharmacological action and the multi-component chemical composition of the raw materials of plants of the family *Ericaceae*, an in-depth study of representatives of the family with the aim of further use in medicine is relevant. important issue is the pharmacognostic research of plant raw materials with the study of chemical composition and establishment of pharmacological properties of raw materials of new promising plant species. Considering these facts, our attention was drawn to the raw material of *Azalea indica*. 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 Rhododendron. 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, Mustafa FADHIL ASKAR mastered the methods of phytochemical analysis of medicinal plant raw materials.

Assessment of work. Mustafa FADHIL ASKAR 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 Mustafa FADHIL ASKAR on the topic: “Phytochemical study of Azalia indian flowers” 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 Azalia indian flowers »**

Relevance of the topic. In the modern world, in connection with the rapid development of the pharmaceutical and chemical industry, the need to invent new sources of medicinal plant raw materials for the creation of therapeutic and preventive medicinal products of plant origin, the cultivation of plants and the expansion of the raw material base has significantly increased. 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 *Azalia indian*, 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 Rhododendron 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 *Azalia indian* flowers (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 Mustafa FADHIL ASKAR on the topic: "Phytochemical study of *Azalia indian* flowers" 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 квіток азалії індійської» здобувача вищої освіти випускного курсу Фм18(5,0д)англ-09 групи Аль-Хаммуд Мустафа ФАДХІЛ АСКАРА.

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-09 групи Аль-Хаммуд Мустафа ФАДХІЛ АСКАРА. на тему «Фітохімічне вивчення квіток азалії індійської».

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 Аль-Хаммуд Мустафа ФАДХІЛ АСКАР до захисту кваліфікаційної роботи за галуззю знань 22 Охорона здоров'я
спеціальністю 226 Фармація, промислова фармація
освітньою програмою Фармація
на тему: «Фітохімічне вивчення квіток азалії індійської».

Кваліфікаційна робота і рецензія додаються.

Декан факультету _____ / Світлана КАЛАЙЧЕВА /

Висновок керівника кваліфікаційної роботи

Здобувач вищої освіти Аль-Хаммуд Мустафа ФАДХІЛ АСКАР 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 Аль-Хаммуд Мустафа ФАДХІЛ АСКАРА 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 /