

ODESSA NATIONAL MEDICAL UNIVERSITY

Department of General and Clinical Pharmacology and Pharmacognosy

METHODICAL DEVELOPMENT OF THE LECTURE

Course: "Pharmacognosy"

Lecture № 14

"Flavonoids. General characteristics Methods of qualitative and quantitative determination. Medicinal plants and raw materials containing flavonoids »

Course: 3rd Faculty: medico-pharmaceutical

The lecture was discussed
at the methodical meeting
departments
30.08.2024

Head department

MD, prof. JV Rozhkovsky



Odessa - 2024

Lecture № 14: "Flavonoids. General characteristics Methods of qualitative and quantitative determination. Medicinal plants and raw materials that contain flavonoids. " (2 years)

1. Actuality of theme. Rationale for the topic.

Flavonoids are a large and very important group of phenolic compounds that are widespread in the plant world and exhibit a variety of pharmacological activity associated with elements of their structure. Recently, special attention should be paid to the so-called bioflavonoids (vitamins), which ensure normal metabolism in the body. Many data have been created and used on the basis of plant raw materials containing different groups of flavonoids. Therefore, this modern knowledge is absolutely necessary for future pharmacists in their next professional activity.

2. Objectives of the lecture:

- educational:

- to acquaint students with the peculiarities of the structure, classification of flavonoids;
- on the example of different groups of flavonoids to consolidate the idea of the relationship between the chemical structure of biologically active substances and their pharmacological action;

- to draw students' attention to the peculiarities of drying and storage of LRS containing flavonoids;

- to acquaint students with the modern range of pharmacopoeial types of LRS containing flavonoids, and the possibility of finding new plant sources.

- educational:

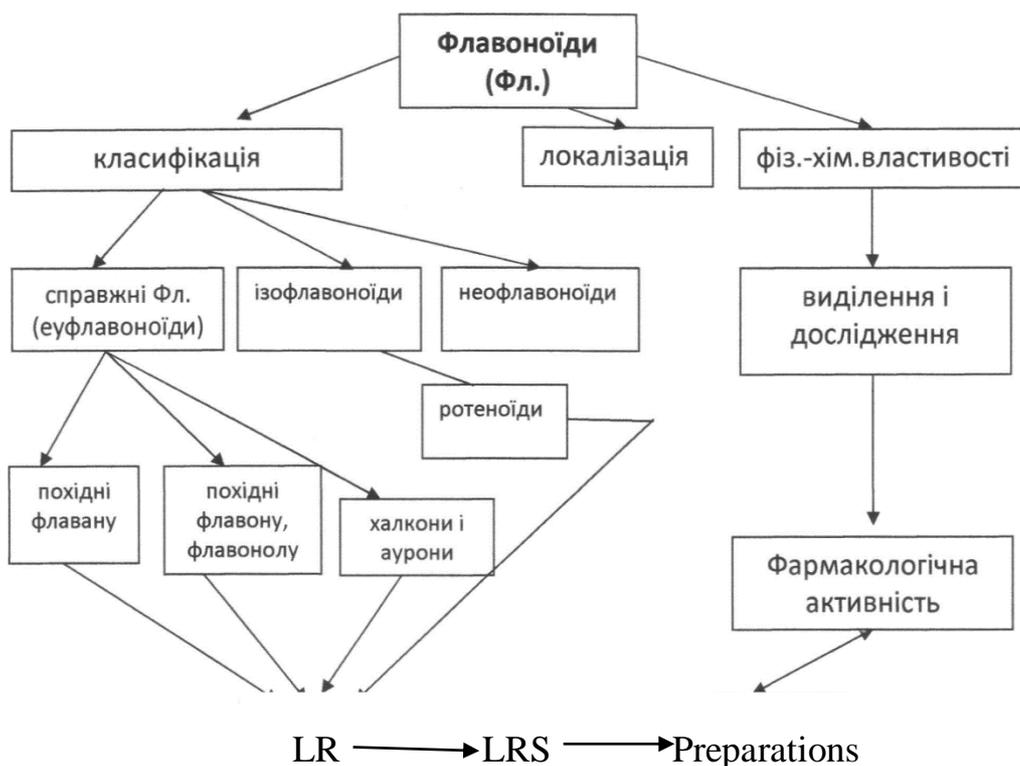
Education of students of professional thinking, conscious attitude to the release of complex herbal preparations with a wide range of pharmacological activity.

3. Lecture plan and organizational structure

№	The main stages of the lecture and their content	Goals in levels of abstraction	Type of lecture, lecture equipment	Time distribution
1	2	3	4	5
I. 1. 2.	Preparatory stage Defining a learning goal Providing positive motivation			5%

<p>II. 3.</p>	<p>The main stage Teaching lecture material Plan: Part 1 General characteristics of flavonoids. 1. Definition of "flavonoids" 2. Classification 3. Localization in the plant world 4. Physico-chemical properties 5. Methods of selection and research, qualitative reactions 6. Biological action, types of pharmacological activity Part 2. Medicinal plants and raw materials that contain flavonoids. 7. Consideration of LR, LRS containing flavonoids in certain groups: - derivatives of flavan - derivatives of flavonoids, flavones - derivatives of chalcone and auron - isoflavonoids - proteinoids (condensed isoflavonoids)</p>	<p>I I II II III III</p>	<p>Combined, tables, overhead projector, slides, LR herbariums, LRS samples, drugs</p>	<p>90%</p>
<p>III. 4. 5.</p>	<p>The final stage Summary of the lecture, general conclusions. Lecturer's answers to possible questions. Tasks for self-preparation</p>		<p>References, questions, tasks</p>	<p>5% 2% 2% 1%</p>

-structural and logical scheme of the lecture:



- text of the lecture (attached)

5. Materials on activating students during the lecture:

Question:

1. To which group of BAS belong flavonoids?
2. Name the general formula of flavonoids.
3. How are flavonoids related to the color of plant particles?
4. Which group of flavonoids is the most common?
5. Which families are richest in flavonoids?
6. What method is used to separate flavonoids from their total selection?

Situational tasks:

1. In order to comprehensively, more fully use the herb lily of the valley Keyske in addition to phytomedicines containing cardiosteroids, get a substance (the amount of flavonoids), which has a choleric effect. Distribute drugs from lilies of the valley according to their action: corglycone, cardiophyte, convaflavin, valocormid.

2. Determine the phases of maximum accumulation of flavonoids in the raw materials of the following LR: Japanese sophora (but.); hawthorn (flowers -in flowers; pl.-in fruits); cornflower blue (color); sand cumin (beginning of color); spores (color); horsetail (veg.); sweet naked (late veg.).

3. From the provided list of LRS species, choose the one collected from plants cultivated in Ukraine: blue cornflower flowers; tea leaves; chokeberry fruits; bean fruit leaves; licorice roots; dog nettle grass; spore grass; buckwheat herb.

General material and methodological support of the lecture:

1. equipment: overhead projector (or multimedia projector), screen;
2. illustrative materials: slides, herbariums of LR, samples of LS, packed up

LRS, pharmaceutical preparations.

2.

Question

1. Define the term "flavonoids".
2. Give the classification of flavonoids.
3. Z. Describe the physicochemical properties of flavonoids.
4. What role do flavonoids play in the life of the plant organism?
5. Name the types of pharmacological activity of flavonoids.
6. Describe the methods of isolation and study of flavonoids in LRS.
7. Name the qualitative reactions to flavonoids.
8. Describe the current domestic scientific achievements in the study of flavonoids and prospects for the study of domestic flora in order to obtain new flavonoid drugs.

Situational and test tasks

1. Conducts a comparative morphological analysis of raw materials of different medicinal species of the genus *Polygonum*.

2. Give the scheme of procurement and use in medicine and pharmacy of raw materials of different species from the genera: *Polygonum*; *Crataegus*; *Viola*.

3. Flavonoids are:

- A. Diphenylpropane derivatives
- B. Derivatives of simple phenols
- C. Anthracene derivatives
- D. Polymeric phenolic compounds

4. It is known that the first flavonoids that were isolated were yellow. Colorless flavonoids include:

- A. Leukoanthocyanidins
- B. Chalconi
- C. Pantocyanidins
- D. Flavones

5. Under the action of ammonia vapor, the petals of the plant changed color from yellow to red, indicating the presence of petals

- A. Chalcones or aurones
- B. Leukoanthocyanidins
- C. Cyanidins
- D. Isoflavones

6. Catechins are:

- A. Derivatives of flavan
- B. Chromone derivatives
- C. Biflavonoids
- D. Chromone derivatives

7. Medicinal raw materials for the manufacture of tinctures prescribed for hemorrhoids are:

- A. The roots of the wolf
- B. The roots of the Baikal sagebrush
- C. I argue with the grass
- D. Plantain leaves

8. Rutin shows vitamin P activity. For industrial production of routine use raw materials:

- A. *Alabastra Sophorae japonicae*
- B. *Nerba Bidentis tripartitae*
- C. *Fruit Hippophaes rhamnoides*
- D. *Herba Polygoni avicularis*

9. Phytopreparation "Aromelin" shows P-vitamin activity. From what LRS is this drug made?

- A. The fruits of chokeberry
- B. Hawthorn flowers
- C. Hawthorn fruits
- D. Japanese sophora buds

10. The herb of this plant is used as a weak diuretic and diaphoretic. This plant:

- A. The herd is three separate
- B. Dog nettle five-bladed
- C. Astragalus woolly
- D. You argue

11. Which of these plant species can be an impurity in water pepper?

- A. The bitterness is small
- B. One-year pepper
- C. Black pepper
- D. Bitter snake

12. LR was received for analysis: the flowers are infertile, blue, funnel-shaped. Vegetable source of this raw material:

- A. *Centaurea cyanus*
- B. *Viola tricolor*
- C. *Polygonum persicaria*
- D. *Scutellaria baicalensis*

13. Tincture of raw materials of this plant has a sedative, hypotensive effect, is part of complex drugs "biovital", "cardiophyte". This plant:

- A. Five-bladed dog nettle
- B. Horsetail
- C. Sweet naked
- D. You argue

14. The pharmaceutical company received a batch of raw materials - wolfberry roots for the manufacture of tincture. Quantitative standardization of these raw materials is carried out in terms of:

- A. Ononin
- B. Hyperoside
- C. Rutin
- D. Kellin

15. Hawthorn flowers and fruits are used to make infusions and liquid extracts, which are used as a cardiotonic agent. Spectrophotometric method determines in this raw material:

- A. Flavonoids
- B. Vitamin C
- C. Lipids
- D. Leukoanthocyanidins
- E.

16. The pharmaceutical plant received a batch of raw materials - knotweed. Standardization of these raw materials is carried out in terms of:

- A. Avicularin
- B. Kellin
- C. Ononin
- D. Rutin

B) on the topic of the next lecture (Quinones)

literature

main:

1. Antonyuk VO A practical course of pharmacognosy (Laboratory manual) / VO Antonyuk, RM Lysyuk, L. Ya. Antonyuk. - Lviv: LNMU, 2011. - 499 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / State Enterprise "Ukrainian Scientific Pharmacopoeial Center for Quality of Medicines". - 2nd type. - Kharkiv: State Enterprise "Ukrainian Scientific Pharmacopoeial Center for Quality of Medicines", 2015. - Vol. 1. - 1500 p.
3. European Pharmacopoeia. - 8th ed. ; - Druckerei CH Beck, Nordlingen (Germany), 2013.- 3655 p.
4. Workshop on the identification of medicinal plant materials: textbook. way. / [B. M. Kovalev, SM Marchyshyn, OP Khvorost and others]; for order. VM Kovaleva, SM Marchishin. - Ternopil: TSMU, 2014. - 250 p.
5. Pharmacognosy: a basic textbook. for students. higher pharmacy. textbook zakl. (pharmac. f-tiv) IV level of accreditation / V.S. Кисличенко, I.O. Журавель, С.М. Marchyshyn and others; for order. V.S. Кисличенко. - Kharkiv: NUPh: Golden Pages, 2015. - 736 p.
6. Medicinal plant raw materials and phytomedicines under Society. ed. Wednesday PI, Kiev, VSI "Medicine", 2010
7. Pharmacognosy. Medicinal raw materials of plant and animal origin. Ed. Яковлева Г.П. St. Petersburg, Spetslit 2013

8. Pharmacognosy: a textbook (University of I-III years) / VP Khodakivska, IA Бобкова, Л.В. Варлахова All-Ukrainian specialized publishing house "Medicine" 2018.
9. Pharmacognosy: textbook (I-III years) / I.A. Бобкова, Л.В. Варлахова. - 3rd edition All-Ukrainian specialized publishing house "Medicine" 2018, 504p.
10. Pharmacognosy with the basics of phytotherapy A. Pastushenkov, N. Bespalova Phoenix Publishing House 2016.

additional:

1. Wednesday PI, NP Maksyutina, LL Давтян. Pharmacognosy. Medicinal plant raw materials and phytomedicines / for general. ed. PI Sereby.-Vinnytsia: NEW BOOK, 2006.- S. 131-139.
2. Medicinal raw materials of plant and animal origin. Pharmacognosy: a textbook / ed. G.P. Яковлева. - СПб .: СпецЛит, 2006. - С. 518 -546.

Question

1. Definition of "quinones"
2. Classification of quinones
3. Definition of "anthraquinones"
4. Classification of anthracene derivatives.
5. Physicochemical properties of anthracene derivatives.
6. Studies (qualitative detection reactions) of anthracene derivatives.
7. Describe the distribution of anthracene derivatives in the plant world.
8. Features of harvesting, drying storage of LRS containing anthraquinones.
9. Ways of using raw materials containing anthraquinones and its medical significance.
10. Describe LRS containing naphthoquinones and its use.

Test tasks

1. Aglycones of anthracene derivatives are insoluble in
 - A. Water
 - B. Ether
 - C. Benzene
 - D. Chloroform
 - E. Alcohols

2. By which reaction it is possible to determine anthracene derivatives in dry raw materials:
 - A. Microsublimation
 - B. Keller-Killiani
 - C. Cyanidin test
 - D. Lieberman-Buchard
 - E. Lafona

3. The laxative effect is shown by BAV
 - A. Anthraquinones of the emodin group
 - B. Naphthoquinones
 - C. Anthraquinones of the alizarin group
 - D. Condensed anthraquinones
 - E. Tannins

4. A drop of 5% NaOH solution was applied to the inner surface of the bark and a dark red color was observed, which indicated the presence of raw materials.

- A. Anthracene derivatives
- B. Tannins
- C. Essential oil
- D. Phenol glycosides
- E. Furanochromones

5. The litholytic effect is shown by drugs containing anthraglycosides

- A. Alizarin groups
- B. Emodin groups
- C. Condensed
- D. Naphthoquinones

8. Literature used by the lecturer to prepare the lecture

- additional

1. Фармакогнозія: підручник (I—III р. а.) / І.А. Бобкова, Л.В. Варлахова. – 3-є видання Всеукраїнське спеціалізоване видавництво «Медицина» 2018, 504с.

2. Фармакогнозія: базовий підручн. для студ. вищ. фармац. навч. закл.(фармац. ф-тів) IV рівня акредитації / В.С. Кисличенко, І.О. Журавель, С.М. Марчишин та ін.; за ред. В.С. Кисличенко. – Харків: НФаУ: Золоті сторінки, 2015. - 736 с.

3. Навчальний посібник з дисципліни «Фармакогнозія» / Я. В. Рожковський, Б. В. Приступа, І. А. Бойко, Н. В. Герасимюк, В. В. Черногорюк -: Методична розробка кафедри фармакогнозії ОНМедУ. – Одеса: ОНМедУ, 2019 – 51 с.

4. Державна Фармакопея України: в 3 т. / Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1500 с.

Додаткова література:

1 Державна Фармакопея України: в 3 т. / 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. Сербін А.Г., Сіра Л.М., Слободянюк Т.О. Фармацевтична ботаніка. Підручник. – Вінниця: НОВА КНИГА, 2007. – 488 с.

3. Практикум з ідентифікації лікарської рослинної сировини: навч. посіб. / [В. М. Ковальов, С. М. Марчишин, О. П. Хворост та ін.] ; за ред. В. М. Ковальова, С. М. Марчишин. – Тернопіль: ТДМУ, 2014. – 250 с.

1. Pharmacognosy with the basics of phytotherapy A. Pastushenkov, N. Bepalova Phoenix Publishing House 2016.

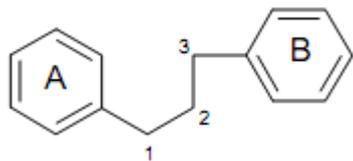
The lecture was composed by _____ MD, Professor Ya.V. Rozhkovsky



LECTURE TEXT

FLAVONOIDS

F. is a group of biologically active substances of phenolic character with the general formula C₆-C₃-C₆. The flavonoid molecule consists of two phenolic residues A and B, connected by a propane link, which can be closed in an oxygen heterocycle C.



Name F. - from Latin. Flavus - yellow (the first highlighted f. They were yellow).

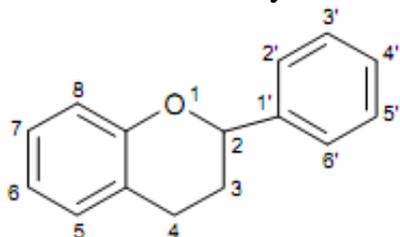
Classification

At the junction of ring B:

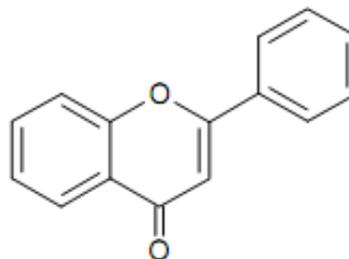
True flavonoids (euflavonoids)	Isoflavonoids	Neoflavonoids

The most common group of phytoplankton is euflavonoids

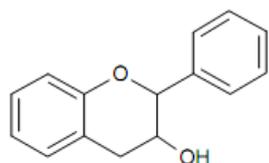
Euflavonoids are classified according to the degree of oxidation of the propane fragment and the size of the heterocycle into 10 classes:



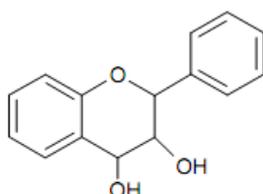
Флаван



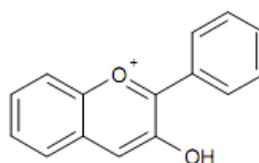
Флафон



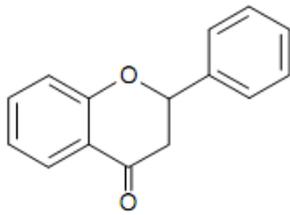
1. Флаван-3-ол
(катехін)



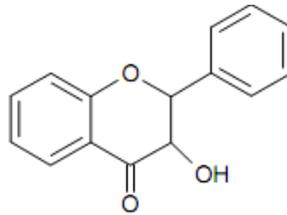
2. Флаван-3,4-діол
(лейкоантоціанідин)



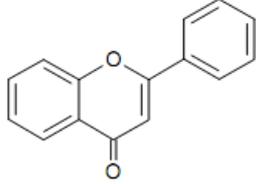
3. Антоціанідин



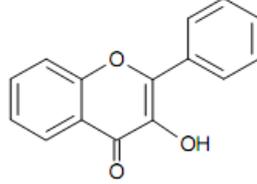
4. Флаванон



5. Флаванол

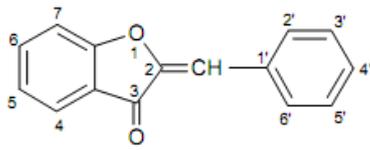


6. Флавор

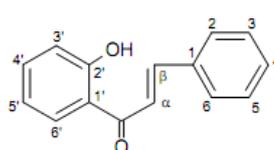


7. Флаворол

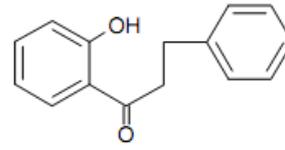
(apigenin, luteolin, gnaphalosides, baicalein)



8. Аурон



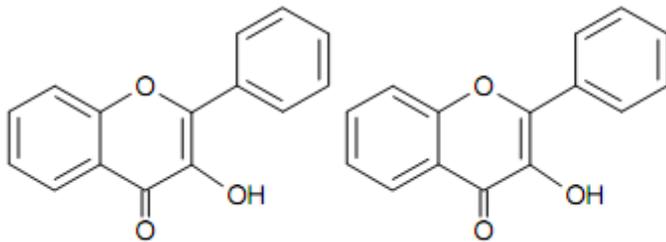
9. Халкон



10. Дигідрохалкон

The most famous and common flavonoids are

Derivatives of flavonoids (about 40% of all flavonoids). Example:



Quercetin and its glycoside rutin

In plants, flavonoids are rarely found in the free state. They condense with other compounds, forming complex structures: dimers, O- and C-glycosides.

Localization

F. are found in almost all plants, as well as found in microorganisms and insects. The richest f. families of legumes, buckwheat, rosacea. Rutin is found in more than 70 species from 34 genera. Quercetin - in more than 400 species. Accumulate f. mainly in flowers, leaves, less - in other organs. The amount is from 0.1 to 30% (for example, in sophora buds). In this case, glycosides - in meristematic tissues (active growth), and aglycones - in woody tissues.

Anthocyanidins provide color. A total of 22 aglycones are known, but only 3 are very injured: pelargonidine (strawberry fruit color), delphinidine (pomegranate, eggplant), cyanidin (apple, cherry, raspberry, red currant), delphinidin + cyanidin. stench., orange).

Chalcones and aurones - in nine families. Their presence in the petals is detected - if under the action of ammonia vapor changes color from yellow to red.

Physico-chemical properties

Crystalline substances are crystalline substances with a certain melting point. Colorless: leucoanthocyanidins, flavanes, isoflavanes, flavanones, flavanols. Yellow or orange: flavones, flavonols, chalcones, aurones. Anthocyanins change color depending on the reaction of the medium: in acid-red or pink, in alkaline - blue or blue.

Solubility: aglycones - in diethyl. ethers, acetone, alcohols and practical. Insoluble in water, glycosides - in dilute alcohols, hot water and insoluble in ether, chloroform, benzene and others.

Catechins are optically active, exist in the form of 4 isomers.

Flavonones and flavanones - labile compounds - can be converted into chalcones and leucoanthocyanidins under the action of oxidizing reagents.

Flavonoid O-glycosides are subjected to acidic, alkaline (when heated) and enzymatic hydrolysis. At the same time, the C-bond in glycosides is very strong (hydrolysis only under the influence of concentrated acids - Kiliani reagents: a mixture of conc. Hydrochloric and glacial acetic acids)

Methods of selection and research:

The most commonly used ethanol and methanol. Next, the alcohol extract is evaporated and treated with chloroform to separate the lipophilic fraction (chlorophyll, carotenoids, wax, fats). Next, the purified aqueous residue is treated with ether, propanol, butanol, obtaining sequential fractions of aglycones, monosides, biosides, trisides.

Separation of flavonoids into individual components - column chromatography (processing of chromatograms with a mixture of chloroform and alcohol).

Qualitative reactions:

1. Specific reaction to flavonoids - Cyanidin test: reduction of flavonoids H during its isolation by the interaction of magnesium metal with hydrochloric acid. At the same time colored anthocyanidins are formed:

Isoflavonoids, flavans give a yellow (red) color;

Flavonols - from crimson to bright red

Anthocyanins - glycosides of delphinidin give a blue-red color,

Cyanidin - bright red, pelargonidine - red.

Chalcones and aurones - do not react, but form under the influence of conc. salt. to-painted oxonium salts.

2. Azo combination reaction (with diazotized sulfonamide):

Flavones, flavonones, flavonols - yellow color with ammonia solution;

Chalcones and aurones - red-purple color.

3. Reaction with alkali solutions:

Flavonones - yellowish solutions that turn over time into bright yellow or red (isomerization to chalcones)

Chalcones and aurones are an image at once. red or purple solutions. This is a specific reaction for them!

Flavonols and flavones - yellow solutions, polyoxyflavonols-red or blue solutions.

4. Reaction with medium lead acetate:

Flavones and flavonols - orange precipitate;

Aurones - red,

Anthocyanins are red or blue.

5. Reaction with metal salts (aluminum chloride, zirconium chloride, iron 3-chloride) - on C = O group, in res. obrazuyutsya color. (Yellow., Brown.) Chelated complexes with metals.

6. Reaction with a solution of vanillin in concentrated salt to - to catechins, which give a red-crimson color.

7. Chromatographic detection (paper or thin layer chromatography) - B in flavonoids fluoresce in UV light!

Biological action and application:

All natural f. low-toxic and give a wide range of biological action, so promising for the creation of new drugs.

The most important types of pharmacological activity:

1. Vitamin P (reduce the permeability and fragility of capillaries, increases their elasticity). This activity is possessed by: flavones hesperidin, eriodictin, flavonols: isoquercitrin, quercitrin, rutin, quercetin, isoramnetin.

2. Diuretic. Flavones (luteolin)

3. Hypoazotemic. Robinin and other derivatives of kaempferol, hyperoside.

4. Cardiotonic. Derivatives of flavonols, catechins and anthocyanins, rutin, quercetin, quercitrin, leukoanthocyanidins, tea catechins, hawthorn preparations.

5. Antispasmodic. "Hungry." musk. blood vessels. Flavones (apigenin), chalcones, flavanones (liquiritin) flavonols (quercetin, rutin).

6. Choleric. Myricetin, flavonoids of sand cumin, chicory, herds.

7. Hypoglycemic

8. Antiulcer ulcer

9. Antitumor. Leukoanthocyanidins - pilargonidine, delphinidin, cyanidin.

10. Wound healing

11. Antioxidant, anti-radiation

12. Estrogenic. Isoflavonoids.

Quantitative definition of f. - Weight, photometric, polarographic, photocolometric, spectrophotometric (basic) methods.

LR AND LRS, WHICH CONTAIN FLAVONOIDS

-flavan derivatives (catechins, anthocyanidins):

Cornflower flowers blue; violet grass, as well as:

Leaves (flushes) tea-Folia Theae (Thea sinensis, Theaceae). Mountain forests of China and Indochina.

Chem. storage: catechins. Quercetin, caffeine, oak condensation; EM, vit. C, B1, B2, PP.

Action and drugs: P-vitamin, tonic, tonic, anti-oxidant, radioprotective. Antidote. infusion, Tea Green Health Capsules, Grail Balm.

Fresh chokeberry fruits - Fructus Aroniae melanocarpae recens
(*Aronia melanocarpa*, *Rosaceae*) .Motherland-North America

Chem. composition: cyanidin and its glycosides, catechins, flavonols quercetin, rutin, hesperidin, carotenoids, ascorb. to-that; org. to-you, oak. substances, pect. substances, iodine.

Action and drugs: P-vitamin, antihypertensive. Juice, vitamin P from the fruits of chokeberry.

-derivatives of flavone, flavonol:

Sand cumin flowers, dried marsh grass, buckwheat grass, tansy flowers, leafy grass, hawthorn flowers, hawthorn fruits, Japanese sophora buds, dog nettle grass, water pepper grass, mountain ash grass, knotweed grass, buckthorn grass, grass grass, linden flowers, ginkgo leaves, lespedecca grass (3 species), St. John's wort grass, horsetail grass, bean leaves, white acacia flowers, woolly astragalus grass, as well as:

Herba woolly woolly - Herba Aervae lanatae (Aerva lanata, Amaranthaceae)

Chem. composition: glycosides kaempferol and isoramnetin-tyroroside, ervitin, narcissin; Inova island, phenolic acid, indole alkaloids, triterpenoids.

Action and drugs: Diuretic, litholytic. Infusion. Pol-pala tea, Grail balm.

The roots of the Baikal sagebrush - Radices Scutellariae (Scutellaria baicalensis, Lamiaceae).

Chem. composition: flavones and their glycosides (baikalin, skutellarin, oroxilin); dub.v-va, em, resin.

Action and drugs: Antihypertensive, sedative, anti-uremic, anti-inflammatory. Tincture, liquid extract, drops on good-night sleep herbs, aspalinate, Baykamin, histinate.

Canadian aspen grass - Herba Solidaginis canadensis (Solidago Canadensis, Asteraceae). Family - North America. It goes wild here.

Chem. composition: apigenin, luteolin, quercetin, kaempferol, rutin, etc .; oak. substances, choline, essential oils, coffee, coumarins, saponins, etc.

Action and drugs: Hypoazotemic, diuretic, antidiarrheal. Erican granules, Marelin, Prostalad, prostanorm, prostapol.

Sickle astragalus herb -Herba Astragali falcati (Astragalus falcatus, Fabaceae) Caucasus, Southern Russia.

Chem. composition: robinin = floronin (2%); alkaloids, caumarins.

Action and drugs: Hypoazotemic, diuretic. Floronin -table. (Robinin)

-derivatives of chalcone and auron:

licorice roots

grass herds

-isoflavonoids:

honeycomb roots

-rotenoids:

grass amorphous