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STUDYING THE RADIOPROTECTIVE PROPERTIES OF SOME PHYTOEXTRACTS FROM AZERBAIJAN PHARMACEUTICAL FLORA

Aim. The aim of this work is to evaluate the radioprotective properties of the extract from the flowers of calendula officinalis (*Calendula officinalis* L.) alone and phytoextracts (CDY) consisting of calendula officinalis (*Calendula officinalis*), dandelion officinalis (*Taraxacum officinale*) and yarrow (*Achillea millefolium*) obtained from medicinal flora of Azerbaijan. **Methods.** The medicinal plants included in the collection were dried and the extract obtained in a water-alcohol mixture. The extracts were injected intraperitoneally in mice at a concentration of 300 mg / kg 30 min before irradiation at a dose of 9 Gy. **Results.** It was found out that the extract of calendula possesses radioprotective activity (55%), somewhat inferior to the activity of the protector-standard of cystamine (80%), and phytoextracts (CDY) decreasing the lethal effect of ionizing radiation, has radioprotective activity (62%) and increases survival and life expectancy lethally irradiated mice more than the extract of calendula (55%) and less cystamine (80%). **Conclusions.** The data obtained by us testify to the prospects of using the extract of calendula separately and in a complex of extracts of dandelion and yarrow in the development of medicinal compositions intended for preventive purposes and in order to prevent local radiation injuries.

Keywords: mice, survival, irradiation, extract, cystamine.

The search for effective medicinal products from plants is a very important task of great practical importance. Medicinal plants have a number of advantages in comparison with synthetic agents: low toxicity, a wide spectrum of pharmacological activity, the ability to influence the physiological processes occurring in the human body and, accordingly, to increase the body's natural defense, and are characterized by a gradual increase in the pharmacological effect [1]. In addition, herbal preparations obtained in the form of extracts have a com-

plex effect on the patient's body, since they contain biologically active substances of different groups in a concentrated form [2]. The severity of the pharmacological effects of extracts largely depends on the natural compounds contained in them. The severity of the pharmacological effects of extracts largely depends on the natural compounds contained in them.

In early studies [3–19], the radioprotective properties of extracts obtained from various medicinal plants of Azerbaijan on the vital activity of plants, higher fungi and mammals were studied.

The medicinal plant (*Calendula officinalis* L.) has a wide spectrum of pharmacological activity, which is caused by a rich content of such biologically active compounds as carotenoids (carotene, lycopene, violaxanthine, citraxanthine, rubixanthin, flavochrome), flavonoids (narcissine, isokvetsitrin, ramnetin and isoramnetin-3-triglycoside, isokvertsitrin), vitamins, essential oil, saponins, resinous substances, calendene, organic acids, unexplored alkaloids, phytosterols, enzymes and some other substances.

In the study of the general action and acute toxicity of galenic preparations of calendula, it was found that they are low in toxicity and have an appreciable inhibitory effect on motor activity and reflex excitability of animals. The effect of calendula preparations on the activity of the cardiovascular system was manifested by a clear cardio tonic and hypotensive effect. When calendula preparations were administered to animals in high doses, they had blood pressure lowered by 30–40% from the baseline, cardiac contractions were reduced and the amplitude of cardiac contractions increased somewhat, there was a decrease and deepening of respiration. Preparations of calendula help slow down the growth of tumors in cancer patients. An unpretentious calendula flower is a whole storehouse of beneficial properties that make it an indispensable medicament.

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Particularly good results are the use of calendula in combination with dandelion medicinal and yarrow. Fitokoekstrakty provides choleric, antipyretic, laxative, expectorant, soothing, spasmolytic, mild hypnotic and anti-inflammatory effect, eliminates bile stagnation, improves bile excreting function.

The aim of this work is to evaluate the radioprotective properties of the extract from the flowers of calendula officinalis (*Calendula officinalis* L.) alone and phytoextracts (CDY) consisting of calendula officinalis (*Calendula officinalis*), dandelion officinalis (*Taraxacum officinale*) and yarrow (*Achillea millefolium*) obtained from medicinal flora of Azerbaijan.

Material and methods

The experiments were carried out on mongrel mice weighing 20–25 g. The animals were kept in a vivarium on a standard diet. From the experiment, the animals were withdrawn in accordance with the rules of the European Convention for the Protection of Vertebrates used for experimental and other scientific purposes.

The medicinal plants included in the collection were collected in the summer-autumn period of the Goygol district of the Republic of Azerbaijan.

To study the radiobiological activity, extracts of calendula and a plant extract containing calendula, dandelion and yarrow were obtained. The dried and ground masses of the plants were extracted with chloroform or ethanol in a Soxhlet apparatus. The solvent was then distilled off, and the residue was passed through a column of silica gel. A mixture of chloroform: carbon tetrachloride 3:1 was used as the eluent. At the exit from the column, the extract was collected.

To determine the presence of the radiobiological activity of the extracts obtained, a test was conducted for the 30-day survival of irradiated animals. In experiments, mongrel mice weighing 20–25 g were used. Acute toxicity was determined when the test extracts were administered in aqueous solution once by the intraperitoneal route in full accordance with the generally accepted pharmacology method.

Behavior monitoring and recording of animal deaths were conducted during the first hour and then the death of the animals was recorded in the next five days after the injection. The animals were irradiated on a γ -facility "RUHUND-20000" with a Co^{60} radiation source at a dose of 9.0 Gy; the radiation dose rate is 0.439 Gy / s. The test extracts were

administered to the animals in an aqueous solution 30 minutes prior to irradiation at 300 mg / kg. The animals of the control groups were given solvent-distilled water at the same time and in equivolume amounts before irradiation. To compare the radioprotective activity of the extracts studied, a radioprotector-standard cystamine (bis (β -aminoethyl) disulphide) was used in the optimal radioprotective dosage of 200 mg / kg, administered 15–20 min before irradiation.

A 30-day survival test for irradiated mice at a dose of 9 Gy was also performed and an average dose was determined for 50% survival of animals (SD_{50}) with the administration of extracts and the average life span (ALS) of irradiated animals. In determining the acute toxicity after the administration of extracts at dosages of 2000 and 1000 mg / kg, a sharp decrease in respiratory function, the appearance of clinical seizures, and a 100 % death within 10 minutes were noted. Reducing the dosage to 750 mg / kg resulted in 100 % death of animals with the same symptoms for an hour. The introduction of the extract at a concentration of 500 mg / kg caused an ambiguous effect: in one cases, 100 % survival was observed, in others – 50 % mortality. The administration of a dosage of 250 mg / kg did not cause a single death during all five days of observation. Thus, it can be concluded that the extracts are also low-toxic; the SD_{50} for it is in the range of 350–500 mg / kg.

Results and discussion

The radiobiological experiment was carried out on mice that received a calendula extract and phytoextracts (CDY) at a concentration of 300 mg / kg 30 minutes prior to irradiation at a dose of 9.0 Gy and fixed the lifetime of irradiated animals for a month. As a comparison of the radioprotective action, a radioprotector-standard cystamine and a control group of animals were used, which was replaced with distilled water instead of the radioprotector. The test results are shown in the table.

The study of the radioprotective activity of the extract of calendula showed that the extract possesses radioprotective activity (55 %), somewhat inferior to the activity of the cystamine (80 %) protector, and phytoextracts (CDY) decreasing the lethal effect of ionizing radiation, possessing radioprotective activity (62 %) and improving survival and the average life expectancy of lethally irradiated mice is greater than the extract of calendula (55 %) and less than cystamine (80 %).

Table. Results of radiobiological tests

Options	The number of mice	Survival rate, %	Life expectancy, day
Control (distil.water)	20	20	30 and more
Irradiated control	0	0	4,32 ± 1,21
Cystamine	16	80	18,31 ± 0,31
Phytoextracts (CDY)	13	62	16,3 ± 2,21
Marigold Extract	11	55	14,53 ± 1,5

Conclusions

The obtained results indicate that with the introduction of the extract of calendula, a significant increase in the life span of animals (almost 2-fold) occurs, although the survival after 30 days is somewhat inferior to that of a radioprotector-standard. In the case of phytoextract (CDY), the lifespan of irradiated animals also increases, but the survival percentage after the end of the experiment – after 30 days – is greater than the extract of ca-

lendula.

The data obtained by us testify to the prospects of using the extract of calendula separately and in a complex of extracts of dandelion and yarrow in the development of medicinal compositions intended for preventive purposes and in order to prevent local radiation injuries.

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ВИВЧЕННЯ РАДІОПРОТЕКТОРНИХ ВЛАСТИВОСТЕЙ ДЕЯКИХ ФІТОЕКСТРАКТІВ З ФЛОРИ ЛІКАРСЬКИХ РОСЛИН АЗЕРБАЙДЖАНУ

Мета. Оцінити радіопротекторні властивості екстракту з квітів календули лікарської (*Calendula officinalis* L.), а також її фітоекстрактів (КОТ), що складаються з календули лікарської, кульбаби лікарської (*Taraxacum officinale*) і деревію звичайного (*Achillea millefolium*), отриманих лікарських рослин, які ростуть в Азербайджані.

Методи. Лікарські рослини, що входять до складу збору, висушені і отримані екстракти у водно-спиртовій суміші. Екстракти внутрішньочеревно вводили мишам, у концентрації 300 мг/кг за 30 хв до опромінення в дозі 9 Гр.

Результати. З'ясовано, що екстракт календули володіє радіопротекторною активністю (55 %), що дещо поступається активності протектора-стандарту цистаміну (80 %), а фітоекстракт (КОТ), знижуючи летальну дію іонізуючої радіації, має радіопротекторну активність (62 %) і підвищує виживання і середню тривалість життя летально опромінених мишей більше, ніж екстракт календули (55 %) і менше, ніж цистамін (80 %). **Висновки.** Отримані нами дані свідчать про перспективність використання екстракту календули окремо і в комплексі екстрактів кульбаби і деревію при розробці лікарських композицій, призначених для профілактичних цілей і з метою запобігання місцевим променевим ураженням.

Ключові слова: миші, виживання, опромінення, екстракт, цистамін.

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ИЗУЧЕНИЕ РАДИОПРОТЕКТОРНЫХ СВОЙСТВ НЕКОТОРЫХ ФИТОЭКСТРАКТОВ ИЗ ФЛОРЫ ЛЕКАРСТВЕННЫХ РАСТЕНИЙ АЗЕРБАЙДЖАНА

Цель. Оценить радиопротекторные свойства экстракта из цветков календулы лекарственной (*Calendula officinalis* L.) в отдельности и фитоекстрактов (КОТ), состоящих из календулы лекарственной, одуванчика лекарственного (*Taraxacum officinale*) и тысячелистника обыкновенного (*Achillea millefolium*), полученных из флоры лекарственных растений Азербайджана.

Методы. Лекарственные растения, входящие в состав сбора, высушенные и полученные экстракты в водно-спиртовой смеси. Экстракты внутрибрюшинно вводили мышам в концентрации 300 мг/кг за 30 мин до облучения в дозе 9 Гр.

Результаты. Выяснено, что экстракт календулы обладает радиопротекторной активностью (55 %), несколько уступающей активности протектора-стандарта цистамина (80 %), а фитоекстракты (КОТ), снижая летальное действие ионизирующей радиации, обладают радиопротекторной активностью (62 %) и повышают выживаемость и среднюю продолжительность жизни летально облученных мышей больше экстракта календулы (55 %) и меньше цистамина (80 %). **Выводы.** Полученные нами данные свидетельствуют о перспективности использования экстракта календулы отдельно и в комплексе экстрактов одуванчика и тысячелистника при разработке лекарственных композиций, предназначенных для профилактических целей и для предотвращения местных лучевых поражений.

Keywords: мыши, выживаемость, облучение, экстракт, цистамин.