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PHARMACOLOGICAL PROPERTIES OF ENDEMIC PLANTS GROWING IN THE STEPPES OF KAZAKHSTAN

The number of people who suffer from secondary immunodeficiency diseases is increasing. Secondary immunodeficiency diseases develop due to environmental degradation, abuse of various preservatives, stabilizers in foods and long-term storage products, abuse of the use of drugs with a cytostatic effect, the use of antibiotics in the cultivation of cattle and poultry. The compoundswere obtained from plants of the Halostachys caspica (Pall) C.A.Mey.ex Schrenk,Suaeda microphylla Pall., Climacoptera obtusifolia (Schrenk) Botsch.Plant extracts were investigatedon myelostimulating activity. The compound obtained from plants of the Halostachys caspica (Pall) C.A.Mey.ex Schrenk by means of water-alcohol extractionwithout heating showed high myelostimulating activity. It effectively stimulated erythro-, thrombocyto- and leukopoiesis, and in stimulating the leukocyte population, it equally effectively increased the values of granulocyte and agranulocyte leukocytes. The compounds derived from the Suaeda microphylla Pall. and Climacoptera obtusifolia (Schrenk) Botsch.showed low myelostimulating activity. It should be noted that the water-alcohol extracts of plants without heating showed higher activity than the extracts that have undergone thermal heating.

Key words: myelostimulating activity, endemic plants, steppes of Kazakhstan.

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Қазақстанның жазық даласында өсетін эндемик өсімдіктердің фармакологиялық қасиеттері

Экологиялық жағдайдың, пайдаланатын өнімдердің сапасының нашарлауы, әр түрлі цитостатикалық әсері бар дәрілік препараттарды мезгілсіз пайдалану нәтижесінде екінші реттік иммунодефицитке шалдыққан адамдардың саны күрт артуда. Каспийлік соляноколосник, кішіжапырақты сведа және тегісжапырақты климакоптера өсімдіктерінен алынған сығындыларға жүргізілген зерттеу жұмыстарының нәтижесінде миелостимулдаушы әсері ең жоғары қыздырусыз

су-спирттік экстракттау әдісімен бөлініп алынған каспийлік соляноколосник өсімдігінің сығындысы екендігі анықталды. Ол эритро-, тромбоцито- және лейкопоэзды эффективті түрде стимулдады, сонымен қатар лейкоциттердің санын көбейту кезінде ол гранулоцитарлы және агронулоцитарлы лейкоциттердің түзілуін бірдей мөлшерде стимулдай алды. Тегісжапырақты климакоптера өсімдігінен алынған сығындының миелостимулдаушы әсері каспийлік соляноколосник өсімдігіне қарағанда бәсеңдеу болды, алайда кішіжапырақты сведа өсімдігінің сығындысынан стимулдаушы әсерінен белсендірек. Өсімдіктердің қыздырусыз алынған су-спирттік экстракттарының белсенділігі термиялық өңдеуден өткен өсімдік сығындыларына қарағанда белсендігі жоғары екендігін атап айтып кеткен жөн.

Түйін сөздер: миелостимулдаушы белсенділік, эндемик өсімдіктер, Қазақстанның аридті аймағы.

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Фармакологические свойства растений эндемиков, произрастающих в степях Казахстана

Число людей, страдающих вторичными иммунодефицитными заболеваниями, увеличивается во всем мире. Прирост населения со вторичными иммунодефицитными заболеваниями происходит из-за ухудшения экологической обстановки, использования стабилизаторов, консервантов, красителей в процессе производства продуктов питания длительного хранения, расширением спектра заболеваний с использованием цитостатических препаратов и использованием антибиотиков при выращивании скота и птицы. Были исследованы на миелостимулирующую активность экстракты, полученные из растений эндемиков Казахстана: соляноколосника прикаспийского, сведы мелколистной и климакоптеры туполистной. Высокую миелостимулирующую активность проявило соединение, полученное из растения соляноколосника прикаспийского путем водно-спиртового экстрагирования без нагревания. Оно эффективно стимулировало эритро-, тромбоцито- и лейкопоэз, причем в стимуляции лейкоцитарной популяции он одинаково эффективно повышал значения гранулоцитарных и агранулоцитарных лейкоцитов. Соединения, полученные из растения сведы мелколистной, уступали по активности соединениям, полученным из растения соляноколосника прикаспийского, но были активнее соединений, полученных из растения климакоптера туполистная. Следует отметить, что водно-спиртовые экстракты растений без нагревания проявляли активность выше, чем экстракты, прошедшие термическую обработку.

Ключевые слова: миелостимулирующая активность, растения эндемики, аридная зона Казахстана.

Introduction

The number of people who suffer from secondary immunodeficiency diseases is increasing. Secondary immunodeficiency diseases develop due to environmental degradation, abuse of various preservatives, stabilizers in foods and long-term storage products, abuse of the use of drugs with a cytostatic effect, the use of antibiotics in the cultivation of cattle and poultry [1]. Various toxic chemical compounds: Sturdart solution, trinitrotoluene, pesticides, especially organochlorine preparations, lindane (gamma-hexachlorocyclohexane) and dichlorodiphenyltrichloroethane also cause severe pancytopenia. The choice of effective myelostimulating drugs that can restore parameters of peripheral blood in a short period of time is very limited [2]. Thus, pharmacological screening of myelostimulating drugs is relevant. In addition, myelostimulators are widely used in ophthalmology, surgery, cosmetology and biotechnology.

Materials and Methods

The following plant extracts were received for research: EES.SES/N – 50% water-ethyl alcoholic extract of the plant *Halostachys caspica (Pall) C.A.Mey. ex Schrenk*with heating, EES.SEB / N

– 50% water-ethyl alcoholic extract of the plant *Halostachys caspica (Pall) C.A.Mey. ex Schrenk* without heating, CIE.SV – 70% water-ethyl alcohol extract plant *Suaeda microphylla Pall.*without heating, COBE – 70% water-ethyl alcohol extract of *Climacoptera obtusifolia (Schrenk) Botsch.*with heating, COFL – 70% water-ethyl alcohol extract of plant *Climacoptera obtusifolia (Schrenk) Botsch.* without heating, COLE – aqueous extract of the plant *Climacoptera obtusifolia (Schrenk) Botsch.* without heating (Table 1).

Table 1 – Active compounds obtained by water and water-ethyl extraction of plants

№	Drug code	Plant	Chemical composition of plants
1	EES.SES/N 50% water-ethyl alcohol extract of a plant with heating	Halostachys caspica (Pall) C.A.Mey. ex Schrenk	Flavanoids, free organic acids, amino acids, alkaloids, saponins, tannins
2	EES.SEB/N 50% water-ethyl alcohol extract of a plant without heating	Halostachys caspica (Pall) C.A.Mey. ex Schrenk	Flavanoids, free organic acids, amino acids, alkaloids, saponins, tannins
3	CIE.SV 70% water-ethyl alcohol extract of a plant without heating	Suaeda microphylla Pall.	Flavonoids, free organic acids, amino acids, alkaloids, saponins, coumarins
4	COBE 70% water-ethyl alcohol extract of a plant without heating	Climacoptera obtusifolia(Schrenk) Botsch.	Flavanoids, free organic acids, amino acids, alkaloids, saponins, tannins
5	COLE Aqueous extract of the plant without heating	Climacoptera obtusifolia (Schrenk) Botsch.	Flavanoids, free organic acids, amino acids, alkaloids, saponins, tannins
6	COFL 70% water-ethyl alcohol extract of a plant withoutheating	Climacoptera obtusifolia (Schrenk) Botsch.	Flavanoids, phenolic acids

Healthy, mature animals of laboratory rats of both sexes, 10–15 weeks of age, weighing 210–280 g, were used in the work. The scatter in the groups according to the initial body weight did not exceed ± 10%. The animals were receivedsimultaneously from one nursery – the biological clinic of the Faculty of Biology and Biotechnology of the Al-Farabi Kazakh National University. Before and during the experiment, the control and experimental animals were kept in the same standard conditions, 6 animals per cage. All types of experiments were carried out in compliance with the chronobiological principles of work and in accordance with the "Rules for conducting preclinical (non-clinical) research on biologically active substances" [8]. Blood sampling was performed from the orbital vein of rats anesthetized with weak ether anesthesia at 09.00 in the morning. A blood test was performed on a hematological analyzer for laboratory animals "Abacus junior VET" (manufactured by Diatron, Denmark). The blood leukogramwas monitored by microscopic examination of a smear stained by Romanovsky-Giemsa on an SA3300C microscope for microscopy and digital micrograph under immersion (magnification 7x100) with 500 cells on each smear[6].Myelosuppressionwas induced by administering cytostatic compound benzopyrene at a dose of 30 mg / kg body weight of the animal dissolved in saline in a volume of 0.5 ml three times with an interval of 24 hours [5, 7]. Then, on the 6, 8, 10 day of the observation, once time in day, intramuscularly was injected: to the 1st group – the EEC.SES/N compound at a dose of 5 mg / kg (for all test compounds, physiological saline was the solvent), in a volume of 0.5 ml, The 2nd group – compound EES.SEB/N at a dose of 5 mg / kg in a volume of 0.5 ml, the 3rd group – compound CIE.SV at a dose of 5 mg / kg in a volume of 0.5 ml, the 4th group – compound COBE in a dose of 5 mg / kg in a volume of 0.5 ml; in group 5, compound COFL in a dose of 5 mg / kg in a volume of 0.5 ml; in group 6, compound COLE in a dose of 5 mg / kg in in volume of 0, 5 ml, the 7th group the drug is compared pantohematogen the dose 0, 4 mg / kg in a volume of 0, 5 ml, 8th group – placebo (saline) in a volume of 0 5 ml and 9th group of animals was intact. Statistical data processing was performed with casting the Student's confidence interval.

Results and Discussion

Already on the 1st day after administration, it was possible to register severe immunosuppression with lesions of leukocyte cells and erythrocyte cells. For control of the level of damage to the blood-forming pools was taken the 3rd day after the administration of the immunosuppressant. After analyzing the hemogram of blood, it was found that the leukocyte pool suffered greatly. The total leukocyte index from the level of intact animals $(9.15 \pm 1.36) \cdot 10^9$ / L of blood dropped to $(2.37 \pm 0.16) \cdot 10^9$/L by 3.86 times ($p \leq 0.05$). In the leukogram, the absolute and relative values of agranulocytic and granulacytic leukocytes decreased. Among agranulocytes, the absolute values of lymphocytes from $(5.46 \pm 0.18) \cdot 10^9$/L of blood dropped 3.41 times to $(1.60 \pm 0.2) \cdot 10^9$/L, while the relative values from index of intact animals (68.03 ± 12.3)% of blood fell only 1.44 times to (47.2 ± 1.8)% of blood. A similar trend was observed with respect to other subpopulations of cells.

Absolute values fell by more than 2 times, and relative values decreased by less than 1.5 times. For example, the absolute values of monocytic cells from the value $(0.5 \pm 0.02) \cdot 10^9$ / L of blood decreased to the value $(0.12 \pm 0.10) \cdot 10^9$/L of blood, i.e. 4.17 times ($p \leq 0.05$), while the relative value (6.28 ± 1.24)% fell only to (4.9 ± 1.3)%, which was only 1.28 times the difference in the meanings. Granulocyte cells with $(3.64 \pm 1.22) \cdot 10^9$/L fell to $(0.65 \pm 0.3) \cdot 10^9$/L, i.e. 5.6 times ($p \leq 0.01$). The relative value of granulocytes from (40.0 ± 8.36)% decreased 1.52 times, reaching a value (26.18 ± 4.5)%. In the blood leukogram absolute values are more important in the diagnosis than the relative values of the blood leukogram. Changes in the values of erythrocyte and platelet cells were recorded, but more than 2-fold reduction was not registered. The level of erythrocyte cells $(6.5 \pm 1.56) \cdot 10^{12}$ / L of blood reached the value of $(4.93 \pm 1.3) \cdot 10^{12}$ / L of blood, i.e. a decrease was observed 1.32 times. Hemoglobin levels fell 4.51 times. In intact animals, it was (140.7 ± 16.7) g / L of blood. After intoxication fell to (90.75 ± 12.0) g / L of blood. But the hematocrit value from the value (39.8 ± 6.3)% fell to 2.88 times ($p \leq 0.05$) times, reaching the value (21.21 ± 2.58)%. A critical decrease was observed among platelets. The level of intact animals was $(660.25 \pm 42.3) \cdot 10^9$/L of blood and with an artificially induced immunosuppressive syndrome was $(70.5 \pm 43.2) \cdot 10^9$/L of blood, which amounted to more than 9.36-fold decrease ($p \leq 0.01$). Having caused an artificial immunosuppressive syndrome, animals were treated with new compounds of plant origin. The compounds were obtained from the following plants: *Halostachys caspica (Pall) C.A.Mey.ex Schrenk*, *Suaeda microphylla Pall.*, *Climacoptera obtusifolia (Schrenk) Botsch.* The compounds were obtained by water – ethyl and water extraction of plants, with and without heating. After the introduction of the studied compounds, the following results were obtained on the basis of which it is possible to isolate the most active compound EES.ESB/N. This compound was distinguished by a high myelostimulating activity in the series of compounds obtained from other plants and in the series of compounds obtained from the *Halostachys caspica (Pall) C.A.Mey. ex Schrenk*. In the group with administration of EEC.SEB/N the level of leukocytes was $(6.9 \pm 0.4) \cdot 10^9$ / L with a control value $(2.79 \pm 0.93) \cdot 10^9$/L ($p \leq 0.05$) and with a value at intact animals $(10.4 \pm 0.19) \cdot 10^9$/L of blood. In the blood leukogram, both in relative and absolute values, positive changes have occurred. The relative value of lymphocytes increased 1.4 times to (70.1 ± 2.3)% against the control value (50.65 ± 14.65)% and with the value of intact animals (73.0 ± 3.8)% (Figure 1). More significant changes can be seen in the change in the absolute values of lymphocytes with the indicator $(4.8 \pm 0.05) \cdot 10^9$ / L opposites tocontrol value $(1.6 \pm 0.9) \cdot 10^9$/L, which is a 3-fold difference ($p \leq 0.05$) and with the value of intact animals $(7.6 \pm 0.1) \cdot 10^9$/L(Figure 1). Positive dynamic was observed in the granulocyte leukocyte series, but within 8-10%.

Compound EEC.SEB/H reliably stimulated myelopoiesis of erythrocyte, platelet and leukocyte cell generation. Stimulation of erythropoiesis was effective and the level of erythrocytes on the 7th day of observation reached the value $(7.43 \pm 0.1) \cdot 10^9$/ Lof blood against the control indicator $(3.67 \pm 0.1) \cdot 10^9$/Lof blood and with the value of intact animals $(7.5 \pm 0.28) \cdot 10^9$/L(Figure 2). The hemoglobin level reached the value of healthy animals (121.0 ± 1.0) g/L with the control value (96.0 ± 1.0) g/L and the value of intact animals (140.7 ± 4.3) g/L. And the hematocrit level was also very high (37.8 ± 0.91)% against the control value (28.1 ± 0.84)% and the value of intact animals (39.8 ± 0.91)%. The recovery in the leukocyte pool was not as intense as in the platelet(Figure 2). With the value of platelets after administration of benzopyrene $(70.5 \pm 4.3) \cdot 10^9$ / L, the level of platelets after administration of EEC. ESB/N increased to $(691.2 \pm 11.0) \cdot 10^9$/Lagainst the control value $(447.0 \pm 5.1) \cdot 10^9$/Land values of intact animals $(660.0 \pm 25.0) \cdot 10^9$/L. Similar changes occurred in terms of thrombocrit, average platelet volume and platelet distribution.

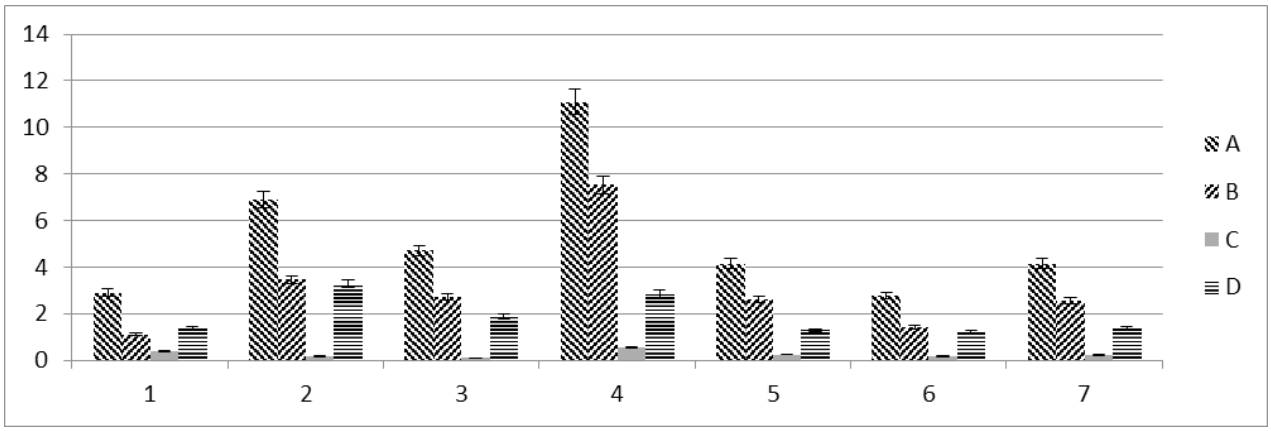

Figure 1 – Peripheral blood hemogram: total leukocyte indicators, · 10^9 / L (A), absolute lymphocyte evidence, · 10^9 / L (B), absolute monocytice eosinophilic indicators, · 10^9 / L (C), and absolute granulocytic indicators, · 10^9 / L (D). 1-data of the group with the introduction of the compound EES.SES/N, 2-data of the group with the introduction of the compound EES.SEB/N, 3-data of the group with the introduction of the compound CIE.SV, 4-data of intact animals, 5-data of the control group with pantohematogen, 6-placebo group data with the introduction of nat. solution. The abscissa axis – the number of groups, the axis of ordinate- blood indicates.

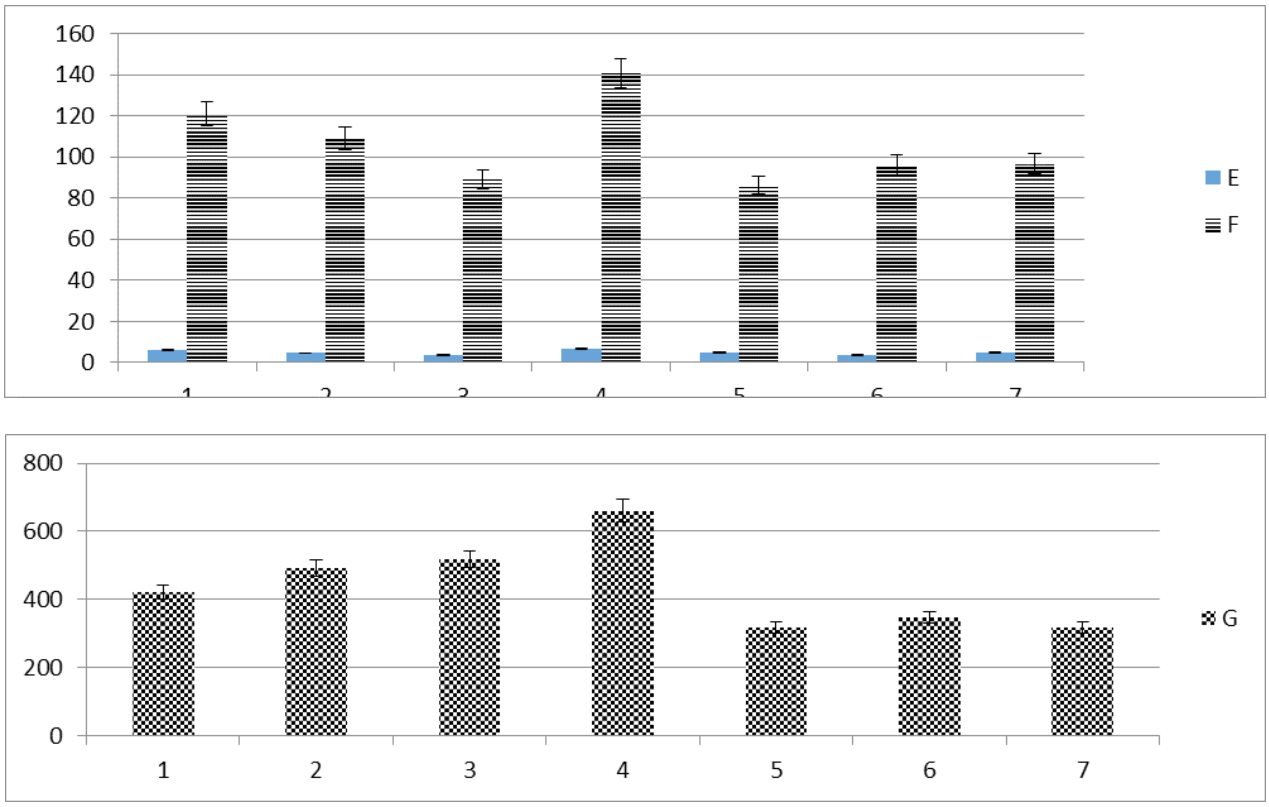

Figure 2 – Peripheral blood hemogram: total erythrocyte indicators, · 10^{12} / L (E) and hemoglobin index, g / L (F), total platelet indicators, · 10^9 / L. 1-data of the group with the introduction of the compound EES.SES / N, 2-data of the group with the introduction of the compound EES.SEB/N, 3-data of the group with the introduction of the compound CIE.SV, 4-data of intact animals, 5-data of the control group with the introduction pantohematogen, 6-placebo group data with the introduction of nat. solution. The abscissa axis – the number of groups, the axis of ordinate – blood indices.

When benzopyrene intoxication was observe a sharp decrease in blood parameters: erythrocyte, leukocyte, platelets.So immediately after the administration of benzopyrene the level of erythrocytes was (4.93 ± 0.5) · 10^9/Lwith hemoglobin (90.75 ± 12.0) g/L, hematocrit (21.21 ± 7.79)%.After 7th days in the control group with the introduction of saline solution, the level of erythrocytes was (3.67 ± 0.1) · 10^9/Lwith hemoglobin (96.0 ± 1.0) g/L, hematocrit (28.1 ± 0.84) %, i.e. not registered positive dynamics in the erythrocyte pool. A similar pattern was observed in the leukocyte cell pool. Immediately after intoxication, the level of leukocytes was (2.37 ± 0.16) · 10^9/Lof blood. After 7th days the level of leukocytes was (2.79 ± 0.93) · 10^9/Lwith absolute lymphocytic index (1.6 ± 0.2) · 10^9/Land absolute agranulocytes index (1.5 ± 0.9) · 10^9/Land absolutegranulocytes index (0.65 ± 0.3) · 10^9/L. Similar pattern was observed in the erythrocyte pool of cells. However, in the platelet pool of cells from a critical value (70.5 ± 4.3) · 10^9/ Lof blood immediately after intoxication, the level of platelets after 7 days increased to (447.0 ± 51.0) · 10^9/L.

In a series of compounds derived from various plants, only compounds derived from plant *Halostachys caspica (Pall) C.A.Mey.ex Schrenk* can effectively stimulated myelopoiesis of blood at benz(a)piren myelosuppression. Among series of compounds obtained from one plant of the *Halostachys caspica (Pall) C.A.Mey.ex Schrenk* only compound obtained from plant without heating (EEC.SEB/N) that showed high activity compared to the extract of the plant with heating (EES.SES/N). The next compound investigated on myelostimulating activity was a compound obtained from the plant *Suaeda microphylla Pall.*, which received the code CIE.SV. It was inferior in activity to the compounds obtained from the plant *Halostachys caspica (Pall) C.A.Mey.ex Schrenk*, but exceeded in activity at the compounds obtained from the plant *Climacoptera obtusifolia (Schrenk) Botsch.* The compound CIE.CV very effectively stimulated platelet cell proliferation. The level of platelets after treatment was (718.2 ± 21.0) · 10^9/ Lwith a control value (447.0 ± 51.0) ·10 / L and the value of intact animals was (660.0 ± 25.0) · 10^9/L, i.e. platelet count exceeded the value of intact animals. Erythrocyte recovery with a rate of (5.27 ± 0.1) · 10^{12} / L, especially hemoglobin (86.0 ± 1.02) g/L, was not very effective(Figure 3).It should be noted that the recovery of leukocytes was slow, but with a significant increase in lymphocytic index. With a total leukocyte index (4.7 ± 0.2) · 10^9/L, the relative lymphocyte count was (78.2 ± 5.5)% with an absolute value (3.7 ± 0.05) · 10^9/L(Figure 3). At the same time, in intact animals the relative value of lymphocytes was (73.0 ± 3.8)% with an extreme variation (70-75)%, and the absolute value was (7.6 ± 0.1) · 10^9/L, i.e. CIE.SV compound very effectively and quickly stimulated the proliferation and release of lymphocytic cells into peripheral blood.

In a series of activity of the newly synthesized compounds, the compounds obtained from the plant *Climacoptera obtusifolia (Schrenk) Botsch.* were in third place. Among three compoundsmore active was the COFL compound. It stimulated erythrocyte- thrombocyte- and leukopoiesis. During the stimulation of erythropoiesis, the level of erythrocytes reached the value (5.94 ± 0.12) · 10^9/Lof blood with the control value (3.67 ± 0.1) · 10^9/L(Figure 4). The hemoglobin level was (99.0 ± 0.1) g/L with a control value (96.0 ± 1.0) g/L, i.e. despite an increase in the erythrocyte pool, hemoglobin levels did not increase. It could also be noted in other values of the erythrocyte pool: the average volume of erythrocytes, the average hemoglobin content, the width of the distribution of erythrocytes, etc. The values in the group of administration of the compound COFL did not differ from the control values. Similar changes were observed in the platelet pool. There was an increase in the total platelet count to (881.0 ± 86.0) · 10^9/ Lof blood, which was 2-fold difference from the control value (447.0 ± 51.0) · 10^9/Lof blood. The value of the total leukocyte index increased to (5.1 ± 0.18) · 10^9/L(Figure 4). But the absolute value of the lymphocytic population was (58.11 ± 5.0)% with the control value (50.65 ± 14.65)% and the value of intact animals (73.0 ± 3.8)%. The absolute and relative values of granulocytes did not differ from the control group: (43.2 ± 1.86)% against (43.35 ± 9.3)% and (2.1 ± 0.03) · 10^9/Lagainst (1, 13 ± 0.13) · 10^9/L, respectively. According to the studied compounds, it can be concluded that the compounds as effective.

Having caused an artificial immunosuppressive syndrome, animals were treated with new compounds of plant origin. The compounds were obtained from the following plants: *Halostachys caspica (Pall) C.A.Mey.ex Schrenk*, *Suaeda microphylla Pall.*, *Climacoptera obtusifolia (Schrenk) Botsch.* The compounds were obtained by water – ethyl and water extraction of plants, with and without heating.

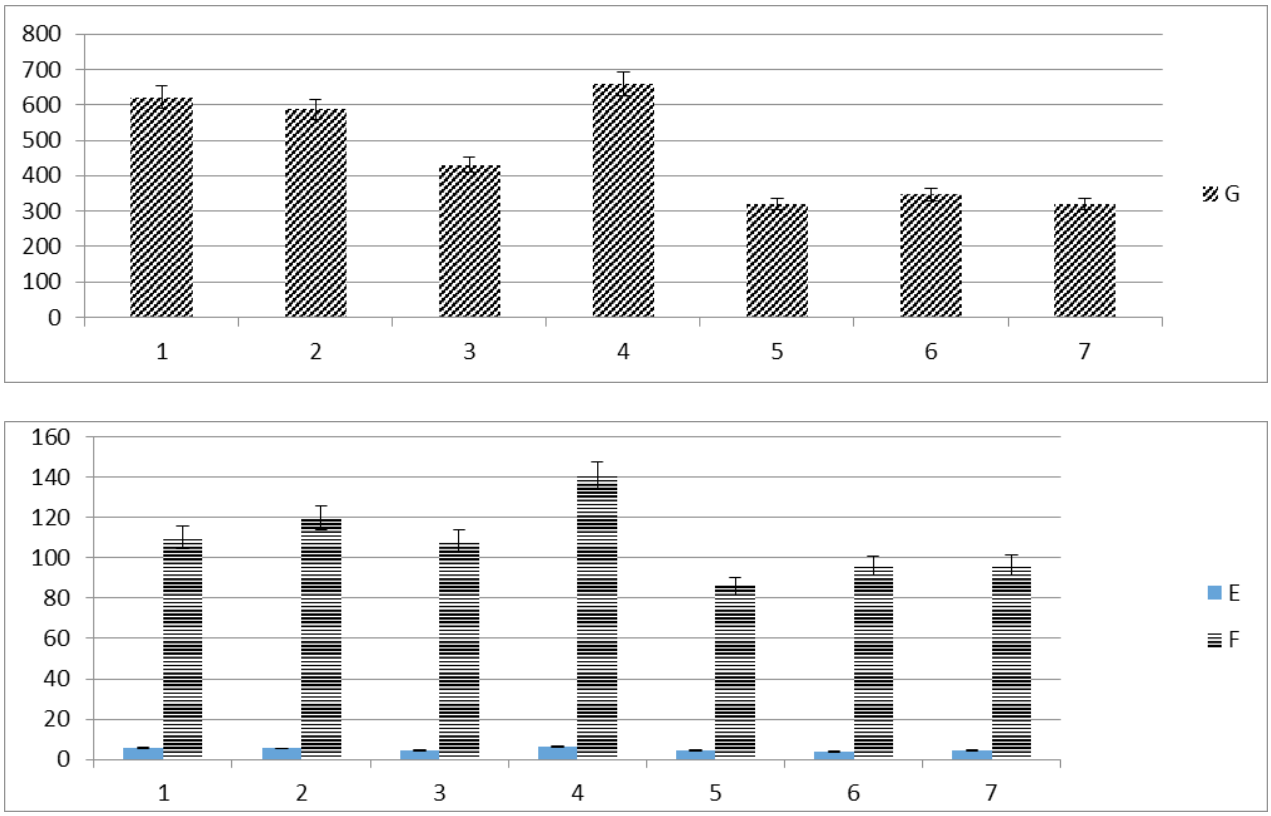

Figure 3 – Peripheral blood hemogram: total erythrocyte indicator, · 10^{12}/L (E) and hemoglobin index, g / L (F), total platelet indicator, · 10^9 / L. 1-data of the group with the introduction of the compound COFL, 2-data of the group with the introduction of the compound COBE, 3-data of the group with the introduction of the compound COLE, 4-data of the intact animals, 5-data of the control group with the introduction of pantohematogen, 6-data of the placebo group with the introduction of physical solution. Abscissa axis – numbers of groups, axis of ordinats – blood indicators.

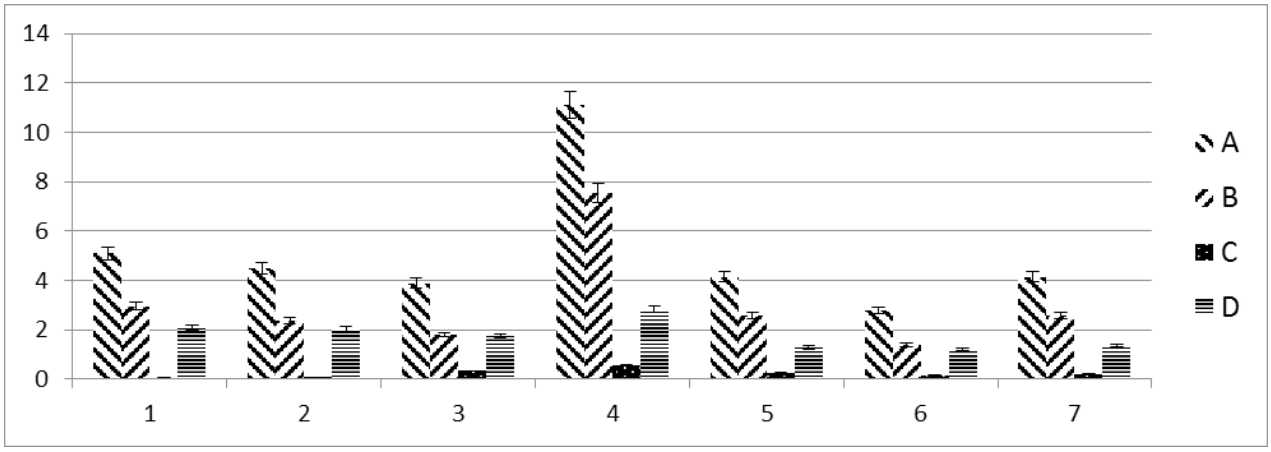

Figure 4 – Peripheral blood hemogram: total leukocyte indicator, · 10^9 / L(A), absolute lymphocyte evidence, · 10^9 / L(B), absolute monocyticeosinophilic indicator, · 10^9 / L(C), and absolute granulocytic indicator, · 10^9 / L(D). 1-data of the group with the introduction of the compound COFL, 2-data of the group with the introduction of the compound COBE, 3-data of the group with the introduction of the compound COLE, 4-data of the intact animals, 5-data of the control group with the introduction of pantogematogen, 6-data of the placebo group with the introduction of physical solution. The abscissa axis – the number of groups, the axis of ordinate- blood indices.

Thus, among the activity of compounds derived from plants of the *Halostachys caspica (Pall) C.A.Mey.ex Schrenk*, *Suaeda microphylla Pall.*, *Climacoptera obtusifolia (Schrenk) Botsch.* the most active ones obtained from the plant*Halostachys caspica (Pall) C.A.Mey.ex Schrenk*hould be distinguished. In a series of compounds obtained from the plant of the *Halostachys caspica (Pall) C.A.Mey.ex Schrenk*hould be isolated extract EEC. SEB/N, not passed thermal heating. It effectively stimulated erythropoiesis, thrombocytopoiesis, and leukopoiesis, it equally effectively increased the values of granulocyte and agranulocyte leukocytes. The extract obtained from the same plant of the *Halostachys caspica (Pall) C.A.Mey.ex Schrenk*, but which the last heating (EEC.SES/N) practically did not stimulate platelet and leukocyte cell proliferation. The next most active was the extract obtained from *Suaeda microphylla Pall.*- CIE. SV. It was inferior in activity to the compounds obtained from the plant*Halostachys caspica (Pall) C.A.Mey.ex Schrenk*, but it was more active than the compounds obtained from the plant*Climacoptera obtusifolia (Schrenk) Botsch.* Compounds extracted from plant*Climacoptera obtusifolia (Schrenk) Botsch.*did not stimulate leuko- and erythropoiesis.

Литература

Алмазов В.А., Афанасьев Б.В., Зарицкий А.Ю., Шишков А.Л. Лейкопения. – М., 1981. – С. 208-240.

Астрахан В.И., Гарин А.М., Личиницер М.Р. Общая характеристика и классификация побочного действия противоопухолевых лекарств. В кн.: Побочное действие лекарственных средств. – М., 1976. – С. 207 – 213.

Баранов А.Е., Бриллиант М.Д., Воробьев А.И. Лечение цитостатической болезни // Тер. арх. – 1975. – № 6. – С. 79 – 87.

Файнштейн Ф.Э. Цитостатическая болезнь и агранулоцитозы. В кн.: Болезни системы крови. – Ташкент: Медицина, 1980. – С. 460 – 469.

Fujisaki F., Aki H., Naito A., Fukami E., Kashige N., Miake F., Sumoto K. Synthesis of new 5-substituted hydantoins and symmetrical twin-drug type hydantoin derivatives // Chem. Pharm. Bull. – 2014. – P. 429-448.

Giemsa, G. Eine Vereinfachung und Vervollkommnung meiner Methylenazur-Methylenblau-Eosin-Färbemethode zur Erzielung der Romanowsky-Nochtschen Chromatinfärbung // Centralbl. f. Bakt. –1904. –P.308–311

Приказ Министра здравоохранения Республики Казахстан от 19 ноября 2009 года № 745 «Об утверждении Правил проведения доклинических (неклинических) исследований биологически активных веществ».

Pedregal C., Trigo G.G., Espada M. Utilisation des plans factoriels fractionnaires pour l'etude dela reaction de Bucherer-Bergs: synthese de la cyclohexanespirohydantoine // J. Heterocyclic Chem. –1984. – P. 1527-1531

Kharkevich D.A. Pharmacology // GEOTAR-MED, Moscow (in Russian) ISBN. –2010. – P. 429-438.

Воробьев А.И., Бриллиант М.Д., Баранов А.Е. Цитостатическая болезнь (к вопросу о лекарственных агранулоцитозах) // Тер. арх. – 1975. – № 6 – С. 3-11.

Воробьев А. И., Бриллиант М. Д. Терапия осложнений цитопенического синдрома. В кн.: Патогенез и терапия лейкозов. – М.: Медицина, 1977. – С. 153-163.

References

Almazov V.A., Afanasyev B.V., Zaritsky A.Y., Shishkov A.L. (1981) Lejkopeniya [Leukopenia]. Medicine, Russia. pp. 208-240.

Astrakhan V.I., Garin A.M., Lichinitser M.R. (1976) Obshchaya harakteristika i klassifikaciya pobochnogo dejstviya protivo opuholevyh lekarstv. V kn.: Pobochnoe dejstvie lekarstvennyh sredstv [General characteristics and classification of the side effects of anticancer drugs. In the book: Side effects of drugs]. Medicine, Russia.pp. 207 – 213

Baranov A.E., Brilliant M.D., Vorobiev A.I. (1975) Lechenie citostaticheskoj bolezni [Treatment of cytostatic disease] Ter Arch., № 6, pp. 79 – 87.

Fainshtein F.E. (1980) Citostaticheskaya bolezn' i agranulocitozy. V kn.: Bolezni sistemy krovi [Cytostatic disease and agranulocytosis. In the book: Diseases of the blood system]. Medicine, Uzbekistan. pp.460 – 469.

Fujisaki F., Aki H., Naito A., Fukami E., Kashige N., Miake F., Sumoto K. (2014) Synthesis of the new 5-substituted-hydantoins and symmetrical twin-drug type-hydantoin derivatives. Chem Pharm Bull.pp. 429-438.

Giemsa G.(1904) Eine Vereinfachung und Vervollkommnung meiner Methylenazur-Methylenblau-Eosin-Färbe methode zur Erzielung der Romanowsky-Nochtschen Chromatinfärbung. Centralbl. f. Bakt. pp.308–311.

Kharkevich D.A., (2010) Pharmacology. GEOTAR-MED, Russia, ISBN 978-5-9704-1568-9. pp.25-29

Prikaz Ministra zdravoohraneniya Respubliki Kazahstan ot 19 noyabrya 2009 goda № 745 «Ob utverzhdenii Pravil provedeniya doklinicheskih (neklinicheskih) issledovanij biologicheski aktivnyh veshchestv» [Order of the Minister of Health of the Republic of Kazakhstan dated November 19, 2009 N. 745 "O-n approval of the Rules for conducting preclinical (non-clinical) studies of biologically active substances"]

Pedregal C., Trigo G.G., Espada M. (1984) Utilisation des plans, factoriels fraction of the reaction of Bucherer-Bergs: synthese de la cyclohexanespirohydantoine. J Heterocyclic Chem. pp. 1527-1531

Vorobyov A.I., Brilliant M.D., Baranov A.E.(1975) Citostaticheskaya bolezn' (k voprosu o lekarstvennyh agranulocitozah) [Cytostatic disease (on the issue of medicinal agranulocytosis)] Ter Arch,pp. 3-11.

Vorobyov A.I., Brilliant M.D. (1977) Terapiya oslozhnenij citopenicheskogo sindroma. V kn.: Patogenez i terapiya lejkozov [Therapy of complications of the cytopenic syndrome. In the book: Pathogenesis and therapy of leukemia]. Medicine, Russia, pp.153 – 163.