ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

2021 • 3

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ

БАЯНДАМАЛАРЫ

ДОКЛАДЫ
НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

REPORTS
OF THE NATIONAL ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN

PUBLISHED SINCE JANUARY 1947

ALMATY, NAS RK

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ
БАЯНДАМАЛАРЫ **2021 • 3**

«Қазақстан Республикасы Ұлттық ғылым академиясының баяндамалары»
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)
Меншіктенуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» Республикалық қоғамдық бірлестігі (Алматы қ.). Қазақстан Республикасының Ақпарат және қоғамдық даму министрлігінің Ақпарат комитетінде 29.07.2020 ж. берілген **№ KZ93VPY00025418** мерзімдік басылым тіркеуіне қойылу туралы куәлік.
Тақырыптық бағыты: *наноматериалдар алу, биотехнология және экология саласындағы бірегей зерттеу нәтижелерін жариялау.*
Мерзімділігі: жылына 6 рет.
Тиражы: 300 дана.
Редакцияның мекен-жайы: 050010, Алматы қ., Шевченко көш., 28; 219 бөл.; тел.: 272-13-19, 272-13-18
http://reports-science.kz/index.php/en/archive

Типографияның мекен-жайы: «Аруна» ЖК, Алматы қ., Муратбаева көш., 75.

ДОКЛАДЫ **2021 • 3**

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

Доклады Национальной академии наук Республики Казахстан»
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)
Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы). Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и общественного развития Республики Казахстан **№ KZ93VPY00025418,** выданное 29.07.2020 г.
Тематическая направленность: *публикация оригинальных результатов исследований в области получения наномате-риалов, биотехнологии и экологии.*
Периодичность: 6 раз в год. Тираж: 300 экземпляров
Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28; ком. 219; тел. 272-13-19, 272-13-18
http://reports-science.kz/index.php/en/archive

Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75.

REPORTS
OF NATIONAL ACADEMY OF SCIENCES OF THE
REPUBLIC OF KAZAKHSTAN

2021 • 3

Reports of the National Academy of Sciences of the Republic of Kazakhstan.
ISSN 2224-5227
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)
Owner: RPA «National Academy of Sciences of the Republic of Kazakhstan» (Almaty).
The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Social Development of the Republic of Kazakhstan **No. KZ93VPY00025418,** issued 29.07.2020.
Thematic scope: *publication of original research results in the field of obtaining nanomaterials, biotechnology and ecology.*
Periodicity: 6 times a year.
Circulation: 300 copies.
Editorial address: 28, Shevchenko str., of. 219, Almaty, 050010, tel. 272-13-19, 272-13-18
http://reports-science.kz/index.php/en/archive

Address of printing house: ST «Aruna», 75, Muratbayev str., Almaty.

REPORTS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
ISSN 2224-5227
Volume 3, Number 337 (2021), 53 – 56 **https://doi.org/10.32014/2021.2518-1483.48**

UDC 547.4:595.14

G. Seribekkyzy, B.K. Esimov
Abai Kazakh National Pedagogical University, Almaty, Kazakhstan
E-mail: gulzynat@mail.ru, esimov.bolat@mail.ru

LUMBRICIDAE SPECIES COMPOSITION IN THE SOILS OF THE FOOTHILL BEYOND ILE ALATAU REGION

Abstract: This article discusses the species composition of earthworms in the soils of the beyond Ile Alatau region. The role of earthworms in the soil is quite large. First of all, it is worth noting their loosening and structuring activities. During the movement process, these soil invertebrates mix a huge number of small fractions of soil. The loosening activity promotes moisture and sufficient oxygen. The most important is the destructive activity and enrichment of soils with active substances, as enzymes. The study of lumbricides began from the time of Charles Darwin, and is still of great importance the essence of such invertebrates in zoology.

Scientific researchers had been carried out over two years (2018-2020) during the active vegetation of plants on the soils of the highest point of the beyond Ile Alatau region - in the peak of Talgar.

As a result of the conducted research, the following earthworm species from the Lumbricidae family were found: Octolasium lacteum, Eisenia foetida, Eisenia nordenskioldi, Nicodrilus caliginosus, Nicodrilus longus, Lumbricus rubellus, Lumbricus terrestris, Dendrobaena octaedra. The most common species are Lumbricus rubellus and Nicodrilus caliginosus, and the rest are less common. In the seasonal dynamics of earthworm numbers, two peaks of activity were observed - in early June and at the end of August.

Key words: lumbricidae, soil, invertebrates, foothill beyond Ile Alatau region, species composition, seasonal dynamics.

Introduction. In damp weather, especially after rains in large quantities appear on the surface of the soil, crawl along garden paths, lie on the bottom of puddles and even on asphalt all well-known earthworms. Earthworms, or Lumbricidae - a family of oligochetes, live in the soil, single species lead a woody or semi-aquatic lifestyle.

Earthworms are of great importance in soil formation, which was first noticed by Ch. Darwin. Since then, many works have been appeared on the role of soil animals in soil formation. Soil invertebrates are of great importance and form the basis of terrestrial ecosystem communities. So, in forests and meadows, soil animals make up 90-95% of biomass and species composition. In fields, they account for up to 99% of biomass [1].

Among the various forms of influence of lumbricides on the soil, first of all, we can note their loosening and structure-forming activities. During the movement process, these soil invertebrates mix a huge number of small soil fractions. Thus, earthworms can process from 50 to 350 tones per hectare of soil annually. The loosening activity of lumbricides, as well as other invertebrates, leads to the fact that the soil acquires a high porosity, which contributes to the intake of moisture and a sufficient amount of oxygen. By laying passages in the soil, they come into direct contact with mineral particles of the soil, which have different effects on them depending on the mechanical composition and aggregate state of the particles [2].

The destructive activity of soil invertebrates is especially noticeable in forest biogeocenoses. On the surface of the soil in forests annually receives about 3-5 tons of vegetation per hectare, which is disposed of by animals and microorganisms. As a result of the life of soil invertebrates, the soil is enriched with the products of their metabolism. Animal excrement becomes centers of microbiological growth. Soil animals act as accelerators of the humus formation process, cleansing the soil from the huge mass of organic matter entering its surface [3,4].

The main factor determining the rate of decomposition of organic substances is microclimatic conditions, which are characterized by high dynamicity on the surface and relative stability in the depth of the soil. The rate of organic degradation also depends on the chemical composition of the substrate. So, the presence of resins and phenols in it, inaccessible to most destructors which slows down the decomposition process. In this regard, according to the observations of B.R. Striganova (1980), the decomposition of the defective is slowest. Among the preferences, the first is the fall of herbaceous plants, then the fall of birch, aspen, currant and other deciduous crops, and, finally, coniferous fall [5].

Earthworms feed on dead plant remains, involving deciduous fall in the soil, and contribute to egogumification. During digestion in the intestines of earthworms, fiber decomposition

and partial mineralization of plant tissues occur. Worms stimulate the development of a number of groups of microorganisms. So according to M.S. Gilyarov and D.A. Krivolutsky (1985), the number of microorganisms in worm excrement is much higher than in the surrounding soil. Due to this, the soil is enriched with enzymes, which activates a number of important elements of plant nutrition [6-8]. Understanding the importance of the role of earthworms, and their little knowledge in the south of Kazakhstan, we decided to study them in the soils of the foothills beyond Ile Alatau region.

In climatic terms, the beyond Ile Alatau region can be divided into several geographical belts located «floors» one above the other. The first - from 1000 m to 1700 m - garden-steppe, covers a vast area from the mouth of the Malaya Almatinka River valley to Gorelnik. The second - meadow-forest - is located in the range from 1700m to 2700m. It is characterized by a wide distribution of coniferous forests and pronounced features of the mountain climate. From a height of 2700m to 3100m, high mountain meadows of the subalpine belt stretch. The last, alpine belt (lies above 3100 m) - a kind of mountain Arctic - a clump of showers, bare rocks, blue glaciers and eternal snow [9].

The purpose of our research is to determine the species composition of lumbricides in the soils of the foothill beyond Ile Alatau region.

Material and research methods. Studies have been conducted over two years (2018-2020) during the active vegetation of plants, i.e. from May to September, since it was during this period that the largest activity of pedobionts was observed. Work has been conducted at the Institute of Zoology of MES of Kazakhstan Republic.

The accounting of soil mesofauna was carried out by the method of soil excavations recommended by M.S. Gilyarov, generally accepted in soil-zoological studies.

When collecting invertebrates from a soil sample, each group of representatives of the soil mesofauna was taken so as to ensure their best fixation (Gilyarov, 1965; Striganova, 1987). Earthworms were fixed with a weak (0.5%) formalin solution. All material was precisely labeled, where the date of excavation was noted, the names of the area, the characteristics of the site, the number of the sample in the numerator and the layer in the denominator, followed by a cameral determination of group affiliation. To identify the lumbricidae species composition scientists used the definitive tables of T.S.Vsevolodova-Perel, B. Matveeva [10-12].

In the process of the study, a number of indicators at the population level were taken into account: species composition, species number, density - the number of individuals per unit area, biomass lumbricide of the studied biogeocenoses. Accounting for lumbricides was carried out on the soils of the highest point of the beyond Ile Alatau region - in the peak of Talgar, to the Subalpine belt.

The results of the research. We have discovered the following species of earthworms from the family Lumbricidae: Octolasium lacteum, Eisenia foetida, Eisenia nordenskioldi, Nicodrilus caliginosus, Nicodrilus longus, Lumbricus rubellus, Lumbellus terrestris, Dendrobaena octaedra. The most populated soil horizon is from 5 to 15 cm.

The most widespread species is Lumbricus rubellus which can reach a length of up to 50-150 mm, a width of 4-6 mm. Pigmentation on the dorsal side is purple, the front end of the body is especially strongly pigmented, and the tail end is flattened. It is a bedding species that prefers moist, peregrine-rich soil. Lumbricus rubellus occurs at a depth of 5 cm in an amount of 52 per square meter of them.

Another single species from the genus Lumbricus type Lumbricus terrestris. Body length from 12 to 30 cm, torso front red, back pale. It lives in deeper layers of soil, being a mink. This species also prefers soils rich in overfishing.

The Nicodrilus caliginosus species has also been discovered. It occurs in large quantities in all soils, which is associated with the ability to go to the depth and in a state of anabiosis to wait out unfavorable conditions. Nicodrilus caliginosus lives in the dry steppe zone, the vegetation of which is represented by loch, elm, tamarisk, lomonosus; wormwood, slush, licorice, cereals, chicory, water pepper and others are found. Under these conditions, Nicodrilus caliginosus dominates in number (up to 59 per square meter of them at a depth of up to 6 cm).

From the Eisenia type, a species was discovered – Eisenia fetida, 40-130 mm long, 2-4 mm wide and Eisenia nordenskioldi, belong to soil-bedding species. Eisenia fetida dominates in number (13 per square meters of them). It is distributed to a depth of 10-15 cm. This species is characterized by high fertility and endurance, easily adapts to various environmental conditions.

The occurrence of Octolasion lacteum is quite low, the length of which reaches 30-180 mm, and the thickness is 2-8 mm. This species has practically no pigment, although most often there are light gray specimens with a bluish tint. Octolasion lacteum is able to live in overwetted soils and endure a long period of oxygen deficiency. It should be noted that it is relatively rare, mainly in soils with relatively high humidity.

From the Dendrobaena family, a species of Dendrobaena octaedra 25-40 mm long and 2-4 mm thick has been discovered, having a bluish pigment with a metallic gloss. Dendrobaena octaedra is a typically forest species, as it is found in mixed forest and birch bark, where forest litter is developed. They are found in the soils of maple plantings, live mainly in the surface layer of soil at a depth of 2 cm reaches a number of 29 per square meter of them.

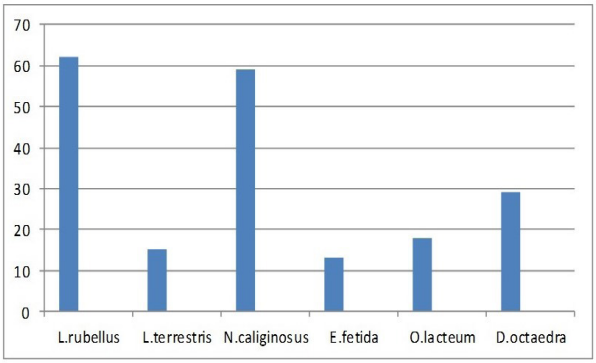

Figure 1 - The occurrence of lumbricides in the soils of the foothills beyond Ile Alatau region

According to the above presented diagram, it can be concluded that the most common species are Lumbricus rubellus and Nicodrilus caliginosus, other species are found in smaller quantities.

It is confirmed the belonging of the studied species of earthworms to two morpho-ecological types.

1. The first type includes Lumbricidae, using fall and slightly dispersed plant residues (Octolasium lacteum, Nicodrilus roseus, Nicodrilus caliginosus, Nicodrilus longus).

2. The second morpho-ecological type includes lumbricides using soil peregrine (Lumbricus rubellus, Eisenia foetida, E. nordenskioldi, Dendrobaena octaedra). They are less moving than worms that feed on plant residues, and often have a more primitive tufted type of arrangement of muscle fibers in the longitudinal musculature of the body wall.

Conclusion. Anthropogenic factors have a significant impact on the number and species composition of earthworms, such as: repowering, trapping, adding fertilizers to the soil, removing foliage in steam zones, burning grass.

As a result of the study, it was revealed that bedding and own-soil (upper and middle-tier) species are dominant. In the seasonal dynamics of earthworm numbers, two peaks of activity were observed - in early June and at the end of August.

In conclusion, we would state that studies which have been conducted proved that the distribution of earthworms in the soil profile is determined by the ecological characteristics of a particular species, as well as, the quantitative composition of a species, depends on the soil conditions. Related species live at different depths of the soil profile.

Г. Серібекқызы, Б.К. Есимов
Абай атындағы ҚазҰПУ, Алматы қаласы, Қазақстан
E-mail: gulzynat@mail.ru, esimov.bolat@mail.ru

ІЛЕ АЛАТАУЫ БӨКТЕРІНІҢ ТОПЫРАҒЫНДАҒЫ ЛЮМБРИЦИДТЕРДІҢ ТҮРЛІК ҚҰРАМЫ

Аннотация. Бұл мақалада Іле Алатауы топырағындағы жауын құрттардың түрлік құрамы қарастырылады. Топырақтағы жауын құрттарының рөлі өте үлкен. Ең алдымен, олардың топырақты қопсыту және құрылымдық қызметін атап өткен жөн. Қозғалыс кезінде бұл топырақ омыртқасыздары топырақтың көптеген ұсақ фракцияларын араластырады. Қопсыту қызметі ылғал мен оттегінің жеткілікті мөлшеріне ықпал етеді. Деструктивті белсенділігі мен топырақты фермент сияқты белсенді заттармен байыту қызметі де маңызды. Люмбрицидтерді зерттеу Ч. Дарвиннің заманынан бастау алып, бүгінгі күнге дейін өзектілігін жоғалтқан жоқ.

Зерттеу жұмыстары екі жыл бойы (2018-2020 жж.) өсімдіктердің белсенді өсіп – өнуі кезінде, Іле Алатауының ең биік нүктесі-Талғар шыңының топырағында жүргізілді.

Зерттеу нәтижесінде Lumbricidae тұқымдас құрттарының келесі түрлері анықталды: Octolasium lacteum, Eisenia foetida, Eisenia nordenskioldi, Nicodrilus caliginosus, Nicodrilus longus, Lumbricus rubellus, Lumbricus terrestris, Dendrobaena octaedra. Ең көп таралған түрлер - Lumbricus rubellus және Nicodrilus caliginosus, ал қалған түрлері аз мөлшерде кездеседі. Құрттар санының маусымдық динамикасында белсенділіктің екі шыңы – маусым айының басында және тамыздың соңында байқалды.

Түйін сөздер: люмбрицид, топырақ, омыртқасыздар, Іле Алатауы бөктері, түрлік құрамы, маусымдық динамика.

Г. Серибеккызы, Б.К. Есимов
КазНПУ им. Абая, г.Алматы, Казахстан
E-mail: gulzynat@mail.ru, esimov.bolat@mail.ru

ВИДОВОЙ СОСТАВ ЛЮМБРИЦИДОВ В ПОЧВАХ ПРЕДГОРИЙ ЗАИЛИЙСКОГО АЛАТАУ

Аннотация: В статье рассматривается видовой состав дождевых червей в почвах Заилийского Алатау. Роль дождевых червей в почве достаточно велика. Прежде всего, стоит отметить их

разрыхляющую и структурообразующую деятельность. В процессе передвижения эти почвенные беспозвоночные перемешивают огромное количество мелких фракций почвы. Разрыхляющая деятельность способствует поступлению влаги и достаточного количества кислорода. Также немаловажна деструкционная деятельность и обогащение почв активными веществами, такими как ферменты. Изучение люмбрицидов началось со времен Ч.Дарвина и по сей день не теряет свою актуальность.

Исследования проводились в течение двух лет (2018 - 2020 гг.) во время активной вегетации растений на почвах самой высокой точки Заилийского Алатау – в пике Талгар.

В результате исследования обнаружены следующие виды дождевых червей из семейства Lumbricidae: Octolasium lacteum, Eisenia foetida, Eisenia nordenskioldi, Nicodrilus caliginosus, Nicodrilus longus, Lumbricus rubellus, Lumbricus terrestris, Dendrobaena octaedra. Наиболее распространенными видами являются Lumbricus rubellus и Nicodrilus caliginosus, а остальные виды встречаются реже. В сезонной динамике численности дождевых червей наблюдалось два пика активности – в начале июня и в конце августа.

Ключевые слова: люмбрицид, почва, беспозвоночные, предгорий Заилийского Алатау, видовой состав, сезонная динамика.

Information about authors:

Seribekkyzy Gulzinat, doctoral student of Abai KazNPU; gulzynat@mail.ru; https://orcid.org/0000-0001-8430-1318;

Esimov Bolat Kabdushevich, Doctor of Science (Biology), docent of biology department of Abai KazNPU; esimov.bolat@mail.ru; https://orcid.org/0000-0002-2575-5659.

REFERENCES

[1] Buzova Yu. B. (2007) Respiration of soil invertebrates. - M.: Comradeship of scientific publications KMK, 328 p. (in Rus.).

[2] Bossuyt H., Six J., Hendrix P.F. (2005) Protection of soil carbon by microaggregates within earthworm casts // Soil Biology & Biochemistry, Vol. 37, No. 2, P. 251–258. (in Eng.).

[3] Gilyarov M.S. (1978) Soil invertebrates as indicators of the soil regime and environmental conditions // Biological methods for assessing the natural environment. - M.: Nauka, P. 78-89. (in Rus.).

[4] Chekanovskaya O.V. (1960) Earthworms and soil formation. - M-L.: Publishing House of the Academy of Sciences of the USSR, 205 p. (in Rus.).

[5] Striganova B.R. (1975) Methods of fixation of soil-dwelling invertebrates // Methods of soil-zoological research. Moscow: Nauka, P. 49-53. (in Rus.).

[6] Cortez J., Billes G., Bouche M.B. (2000) Effect of climate, soil type and earthworm activity on nitrogen transfer from a nitrogen-15-labelled decomposing material under field conditions // Biology and Fertility of Soils, Vol. 30, No. 4, P. 318–327. (in Eng.).

[7] Mora P., Seuge C., Chotte J. L., Rouland C. (2003) Physico-chemical typology of the biogenic structures of termites and earthworms: a comparative analysis // Biology and Fertility of Soils, Vol. 37, No. 4, P. 245–249. (in Eng)

[8] Scheu S. (2003) Effects of earthworms on plant growth: patterns and perspectives // Pedobiologia, Vol. 47, No. 5-6, P. 846–856. (in Eng.).

[9] Makarevich K.G., Palgov N.N., etc. (1969) Glaciation of the Zaili Alatau / Makarevich K.G. – Moscow: Nauka, - 286 p. (in Rus.).

[10] Gilyarov M. S. (1965) Zoological method of soil diagnostics. - M.: Nauka, 273 p. (in Rus.).

[11] Coq S., Barthes B.G., Oliver R., Rabary B., Blanchart E. (2007) Earthworm activity affects soil aggregation and organic matter dynamics according to the quality and localization of crop residues—an experimental study (Madagascar) // Soil Biology & Biochemistry, Vol. 39, No. 8, P. 2119–2128. (in Eng.).

[12] Postma-Blaauw M. B., Bloem J., etc. (2006) Earthworm species composition affects the soil bacterial community and net nitrogen mineralization // Pedobiologia, Vol. 50, No. 3, P. 243–256. (in Eng.).

МАЗМҰНЫ-СОДЕРЖАНИЕ-CONTENTS

Publication Ethics and Publication Malpractice in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the originality detection service Cross Check http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will onh accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайте:

www:nauka-nanrk.kz
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)
http://reports-science.kz/index.php/en/archive

Редакторы: *М.С. Ахметова. Д.С. Аленов, Р.Ж. Мрзабаева*
Верстка на компьютере *В.С. Зикирбаевой*
Подписано в печать 12.06.2021.
Формат 60х881/8. Бумага офсетная. Печать - ризограф.
8,5 п.л. Тираж 300. Заказ 3.

Национальная академия наук РК 050010,
Алматы.ул. Шевченко, 28, т. 272-13-18, 272-13-19