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**LEAFHOPPERS, TREEHOPPERS AND SPITTLEBUGS
(Hemiptera, Auchenorrhyncha) – SOYBEAN PESTS
IN THE SOUTH-EAST OF THE REPUBLIC OF KAZAKHSTAN**

Abstract. The fauna of the leafhoppers, treehoppers and spittlebugs (Hemiptera, Auchenorrhyncha) damages soybean in the fields of fodder crops of «Baysyerke Agro» LLP of Panfilov district and «Kaskelenskoe» LLP of the Karasai district of the Almaty region. In all 10 species and 8 genera from 3 families (Aphrophoridae, Cicadellidae and Membracidae) noted. The greatest number of species belongs to the family Cicadellidae - 8 species, to Membracidae and Aphrophoridae belongs to one species. The genus *Agallia* and the genus *Macrosteles* of the family Cicadellidae are represented by 2 species each, all the other genus of all families include one species. All these species are polyphage pests of agriculture, damaging a variety of grains, legumes, fodder, technical, fruit and berry and technical crops. The most important of them are *Cicadellaviridis* Linnaeus, 1758, *Kyboascabipunctata* (Oshanin, 1871) from the family Cicadellidae, and *Stictocephalabisonia* Kopp & Yonke, 1977 from the family Membracidae. All of noted influence on soybean crops in large quantities, and are capable of causing serious economic damage by sucking the juices, and weakening the plants, and bringing the phytopathogenic infection through the lesions. The number of other species is very small, they can be of economic importance for the production of soybeans only in the event of an outbreak of mass reproduction. In the List of pesticides permitted for use in the territory of the Republic of Kazakhstan, against sucking pests, incl. leafhoppers, treehoppers and spittlebugs, only chemical agents are registered. At present, in connection with the global increase in demand for organic agricultural products, it is necessary to search for new ways to limit the number of pests. One of them may be artificial cultivation in the fields of fodder crops, incl. soybean stinging hymenoptera, some of which are entomophages of cicadas and other sucking pests.

Keywords: leafhoppers, treehoppers, spittlebugs, Hemiptera, Auchenorrhyncha, fauna, pests, soybean, Almaty oblast, Kazakhstan.

Introduction. Leafhoppers, or treehoppers, or spittlebugs (Auchenorrhyncha) – suborder of insects from the order of the homopterans (Hemiptera). More than 40,000 species are known in the world fauna. Insects are mainly of medium to small size, body length from 1.8 to 38 mm; the largest tropical species – lantern flies *Fulgora laternaria* Linnaeus, 1758 reaches 95 mm in length and in the span of the wings up to 13 cm. Distributed worldwide. Feed on plant juices. Individual species are capable of producing sounds (singing cicadas Cicadidae) to attract a partner. The base of the 3-segmented proboscis is located at the posterior margin of the head near the base of the anterior pair of legs (hence the second name of the group - spittlebugs); proboscis folded down and back. Of the 6 pairs of strong legs, the front differs in wide hips, provided with spines; middle pair - short and also wide thighs. The posterior one in most species elongated, hopping. The shins of all pairs of legs are cylindrical. There are 2 pairs of wings, the upper pair is longer and stiffer. The coloring of the wings and the shape of the pattern on them depend on the species of the cicada. Larvae of cicadas, or nymphs, outwardly resemble little adults - their body length is 3-5 mm,

wings are absent, legs with 1-segmented legs are very thick and covered with a hard smooth cuticle. Broad hips and tibia of the forelimbs are provided with powerful spines and adapted to digging movements. This structure of larvae is associated with the features of their habitat, remote from the soil surface: usually this is the root part of the stems and the root system of plants. The color of the nymph depends on the type and age. Most of them are whitish in color, there are specimens of brown and other soft color with bands and spots. Females lay eggs in autumn in the soft tissue of leaves, stems, in the root part of plants and in the carob. Depending on the species, after 30-40 days, larvae appear from the eggs. They pass several stages of molting and, accordingly, there are 4-5 ages. The wintering stage for different species of cicadas is eggs or larvae. In spring, the overwintered nymphs begin to wing and move to the stage of adult insects. Eggs are deposited by females of different generations, and as a result, during the summer, cicadas develop in 2-3 generations. From the beginning of summer to the end of autumn in the fields there also larvae of different ages, and adults. Damage to agriculture from these insects is very great, given that damage to plants and larvae, and imago. The spectrum of their nutrition is quite wide: practically all cereals; most of the vegetable; grain and fodder beans; technical and melon crops; fruit and berry and ornamental crops. Harm aggravated by the fact that insects produce sweet excrement, polluting leaves and other organs of plants (pad), favorable for the development of fungi; as a result, a black raid is formed on the plants. Some species are carriers of viral and other plant diseases [1-13, 15].

Thus, the study of the species composition of the leafhoppers, treehoppers and spittlebugs soybean pests in the Almaty region is of great scientific and practical interest.

Materials and methods. Basis for this work is data collection by authors made in the period of 2015-2017 on the fields of fodder crops in the southeast of Kazakhstan (Almaty region, Panfilov district, Baysyerke settlement, "Baysyerke Agro" LLP and Karasai district, "Kaskelenskoe" LLP) within the framework of the project on the theme "Development of ecologically clean methods for increasing the yield of fodder and industrial crops (alfalfa, soybean, corn, triticale)". When one of the subtasks of the project is performed, pests of fodder crops and their entomophages are studied, herewith the species of leafhoppers, treehoppers and spittlebugs insects that damage soybean are identified. Data on the abundance and species composition of the leafhoppers, treehoppers and spittlebugs are obtained by mowing the standard entomological net with 25 strokes in 4-fold replication, once every seven days. To determine the density of plant populations, pests were allocated in 5-10 model plants at 10 points. To identify species and determine information about their bioecological features and distribution, sources from the list of literature were analyzed [1-13, 15].

Results of the study. In the course of the surveys on the fields of fodder crops in the Almaty region of the Republic of Kazakhstan, material was collected on leafhoppers, treehoppers and spittlebugs insects belonging to several families of the suborder. Some types and damages caused by soybeans are presented in photographs (Figures 1-4). The list of identified species given below:

Order Hemiptera Linnaeus, 1758 (Rhynchotha Burmeister, 1835) – Hemipterans

Suborder Auchenorrhyncha Dumeril, 1806 – Homoptera, or Cicadas

Family Aphrophoridae Amyot & Audinet-Serville, 1843 – Spittlebugs

Phyllaenus pumarius Linnaeus, 1758 - Meadow froghopper, or Meadow spittlebug. Polyphage pest that damages a variety of cereals, vegetables, fodder, technical, fruit and berry and ornamental crops. It sucks out the juice, causes wrinkling of leaves, underdevelopment of ovaries, crippling of vegetative and generative organs of plants. It carries viral diseases, for example, alfalfa pyrexia and jaundice of peaches. In the year - 1 generation. Winter eggs hibernate from the autumn and are covered with wax secretions of the female. Breeding in April, the larvae spread over fodder plants and are covered with a foamy mass, the isolation of which ceases only at the age of 5. The development of larvae lasts 5-7 weeks. Winged imagoes met before the onset of cold weather. Egg laying in September, October. Widely distributed in Europe and extra-tropical Asia species, brought to North America. On soybeans in single quantities.

Agallia laevis Ribaut, 1935 – Smoked leafhopper. Wide polyphage, marked as a pest of legumes, alfalfa, beans, peas, as well as beets and carrots. Adults and larvae suck out juices from stems, petioles and veins of leaves. Winter imago, in the year 2 generations develop. In the year 1 generation develops. Hibernates fertilized females in crevices under the bark. Larvae on the underside of leaves, on petioles and young branches. Wings formed from the middle or the end of June. Distribution: North America, Southern Europe, Caucasus, Turkey, Iran, Kazakhstan, Central Asia. On soybeans in single quantities.



Figure 1 – Meadow froghopper *Phyllaenus pumarius* L.
Family Cicadellidae Latreille, 1802 – Leafhoppers

Agalliavenosa (Fourcroy, 1785) – Venous leafhopper. The polyphage species, known as the pest of sunflower, is common in crops of alfalfa, clover and sugar beet. Carries a virus of curly leaves of tomato, potato, pepper, tobacco, beet, chicory, cereals. In the year 2 generations. Winter imago in the litter. In May, after supplementary feeding on young greens, females begin laying eggs. The summer generation is winged in late June - July, wintering - in August. Adults and especially larvae kept in the lower tier of plants and among plant remains in dry biotopes with low grass stand. Distribution: Europe, North Africa, Caucasus, Kazakhstan, Central Asia. On soybean in a single quantity.

Aphrodesbicinctus (Schrank, 1776) – Girdled leafhopper. The polyphage species, preferring herbaceous legumes - clover, alfalfa, sainfoin, etc., sometimes harms tobacco and hemp, dill, sorrel, wheat, red clover and sugar beet. The carrier of viral diseases - a column of nightshades, dwarfish and greenery of the flowers of clover and strawberry. In the year 1 generation. Hibernates eggs. Larvae appear at the end of May and develop in basal rosettes, in the axils of the leaves of clover, alfalfa, plantain and many other herbaceous plants. Wings of adults in late June, in July. Mating and laying of eggs - in August. Widely distributed in Europe, North Africa and extra-tropical Asia. On soybean in a single quantity.

Cicadellaviridis Linnaeus, 1758 – Green leafhopper. A polyphage pest, sucks out the juice from plants, carries viral diseases. It feeds on both mosses of the genus sphagnum, and on various herbaceous plants: *Holcus*, *Juncus*, *Arundo*, *Carex*, *Phragmites*, *Panicum*, *Cyperus*, *Filipendula*, *Glyceria*, *Oryza sativa*, *Rumex*, also some species of legumes and grapes. Prefers cereals and other monocotyledonous. In addition to mossy and herbaceous vegetation, it can feed on young trees such as apple, pear, cherry, alder, peach, plum and mulberry. Laying eggs inside shoots or stems of grapes and young fruit trees may further cause cancer of the bark. Is also a carrier of bacteria *Xylella fastidiosa* Wells et al., 1987, is fatal to plantations of Grapevines. In a year gives 2 generations. Hibernates eggs on the branches and trunks of young trees and shrubs in incisions of the cortex of the semilunar form. Larvae of the 1st generation in May-early June, II - in July-August. Females lay eggs in stems of different plants. Widely distributed in Europe and extratropical Asia species, brought to North America. Usual on a soya, a mass at times species.

Kyboascabipunctata (Oshanin, 1871) - Two-point leafhopper. Wide polyphage, damages potatoes, beets, carrots, hemp, alfalfa, beans, corn, cotton, apple tree, raspberry, various fruit species, especially cherry. Imago and larvae damage the leaves from the lower side, leaf petioles and stems, causing the appearance of whitish or light-green spots of angular shape at the jabs. Hibernating, probably, adult insects. Distribution: Southern and Eastern Europe, the south of the European part of Russia, Ukraine, the Caucasus, Southern Siberia, Kazakhstan, Central Asia. On soybean in large quantities.

Macrosteles laevis (Ribaut, 1927) - Six-point leafhopper. The polyphage pest injures mainly cereals - wheat, rye, oats, barley, corn, rice, sunflower, buckwheat, millet, peas, dill, pumpkin, sorrel, strawberries,



Figure 2 – Green leafhopper *Cicadellaviridis* (L.)

as well as clover, sainfoin, lupine etc.; from garden crops especially strongly harms table beet, early cabbage, cucumbers, carrots, tomatoes. Damaged crops characterized by thinness, poor bushiness, drying of the leaves from the top and the appearance of spotting at the injection sites. The carrier of the virus is the nightshades stolbur, the greening of the clover flowers, asters jaundice virus. It develops in 2 generations in the north, 5 in the south. Hibernates in the tissues of the root part of the stems and winter cereals. In late April, larvae are born, their development occurs on young leaves of cereals. Damaged plants become flaccid, the leaves become whitish-yellow or greenish-brown in color, dry out and curl along the main vein. Widely distributed in Europe and extra-tropical Asia species, brought to North America. On soybean in a single quantity.

Macrostes cristatus (Ribaut, 1927) - Pectinate leafhopper. Polyphage, damaging potatoes, carrots, sugar beets, tomatoes, oats, rye, wheat and other crops. In the conditions of natural biotopes, it inhabits mainly dry stations, feeding on composite, cereals, cruciferous, umbelliferous, preferring composite and cereals. During the season, 2 generations. Eggs hibernate in the basal part of dandelion and other plants. Larvae of 5th age migrate to young plants of osseous and other weeds. After the inspiration, the mass migration of the leafhoppers to the fields starts, where eggs are laid and the second-generation larvae develop. At the end of summer, the transition of fertilized females to dandelion begins. Widely distributed in Europe and extratropical Asia species, brought to North America. On soybean in a single quantity.

Psammotettix alienus Dahlbom, 1851 (= *striatus*) - Striped leafhopper. Polyphage, prefers cereals. It damages wheat, rye, oats, barley, corn, rice, millet, alfalfa, lobium, beets, carrots, radishes, etc. It damages cereal crops especially as a vector of viral diseases: ordinary and pale green dwarfish wheat, mosaic of winter wheat. The latter affects other grains. The imago and larvae transfer virus, the causative agent can be transmitted and transovarially. The plants on which the leafhoppers feed are susceptible to powdery mildew infection. Gives in a year from 1 to 3-4 generations, depending on climatic conditions. Eggs are laid in stalks, leaves and spiked scales of cereals under the epidermis in groups of 2-10 pieces. One female lays 50-200 eggs. Larvae pass through 5 ages; development lasts 15-25 days. Winter spends in the egg stage. Distribution: Europe, North Africa, the Caucasus, Siberia, Kazakhstan, Central Asia, extra-tropical Asia. On soybean noted in a single quantity.

Family Membracidae German, 1821 – Treehoppers

Stictocephala bisonia Kopp & Yonke, 1977 - Buffalo treehopper. The name is received because of two thorns, which are on the sides of the pronotum and directed laterally. A polyphage pest, sucks out the juice from plants, carries viral diseases. When laying eggs, significantly damages young fruit trees - plum, apple tree, pear, apricot, quince, cherry, walnut, damage from willow, poplar, ash, oak, elm, and other. The larvae feed on the juice of herbaceous plants: alfalfa, peas, carrots, potatoes, etc., including weeds. In the year 1 generation. Hibernates in eggs laid in autumn in branches 4-6 mm in diameter, less often in trunks of young fruit trees. When laying eggs, the female makes paired longitudinal incisions of the bark and partly the wood in the form of round parentheses. Often the incisions merge, forming one wound. In damaged areas, the gum is abundantly liberated, the crust lags behind, darkens and dies. Through incisions in the wound phytopathogens penetrate. Lays eggs only in live branches. In the spring, the sap flow in

the damaged branches disturbed, the trees weaken and often die. For young trees, massive damage is especially dangerous (20-100 clutches per 10 cm branch). Larvae are born during June. They fall under the trees or blown away by the wind and spread no farther than 1-2 m from the tree. Larvae of younger ages are inactive, feed in the root part or on leaf petioles of various herbaceous cultural and weed plants, preferring wet, shaded places, the larvae of older ages are more phytophiles. In total, they pass 5 ages, fully completing the development until the end of the first decade of August; Wings begin at the end of July. The imago, like the larvae, lives mainly on grassy vegetation. Egg laying begins in August and lasts until early October, after which adult individuals die. Alien species, imported from North America. The distribution covers Europe, Kazakhstan, Central Asia, and continues to expand in a southeasterly direction. Usual species on soybean.

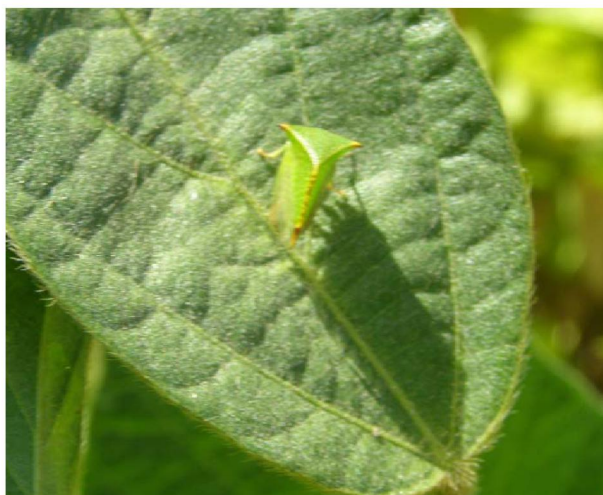


Figure 3 – Buffalo treehopper *Stictocephalabisonia* Kopp&Yonkeon the leaf of soybean



Figure 4 – Beans and soybean leaves damaged by Buffalo treehopper *Stictocephalabisonia* Kopp&Yonkeand infected with a viral disease

The discussion of the results. Total recorded of 10 species and 8 genera of leafhoppers, treehoppers and spittlebugs belonging from 3 families (Membracidae, Cicadellidae and Aphrophoridae) on the soybean fields in Almaty region. The greatest number of species belongs to the family Cicadellidae – 8 species, to Membracidae and Aphrophoridae belongs by one species. Genus *Agallia* and genus *Macrosteles* from the family of Cicadellidae are represented by 2 species each, all the rest of the genus from all families include one species. All the species found are polyphagous pests of agriculture, damaging a variety of grains, legumes, fodder, technical, fruit and berry and industrial crops. Of these the most

important ones are Green leafhopper *Cicadellaviridis* Linnaeus, 1758, Two-point leafhopper *Kyboasca bipunctata* (Oshanin, 1871) from the family Cicadellidae, and Buffalo treehopper *Stictocephalabisonia* Kopp&Yonke, 1977 from the family Membracidae. All of them noted on soybean crops in quantities large, and capable of causing serious economic damage by sucking out the juices and thereby weakening the plants, and opening the gate of the phytopathogenic infection through damage. The number of other species was very small, so they can have a tangible economic significance for the production of soybeans only in the event of an outbreak of mass reproduction.

Conclusions. A relatively high species diversity of harmful leafhoppers, treehoppers and spittlebugs noted in soybean crops in the Almaty region. Most of them have no special significance, but 3 species are capable of causing quite large crop losses. Infection with soybean virus diseases in seed farms in the Almaty region in some years reaches 46%, which entails a loss of grain yield to 6.7 c/ha. Accordingly, the germination energy reduced by 32%, seed germination by 34% and protein content by 12%. In the List of pesticides (chemicals) [14], approved for use in the territory of the Republic of Kazakhstan, against sucking pests, incl. leafhoppers, treehoppers and spittlebugs, only chemical agents are registered. At present, in connection with the global increase in demand for organic agricultural products, it is necessary to search for new ways to limit the number of pests. In countries far abroad, similar studies were already conducted [17-20]. One of them may be artificial cultivation in the fields of fodder crops, incl. and soybean stinging hymenoptera, some of which are entomophages of cicadas and other sucking pests. An experiment of this kind carried out by the authors on the fields of fodder crops in the "Bayerke Agro" LLP and gave a positive result [16]. In addition, in Kazakhstan, it is necessary to develop other ways of biological control of the number of harmful leafhoppers, treehoppers and spittlebugs in soybean crops, for which further research needed.

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ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ Оңтүстік Шығысындағы Қытайбұршақ Зиянкестері – Теңқанаттылар (*Hemiptera, Auchenorrhyncha*)

Аннотация. Алматы облысының Панфилов ауданындағы «Байсерке Агро» ЖШС және Қарасай ауданындағы «Қаскелең» ТЖ-дегі мал азықтық дақылдар егістігіндегі қытайбұршаққа зиян келтіретін теңқанатты тұмсықтылар (*Hemiptera, Auchenorrhyncha*) фаунасы зерттелді. Барлығы 3 тұқымдастың 10 түрі және 8 туысы анықталды – Көбікті цикадкалар (*Aphrophoridae*), Цикадкалар (*Cicadellidae*) және Бүкір цикадкалар (*Membracidae*). Түрлердің басым бөлігінің 8 түрі *Cicadellidae* тұқымдасына жатады, *Membracidae* және *Aphrophoridae* бір-бір түрден жатады. *Cicadellidae* тұқымдасының *Agallia* және *Macrostelus* туыстарынан әр қайсысынан 2 түрден, қалған тұқымдастар бір-бір түрден кіреді. Барлық табылған түрлер әртүрлі дәнді бұршақты, малазықты, техникалық, жеміс-жидек дақылдарды зақымдайтын ауыл шаруашылығының көпқоректі зиянкестер болып табылады. Олардың ішінен ең маңыздылары *Cicadellidae* тұқымдасынан *Cicadella viridis* Linnaeus, 1758, *Kyboasca bipunctata* (Oshanin, 1871) және *Membracidae* тұқымдасынан *Stictocephala bisonia* Корр & Yonke, 1977. Олардың барлығы қытайбұршақ егістігінде көптеп кездескені байқалды, және шырынын сору арқылы олар өсімдікті әлсіретіп, зақымдаған жерлері арқылы фитопатогенді инфекцияны ендіріп, айтарлықтай экономикалық зиян келтіреді. Қалған түрлердің сан-мөлшері айтарлықтай көп болмады, қытайбұршақ өндірісі үшін олардың шаруашылықтық маңыздылығы тек жаппай көбейген жағдайда ғана болады. Қазақстан республикасы территориясында қолдануға рұқсат етілген пестицидер (улы химикаттар). Тізімінде, сорғыш зиянкестер, соның ішінде теңқанатты тұмсықтыларға қарсы тек химиялық препараттар тіркелген. Қазіргі таңда ауылшаруашылығының органикалық өнімдеріне сұраныстың жаһандық ұлғаюына байланысты, зиянды ағзалардың сан мөлшерін шектеудің жаңа жолдарын іздестірудің қажеттілігі туындауда. Оның бір жолы, мал азықтық дақылдар егістіктерінде, оның ішінде қытайбұршақ шағатын жарғаққанаттыларды қолдан өсіру, олардың кейбіртүрлері цикадка және басқада сорғыш зиянкестердің энтомофагтары болып табылады.

Түйін сөздер: теңқанаттылар, *Hemiptera, Auchenorrhyncha*, фауна, зиянкестер, қытайбұршақ, Алматы облысы, Қазақстан.

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**РАВНОКРЫЛЫЕ ХОБОТНЫЕ (*Hemiptera, Auchenorrhyncha*) –
ВРЕДИТЕЛИ СОИ НА ЮГО-ВОСТОКЕ РЕСПУБЛИКИ КАЗАХСТАН**

Аннотация. Изучена фауна равнокрылых хоботных (*Hemiptera, Auchenorrhyncha*), вредящих сое на полях кормовых культур ТОО «БайсеркеАгро» Панфиловского района и ОХ «Каскеленское» Карасайского района Алматинской области. Всего было отмечено 10 видов и 8 родов из 3 семейств – Пенницы (*Aphrophoridae*), Цикадки (*Cicadellidae*) и Горбатки (*Membracidae*). Наибольшее число видов относится к семейству *Cicadellidae* – 8 видов, к *Membracidae* и *Aphrophoridae* принадлежит по одному виду. Род *Agallia* и род *Macrosteles* из семейства *Cicadellidae* представлены 2-мя видами каждый, все остальные рода из всех семейств включают по одному виду. Все обнаруженные виды являются многоядными вредителями сельского хозяйства, повреждающими разнообразные зерновые, зернобобовые, кормовые, технические, плодово-ягодные и технические культуры. Из них наибольшее значение имеют *Cicadellaviridis* Linnaeus, 1758, *Kyboasca bipunctata* (Oshanin, 1871) из семейства *Cicadellidae*, и *Stictocephalabisonia* Kopp&Yonke, 1977 из семейства *Membracidae*. Все они были отмечены на посевах сои в большом количестве, и способны нанести серьезный экономический ущерб высасывая соки и ослабляя растения, и заноса фитопатогенную инфекцию через повреждения. Численность остальных видов была очень незначительной, они могут иметь хозяйственное значение для производства сои только в случае вспышки массового размножения. В Списке пестицидов (ядохимикатов), разрешенных к применению на территории Республики Казахстан, против сосущих вредителей, в том числе равнокрылых хоботных, зарегистрированы только химические средства. В настоящее время в связи с глобальным увеличением спроса на органическую продукцию сельского хозяйства, необходимо проводить поиск новых путей ограничения численности вредных организмов. Одним из них может быть искусственное разведение на полях кормовых культур, в том числе и сои, жалящих перепончатокрылых, некоторые виды которых являются энтомофагами цикадок и других сосущих вредителей.

Ключевые слова: равнокрылые, *Hemiptera, Auchenorrhyncha*, фауна, вредители, соя, Алматинская область, Казахстан.

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