მცენარეთა დაცვა
Plant protection

Pests and Diseases of Legume Crops in Georgia and Their Control m

Guram Aleksidze –Academician Georgian Academy of Agricultural Sciences,
Svetlana Kazarova - M.S student

Key words: Legumes, pests, diseases, pesticides.

Abstract

The article is devoted to the study of pests and diseases common in leguminous crops of Georgia.. Selected from legumes: common beans, peas, lentils, lentils, clover, etc., from pests: beans and peas grains, aphids, miner flies and more. See also fungal and viral diseases–anthracnose, ascochytosis, root rot, yellow and common viral mosaics, and more. Measures have been taken to control them, both in the field and in storage.

The measures are designed in such a way as to obtain an ecologically clean product.

Pests of Legume Crops. There are more than 150 species of pests spread in Georgia which are damaging annual and perennial legumes - peas, soybeans, beans, broad beans, alfalfa, clover, sainfoin and others. It is identified in Georgia that main harmful pest for pea legume is *Bruchus pisorum L;* for soy bean - *Pyrameis cardui L*; for beans - *Acanthoscelides obtectus Say*; for alfalfa - *Phytonomus variabilis Hbst.* etc.

Sainfoin is slightly damaged, however, in non-irrigated areas (Shiraki at al, 2001), It is still quite sensitive and damaged easily by *Bruchus pisorum L* and *Oxythyrea cinctella Schaum*. This kind of pests are destroying plants in such way that only stem is remained. Old crops of sainfoin are damaged also by *Agapanthia violatsea F.*

Clover is damaged by different pests, although, more attention is given to *Bruchus pisorums* and clover grazing livestock, which are significantly damaging pulse crops, resulting in loosing seeds of 20-26%.

There are also several phytophagous insects which are damaging the legume crops, among them most important are wireworms: *Agriotes gurgistanus Fald. A. obscurus L., A. lineatus L., Fulswireworms: Pedinus femoralis L., Blasp halophila Fisch., grashoppers: Locusta migratoria L., Dociastaurus moroccanus Th., Calliptamus italicus L., Anacridium aegyptum L* (Aleksidze, 2001, 2014).

Aphids. On pulse crops there are different kinds of aphis in Georgia, namely: *Aphis medicaginis Koch, A. fabae Scop, Trifidaphis phaseoli Pass*, etc. Among them more attention is paid to *Aphis medicaginis Koch*, which is characterised with its frequency and harmfulness.

Alfalfa aphiss are common throughout Georgia both in a plain and hilly areas; here we can find it on some plants such as alfalfa, sainfoin, mulberry, apple, Japanese mespilus, *eucalyptus, acacia,* etc. Alfalfa aphis is causing damage to leaves, shoots and other soft parts of the plant. Before the first mowing of alfalfa, aphids have been ahead of mass reproduction, so this time the injury is significant. Also badly affected soft stems of alfalfa which are to be mowed second time, resulting in straw yield and reduced number of seeds.

Alfalfa aphid overwinters stage imago after they transfers to other plants. Already in April, we can see aphid colonies on alfalfa, and in May-June - its huge number, if there will be enough humidity. Aphids are propagating through parthenogenesis way throughout spring and summer time, and in fall it gives gamogenesis generation, the fertilized egg of which spends winter mainly in the white acacia; Its generations exceed ten per year.

It should be emphasized that the drought, as well as its natural enemies, are hindering aphis propagation, for example, in eastern Georgia aphids' propagation are hindered by the entomophags: *Coccinella 7-punctata L., Adonia variegata Goeze., Propylaea 14-punctata L., Bulaea lichatschovi Humm.* and so forth.

Control measures: At the beginning of aphids spreading, organic-phosphorous compounds or pyrethroid sprays should be used on crops.

Alfalfa bug - *Adelphocoris lineolatus Goeze.* This variety of alfalfa bug is characterized by a broad scope. It is spread both in eastern and western Georgia, but its economic importance is bigger in Eastern part (Kartli region), where it can be found on the most forage fields. West Georgia is less favourable for alfalfa plant bug propagation because of excessive humidity. It is estimated that 10-12 forage bugs are caught on 50 times of grid movement, which has been considered a dangerous quantity. Therefore, alfalfa bug, more precisely - bug complex, should be regarded as significant pest for forage crops in Kartli region.

Bugs are feeding with - alfalfa, sainfoin, clover, melilotus and many others. Eggs that have overwintered in stems hatch in early May. Development proceeds through 3-4 weeks and adults begin to appear. During this period they eat plant's parts and are damaging them. Feeding injury to alfalfa vegetative growth, flower buds and flowers, and to immature seed within the pod causes reduced yield and quality of seed. This happens mostly in non-irrigated areas during droughts.

Alfalfa bugs are preparing hollows on stems of host plants for laying eggs. One egg in one row. They are laid closely together in small groups, and about 10-30 eggs are deposited daily. The incubation period of the eggs is more than one week, depending regions. Nymphs pass through five instars or stages of development. In low land regions Alfalfa plant bugs may produce three or four generations in one season;

There are other species of bugs on alfalfa and sainfoin, which number in Georgia are more than 40, there is widely spread among them *Lygus pratensis L*. and *Piezodorus lituratus F,* which are damaging alfalfa fields in East Georgia.

Control measures: The use of resistant varieties is one of the most effective tools for reducing insect damage. Tilling the soil on early spring. Deep tillage is often recommended for alfalfa to improve rooting depth and water infiltration; Good seeding technique and especially proper seeding depth; Land levelling is very important. It is also recommended alfalfa crop rotation and using of pyrethroid pesticides.

Alfalfa weevil - *Phytonomus variabilis Hbst.* This weevil covers a wide area in Georgia, especially in the lowland regions. It can be found everywhere, where the alfalfa crops are sown. It causes serious damage to forage crops resulting in yield reduction. For example, according to recently conducted survey it has been identified that 100 kg of hay is lost per hectare due to harmful effects of *Phytonomus variabilis Hbst.* It should be emphasized that this is the most harmful pest for alfalfa fields.

In the conditions of east part of Georgia (Gardabani region) the pest overwinters in imago or partly larval stage in soil and under the plant residual where alfalfa was grown.

In other parts of the country they overwinter only in a beetle stage. Beetle finishes overwintering in March - April, when the average daily temperature reaches 12°C. After about two weeks, when imago gets additional feed, it lays the eggs mainly in old parts of alfalfa, several eggs in each cluster. After laying eggs it covers the cell holes with excrements. Females egg production may reach to two thousand in a favorable conditions for insect development. Intensive feeding of worms takes place in the second half of April and the first half of May in East Georgia (Gardabani and Marneuli municipalities). They are destroying plants that time. The feeding punctures of this species may cause malformation in the flowering buds, leaves are damaged, and plants gradually die. Larvae feed on terminal leaves, removing the tender leaf tissue while leaving a "skeleton" of tougher leaf veins. Their feeding reduces forage quality. Adults also feed on plants and are more likely to damage the regrowth of the second cutting by eating the new buds. The adults of first generation of beetles start coming at the end of April, and continues in June.

Larvas are using the secret derived after the end of growth for making cocoons where they become pupa. Cocoon is usually placed among the leaves, which can be found openly in the leaf surface. The pupal stage requires 1 to 2 weeks for completion. Upon their emergence from cocoons, adults feed for a week or two, and then move to sheltered areas to spend an inactive summer. It is quite likely that at any given point in time during the summer, most, if not all, alfalfa weevil life stages can be found. Older adult weevils may continue their egg-laying activities, while at the same time, larvae, cocoons, and newly emerged adults may also be observed.

About two months is needed for beetles normal development and a temperature of not more than 25^0C. As on high temperatures maturation does not take place. Overwintering starts when daily temperature is 12^0C. In Russia alfalfa weevil gives only one generation per year (Some endoparasites are playing significant role for reduce the number of this pest. In some years it reaches 30% in Georgia).

Control measures: Agro-technical measures such as strip-tillage operation in the spring time is recommended (at the beginning of the vegetation), these include also proper site selection, fertilizer management, seeding timing, good seeding technique and especially proper seeding depth, proper irrigation and proper timing of the first harvest.

Bruchidae. Four different families of Bruchidae are found in Georgia legume fields: Bruchus, Bruchidius, Euspermophagus and Pachymerus. From Bruchidius there are mostly spread B. unicolor Oil., Bruchus pisorum L. The first of this can be found mostly in East Georgia (Shiraki and Kartli regions) in sainfoin fields. They are also spread and cause great injury to clover fields but mainly it is sainfoin seed pest.

Bean Weevils - *Acanthoscelides obtectus Say*. This pest causes significant damage to bean fields, as well as to bean storages.

The pest also migrates to grain fields. Larvae penetrate into the grains, eating the contents completely. Several larvae can develop in one grain. Larval period lasts 3-3.5 weeks. Pupation also takes place in grain. It hibernates at the adult stage in shivered grains, which remain in the field after harvesting and in stored grains. 4-6 generation can be developed per year. Out of which 1,5-2 generation is developed in the field, others in storehouses. The pest arrives in the storehouse with grain where it develops until cold.

Overwintering of the Bean Weevil takes place at the stages of beetle or larva, usually in storehouses. The overwintering can be observed in plant residues.

Control measures: Effective cleaning of the plots; Good seeding technique and especially proper seeding depth and timing; Proper usage of fertilizers, because of excess inputs of phosphate fertilizers in the soil helps Bean Weevils to settle on raw bean stalks. In case of an intensive pest spreading (above 5) plants should be sprinkled with pyrothroid pesticides, or substitutes.

It is recommend that beans should be harvested in time and without losses. Grain must be stocked in well-closed places, clean storehouses, separately according to bean varieties.

During the storage time it should be checked the spread of bean weevil. It is not recommended to leave damaged beans in storehouses or throwing them without their elimination.

In family conditions the effective results may get from coal inputs in beans grain. Thermal processing is allowed before sawing and during storage time. For this purpose, the beans are heated in grain dryer on 64-60^{0}C for 25 minutes. Bean Weevils are sensitive to low temperatures - 4^{0}C when all phases are dying in 25-30 days, on - 10^{0}C in 15 days etc. For this purpose, placing the beans in the refrigerators prevents the spreading of pests. Similar preventing measures are for other legumes also.

Pea weevil - *Bruchus pisorum L.* This pest is an economically important pest of field pea worldwide. In Georgia it is spread in the most fields and overwinters mostly in storehouses, settled in pea grains. The pea weevils can also overwinter in fields, in peas fallen during harvesting. In warm regions, for example, on the Black Sea coast of Georgia in winter bugs overwinter in plant residuals, under the bark of trees and other places.

In the spring, when the pea flowering begins, overwintered weevils are flying out of grains. They feed with plant parts. It is identified from some relevant studies that female beetles should be fed with pea pollen for eggs normal development. The pea weevil has one generation per year and it reproduces only on field pea. Upon emergence from hibernation sites adult weevils fly into the pea fields and start to search for mate and oviposition sites. Egg laying starts about 2–3 weeks after the arrival of the weevils. The female weevil lays its eggs on pods of peas and upon hatching the first instar larva bore directly to the seed. Larvae develop inside the seed by consuming the content of the seed, which results in damage to the crop. The pea weevil is monophagous, the most important pests of cultivated pea (*Pisum sativum and P. arvense*).

After receiving additional food beetles begin laying eggs on the surfaces of pea green shells. Number of eggs depends on the number of bbeetles. In favorable insect development conditions the number of eggs reaches to 600-700, usually the egg number is 100-150.

Larval phase duration according to temperature is 1-1,5 weeks. The larva may enter the seed only one larva develop in one seed. Once inside the seed, the larva develops rapidly, feeding upon the seed content. After the larva has finished feeding and has the inside of the cap properly thinned it is ready to pupate. The pupal stage lasts 2-3 weeks after adult cuts the circular cap, and leaves the seed. In warm regions beetles are leaving grains in Summer (during the harvesting time and sometimes in winter when seeds are kept in storehouses); In comparably cold regions they leave grains only the second year spring time, after the sowing of pea. The pea weevil is damaging the whole pea plant. It should be noted that the number of insect is regulated by its egg parasite Latromeris bruchicida Vas.

Control measures: Sowing of properly selected healthy seeds. It is necessary to separate the damaged seeds from healthy seeds using the following method: seeds should be placed in a table salt solution (3 kg salt on 16 litres of water). Fumigation of storehouses with the relevant fumigants. Pea plants should be sprinkled with organophosphorous or pyrothroid pesticides.

Alfalfa moth - *Chloridea dipsacea L. (Heliothis viriplaca Hfn).* Worms are damaging legume crops and other plants such as soybean, sainfoin, alfalfa, flax, sunflower, castor, cotton, corn, wheat, and so forth. Worms are

mainly feeding with the plant leaves. Young worms cause skeletonization of leaves, while the older worms completely destroy them, leaving uneaten only leaf petiole.

Alfalfa *chloridea dipsacea* is widely spread in Georgia and can be found almost everywhere; This pest Pupae overwinters in the soil. Hatching begins at the end of April or beginning of May. Adults are feeding additionally, reach sexual maturity and and then begin laying eggs in the growing stems, on leaf surfaces and flowers. If there is suitable conditions for alfalfa moth development they can lay more than 600-700 eggs. Embryonic development lasts 3-9 days depending on the temperature. When hatched adults finish development during 3 weeks, they transfer in a pupal stage in a soil upper layer. Pupal stage lasts 2 weeks. In case of droughts in a pupal stage it suffers long diapauses and flying out of butterflies is delayed. There are some cases when butterflies flied out late are infertile. Alfalfa moth is characterized with 2-3 generation per year.

Control measures: Destruction of wild grown legumes; Soil plowing immediately after harvesting; Soil tillage in a pupal stage of Alfalfa moth; Using of pesticides against yang worms.

Chickpea "miner" fly - *Liziomyza Cicerina Rond.* The pest is widely spread in different countries of the world, such as, Germany, Tunis, India, Egypt, Turkmenistan, Tajikistan, Uzbekistan, Ukraine, Russia, (Shevchenko, 1934; Alimjanov, 1964; Vasiliev, 1974). This pest has been first identified by Georgian scientists in the past few years in Mtskheta Breeding Station in which testing process of different species of chickpea introduced from International Research Center - ICARDA.

In Georgia, massive distribution of this fly has been detected in Mtskheta and Gori regions. The injury caused by this pest is particularly intensive in the period between May - August. The pest begin emerging in early spring (April). The injured leaves become yellow and they fall down. The upper side of the leaf features the trace of damage, which appear in different quantities. A female insect pricks leaf surface from above and lays eggs under skin. Larva grows under the skin and makes passes - "curved lines" which often occupy one third, or the half of leaf surface.

The number of generations of *Liziomyza Cicerina Rond*, according to our observations, may reach 5-6, and it depends on the local climate. In unfavorable climate conditions, the fly may turn into dormant stage and spend winter as a"false pupa" (Aleksidze, Berishvili, 2005).

Control measures: It has been established that pyretroides and organophosphorous pesticides are high effective against them, especially in the spring when the larvas appearing in the leaves. If necessary, the second application should be used.

Cotton moth - *Chloridea armygera Hb.* Is one of the important pest of Chickpeas. It is spread in the countries where this crop is raised. The pest is particularly widely spread in the European part of Russia, Caucasus region, Ukraine, countries of central Asia, China, Syria, Indonesia, Japan, Africa, China, Philippines, Australia, and other countries. (Vasiliev, 1974).

The pest is a polyphag and damages the following crops: cotton, tomato, chickpea, sorghum, tobacco, alfalfa, pepper, basil, and other.

In Georgia, cotton moth damages chickpea leaves and pods in the process of ripening when the larva pierces the pod of chickpea and is fed on the seed. The damage of the seed can be seen when the pod is opened. The excrements of the pest are also found inside the pod. After some period of time, pest leaves the pod and moves to a healthy new one and continues its damage. So, the pest in the process of its development can damage a few pods. Adult overwinters at the end of April - beginning of May, when the temperature of the soil reaches 15^0C.

Adult lays eggs on the surface of upper part of chickpea leaf. First the pests are fed on leaves, later they start eating the seed, finally, they move to the soil and pupaid.

According of R. Alijanov, (1968), chickpea pest in Central Asia produces 4-5 generations. According to V. Vasiliev, (1974), in Ukraine, chickpea moth produces 2-3- generations.

The first age larve in Shida Kartli region damage chickpea, corn, alfalfa, tomato leaves. The second age larva of pests is fed on generative organs.

In Georgia conditions, cotton moth produces 3-4- generations, in the process of regulation of the pest number, a significant role plays parasites of egg and larva, also entomophagous fungi (Aleksidze, Berishvili, 2005).

Control measures: The chemicals from the pyretroid and organophosphorous groups are characterized by high effectiveness against larva. Considering its biology, the first chemical treatment should take place in spring when larva are appearing, and the second one, in the beginning of ripening period of chickpea, when pest starts active damage of pods.

Diseases of legume crops. ***Pea Aschohita - Ascochyta pisi Lib.*** This disease affects the pea pods, leaves and stems; spots on stems, leaves, tendrils, and pods can be purplish, black, or brown in color; It injures as bean anthracnose. Such spots are appeared when young parts of plants are infected. If the matured plant is infected, then not spots but fungus appear on the whole plant parts and Picnidiums are spread. It completely ruins the pea pods and transfers on seed cover where many yellow spots appear. *L*ightly infected seeds often appear healthy. Ascochyta disease development is favoured by high temperatures and humidity.

If the seeds are slightly damaged and appear in relatively good conditions they may germinate.

If the soil conditions are bad, then slightly damaged seeds also lose importance.

Fungus does not effective grown plants greatly, if we don't include the infected pea pods which are becoming completely blighted and falling off. Fungus is typical for peas and does not infect other kind of legumes in natural conditions. In case of artificial infection of other legumes the disease is not significant.

Control measures: Agronomic practices including deep tillage immediately after harvesting; Using of healthy and resistant seed materials and 3 year crop rotation.

Bean Anthracnose - ***Colletotrichum lindemuthianum Sacc. et Magn*****.** Anthracnose is major and widespread disease caused by a fungus which has a wide host range on many legume species such as beans, soybeans, peas, chickpeas, etc. This disease can cause serious losses in bean crops. Leaves, stems and pods of bean plants are susceptible to infection. Small reddish-brown, slightly-sunken spots form on the pods and rapidly develop into large, dark-sunken lesions. In moist weather, masses of pink spores develop on these lesions. Black-sunken spots, similar to those on the pods, are produced on the stems and the leaf stalks. Infection of the leaves causes blackening along the veins, particularly on the undersurface. Development of the disease is most rapid in warm, damp conditions (Kanchaveli, 1987).

First signs of infection are small irregular brown lesions on leaves which expand gradually, sometimes it reaches 1 cm on diameter and turn gray-brown or dark brown with concentric zones; older areas of lesions may dry out and drop from leaves causing shot hole; lesions coalesce to form large necrotic patches. During the leaf infection the Anthracnose is spread only to leaf veins, whereas leaf tissue near the infected vein is getting dark and brown resulting in surface damage.

Control measures: Using of disease-free seed is the most important control measure; Crop rotation is highly recommended; nitrogen and potassium fertilizers application may be required.

Root rot - ***Fusarium avenaceum (Fr.) Sacc*****.** This disease is mainly caused by soil borne fungus, so the symptoms are evident mostly on severely infected plants leaves and stems followed by earlier discoloration of the plant. Initially plant root and stem is darkening. The infected plants roots become wrinkled and weak, easily removed from soil. Root decay signs are found in early crops and that time when cold and rainy weather gets after bean sawing time.

Disease-causing infection is mainly in the soil, also it can be noted on plant residuals and seeds (Kanchaveli, 1987).

Control measures: Crop rotation is recommended so that after 5-6 years legume crops should be repeated. Using of resistant varieties; Maintenance of optimum terms and depths of sowing considering different zones.

Bean yellow mosaic - The symptoms are bright yellow to green mosaic or mottle appearances of infected leaves, which becomes most apparent on leaves as they become older. Leaves mostly become chlorotic and narrow, and plants are severely stunted. Infected leaves also show varying degrees of leaf distortion, down cupping, and wrinkling. Plants infected at a young age may show stunted growth. The striking yellow mosaic symptoms differentiate bean yellow mosaic infections from those of bean common mosaic, which causes light and dark green mosaic patterns of infected leaves.

The virus is not known to be seed-transmitted in beans. Bean yellow mosaic has a wide host range in legumes and can readily overwinter in perennial legume crops (alfalfa, clovers) or weeds. The virus is transmitted by aphids. Beans become infected when virus-carrying aphids move into bean fields. Transmission of the virus occurs within seconds once aphids begin feeding on the crop. Aphids can efficiently spread the virus within a field, resulting in high rates of infection.

Control measures: The best management approach is to plant resistant varieties. Removal of sources of infection is important to prevent or reduce secondary spread in crops; Controlling virus spread; Choice of resistant cultivars, use of virus-free seed, dense sowing, and removal of infected plants.

Beans common mosaic. The typical symptoms of Beans common mosaic are a light green or yellow and dark green mosaic pattern on leaves, usually accompanied by puckering, distortion and rolling of the leaves.

Spreading of this virus mosaic is available through seeds. Infected seed can result in rapid and widespread disease development. In some legumes there are certain parts infected, others are not. Artificial infection hardly happens. Disease is mainly spread by pests.

Control measures: The most effective control is to crop resistant varieties; infected plants should be removed, and fighting against pests (transmission the virus) using contact pesticides.

Pesticides and herbicides impact on soil micro flora. In the system of Pulse crops protection particular attention is paid to negative impacts on soil micro flora caused by pesticides used against harmful organisms. Heavy treatment of soil with pesticides can reduce beneficial soil microorganisms. Plants depend on a variety of soil microorganisms to transform atmospheric nitrogen into nitrates, which plants can use. Common herbicides disrupt this process, reduces the growth and activity of free-living nitrogen-fixing bacteria in soil. Integrated Plant Protection is the use of methods valuable for a particular case giving preference to non-chemical measures versus chemical methods used to raise plant resistance and maintain natural equilibrium.

Pic. 1. Bean weevil

Pic. 2. Caterpillars peas

Pic. 3. Aschohita

Pic. 4. Root rot

There are many different types of pesticides and according to sustainability they are divided into the following groups:

- Substances which retain their stability for more than 18 months (majority of organochlorine pesticides);
- Substances of 18 months stability (Some of the urea produced, some triazini and others);
- Pesticides, which maintain the stability of 12 months (benzoic acid derivatives, acid amides);
- Substances that maintain the sustainability up to 6 months (nitroanilines, carboxylic acids etc.);
- Substances that are sustainable during 3 months (carbamic acid derivatives, aliphatic carbonic acids and others);
- Pesticides, which are sustainable less than 3 months period (organophosphorous compounds and others).

Pesticides cover a wide range of compounds, effecting different way on soil micro flora and fauna. Among these, organochlorine insecticides, used successfully in controlling a number of insects are not reducing the number of soil microorganisms, whereas the introduction of other synthetic insecticides – organophosphate insecticides strengthens their development process. Fungicides can cause serious damage, resulting in critical losses of yield, quality and profit. Sustainable insecticides effect negatively on healthy fauna of soil, less sustainable are effecting slightly and unusual. Herbicides have a small influence on these organisms and their further actions are insignificant. (Gegenava, Ugrekhelidze, 1991).

According to R. Keshelava (2000) in Georgia there is identified that Herbicides cause harmful injury to the soil microflora. Reduce their number in corn, vegetable and vineyard fields. Bacteria are more susceptible to herbicides, than fungi. Herbicides do not adversely effect on the free nitrogen fixation, their negative actions reduces when their intakes together with mineral fertilizers. Fungicides – cause more harmful injury of nitro microorganisms then insecticides and herbicides.

პარკოსანი კულტურების მავნებელ-დაავადებები და მათ წინააღმდეგ ბრძოლა საქართველოში

გურამ ალექსიძე-საქართველოს სოფლის მეურნეობის მეცნიერებათა აკადემიის აკადემიკოსი,
სვეტლანა კაზაროვი-მაგისტრი, ტექნიკური უნივერსიტეტი.

საკვანძო სიტყვები: პარკოსანი კულტურები, მავნებლები, დაავადებები, პესტიციდები.

რეფერატი

ნაშრომი ეხება საქართველოში პარკოსან კულტურებზე გავრცელებული მავნებლების და დაავადებების შესწავლას. პარკოსნებიდან შერჩეულია: ჩვეულებრივი ლობიო, ბარდა, ოსპი, მუხუდო, სამყურა და სხვა, მავნებლებიდან: ლობიოს და ბარდას მემარცვლიები, ბუგრები, მენაღმე ბუზები და სხვა. აგრეთვე სოკოვანი და ვირუსული დავადებები-ანთრაქნოზი, ასკოჰიტოზი, ფესვის სიდამპლე ყვითელი და ჩვეულებრივი ვირუსული მოზაიკა და სხვა. შემუშავებულია მათ წი–ნააღმდეგ ბრძოლის ღონისძიებები, როგორც მინდვრის, ასევე შენახვის პირობებში. ღონისძიებები შედგენილია იმგვარად, რომ მივიღოთ ეკოლოგიურად სუფთა პროდუქტი.