

# Introductory methods of protection measures and disease control of fodder mulberry

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**Abstract.** In response to disease control in agriculture, the decision of the President of the Republic of Uzbekistan dated January 17, 2020 "On measures to develop the silkworm feed base in the cocoon industry" PQ No. 4567 deepening the reforms implemented in the cocoon industry, creating favorable conditions for the rapid development and diversification of the industry, introducing the cluster method of production organization, forming orchards on the basis of family contracts, systematic reproduction of fertile seedlings, and expansion of intensive-type special nutrient orchards. Despite the high level of immunity against various infectious and non-infectious diseases caused by disease-causing microorganisms caused by climatic conditions and soil composition in various regions of Uzbekistan, cylindrosporiosis is caused by the negative effects of bacteria, viruses, and fungi. Mulberry seedlings, saplings, adult trees with the help of means, preparations, depending on the type of pathogen used in the treatment, protection and fight against powdery mildew, chlorosis, fusarium, leaf swelling (curl), powdery mildew (fungus) diseases and nutritious leaf production is achieved through the healthy maintenance of special feeders.

**Keywords.** Sericulture, food base, pathogen, microflora, phytopathology, cylindrosporiosis, chlorosis, fusarium, powdery mildew.

## 1 Introduction

One of the important directions of the agriculture of the Republic of Uzbekistan is the cocoon industry, and determining its future development prospects and increasing its attractiveness depends on the quality and quantity of the only irreplaceable food base of the silkworm, i.e. the leaves of the mulberry tree. Therefore, diseases and pests of mulberry trees not only affect the quality and nutritional properties of cultivated mulberry leaves, but also destroy them completely [1-3].

In general, among perennial plants in nature, mulberry (mulberry tree) belonging to the mulberry family has a simple structure, but it is distinguished by its resistance to pathogenic microflora [4]. However, in order to obtain highly nutritious leaves and medicinal fruits from mulberry trees and specially nutritious mulberry trees, it is necessary to carry out preventive treatment and protection, as well as to prevent damage from the first signs of

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disease, and to take control measures [5, 6]. It is important to increase the seasonality of mulberry leaf and increase its satiety by using it at the right time.

Currently, every farmer, cluster worker, sericulture agronomist, mulberry specialist, householder and agricultural specialist need to know how to correctly identify crop diseases and maintain and improve productivity based on the use of modern countermeasures [7, 8]. For this purpose, the training of graduates studying in higher education institutions fighting against agricultural phytopathology and mulberry diseases as mature specialists with qualified knowledge plays a key role in production.

In particular, more than 30% of the products grown in the world's agriculture die during the growing season as a result of the negative effects of diseases, insects, and weeds [9-11]. To reduce the amount of damage, to know the species composition of microorganisms that cause diseases, to study their biological properties, to develop and apply the correct treatment, protection and countermeasures against diseases in the production of ecologically clean food products for the population and it can be said that it is very relevant from a practical point of view.

## **2 Materials and methods**

Research and phenological observations were carried out in the regions of Tashkent and Kashkadarya (Uzbekistan). Cylindrosporiosis, powdery mildew, fusarium, chlorosis, leaf curling, mulberry seedlings, seedlings, special feeding mulberry trees, fruit and ornamental mulberry trees, powdery mildew, powdery mildew are the subjects of research. studies, detection, protection and implementation of countermeasures were shown.

Despite the high level of immunity against various diseases and the influence of external environmental factors, plants and mulberry seedlings, seedlings and intensive type special feeding mulberry trees are susceptible to infectious diseases due to the negative effects of bacteria, viruses, fungi, as well as protection and combat measures by using tools, drugs and agrotechnical measures used in the treatment of infectious diseases in spring, depending on the type of pathogens, were carried out as a scientific innovation.

To protect against infectious diseases and get rid of disease-causing microorganisms and parasitic fungi, the main organs of mulberry are the root, trunk, branch, shoot, leaf and fruit. Identifying and countering negative processes such as becoming a wound, forming a cavity in the place of spots, and increasing the number of holes in the diseased area on the development, growth, formation, productivity and quality of the leaves of the mulberry tree. It is recommended to apply new innovative methods in time to eliminate negative situations by fighting.

Bacteriosis, cylindrosporiosis, powdery mildew, fusarium, chlorosis, leaf curl, and powdery mildew are among the most common infectious diseases in Tashkent and Kashkadarya regions of Uzbekistan (Figure 1). in the fight against diseases caused by disease-causing microorganisms, it is necessary to spray 2-5 liters of a mixture of 20 mL per 10 liters of water per tree. This preventive process is carried out until the budding phase and the flowering period.

In addition, in order to get rid of the fungal parasite that causes ringworm, it is necessary to treat and combat the ringworm with a solution of 5% copper sulfate (100 grams per 10 liters of water). For this, it is necessary to prepare a mixture of local fertilizer, soil and lime (2:1:1) and apply the treated slurry (mixture) to the hole with a special brush.



**Figure 1.** Symptoms of mulberry cylindrosporiasis disease.

It is especially recommended to spray the tree with a solution of lime and sulfur in the fight against fungi. The method of preparing this solution is to mix 0.5 L of hot water and 0.6 kg of slaked lime. Always add 0.4 kg of sulfur powder to the mixture, add 1.5 liters of hot water and put it on the fire covered with a lid. The duration of boiling is 15 minutes, and the finished solution should be cooled.

In fact, it is necessary to dilute the suspension for mulberry processing. One tree needs 3-4 liters of solution and it is sprayed twice until the buds swell (re-applied after 14 days). In short, the best way to prevent and protect against mulberry diseases (especially fungi, Figure 2) is to whitewash the trunk, i.e., the cracked areas of the body, with lime as a preventive measure.



**Figure 2.** Appearance of the fungus (fungus) disease that is formed and occurs on the trunk of a mulberry tree.

In addition, as an effective solution, 2 kg of lime and 300 g of copper sulfate should be mixed with 10 liters of water. It is recommended to use garlic solution as one of the other effective treatment measures. It is necessary to grind 100 pieces of garlic, put it in 1 liter of

water and cook it, and squeeze it after it cools down. Mix this liquid solution with 1 liter or 300 mL small bottles with 10 liters of water, after the beginning of the growth period, it is necessary to wash the affected and swollen areas with 7-8 liters of solution 2-3 times.

### 3 Results and discussion

Of the above-mentioned infectious diseases found in mulberry trees, 483 out of 1276 mulberry seedlings, or 35.1%, were infected with fusarium in existing nurseries in Bostonlik district of Tashkent region. The disease was found in seedlings grown from seeds, two-year and multi-year mulberry seedlings, and in the study of 279 grafted mulberry seedlings in mulberry orchards of Yangiyul district, it was found that 32% of them were infected with fusariosis.

In most districts of Tashkent region, 31-47% of mulberry seedlings belonging to farms and clusters engaged in cocooning were infected with fusarium. 31 out of 114 plants, or 21.1%, were infected with fusariosis in farms belonging to Kuyi Chirchik and Akkurgan districts and in special feeding orchards belonging to clusters. 38 of 185 plants with disease symptoms from special feeding orchards of Bekobod district, or 21.9%, were found to be infected with fusarium.

In addition, according to the observations made in the southern regions, the number of *Fusarium* species causing fusarium disease is higher than in other regions. Because the favorable ecological conditions in the southern regions, the length of the vegetation period and the change of crop types several times in one season also affect the way of nutrition of the fungi living in the soil. The winter is warm compared to the northern regions, the amount of infection in the soil is maintained throughout the year, there are few cold days, the plant lags behind in the event of violation of agrotechnical measures, and the resistance to disease-causing fungi is the reason. Therefore, 24-33% of seedlings grown in farms specializing in mulberry production were dry or withered.

Based on the study of the occurrence of *Fusarium* species isolated from mulberry in the conditions of Kashkadarya region (Table 1), they belong to 9 species and more than 456 strains of them were isolated.

The most common species are 2, sometimes 3 representatives of these species are involved in the bright manifestation of disease symptoms of agricultural plants and weeds. The rarest species participate in the disease process of plants along with the main species and cause their external symptoms to be clearly expressed.

In fact, it was found that instead of 16-20 kg of yield from one mulberry bush, the yield dropped to 4-8 kg/year in the years when the disease developed strongly. The disease is spread by wind and water due to the conidia formed on the leaf. Khasak, Saniish-3, Jararik varieties are susceptible to the disease, Kokuso-70, Sioziso, Vostok, Georgian varieties are resistant.

The number of seedlings should not exceed 6,600 on 1 ha of land intended for orchards, and mineral fertilizers in the amount of 120-180 kg of nitrogen, 60-90 kg of phosphorus, and 30-40 kg of potassium should be applied to 1 ha of orchards. It is necessary to plow the soil of mulberry fields to a depth of 25-30 cm, fight against weeds in crops and burn their remains. To treat mulberry trees with signs of disease with a sulfur-lime solution (1 part of lime, 2 parts of sulfur, 17 parts of water are needed to prepare such a 5% solution) 1 mulberry bush is sprayed with 2 liters of solution.

The external symptoms of the disease are brown round spots of various shapes on the surface of the leaf. The border of these spots covers the areas up to the leaf vein and is surrounded by a border. Tissues formed by the stain die. The back side of the leaf is covered with conidia formed in the mycelium of the fungus. Spots are 0.25 mm in size when they first appear, then they become larger and are covered with white mycelium.

**Table 1.** Spread and development of powdery mildew disease in special feeding orchards, % (2020-2022).

Districts in Kashkadarya region, Uzbekistan	2020			2021			2022		
	Disease			Disease			Disease		
	Spread, %	Dev., %	Index, %	Spread, %	Dev., %	Index, %	Spread, %	Dev., %	Index, %
Shahrisabz	50.4	24.7	12.4	46.3	23.4	10.8	44.1	22.7	10.0
Kukdala	30.2	13.5	4.1	27.7	12.6	3.5	26.3	12.1	3.2
Kamashi	31.9	11.3	3.6	29.4	10.4	3.1	28.0	9.9	2.8
Kitob	57.7	30.8	17.8	53.6	29.5	15.8	51.4	28.8	14.8
Guzor	36.0	16.2	5.8	33.5	15.3	5.1	32.1	14.8	4.8
Nishon	34.7	14.5	5.0	32.2	13.6	4.4	30.8	13.1	4.0
Karshi	48.7	26.9	13.1	44.8	25.6	11.4	42.4	24.9	10.6
Kasbi	22.9	7.4	1.7	20.4	6.5	1.3	19.0	6.2	1.1
Koson	44.6	22.0	9.8	40.5	20.7	8.4	38.3	20.1	7.7
Mirishkor	49.3	28.6	14.1	46.8	27.3	12.8	44.6	26.6	11.9
Chiroqchi	40.3	19.1	7.7	36.2	18.2	6.6	34.8	17.7	6.2
Yakkabog	45.9	23.7	10.9	41.8	22.4	9.4	39.6	21.7	8.6
<b>O'rtacha:</b>	41.0	19.9	8.8	37.8	18.8	7.7	36.0	18.2	7.1

Spots are limited by leaf veins. The size of such spots increases by 4-15 mm. Sometimes the spots merge with each other and occupy a volume of 30-60 mm. The number of spots on the leaf surface can be 1-50, depending on the level of disease. Infected leaves regularly turn yellow and then fall off. In late autumn, the white mycelium on the surface of a fallen leaf turns black.

To isolate the fungus from the leaves of the infected plant, a small piece of it is placed in a sterilized moist chamber. A powder of conidia formed in the white mycelium of the fungus is formed on the infected surface of the leaf. These conidia of the fungus are washed in sterilized water, and the conidia are planted on agar medium using a microbiological hook.

The disease mainly infects grass from local varieties and manifests itself on the leaf and leaf band of mulberry. On the lower part of the infected leaves, a powdery white powder appears. Spots can cover 100% of the leaf surface. Brown spots appear on the upper part of the surface where the spot is formed, and under the leaf, the reproductive cells of the fungus form cleistothecia. The mycelium formed by the development of the spore enters the leaf through the openings of the mulberry leaf, and forms a flour-like mold on the back of the leaf and a brown spot on the surface of the leaf.

However, Japanese varieties are more vulnerable to fungal diseases, are characterized by a low amount of mold and cover only 1-4% of the leaf surface. If the surface of the leaf turns brown, it means that it has become very weak. Cleistocarpia appear as pale dots on the back of the leaf. Their formation corresponds to the wintering period of the mulberry tree. Cleistocarpia develop 10-40 ascospores, and cleistothecia fall into the soil with infected plant debris and infect healthy plants in July-August. Khasak, Kokuso-70, Kokuso-13, Kinriu varieties are susceptible to this disease, Tajik seedless mulberry, Balkhi mulberry, Uzbekistan, Mankent varieties are resistant to this disease.



*Phyllactinia suffultta* Sacc., the causative fungus, is considered a true parasite and infects only mulberry and reproduces in the form of conidia and cleistocarp (Figure 3). In the conidial stage, the fungus penetrates through the leaf apices on the back of the leaf, produces long, tip-expanded, cross-barred conidia bands, and at the end produces tuberous, pear-shaped, and elliptical conidia.



**Figure 3.** Appearance and pathological symptoms of powdery mildew disease of mulberry.

The conidial stage of the fungus is called *Ovulariopsis erysip hoides* Pat. Et. Hariot, the length of the conidial bands is 30-240  $\mu\text{m}$ , the width is 4.5-7  $\mu\text{m}$ , the length of the conidia is 42-94, the width is 18-27  $\mu\text{m}$ , and their sum is uniform and creates a foam. The cleistocarpic stage of the fungus is called *Phyllactinia suffultta* Sacc. f. *Moricola* Jacz, and is formed one month after the formation of conidia.

The cleistocarpia of the fungus are round, with 5 rays spreading from the side. The rays are hard, shiny, with a sharp tip and a widened base. At the initial stage of the formation of cleistocarpia, its color is yellow, then turns gray and then turns black. Each kletocarpia produces 5 to 40 ellipsoidal ascospores with long, golden short legs.

The manifestation of the disease is calculated with the following points: I- point, white dust is sparsely located on the leaf; II- point, dust on the leaf is combined with each other and covers 50% of the surface of the leaf; and, III- point, leaf surface is completely covered with dust.

In general, leaf curl disease of mulberry and fruit trees, belonging to the group of perennial plants growing in different regions, reduces the productivity of mulberry trees and fruit trees. Usually, this viral disease is an infection spread by insects, and it appears in the form of wrinkles, grainy nodes, discoloration, swelling between the leaf veins. In this case, the leaves are curled, their size decreases, the growth of young branches changes, their number decreases and they look deformed.

In particular, flowering leaves lose their color, become brittle, appear rough, an abnormal increase in the number of disease-causing microorganisms is observed, and in the treatment of this disease, control measures, preventive and agrotechnical events are important. So, the carriers of the viral disease of curling due to various color changes, which look like small leaves, are pests (Figure 4).



**Figure 4.** Mulberry leaf curl disease.

Therefore, in most cases, in the protection of this disease, in mulberry plants, feeding mulberry trees and fruit trees, the effect is almost not noticeable, because the leaves on the branches of the tree are strongly affected, it is recommended to use preventive measures and agrotechnical measures.

Among the conducted scientific researches and experiments, applying protection measure by washing 1-2 liters to young mulberry bodies after a period break of 1-2 weeks, and 7-8 liters to adult mulberry trees and fruit trees before fruiting. gives its result.

## 4 Conclusions

Mulberry stands out among perennial plants due to its simplicity and resistance to pathogenic microflora. However, in the cultivation of abundant, high-yielding and nutritious mulberry leaves from mulberry seedlings, seedlings, adult mulberry trees and special feeding mulberry groves, it is not necessary to observe only agrotechnical measures. Perhaps, in the fight against infectious and non-infectious diseases, it is possible to achieve positive results by applying preventive treatment measures, biological protection, combating and agrotechnical measures in due time.

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