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## **TOMATO CROPS POWDERY MILDEWS IN THE WESTERN PART OF AZERBAIJAN AND MEASURES TO COMBAT IT**

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## **МУЧНИСТАЯ РОСА ПОСЕВОВ ТОМАТОВ В ЗАПАДНОЙ ЧАСТИ АЗЕРБАЙДЖАНА И МЕРЫ БОРЬБЫ С НЕЙ**

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*Abstract.* In the western part of Azerbaijan, tomato plants currently make up half of the open and covered fields. In recent years, the range and damage possibilities of fungi, which were rarely encountered before and were not characterized by high damage, have expanded in the tomato plant belonging to the Solanaceae family. The route and stationary observation-calculation works conducted in the western part of Azerbaijan showed that numerous pathogens are spread in tomato crops. Among these diseases, it has been determined that powdery mildew disease, which was not of economic importance before, prevails due to its spread and damage to crops. A fungicide trial was conducted against the disease.

*Аннотация.* В настоящее время в западной части Азербайджана половина площади открытых и закрытых грунтов занято под томатами. В последние годы на томате, принадлежащем к семейству пасленовых, расширились ареалы грибов, которые раньше встречались редко и не характеризовались высокой повреждаемостью, а также их вредоносные способности. Исследования и стационарные наблюдательно-расчетные работы, проведенные в западной части Азербайджана, показали, что в посевах томатов распространены многочисленные патогенные микроорганизмы. Было установлено, что среди этих болезней мучнистая роса, которая раньше не имела экономического значения, преобладает по распространению и вредоносности. В исследовании были изучены ареал распространения и биоэкологические особенности мучнистой росы. Против мучнистой росы были испытаны различные фунгициды и определена норма их применения.

*Keywords:* *Solanum lycopersicum*, powdery mildews, distribution, infectious diseases, conidia, pathogens, fungicides.

*Ключевые слова:* томат обыкновенный, мучнистая роса, распространение, инфекционные болезни, конидии, патогены, фунгициды.

Tomato (*Solanum lycopersicum* L.) belongs to the Solanaceae family. The Solanaceae family is one of the most widespread families in the world, including about 90 genera and at least 2500 species [8].

One of the factors that reduce the productivity of tomatoes, like all agricultural crops, is various fungal diseases. In the course of the research, it was determined that 30–35% decrease in productivity is done every year in the areas of the farms engaged in vegetable growing of Azerbaijan in which there is no fight against diseases in tomato crops. This has a negative impact on the economy of farms.

Various literature sources indicate that these plants are infected with numerous disease agents when cultivated in open conditions. Analyzing the mycobiota of the tomato plant, researchers note that many genera of fungi (*Alternaria*, *Erysiphales*, *Fusarium*, *Phytophthora*) are prevalent and pathogenic. Among them, it is written that powdery mildew fungi have recently spread and caused serious consequences in farms [3, 4].

Two types of fungi (*Leveillula taurica*, *Oidium lycopersicum*) cause powdery mildew disease in tomato plants. Powdery mildew disease in tomato was first recorded in 1988 in the western part of former USSR in covered soil. Then the disease was observed in Latvia. Powdery mildew disease was detected in tomato plants cultivated in open conditions in Ukraine. Powdery mildew caused by the fungus *Leveillula taurica* was first found in Kazakhstan in 1957 and in the field in Krasnodar Territory since 1966 [1].

Russia ranks second after India and China (FAO, 2012) for the production of cultivated plants belonging to the gooseberry family. 30 million tons of tomatoes and potatoes are produced here in all production categories. Tomato cultivation consists of several stages, from planting seeds to harvesting fruits. At this time, in addition to all agrotechnical maintenance work, crops should be constantly monitored by phytosanitary control so that there is no loss of crops due to the spread of harmful organisms [5, 6].

The distribute of powdery mildews — *Leveillula taurica* fungus in crops during vegetation causes changes in the quantity and quality of the product. Changing climatic conditions make the fungus more aggressive.

It is noted that the other causative agent — *Oidium lycopersici* fungus is more common in cultivated plants belonging to 13 families, including Solanaceae, Alliaceae, Cucurbitaceae, Apiaceae families. Researchers identify this fungus as *Oidium lycopersici* in Russian greenhouses.

The analysis of the literature sources of American researchers also shows that there are the same opinions about the powdery mildew fungus.

Powdery mildew is a foliar disease of the tomato plant and is observed in nearby areas of the United States. The fungus spreads more in the open field and quickly covers the leaf surface in the form of a white coating, the leaves fade, the quality of the product deteriorates. Sometimes weeds are also covered with this coating, and they are a source of infection. In the eastern United States, this cover is formed by *Oidium lycopersicum*, and in California and Mexico by *Leveillula taurica*. Both fungi are spread through conidia, which are formed as a result of asexual reproduction. Leaf humidity is not very important for these spores [9, 10].

In the literature, it is written that the fungus *Leveillula taurica* = *Oidiopsis sicula* in the anamorphic stage) is currently spreading in tomato crops [2, 6].

The opinions of many researchers about the symptomatology, biology, distribution and damage of powdery mildew fungi spreading in tomatoes coincide. Researchers studying the disease also noted that powdery mildew fungus was observed with a coating. Sometimes the symptoms of the disease change. Light-green or yellow irregular spots are seen on the leaf. Mycelium and spores of the fungus, which is an ectoparasites like white flour, can be seen on these spots. The fungus is more visible on the lower edges of the leaf.

### Material and Methods

The research was conducted in tomato fields cultivated in the western region of Azerbaijan in 2018-2021. The symptoms of the disease and the degree of infection of the leaves in the plants were determined visually and the average values were calculated. Examinations were carried out every 7-10 days depending on the conditions. Powdery mildew infection of tomato leaves was reported according to accepted methodology [7]. The following scoring scale was used for the report: 0- no infection, plants are healthy, 1- infection up to 1/4 of the leaf surface, 2- infection up to 1/2 of the leaf surface, 3- more than 1/2 of the leaf surface is infected.

During the research years, 200 patients with symptoms of powdery mildew were sampled in the stationary experimental field, and at the same time, 500 more samples were collected from different regions and farms during route examinations. The samples were analyzed in laboratory conditions and viewed under a microscope. According to the results of numerous analyses, the conidial stage of the fungus that causes powdery mildew in the Western region of the country is *Oidium lycopersicum*. Studies have shown that *Oidium lycopersicum* infection forms a white circular coating on the surface of the leaves. This coating indicates the formation of the conidial stage of the fungus. When the disease develops, the surface of the leaf is completely covered with powdery mildew, the chlorosis of the infected leaves gradually turns to necrosis. In the places of infection, the spots converge and take similar concentric circular shapes, they gradually become necrotic, and sometimes they spread to the underside of the leaf. Diseased leaves wither, dry and completely fall off (Figure 1).

The symptoms described above are observed in the stem of the plant. It is natural that during the growing season the parasite is spread only by conidia.

During the vegetation period, we paid attention to the number of incubations of the parasitic fungus with special research, and it was determined that in 2018, *Oidium lycopersicum* had 5 incubations, and in 2019, the number of incubations was 8. These numbers were typical for other years of the study, and it was determined that the causative agent gave an average of 5 incubations for the years 2020–2021. Due to the effect of the fungus, yield reduction and defoliation of the plant occur.

Studies show that powdery mildew is more characteristic for summer crops of tomatoes, because powdery mildew dominates crops grown in September-October. The reason is characterized by the fact that climatic factors are more reliable in this period. Although the initial symptoms of powdery mildew in spring crops appear in the second decade of May, the conditions in June are ideal for the parasite, the relative humidity is 65–70%, the daily average temperature is 22–24°C, occasional summer rains help the spread of this disease and is very important for development. Later, with the heat of July-August intensifying, reaching the limit of 32–35°C on separate days, the fungus descends, becomes depressed, and begins to develop in an ascending line in the tomato plantations of II summer crops from September. Under laboratory conditions, samples of the white coating taken from the surface of infected leaves under a microscope show the formation of a conidial chain along with a thin delicate mycelium. Conidia are cylindrical, elongated, 22.8–30.5 µm in size, surrounded by 4–6 chains of conidia (Figure 2).

Powdery mildew, which has become more widespread in recent years, is a real threat to tomato plantations. According to the reports conducted in 2018–2021 before harvest, the infection in some plantations reaches 35–40%. At the same time, since the disease causes high damage in greenhouse conditions, it makes the process of mutual transmission of infections even more difficult.



Figure 1. Symptoms of powdery mildew disease on tomato leaves



Figure 2. Microscopic view of conidia

During the conducted research, we found out that powdery mildew disease spreads massively in autumn crops in the open field. We have determined the spread of diseases such as ascochytirosis, cladosporiosis, white rot, fusarium, which are present in the mycobiota of the tomato plant, and these diseases are characterized by a decrease in yield and a decrease in commodity quality. The extent of crop damage by multiple diseases varies even within a single agro-ecological region. Environmental factors are the main condition affecting the development of the pathogen. The biological characteristics of the pathogen develop according to these conditions (Figure 3).

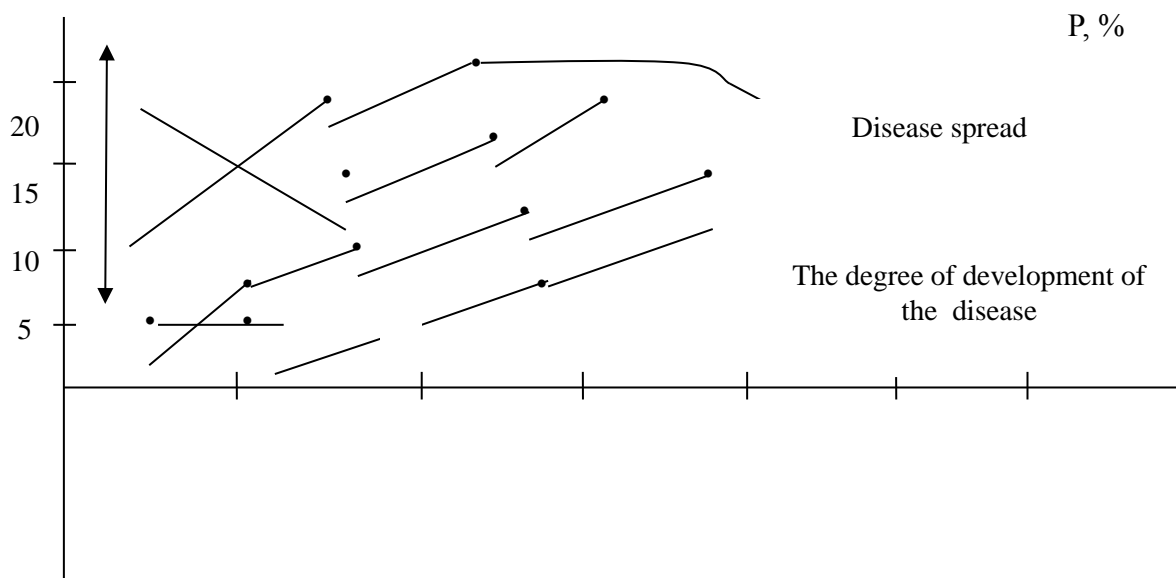


Figure 3. Development of powdery mildew disease pathogen on tomato plant

During the research years, Collis preparation against powdery mildew disease in tomato crops was tested at the consumption rate of 0.2; 0.4 and 0.6 kg/ha. Biological efficiency of fungicides applied against powdery mildew (Table)

Table

BIOLOGICAL EFFICIENCY OF FUNGICIDES APPLIED AGAINST POWDERY MILDEWS

Variants	The rate of consumption of the drug is l/ha	Disease development rate after medication % (in days)				Biological efficiency of drugs, % (by days)			
		3	6	9	12	3	6	9	12
Collis	0.2	6.4	8.1	10.4	12.1	54.2	50.1	44.6	42.3
Collis	0.4	2.2	2.8	4.2	6.1	84.2	80.3	77.6	70.9
Collis	0.6	1.9	2.4	3.6	4.3	86.4	85.7	80.8	79.5
Tiovit jet (standard)	3.0	2.0	2.4	4.0	4.8	85.7	85.7	78.7	72.3
Control	—	14.0	16.8	18.8	21.0	—	—	—	—

As can be seen from the table, the Collis preparation showed 84.2 and 86.4% biological efficiency at the application rate of 0.4 and 0.6 kg/ha, respectively. The consumption norm of 0.4 kg/ha of the preparation is satisfactory for carrying out control measures. In the standard variant, the biological efficiency was 85.7%.

*Result of the Research*

1. Analyzing the mycobiota of the tomato plant in open and covered fields in the Western region, the powdery mildew disease spread here differs from other diseases in terms of its spread and damage. Thus, powdery mildew fungus is an obligate pathogen, spreads in crops and causes serious damage to the quantitative and qualitative indicators of the product.

2. As a result of the research, we determined that the fungus becomes more aggressive as a quick adaptation to the change of environmental factors.

3. Fertile conditions exist for the spread and development of powdery mildew in almost all regions of our country, including the Western region. Powdery mildew disease occurs and develops in tomato crops starting from April and ending with a sharp cooling of the weather at the end of autumn.

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