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TOMATO BROWN SPOTTING (*CLADOSPORIUM FULVUM* COOKE) AND POWDERY MILDEW (*OIDIUM LYCOPERSICUM COOKE ET MASS*.) IN GREENHOUSES

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Abstract. The current article presents the spreading, features, development of Cladosporioz in greenhouses in Apsheron Peninsula of Azerbaijan. The results of our studies has been identified spreading, features, microscopy analysis of pathogen and damage degree of powdery mildew (*Oidium lycopersicum*) and brown spotting (*Oidium lycopersicum*) on tomato. Besides, tested the effectiveness of biological and chemical agents against the diseases, too.In this article was given information about specific changes and new specialized race in the morphological features of pathogen and about perspective biological and chemical preparations (Qamair, Alirin-B, Kvadris, Strobi, Bayleton, Topaz) tested in disease control.

Keywords: *protected ground, tomato, disease, greenhouse, Cladosporium fulvum, Oidium licopersicum, biological control, Alirin-B, Qamair.*

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1. Introduction

In recent years the greenhouse vegetable growing is expanded still more against the background of developing of agrarian reforms. Transportation and application of modern technologies to Azerbaijan and increasing of productivity of tomato and its marketable quality had caused changing of composition of diseases and pests and wide spread of individual pathogens. So, the phytosanitary analysis of Apsheron Peninsula in last twenty years shows that wide spreading of powdery mildew (*Oidium lycopersici* Cooke et Massee) and phytopathogenic fungi (*Cladosporium fulvum* Cooke) lead to problems in the greenhouse site. Firstly, Powdery mildew on tomato in Azerbaijan was remarked by S. Abdullaev and V. Belousova (Belousova, 1989). In spite of different data about pathogen it was identified by T.Tereshenkova. Her researches are about fungi and specified it as *Oidium licopesici* Cooke Et. Masse (Tereshonkova, 2002).

2. Material and methods

Disease occurs mostly in Apsheron Peninsula of Azerbaijan. From the observation held in large greenhouses protected ground vegetable growing in Zire of Apsheron Peninsula.The disease is spread in most of polyethylene covered greenhouses in Apsheron Peninsula. Progression of the disease on the tomato leaves of model plants continues from first observation till quantity of vegetation. Conidiums and carriers of

conidiums of pathogen have been studied properly by the systematic microscopy of taken samples.

First, to control biological and chemical measures developed by *Oidium lycopersicum* against diseases must be identified the pathogen.

After determination of presence of pathogen must be used the biological preparation received from its natural antagonist for fighting against it. In 2012-2014 it was studied and tested the applied schedule of the preparations as Gampir (*Bacillus subtilis*, stamp M22 VİZR) and Alirin-B (*Bacillus subtilis* stamp B-10 VİZR) against *Oidium licopersicum*. When Gamair was applied the titer was ^{11} KYO/gr.

3. Results and discussion

It was clear that some years of out of turn tomato growing caused to specialization of Cladosporioz on plant. From the kept records, we can see that during 28-35 days all leaves have been infected with *Cl.licopersicum* and burnt (Fig. 1, 2).

Figure 1.

The infectious agent is *Cladosporium fulvum* Cooke. Fulviafulva-the synonym of pathogen is recorded on the tomato in a greenhouse. *Cladosporium* infects open and closed leaves, butt, stem, calyx, calyx lobe and fruit. First signs are observed on the top of lower tier of leaves as light green, then with yellowish spots. Later in the bottom of these spots are formed as brown dots the carriers of conidia and conidia's of fungi. And it plays the main role in the spread of disease. It is possible to spread by water drop or wind shortly. The relative humidity of air must be 80-95%. The foggy morning and evening weather is favorable for spread of disease. Because of high humidity in the greenhouses the disease is widespread in the polyethylene covered greenhouses. *Cladosporiose* is widespread in Azerbaijan regions. It was found that during its development the pathogen creates different races and subspecies. It occurs when pathogen lives in the soil as a saprophyte. Pathogen falls onto the soil in the plant remains and conforms to saprophyte circumstances. It widens its breeding area under favorable conditions. Because of this

feature, the development of sustainable varieties and their use are not successfully. The main role in the spread of *Cladosporiose* play conidia, which create brown cover on the yellowish spot, appeared in the bottom of the leave. Conidia are viewed on the branched carriers of conidia, they are round or egg shaped and they have 1-5 cells. The membrane color of conidiums is light brown, intracellular color is whitish-grey.

Figure 2.

Sizes: unicellular are 4-7 x 6-9 mkm, bicellulars are 5-8 x10-14 mkm, with 3-5 cells are 6-10 x 13-29 mkm. The disease develops on the tomato. So the producers cannot fight against the disease. Although they use the fungicides with different contact source the profit is too low and it does not satisfy the producers, the economic damage increases. Against the brown spotting *Clasdiporum*are used the systems, or fungicides with system or contact effect. With this end of view, they use the fungicides with substances Metalaxyl, Iporoion, Triadimefon, Mefenoksam, Azoksistrobin and get a high productivity.

At first, on the tomato grown in the greenhouse appear white-grey little covers on the down layer leaves. *O.lycopersicum* covers all leaf surface under favorable conditions. The disease is spread in, most of polyethylene-covered greenhouses in Apsheron Peninsula. Conidiums have egg-shaped, elliptic and cylindrical forms (Fig. 3).

Figure 3.

The carriers of conidia's micelles are shortsept as are observed. Fledgling elliptic conidiums are elliptic form with sharp head. This sign was found by us first and was made visual.

The main reason of spreading of disease in 2014 is development of new pathogenic race specialized on tomato. Dynamic of disease on seedlings of tomato for Durinta have been studied till the end of vegetation period in the polyethylene covered greenhouse condition.

Pathogen continues its development till the end of the vegetation. Referring to the results from the registrations it was found that 20-32^{o}C temperature and 55-85% relative humidity had been favourable for optimal development of *O.lycopersicum*. As can be seen from the result the condition like that exists in all greenhouses. If the pathogen has resources, its spread is inevitable. During the disease period, power mildew spreads and as the result the leaves turn yellow, their parenchyma turn yellowish-brown, if there is a lot humidity begin deformation of leaves, turgor disappears and occurs early leaf fall. Contaminating fruit with the disease is not observed. In spite of it the stalk, receptacle and sepal are infected. In addition, you can see powdery mildew on the tomato growing in open conditions, but it has not economic importance. In summer period, after foggy and drizzly on the weather appears dew, as the result of it the disease spreads too quickly. If in the sowing area, the aeration among the plants is very little and the agro technical conditions are not met, the infection kills down leaves. The disease spreads on leaves of middle layer quickly under favorable conditions, which leads to aging and leaf falling.

Oidium lycopersicum besides tomato infects other sweet and bitter plants, wild nightshade and other weeds. N. Pidoplichko considered that ascigerous form of *Levellula taurica* Arnaud is indicated as Yachevsky (Pidoplichko, 1977).

First, *L.taurica* is observed with light-green and yellow patches on the leaves. It covers the surface of the leaf as powdery coating under favorable conditions. Whitish-grey coating are conidiums and micelles of pathogen. Conidiums spread intensively by wind, raindrops, irrigating water drops and mist. In mass spread years the leaves of tomato fall, fruits are little, as the result of intensive sun streams can be observed the burns on the fruit. Conidiums can migrate to the far distance by mist and wind. It can spread in large range climate conditions. It develops intensively in 13-32^{o}C temperature 50-85% relative humidity.

Measures of Cladosporium fulvum of tomato:

In 2012-2013 to improve the chemical fight measures Poliram (350 gram/kg Metiram), RidomilQold (Mankozeb 640 gram/kg + Mefenoksam 40 gram/kg), Kbadris CK (Azoksistrobin 250 gram/kg), Kaptan–H, Enerkol (70% Propineb), TivoksinAL (50% Polioksin), Hektaneb M-22 (80% Maneb) have been tested, the biological efficiency of these fungicides have been studied. Among the tested fungicides' normally use as Kvadris CK a liter/ha was 85,7%, Tivoksin AL's normally use 83,9% was 0,5 liters/ha and showed higher results than others.

The biological productivity of other preparations used against the disease was as following:

- Ridomil gold 3 kg/ha with the standard norm of 80%, Kaptan H 3 kg/ha with the standard norm of 71%, Enerknol 4,5 kg/ha with the standard norm of 78,5%, Hektane M - 223 kg/ha with the standard norm of 73,2%, Poliram 3 kg/ha with the standard norm of 75% (Table 1).

Table 1. The productivity of fungicides against brown spotting (*Cladosporium fulvum)* of tomato (Station: Zire private greenhouse, Durinta F1)

Nameofpreparations	Expense norm kg/ha, liter/ha	Spread,%	Intensivity,%	Biologicalproductivity, %
Ridomil-Qold	3	35	11	80
Kvadris CK	1	32	8	85,7
Kaptan H	3	40	16	71,4
Enerkol	4,5	38	12	78,6
Tivoksin AL	0,5	28	9	83,9
Hektaneb M 22	3	46	15	73.2
Poliram	3	30	14	75
Etalon:AntrakolWP70	3,5	34	15,5	76,8
Control:	--	92	56	-

Because of long term of yield ripening and collecting period (50-65 days) during this period have been used the chemical preparations against *Clodosporiose*, because of increasing pesticide remains in the composition and decreasing of marketable quality of yield must be used biological fight measures. With this end of view in some scientific sources Psevdobakterin-2 (*Pseudomonas aureofaciens* stamp: BCB 93, titer: $5 \cdot 10^{11}$) was efficiently and so was studied its productivity against *Cladosporiose* (2). The carried out tests show that twice use of Psevdobakterin-2 with 7 days interval with the standard norm of 0,03 kg/ha was productive of 75%. The result is considered as satisfactory and its use is advisable.

So, by using of the phytosanitary measures, use of chemical and biological fungicides with system effect could be used the following measures against Cladosporiose of tomato:

1. Phytosanitary and agro technical measures:
   - keeping of optimal climate condition (the relative humidity of weather of 65-75%, temperature 18-22^{o}C)
   - take measures on water drops in polyethylene covered greenhouses.
   - refusal of artificial rain.
   - use of drip irrigation and growing of rows and intervals between plants.
   - clearing of plant remains and weeds, their private for decreasing of pathogen resources.
   - apply of regular sowing system.

2. Chemical fight measures must be stopped 15 days before ripening of fruit in the first tier. So the composition of Azoksistrobin and polioksin are more productive. It means that Kvadris CK with the norm of 1litr/ha, Tivoksin AL with the norm of 0,5 liters/ha can be used both seed-plot and productive area. The expense of working solution must be 400 liters/ha in productive area and 1 liter in 10 m^2 seed-plot. During the application, the preparations must be replaced, so it helps to prevent the creation of sustainability of pathogen to fungicides and increases the efficiency of fight.

3. Biological fight measures. To keep in control, the plant during its ripening use of the preparations of Psevdobakterin-2 with the norm of 0,03 kg/ha, EWS must be 400 liters/ha. From ecological view during the safety yield regularly use of Psvdobakterin-2

with 250 grams of Qamair İT (*Bacillus subtilis*, stamp M-22 VİZR, titer 10^{10} kg/gram), 250-300 gram Alirin-B (*Bacillus subtilis*, stamp B-10 VİZR, titer 10 kyo/gram) gives an opportunity to get a yield with no pesticide and gives high productivity.

Measures:

From the tests, carried out on efficiency of influence to development and spread of disease under different expenses, the results showed that the biological efficiency of preparation was by 68% in 0,3 kg/ha variant. During the application process the titer of Alirin was 10^{11}KYO/gr. Alirin-B had been applied during fruit ripening time of the first and second flower clusters of tomato and efficiency was by 65% in 0,2 kg/ha application rate.

Sharing of Alirin-B and Gamair was effective by 72% in 0,2+0,2 kg/ha application rate. Based on the results, use of Gamair and Alirin-B is promising in green food production, so there were no pesticide remains in the ripening period (Aghayev, 2012).

In years, when powdery mildew was common on tomato for fighting against it and rational organization it is useful for 85-90% of applying 0,3-0,5 kg/ha ofStrobi (krezoksin-metil), 0,4-0,6 liter/ha of Kvadris SK (Azoksistrobin) 20 days before yield collecting. If these preparations are absent, they can be changed with Topaz (Penkonazol) and Bayleton (Triadimefon).

Ecological factors play key role in fight against Powdery Mildew. If sowing scheme is broken, the space between plants and rows is close aeration balance is disturbed, because of damp air persists among dense part of plants continuously it is suitable for developing of pests. Temperature and damp balance must meet to quota.

Main reasons of disease emergence are cool, dewy and foggy evenings, and in the greenhouse is increasing of relative humidity after evening watering. Therefore, watering must be carried out in the morning. The aeration will be better, if the leaves closer to the ground and understory will be cleaned in time. The macro and microelements in the ground must be under control. Before each sowing, the ground must be analyzed and the food elements must be reached to normal level. Irrigation water also plays an important role. The metabolism of tomato plant is interrupted and common sustainability decreases, the plant gets weak, if during the irrigation it is used water with sour or alkali reaction, also hard water and as the result, the weak plants are infected with powdery mildew rapidly.

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