

Pest control in seedling production

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Abstract

The main diseases and pests attacking vegetable seedlings, as well as the favourable conditions for their development, are indicated. The symptoms of damage are described. The agrotechnical control measures are: cultivation of resistant varieties, seed disinfection, observance of good sanitary practices, maintenance of an optimal temperature and humidity regime in the seedling compartment, placement of sticky boards and pheromone traps for recording pests, optimal nutrition regime, regular monitoring for early detection of diseases and pests. Where chemical control is required, the registered plant protection products (PPPs) against the causal agents of diseases and pests are listed.

Control of diseases and pests in the seedling compartment starts with good sanitary practices. These include periodic cleaning or disinfection of all materials and facilities used. Regular monitoring for early detection of the occurrence of diseases and pests and preventive plant protection, in line with the economic injury level (EIL), also supports them.

To detect and capture the flying forms of small insects (greenhouse whitefly, aphids), yellow sticky traps are hung; for thrips – light blue, and for leaf-mining flies – orange-yellow. Pheromone traps can also be used to determine the beginning of the flight of the tomato leaf miner moth, as well as to reduce its population. Leaves and petioles with disease spots, aphid colonies, egg clusters, larvae, mines, etc. are removed, taken out of the greenhouse and destroyed.

Diseases in seedling production

In tomato seedlings damping-off, early blight, leaf mould and grey mould may occur. Cucumber seedlings may be attacked by powdery mildew and downy mildew. Pepper seedlings are also attacked by damping-off and early blight.



Damping-off in seedlings

It occurs in all vegetable crops grown from seedlings – tomato, pepper, cucumber, eggplant, lettuce, etc. It develops year-round in the production of seedlings for the various production directions. It appears when conditions for plant development are unfavourable – low air and soil temperatures, waterlogging, excessive nitrogen fertilization, etc. The pathogens can affect already swollen seeds and cause their rotting. Sometimes they attack very young, not yet emerged sprouts, which die very quickly. Usually these processes take place in the soil and the damage cannot be noticed. Seedlings that emerge under such conditions are poorly established. It is caused by fungi of the genera *Pythium*, *Phytophthora*, *Fusarium*, *Pyrenochaeta lycopersici*, and *Colletotrichum atramentarium*, which have different temperature requirements.

The first diseased plants and the healthy ones around them are removed. The patches are watered with a solution of copper sulphate or ammonium nitrate – 3.0%. The remaining plants are treated with registered fungicides – Beltanol 400 g/da, Rival 300 ml/m³; Propplant 722 SL 5 ml/m²; application of biological products Trichodermin or Fuzaclin; use of resistant rootstocks. In case of established root rot in transplanted crops, similar practices are applied.



Early blight (*Alternaria porri* f. sp. *solani*)

The occurrence of this pathogen is observed at high air humidity. Small watery spots appear on tomato and pepper leaves, reaching 5-7 mm in diameter. Later they dry out, become dark brown to black, with a concentric structure, merge and the leaf scorches. The spots on the stem and petioles are similar, with the characteristic

concentric structure. At high relative air humidity the affected areas are covered with a black coating of the fungus sporulation.

Control: Seed disinfection; Production of seedlings in sterile or disinfected substrate; Maintenance of an optimal temperature and humidity regime in cultivation facilities; Regular ventilation of the facilities; Treatment with PPPs upon occurrence or in the presence of favourable conditions;

Authorised PPPs: Difcor 250 SC 50 ml/da; Zoxis 250 SC 70-80 ml/da; Karyal Star 60 ml/da; Captan 80 WG 150-190 g/da; Ortiva Top SC 100 ml/da; Polyram DF 0.2%; Sinstar 70-80 ml/da; Score 0.05%; Cidely Top 100 ml/da.



Leaf mould (*Fulvia fulva*)

On the upper side of the leaves relatively large, light spots of irregular shape with indistinct borders appear. Later they turn yellow. At high air humidity their lower surface is covered with a light coating of the fungus sporulation, which later darkens and becomes velvety brown. When the number of spots on a leaf is significant, they merge and the leaf scorches. Under favourable conditions the plants may defoliate. The disease develops at high air humidity.

Control: Cultivation of resistant varieties; Maintenance of optimal air humidity in the seedling compartment; Regular ventilation; Destruction of plant residues and weeds, as the pathogen survives in them. If necessary –

treatment with PPPs.

Authorised PPPs: Zoxis 250 SC 70-80 ml/da; Ortiva Top SC 100 ml/da; Sinstar 70-80 ml/da; Score 250 SC 0.05%; Cidely Top 100 ml/da.



Grey (Botrytis) mould (*Botrytis cinerea*)

It attacks plants at all stages of their development. Light brown elongated spots appear on the petioles and tips of the leaf blades. At high air humidity the spots are covered with abundant grey-brown mycelium and sporulation of the fungus. High air humidity is a favourable environment for the development of the disease.

Control: Maintenance of optimal air humidity in the seedling compartment; Regular ventilation; Destruction of plant residues and weeds, as the pathogen survives in them; When pruning side shoots, no parts of the shoots should be left. It is recommended that this be done in sunny weather and after the dew has lifted; The affected plant parts are collected in bags and destroyed outside; At increased air humidity and appearance of the first spots, treatment with PPPs is carried out;

Authorised PPPs: Avalon 200 ml/da; Botrybel 0.4-1.5 l/da; Geox WG 50 g/da; Difcor 250 SC 50 ml/da; Erune 40 SC 200 ml/da; Julieta 250 g/da; Captan 80 WG 150-190 g/da; Laitane 200 ml/da; Polyversum 10-30 g/da; Pretil

200 ml/da; Prolectus 50 WG 80-120 g/da; Serenade ASO SC 400-800 ml/da; Signum 100-150 g/da; Skomrid Aerosol 3 g/da; Switch 62.5 WG 100 g/da; Fontelis SC 240 ml/da; Fungisei 300 ml/da.



Cucumber downy mildew (*Pseudoperonospora cubensis*)

This disease is important in cucumber cultivation throughout the vegetation period. On the upper side of the leaves yellowish spots of irregular shape appear, limited by the venation. In wet weather they are watery, and their lower surface is covered with a loose grey-violet coating of the fungus sporulation. Later the spots increase, merge and the entire leaf scorches. At high air humidity in the seedling compartment the disease can cover the entire plant in a short time and cause its death.

Control: Maintenance of an optimal air and moisture regime. Regular ventilation of the compartment. If possible, turning on the heating in the early hours of the day. Removal of the first diseased leaves and their destruction outside the greenhouse. If necessary, treatment with PPPs.

Registered PPPs: Aliette Flash 0.3%; Bordeaux Mix 20 WP 375-500 g/da; Enervin SC 120 g/da; Erwan SC 250 ml/da; Golbex WG 250 g/da; Golbex WP 250 g/da; Zoxis 250 SC 70-80 ml/da; Infinito SC 120-160 ml/da; Keefol WG 250 g/da; Kilate WP 250 g/da; Kilate WG 250 g/da; Kopranol Duo 250 g/da; Corseit 60 WG 20-30 g/da; Kocide 2000 WG 100-155 g/da; Quantum Rock 300 g/da; Previcur Energy (Prev-Gold) 160-600 ml/da; Polyram

DF 180-200 g/da; Presidium One 83-100 ml/da; Propplant 722 SL 300 ml/da; Ranman Top 50 ml/da; Taegro 18.5-37.0 g/da.



Powdery mildew on cucumber (*Podosphaera xanthii*)

On the leaves small light spots of irregular shape appear, dusted on the upper side with a white powdery coating of the fungus sporulation. Later the spots merge. The leaves scorch. Spots can be observed on both the upper and lower leaf surfaces and on the petioles. In cases of severe infestation, plants become defoliated. It occurs under limited light and low air humidity. The winter months are favourable for its appearance.

Control: Cultivation of resistant varieties; Cleaning of plant residues from the previous vegetation; Balanced nitrogen fertilization; Maintenance of an optimal temperature and humidity regime; Treatment with PPPs upon appearance of the first spots;

Authorised PPPs: Vivando 20 ml/da (0.02%); Dagonis 60 ml/da; Domark 10 EC 50 ml/da; Eminent 125 ME (Rivior) 40 ml/da; Zoxis 250 EC 70 ml/da; Carbicure 300 g/da; Kozavet DF 500 g/da; Collis SC 40-50 ml/da; Custodia 50-100 ml/da; Legado 80 ml/da; Limocide 800 ml/da; Ortiva Top SC 100 ml/da; Polyversum 10-30 g/da; Previcur Energy (Prev-Gold) 160-600 ml/da; Sivar 80 ml/da; Score 250 EC 0.05%; Sonata SC 500-1000 ml/da; Taegro 18.5-37.0 g/da; Topas 100 EC 35-50 ml/100 l; Trezin 80 ml/da; Trunfo 80 ml/da; Cidely Top 100 ml/da; Phytosev 200 ml/da; Flint Max 20 g/da; Fontelis SC 240 ml/da; Fungisei 300 ml/da;

Pests in seedling production

A large proportion of the pests that damage seedlings in compartments are polyphagous. Sucking insects such as aphids, thrips and whiteflies are often vectors of viral diseases. These circumstances pose risks that, if plant protection measures are not carried out in a timely manner, the infection may be transferred to the production areas. The following pests damage seedlings:



Greenhouse whitefly (*Trialeurodes vaporariorum*).

The larvae, nymphs and adults cause damage. They suck sap mainly from the lower side of plant leaves. During feeding, the larvae excrete large amounts of sugars in the form of „honeydew”, as a result of which the leaves become sticky. Sooty mould fungi develop and the physiological processes of the affected plants are disturbed.

Control: To monitor the occurrence and population density of whitefly, yellow sticky traps or tapes should be used; Upon appearance of the first individuals, treatment with PPPs is carried out.

Authorised PPPs: Abanto 75 ml/da; Azatin EC 100-150 ml/da; Brai 50-112.5 ml/da; Limocide 400 ml/da; Krisant EC 75 ml/da; Natur Breaker 75 ml/da; Niimik Ten 390 ml/da; Oikos 100-150 ml/da; Pyreguard 75 ml/da; Previcur Energy (Prev-Gold) 160-600 ml/da; Requiem Prime 500-1000 ml/da; Sivanto Prime 56 ml/da; Dekka EC (Desha

EC, Dena EC, Poleci, Decis, Deltin) 30 ml/da; Expedient 10 EC 50-80 ml/da; Closer 120 SC 20 ml/da; Mulligan 25-95 ml/da; Naturalis 75-100 ml/da; Flipper 1-2 l/da; Harpun 50-112.5 ml/da.



Aphids (*Aphididae*)

Adults and larvae cause damage by sucking sap from the lower side of leaves, the growing tip and stems of plants. They prefer young, succulent and fresh tissues. In cases of mass infestation, the leaves curl strongly and become deformed. The plants lag in their development. On the “honeydew” secreted by aphids, saprophytic sooty mould fungi develop. Aphids are vectors (carriers) of viral diseases.

Control. Upon detection of the first individuals in the seedlings, treatment with PPPs should be carried out; The last treatment is carried out immediately before planting in the permanent place; Destruction of weed vegetation in and around the beds, which is a reservoir for preservation and a source of viral infection.

Authorised aphicides: Azatin EC 100-150 ml/da; Ampligo 150 ZC 20 ml/da; Delmur 50 ml/da; Deltagri (Deltafar) 30-50 ml/da; Deka EC (Desha EC, Dena EC, Deltin, Decis, Poleci) 30 ml/da; Closer 120 SC 20 ml/da; Lamdex Extra 28-60 g/da; Meteor 60-70 ml/100 l water; Niimik Ten 390 ml/da; Oikos 100-150 ml/da; Sivanto Prime 45 ml/da; Skato 30-50 ml/da; Teppeki/Aphinto 10 g/da; Flipper 1-2 l/da; Flipper 1-2 l/da; Shirudo 15 g/da.



Thrips: onion (tobacco) and western flower (*Thrips tabaci*, *Frankliniella occidentalis*)

In seedling production mainly onion (tobacco) thrips (*Thrips tabaci*) and Californian thrips (*Frankliniella occidentalis*) occur. Adults and larvae cause damage by sucking sap from the leaves and the growing tip. At the sites of damage small, silvery white spots with black dots appear. At high population density the spots increase and merge. The leaves dry out. The plants lag in their development. The nymph stage of the pest occurs in the soil, and the eggs are laid in the leaf tissue. Thrips transmit the viral disease tomato spotted wilt (bronzing).

Control: For monitoring, blue sticky traps should be used, which, in greater numbers, reduce pest density; Upon occurrence, treatment with PPPs is carried out.

Authorised PPPs: Azatin EC 100-150 ml/da; Deka EC (Deltin, Dena EC, Desha EC, Decis, Poleci) 30 ml/da; Dicarzol 10 SP 556 g/da; Exalt 200-240 ml/da; Lamdex Extra 28-60 g/da; Limocide 800 ml/da; Niimik Ten 390 ml/da; Oikos 100-150 ml/da; Requiem Prime 500-1000 ml/da; Sineis 480 SC – 10-37.5 ml/da; Meteor 60-70 ml/da; Naturalis 100-150 ml/da; Flipper 1-2 l/da.



Tomato leaf miner (*Tuta absoluta*)

The caterpillars cause damage. They prefer leaves most of all. Symptoms of the presence of the moth are short and wide mines on the leaves, in which caterpillars and excreta located at one end can be seen. In cases of severe infestation, the mines merge and the leaves dry out.

Control: Use of pheromone traps and black sticky boards for timely detection of the pest, reduction of its population density and implementation of adequate control measures. At low population density, one of the biological agents *Macrolophus pygmaeus* or *Nesidiocoris tenuis* may be released. Upon detection of the first individuals, treatment with PPPs is carried out.

Authorised PPPs: Azatin EC 100-150 ml/da; Altacor 35 WG 8-12 g/da; Ampligo 150 ZC 40 ml/da; Affirm 095 SG 150 g/da; Voliam Targo 063 SC 80 ml/da; Beltirul 50-100 g/da; Delmur 50 ml/da; Dipel DF 75-100 g/da; Exalt 200-240 ml/da; Coragen 20 SC (Voliam) 14-20 ml/da; Niimik Ten 390 ml/da; Neem Azal T/S 0.3%; Rapax SBS 100-200 ml/da; Sineis 480 SC 10-25 ml/da.

Although less frequently, damage from cutworms and leaf-mining flies may be observed on seedlings; at high temperatures and drought in the seedling compartments there may also be infestation by the two-spotted spider mite.

All requirements for application (registered PPPs, quality spraying, dosages, pre-harvest intervals), transport and storage of plant protection products must be observed. Hygienic and sanitary standards for working with toxic substances must be complied with. A treatment log must be kept in accordance with the requirements of the Bulgarian Food Safety Agency (BFSA).

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