Agricultural Marketing and Commercialization Journal
8(1), 70-75, 2024, ISSN Print: 2676640X, ISSN online: 2676-7570

A review of cucumber damping-off disease management in Iran

Laleh Naraghi [1]

Received: 17 Nov 2023/ Revised: 25 Feb 2024/ Accepted: 30 Mar 2024/ Published: 1 Jun 2024

Abstract

Damping-off is actually a general term for several diseases with similar symptoms that attack new plant seedlings and are caused by several pathogenic soil fungi, including Pythium, Phytophthora, Fusarium, and Rhizoctonia. In Iran, the damping-off disease of summer crops is known by the local names of dry green, scorching, and water-affected, and is a major disease of cucumbers, melons, watermelons, and pumpkins. This disease has been prevalent in all cultivation areas of these plants, including Khuzestan, Isfahan, Fars, Kerman, Jiroft, Tehran, Varamin, Saveh, Kashan, Lorestan, Qazvin, Hamadan, Khorasan, Bandar Abbas, Azerbaijan, and Mazandaran. Agricultural, chemical, and biological control methods are applied in the management of cucumber damping off. In general, a review of the research showed that the use of chemical and biological pesticides is a very suitable solution to control plant rot, because if it is not controlled in time, it can destroy the entire crop and cause irreparable damage to the greenhouse or farm owner.

Keywords: Cucumber, Damping-off disease, Management.

Introduction

Cucumber (*Cucumis sativus*) mainly originates from India and China, which was then domesticated in Europe (Wien, 1997). Cucumber is considered one of the major summer crops in Iran and many other countries. This herbaceous plant belongs to the Cucurbitaceae family, containing 118 genera and 825 species. Cucumber is cultivated in a wider area than the other genera of the Cucurbitaceae family (Wien, 1997).

According to the latest statistics, Iran ranks fourth in terms of cucumber production in the world. In Iran, cucumber ranks third with about 22.2% among the harvesting level of summer crops, while it ranks second with 20.9% among summer crop production (Mousapour & Saadat, 2018).

This disease is one of the most destructive diseases of cucumber and it is prevalent in most cold, hot, and temperate regions as well as greenhouses and plasticulture (Moorman et al., 2002). In this disease, plant tissue is sunken, especially in the crown area. The shrinking area is initially hard and felt and gradually becomes soft. This disease results in the rapid destruction of xylems, particularly in the crown area, and the plant dies while it is completely healthy and fresh.

[1] Department of Plant Diseases Research, Iranian Research Institute of Plant Protection, Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran, https://orcid.org/0000-0001-5767-2498, Email: lale_naraghi@yahoo.com

The most important pathogenic agents of this disease include *Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia*. Based on the literature, this disease is managed using agricultural, chemical, and biological methods, separately or by integrated management (Etebariyan, 2011) and (Lori et al., 2015).

Symptoms

The symptoms of cucumber damping-off on the root are soft rot and the appearance of brown or olive-colored wounds. Other symptoms, such as wilting, stunted growth, and finally seedling plant drying are also seen with the root infection (Figure 1). The disease symptoms on the fruit can be seen when the fruit is in contact with the soil surface (Figure 2).

Figure 1. Symptoms of cucumber damping-off disease: soft root rot, wilting, stunted growth, and plant drying

Figure 2. Symptoms of cucumber damping-off disease on fruits

Causative agents of the disease

Pythium spp. and *Phytophthora* spp.

Oomycetes of *Phytophthora* spp. and *Pythium* spp. usually attack the roots and crowns of plants and cause heavy damage to vegetables, crops, and trees. *Pythium* and *Phytophthora* usually infect the plant in the early growth stages. The symptoms appear as a soft rot or a soft and watery tissue with dark brown to black juice that quickly spreads throughout the entire seedling or sprout. Ultimately, they block the crown xylems and cause the plant wilt and death (Figure 3). The

Agricultural Marketing and Commercialization Journal
8(1), 70-75, 2024, ISSN Print: 2676640X, ISSN online: 2676-7570

oomycete species causing this disease include *Pythium aphanidermatum*, *P. debaryanum*, *Phytophthora dreschleri*, and *P. capsica*.

Figure 3. Cucumber damping-off caused by *Pythium* and *Phytophthora*

Fruits of many plants, such as cucumber, cabbage, and potato, are attacked by *Pythium* during transportation or storage. The outer surface of such fruits is covered with fungal mycelia, with a watery inner surface (Figure 2).

Fusarium sp.

Pathogenic strains of this fungus cause vascular wilt and root rot diseases. It infects different types of vegetables and crops around the world.

Cucumber is the exclusive host of *F. oxysporum* f. sp. *cucumerinum* strain. Infected plants present various symptoms, the most important of which is vascular wilt. Other symptoms include yellowness, necrosis, dwarfing, and browning of xylems (Figure 4) because this fungus is active inside the xylems.

Figure 4. Cucumber damping-off caused by *Fusarium*

Rhizoctonia solani

Disease symptoms vary depending on the age of the plant. If the seed of a vulnerable plant is sown in soil contaminated with *Pytium*, *Rhizoctonia*, etc., it will rot without sprouting, or it sprouts, and its seedling is attacked and destroyed before emergence from the soil. The seedling is very vulnerable and prone to fungal penetration because its rigidity tissue is still incomplete. Therefore, a symptom of infection with this disease is the non-emergence of sown seeds. All the aforementioned symptoms occur in a stage of the disease called pre-emergence damping off (Figure 5).

Figure 5. Different symptoms of *Rhizoctonia*-induced damping-off disease in the seedling pre-emergence from the soil. From right to left: seed rot, pre-emergence seedling damping off from the soil, and no seed germination.

Seedling death may occur after emergence from the soil. In this case, the area of crown and root becomes rotten and very thin so that the thinned part will not bear the weight of the seedling aerial part and, consequently, it rots after falling to the ground. This stage of the disease is called post-emergence damping off (Figure 6).

Figure 6. Symptoms of post-emergence damping-off caused by *Rhizoctonia*

Cucumber damping-off disease management

Cropping control method:
- Sowing seeds in disinfected soil and a sterile and clean planting bed
- Pre-sowing seed disinfection
- Reduction of the irrigation frequency and sowing seeds at a suitable distance in the soil
- Placing the seedling tray on a platform for proper ventilation
- Prevention of the disease agent transfer to the greenhouse by observing the hygiene principles, including the presence of a lime

pan at the greenhouse entrance to disinfect shoes.
- Soil disinfection with hot water vapor or sunlight on hot summer days
- Humidity and temperature control in the greenhouse
- Assuring manure putrefaction
- Avoidance of overly nitrogen fertilization in the soil
- Observing crop rotation and land fallow

Chemical control method

To control cucumber damping off disease, the fungicides granular 5% Redoxil® and Ridomex® (Metalaxyl), 72% powder and tablet Mencolaxil® (Metalaxil + Mancozeb), Downey G® 72% powder and tablet (Metalaxil + Mancozeb), and 84% liquid Procor Energy® (fustil aluminum + propamocarb hydrochloride) should be used at two times, after the cotyledon stage with the appearance of the first true leaf and the two-leaf time.
The doses of Redoxyl GR 5% (Metalaxyl), Ridomex GR 5% (Metalaxyl), powder and tablet Downy G® 72% (Metalaxyl + Mancozeb), Procor Energy® liquid 84% (fustil aluminum + propamocarb hydrochloride), and powder and tablet fungicide Mencolaxil ® Vetabal Powder 72% (Metalaxil + Mancozeb) are respectively recommended at 2/3000, 3/1000, and 1.5/1000 (Nourbakhsh, 2014).
Based on the estimates, the doses of granular fungicides (Redoxil/Ridomex) and Mancolaxil will be respectively 2 and 1.5 g/m^2 in their direct soil application without increasing their volume with water (Naraghi et al., 2020).

The chemical control method requires the following considerations:
- The minimum interval between spraying and harvesting is 7 days.
- It is recommended to cultivate summer crops in light soils, rotation with cereals, removal of weeds, and destruction of infected plant residues.
- The water level should be lower than the crown area, and it is necessary to avoid the direct contact of water with the plants.
- Attempts should be made to reduce the irrigation water volume and increase the frequency of irrigation.
- In greenhouse crops, plants are cultivated on the stack, and it is preferable to use drip irrigation (Nourbakhsh, 2014).

Biological control method

The use of commercial biological fungicides named Trianum-P® containing the disease inhibitor *Trichoderma harzianum* T22 and Polyversum® containing the disease inhibitor *Pythium oligandrum* with water-soluble powder formulation (WP). The first application is 30 g for every 1000 plants at the transplantation time, and it is repeated immediately 20 days after transplantation. It protects the plant from soil pathogens, such as *Pythium* and *Fusarium*, and increases the plant's resistance against existing stresses (Ameri, 2015) and (Azimi & Naeimi, 2019).

Conclusion

In general, it can be concluded that the following solutions are suitable for managing cucumber damping off disease:
1- One of the ways to combat cucumber wilt is to use resistant cultivars.

2- Removing plant residues at the end of cultivation can be effective. Because the fungus can survive in plant remains for years.
3- Using the method of soil disinfection using sunlight (soil solarization) in sunny areas can reduce the population of this fungus and other soil fungi and plant parasitic nematodes.
3- Drainage of wet soils, keeping pH at 6-7 and reducing soil nitrogen levels are effective in disease control.
4- Crop rotation with other crops is also recommended. If pumpkins are planted in the same field one after the other, the soil becomes more polluted than before and the problem of bush dying increases every year.
5- Avoiding excessive watering is effective in controlling this disease.
6- Ridomil systemic fungicide is used for chemical fight against this disease. This poison is available in the form of granules in the market, which can be sprinkled on the soil and then watered.
7- The use of antagonistic bacterial and fungal microorganisms.

References

- Ameri V. (2015). Technical guidelines for integrated management of greenhouse cucumber damaging agents. Publications of the Iranian Research Institute of Plant Protection.
- Azimi H. & Naeimi Sh. (2019). Effectiveness of the *Pythium oligandrum* (Polyversum®) commercial formulation in controlling cucumber seedling damping off with the *Pythium ultimum* agent. Journal of Pesticides in Plant Protection Sciences, 6(2):159-171.
- Etebariyan HR. (2011). Vegetable and summer crop diseases and control methods, Tehran University Publications, 4th edition.
- Lori Z. & Pourkhaton MR. & Farid S. (2015). Seedling damping off and death in Cucurbitaceae, Kerman Agricultural Extension Coordination Management, Extension Media Department.
- Moorman GW. & Kang S. & Geiser DM. & Kim SH. (2002). Identification and characterization of pythium species associated with greenhouse floral crops in Pennsylvania. Plant Disease, 86(1): 1227-1231.
- Mousapour S. & Saadat J. (2018). The identity of bush and vining cucumber. Ministry of Industry, Mine, and Trade, Iran Trade Development Organization, Deputy for Export Development of Goods and Services, Agricultural Products Export Coordination Office.
- Nourbakhsh S. (2014). A list of important pests, diseases, and weeds of major crops, and recommended poisons and control methods. Publications of the Plant Protection Institute.
- Naraghi L. & Rastegar M. & Dehghan L. & Azimi H. & Almasi H. (2020). Efficacy of redoxil and ridomex GR 5% (metalaxyl) and mancolaxyl WP 27% (matalaxyl+mancozeb) fungicides in controlling cucumber seedling damping-off diseases caused by Pythium aphanidermatum. Plant Archives, 20(2):3277-3284.
- Wien HC. (1997). The cucurbits: Cucumber, Melon, Squash and Pumpkin. In the Physiology of Vegetable Crops. CAB International, H.C. Wein Ed., 345-386.