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PHYTOPHTHORA DISEASE OF TOMATO AND ITS CONTROL

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ABSTRACT
Phytophthora disease of Solanum lycopersicum L. is one of the most widespread and economically damaging diseases of the tomato plant. Under the influence of the disease, productivity can decrease up to 10-50%, and in epiphytotia up to 100%. The disease begins during flowering and damages the leaves, stems and fruits of the plant. This article presents the results of our research on the application of Vinkozeb 80% w.p. fungicide against phytophthora disease of tomatoes in the open field.
KEY WORDS: *tomato, disease, phytophthora, fungus, phytophthora infestans, disease control.*

INTRODUCTION

Fungi are one of the main pathogens of plant diseases. There is a variety of methods for pathogenic fungi to reproduce, spread, and cause disease in plants. Some fungi kill the host plant and feed on dead matter (necrotrophs), while others thrive on living tissue (biotrophs). Fungi use virulence factors to reproduce and spread within the host plant. Depending on the method of infection, virulence factors perform different functions. Almost all pathogens destroy the primary defenses of plants, while necrotrophs produce toxins to kill plant tissues [21; 23].

Tomato is the second most important vegetable crop in the world and its production is the main branch of agriculture [15]. Phytophthora disease of tomato, caused by the oomycete pathogen *P. infestans,* is one of the most destructive diseases of tomatoes grown in field conditions [10; 26]. Phytophthora is common in many countries and is a major threat to tomato production [10]. For example, phytophthora disease caused a large economic loss in the production of tomatoes in Mongolia, China, and the United States of America in the early 2000s [11; 27].

LITERATURE REVIEW

Phytophthora infestans (Mont.) de Bary is not a true fungus, but a fungus-like organism. This pathogen is currently classified as an oomycete, a member of the order Chromista (Stramenopiles or Straminopiles). Oomycetes belong to one of two orders, *Saprolegniales* and *Peronosporales*. The order *Personosporales* includes species of *Phytophthora* and a number of other highly important phytopathogens, including the genus *Pythium*. *P.infestans* is widespread worldwide, but the most severe epidemic often occur in regions with cool, humid climates [16]. The annual yield loss due to phytophthora is 10-50%, and in epiphytotia it can be up to 100% [1].

Plant pathogens can be classified as biotrophs, hemibiotrophs, or necrotrophs based on their infestation strategy. Biotrophic pathogens are reproduced inside the tissue and feed on living tissue, while necrotrophs destroy host plant tissue and feed on dead cells [13; 28], oomycetes such as *Phytophthora infestans* are hemibiotrophic pathogens, exhibiting an initially asymptomatic biotrophic phase followed by a necrotrophic phase. In the biotrophic phase, *P.infestans* successively forms appressoria, primary and secondary hyphae, and finally special structures called haustoria, through which proteins and small molecules called effectors are delivered to neighboring plant cells [12; 14; 28]. These effectors allow pathogens to control host plant metabolism and overcome its defense mechanisms [8; 25; 28]. The next necrotrophic phase is characterized by branching of the hyphae, followed by tissue hydration and necrosis [14; 28].

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The disease begins at the stage of flowering of the plants. The leaf bands are bent down and the leaves hang down; scald-like spots appear on the leaves, which then turn brown or dark brown, and later the leaf tissue becomes slightly pale and papery. In wet weather, a soft, thin, oozing layer of mold appears around the spots on the underside of the leaves. In high humidity and warm temperatures, the leaves can completely rot and almost all plants can die. When the flowers are infected, the corollas and sepals darken and wither. Elongated or variably shaped, reddish-brown spots develop on the affected shoots, the leaves and shoots appear burnt. Hard, irregularly shaped, brown spots and wounds appear on the fruits. Such fruits quickly rot completely under the influence of secondary microorganisms. High humidity (rain, dew) and cool temperature (10-25^{o}C) are favorable conditions for the development of the disease [7].

RESEARCH METHODS AND EXPERIMENTAL SITE

We conducted our experiments in 2022 in the fields of the "Kibray Salar Fayz" farm in Kibray district of Tashkent region. Fungicide spraying was carried out in the open tomato fields where phytophthora was spread, on June 10, 25 and 10, 2022, with the consumption of 300 liters of working solution per hectare. It was taken into account that the air temperature would be 25ºC and the wind speed would be 1-2 m/sec.

In the experiment, we applied the fungicide Vinkozeb 80% w.p. containing 800 g/kg of Mankozeb at the rate of 1.2 - 1.6 kg/ha and as a standard fungicide Pennkozeb 80% w.p. at the rate of 1.6 kg/ha against phytophthora disease of tomato by spraying during the growth period.

Prevalence of the disease was found according to the following formula:

$$P = \frac{n \cdot 100}{N}, \text{ here}$$

P - prevalence of disease,% ;
n - number of infected plants, piece;
N - total number of sampled plants, piece [3; 4; 5; 6; 9; 17; 18; 19; 20;].

Disease progression was calculated by the following formula:

$$R = \frac{\Sigma(a \times b) \bullet 100}{N \bullet K}$$

here, R – disease progression %; Σ(a • b) – the sum of the number of plant parts affected by the disease multiplied by the number of their points; N – total number of observed plant parts; K – the highest point in the scale [3; 4; 17; 18; 19; 20; 21; 22; 24].

The disease index was determined according to the following empirical formula:

$$К_и = T \bullet P/100$$

here, $К_и$ – disease index;
T – disease prevalence, %;
P – disease progression, %.

Biological efficiency of fungicides was determined by the following formula:

$$C = \frac{(Ab - Ba)}{Ab} * 100, \text{ here}$$

C – biological efficiency of fungicides, %;
Ab – disease progression in control option, %;
Ba – disease progression in experimental option, % [3; 4; 5; 6; 9; 17; 18; 19; 20; 21; 22; 24].

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RESEARCH RESULTS AND THEIR DISCUSSION

As a result of our research, it was found that the prevalence of the disease in the control variant was 34.8% in the leaf, 28.3% in the stem, 32.2% in the fruit, and the development of the disease was 13.3% in the leaf, 11.6% in the stem, and 12.4% in the fruit (Table 1).

Table – 1
Biological efficiency of Vinkozeb 80% w.p. against the Phytophthora disease of tomato

№	Preparations	Consumption rate, kg/ha	Infected parts	Disease prevalence, %	Disease progression, %	Biological efficacy, %
1	Vinkozeb 80% w.p.	1,2	leaves	12,8	1,8	86,5
			shoots	11,3	1,6	86,2
			fruits	11,8	1,6	87,1
2	Vinkozeb 80% w.p.	1,6	leaves	13,2	1,2	91,0
			shoots	11,7	1,1	90,5
			fruits	12,5	1,0	91,9
3	Pennkozeb 80% w.p. standard	1,6	leaves	13,1	1,7	87,2
			shoots	11,7	1,5	87,1
			fruits	12,4	1,4	88,7
4	Control – fungicide free	-	leaves	34,8	13,3	-
			shoots	28,3	11,6	-
			fruits	32,2	12,4	-

In the experimental option, the highest biological efficiency was observed in the variant treated with fungicide Vinkozeb 80% w.p. at a rate of 1.6 kg/ha. In this case, the disease progression was 1.2% in the leaf, 1.1% in the stem, 1.0% in the fruit, and the biological efficiency was 91.0% in the leaf, 90.5% in the stem, and 91.9% in the fruit. In the variant treated with this fungicide at the rate of 1.2 kg/ha, the biological efficiency was 86.5% in the leaves, 86.2% in the stem, and 87.1% in the fruit.

In the option treated with fungicide Pennkozeb 80% w.p. taken as a standard preparation, at a rate of 1.6 kg/ha, disease progression was 1.7% in leaf, 1.5% in stem, 1.4% in fruit, and biological efficiency was 87, 2% in leaf, 87.1% in stem and 88.7% in fruit.

Many researchers have tested different means of control against phytophthora. In particular, O.A. Palastrova tested the fungicide Ridomil Gold MS w.d.g containing 640 g/l of Mankozeb and 40 g/kg of Mefenoxam at a consumption rate of 2.5 kg/ha against phytophthora disease of tomatoes in the open field in the Kurgan region and this application showed high biological efficiency and the total yield was 297.7 tons/ha [2]. In our research also, it can be seen that preparations containing Mankozeb have a strong effect against phytophthora of tomatoes.

CONCLUSION

Phytophthora is considered one of the most dangerous diseases of tomatoes, and if timely control measures are not taken, the yield can be significantly reduced. When the first symptoms of phytophthora disease appear in tomato fields, the initial treatment with fungicide Vinkozeb 80% w.p. at the rate of 1.6 kg/ha and the second treatment after 15 days and the third treatment after 30 days will stop the development of the disease. With the application of this fungicide against tomato phytophthora disease, it is possible to achieve a high yield of tomatoes.

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LIST OF REFERENCES

1. *Нековаль С. Н. и др. Оценка устойчивости коллекционных образцов томата к фитофторозу Phytophthora infestans (mont.) de bary //ББК-44 Б-63. – 2016. – С. 441.*
2. *Паластрова О. А. Болезни томата и обоснование мер борьбы с ними в условиях Курганской области //Вестник Курганской ГСХА. – 2018. – №. 4 (28). – С. 22-29.*
3. *Содиков Б. С. и др. Применение новых фунгицидов в защите растений //Journal of Agriculture & Horticulture. – 2023. – Т. 3. – №. 1. – С. 13-18.*
4. *Содиқов Б. С. Янги фунгицидларнинг биологик самарадорлигини ўрганиш //Yangi O'zbekistonda milliy taraqqiyot va innovasiyalar. – 2022. – С. 380-385.*
5. *Содиқов Б., Хамираев У., Омонлиқов А. Применение новых фунгицидов в защите растений. Общество и инноваtsiи. 2, 12/S (фев. 2022), 334–342. – 2022.*
6. *Хамираев У. К., Содиков Б. С. Защита картофеля от фитофтороза //Актуальные проблемы современной науки. – 2021. – №. 1. – С. 91-97.*
7. *Ҳасанов БА О. Р. О., Гулмуродов Р. А. Сабзавот, картошка ҳамда полиз экинларининг касалликлари ва уларга қарши кураш //Ўқув қўлланма. Тошкент:"Voris-Nashriyot. – 2009. – Т. 244.*
8. *Abramovitch, R.B. and Martin, G.B. (2004) Strategies used by bacterial pathogens to suppress plant defenses. Curr. Opin. Plant Biol. 7, 356–364.*
9. *Bahrom S., Ural K., Alisher O. Application of New Fungicides Against the Diseases of Agricultural Crops //Бюллетень науки и практики. – 2022. – Т. 8. – №. 2. – С. 110-117.*
10. *Cui J. et al. LncRNA33732‐respiratory burst oxidase module associated with WRKY1 in tomato‐Phytophthora infestans interactions //The Plant Journal. – 2019. – Т. 97. – №. 5. – pp. 933-946.*
11. *Cui, J., Xu, P., Meng, J., Li, J., Jiang, N. and Luan, Y. (2018) Transcriptome signatures of tomato leaf induced by Phytophthora infestans and functional identification of transcription factor SpWRKY3. Theor. Appl. Genet. 131, 787–800.*
12. *Dou, D., Kale, S.D., Wang, X., Jiang, R.H., Bruce, N.A., Arredondo, F.D., Zhang, X. and Tyler, B.M. (2008) RXLR‐mediated entry of Phytophthora sojae effector Avr1b into soybean cells does not require pathogen‐encoded machinery. Plant Cell, 20, 1930–1947.*
13. *Glazebrook, Jane. "Contrasting mechanisms of defense against biotrophic and necrotrophic pathogens." Annu. Rev. Phytopathol. 43 (2005): 205-227.*
14. *Grenville‐Briggs, L.J., Avrova, A.O., Bruce, C.R., Williams, A., Whisson, S.C., Birch, P.R. and van West, P. (2005) Elevated amino acid biosynthesis in Phytophthora infestans during appressorium formation and potato infection. Fungal Genet. Biol. 42, 244–256.*
15. *Jiang N. et al. Tomato lncRNA23468 functions as a competing endogenous RNA to modulate NBS-LRR genes by decoying miR482b in the tomato-Phytophthora infestans interaction //Horticulture research. – 2019. – Т. 6.*
16. *Khamiraev U. et al. Phytophthora Potato Disease and Measures to Combat with It in Uzbekistan //XV International Scientific Conference "INTERAGROMASH 2022" Global Precision Ag Innovation 2022, Volume 2. – Cham : Springer International Publishing, 2023. – С. 2168-2178.*
17. *Nelson S. C. Late blight of tomato (Phytophthora infestans). – 2008.*
18. *Sattarovich S. B. et al. Fungal diseases of sunflower and measures against them //PalArch's Journal of Archaeology of Egypt/Egyptology. – 2020. – Т. 17. – №. 6. – С. 3268-3279.*
19. *Sodikov B. Chemical protection of Helianthus annuus L. from Botrytis cinerea Pers //Bulletin of Science and Practice. – 2018.*
20. *Sodikov B. et al. Soil-borne plant pathogenic fungi biodiversity of sunflower //IOP Conference Series: Earth and Environmental Science. – IOP Publishing, 2022. – Т. 1068. – №. 1. – С. 012018.*
21. *Sodikov B. S. Fungal diseases of sunflower and measures to combat them/Sodikov Bahrom Sattarovich //Abstract. dis... PhD. agricultural sciences.-Tashkent. – 2019.*
22. *Sodikov B., Sodikova D., Omonlikov A. Effects of Phytopathogenic Fungi on Plants (Review) // Бюллетень науки и практики. 2022. Т. 8. №4. С. 192-200. https://doi.org/10.33619/2414-2948/77/22*
23. *Sodikova D. G., Sodikov B. S., Mardonov S. U. Taxonomic analysis of micromycetes of the highest plants of the Denau arboretum //IOP Conference Series: Earth and Environmental Science. – IOP Publishing, 2022. – Т.* ***1112****. – №. 1. – С.*

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012120.
24. *Sodiqov B. S. Chemical protection of sunflower from downy mildew //Sidoarjo university (indonesia), universiti utara malaysia (malaysia), Global research network (usa) publishing. http://ojs. umsida. ac. id/index. php/icecrs. Generating Knowladge Through Research. – 2019. – T. 1. – №. 1. – C. 63-65.*
25. *Sodiqov B., Khamiraev U., Omonlikov A. Application of new fungicides in plant protection //Society and Innovation. – 2022. – T. 2. – C. 334-342.*
26. *Tian, M., Huitema, E., Da Cunha, L., Torto-Alalibo, T. and Kamoun, S. (2004) A Kazal-like extracellular serine protease inhibitor from Phytophthora infestans targets the tomato pathogenesis-related protease P69B. J. Biol. Chem. 279, 26 370–26 377.*
27. *Zhang, C., Liu, L., Wang, X. et al. (2014a) The Ph-3 gene from Solanum pimpinellifolium encodes CC-NBS-LRR protein conferring resistance to Phytophthora infestans. Theor. Appl. Genet. 127, 1353–1364.*
28. *Zhang, C., Liu, L., Zheng, Z. et al. (2013a) Fine mapping of the Ph-3 gene conferring resistance to late blight (Phytophthora infestans) in tomato. Theor. Appl. Genet. 126, 2643–2653.*
29. *Zuluaga A. P. et al. Transcriptional dynamics of Phytophthora infestans during sequential stages of hemibiotrophic infection of tomato //Molecular plant pathology. – 2016. – T. 17. – №. 1. – C. 29-41.*