Eco. Env. & Cons. 29 (November Suppl. Issue) : 2023; pp. (S504-S507)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i06s.079

Survey on the incidence of Fusarium wilt of tomato incited by *Fusarium oxysporum* f. sp. *lycopersici* (FOL) in major tomato growing areas of Khordha district, Odisha, India

Bidwan Ranjan Sahoo[1]*, Kartik Chandra Sahu[1], Raghu S.[2], Bignyan Ranjan Sahoo[3] and Sonali Gouda[4]

[1]Department of Plant Pathology, Faculty of Agricultural Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha, India
[2]Division of Plant Pathology, National Rice Research Institute, Cuttack, Odisha, India
[3]Department of Soil Science and Agricultural Chemistry, OUAT, Bhubaneswar, Odisha, India
[4]Department of Fruit Science and Horticulture Technology, OUAT, Bhubaneswar, Odisha, India

(Received 2 June, 2023; Accepted 9 August, 2023)

ABSTRACT

One of the main issues with tomato production is fusarium wilt, often known as vascular wilt or *Fusarium oxysporum* f. sp. *lycopersici*. In order to determine the disease incidence of fusarium wilt in several tomato-growing regions of the Khordha district, Odisha, in the years 2021–22 and 2022–23, a survey was conducted. A total of ten villages (one village from each block) were visited, and each village's five fields were examined. This was done by counting the number of sick or infected plants in each field's randomly chosen five-by-five-meter tomato field. Pichukuli village (25.70%), Jankia village (23.69%), and Jagannathpur village (22.59%) had the highest per cent disease incidence. Nachuni village (16.72%) and Siko (17.28%) had the lowest per cent disease incidence, respectively. The survey's findings showed that there was a disease incidence that was causing output and crop losses for tomatoes.

Key words: *Survey; Tomato, Wilt disease, Fusarium oxysporum f. sp.* lycopersici

Introduction

One of the most widely grown and consumed vegetable crops worldwide is the tomato (*Solanum lycopersicum* L.), which is a member of the Solanaceae family (Pastor *et al.,* 2012). A rather cool, dry temperature is ideal for tomato cultivation, yet it can thrive in all world climatic regions. The quality and productivity of tomatoes are influenced by a variety of biotic and abiotic factors. According to Sahu *et al.* (2013), tomato plants are susceptible to a variety of infections brought on by diverse agents, including bacteria, viruses, nematodes, fungi, and abiotic factors. Fusarium wilt is one of the most most common fungal diseases, is carried by *Fusarium oxysporum* f. sp. *lycopersici* and it causes economic loss of tomato production world wide. *Fusarium oxysporum* f. sp. *lycopersici* is a soil-borne disease that enters the plant through the roots and disrupts the vascular system, causing yellowing, leaf drooping, downward curvature, and ultimately plant death, according to Lukyanenko (1991) and Nirmaladevi *et al.* (2016),

the fungus *F. oxysporum* f. sp. *Lycopersici* is causing a loss of production of up to 80% and may reach 30-40% currently (Lukyanenko, 1991). Foliar chlorosis is one of the first signs of fusarium wilt, and as the disease spreads, the majority of the plant begins to yellow and this causes the plant to wilt and eventually die, either without bearing fruit or with poor fruit production (Baez-Valdez *et al.,* 2010). This discoloration frequently rises high on the stem and is most obvious in a petiole scar. According to Sally *et al.* (2006), infected plants exhibit the light vein clearing of young leaves, followed by the epinasty of old leaves. Yellowing of lower leaves is one of the disease's primary symptoms. Strong indications of Fusarium wilt include browning of the vascular system in infected stems and leaf petioles that are bigger than usual (Fig. 1 and 2); in the stem, a white or pink fungal growth may be seen, particularly under moist conditions (Ajigbola and Babalola, 2013). Early signs of the disease were browning of the vascular system, water movement and transport blockage in the xylem, and severe wilting (Decal *et al.,* 2000). The fundamental requirements for determining the incidence of any disease, the spread of the pathogen population, and for further research into the biology and variability of the pathogen are surveyed.

Fig. 1. Wilting infection on tomato plant

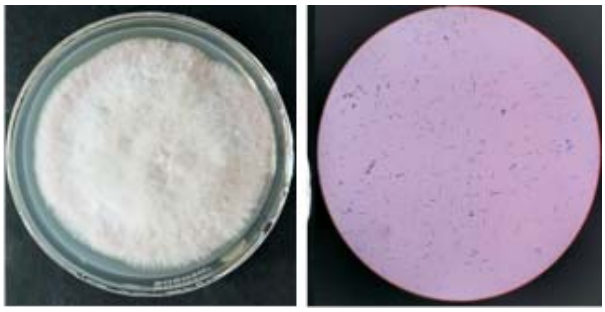
Materials and Methods

To determine the severity of tomato wilt between the years 2021–2022 (October–February) and 2022–2033 (October–February), a survey was conducted in ten distinct tomato-growing areas in the Khordha district of Odisha, including Bhubaneswar, Balianta, Balipatana, Jatni, Khordha, Begunia, Banapur, Tangi, Chilika, and Bolgarh. In total, 10 different villages were assessed across all ten blocks (Table 1 and Fig. 3). The following formula was used to calculate the % disease incidence by counting infected or diseased plants in tomato fields that consisted of each 5×5 m^2 in size, randomly picked from four to five locations in each field (Mayee and Datar, 1986).

$$\text{Disease Incidence\% (PDI)} = \frac{\text{Number of infected Plants}}{\text{Total Number of Plants}} \times 100$$

Results and Discussion

A survey was conducted to determine the severity of tomato wilt during the years 2021–2022 (October–February) and 2022–2023 (October–February) in various tomato-growing areas of the Khordha dis-



Culture of *F. oxysporum* f sp. *Lycopersici* on PDA

Microscopic view of macro-conidia and micro conidia (40x)

Fig. 2. Cultural and morphological structure of *F. oxysporum* f. sp. *Lycopersici*

Table 1. Disease incidence of Fusarium wilt of tomato in different tomato growing area of Khordha district, Odisha

Field No.	Block Name	Village Name	Latitude	Longitude
1.	Bhubaneswar	Malipada	20.287482^{0}N	85.758562^{0}E
2.	Balianta	Jagannathpur	20.332024^{0}N	85.912687^{0}E
3.	Balipatana	Pampalo	20.178585^{0}N	85.941590^{0}E
4.	Jatni	Chhatabara	20.175858^{0}N	85.699248^{0}E
5.	Khordha	Jankia	20.055814^{0}N	85.547289^{0}E
6.	Begunia	Siko	20.059220^{0}N	85.418169^{0}E
7.	Banapur	Nachuni	19.849748^{0}N	85.284356^{0}E
8.	Tangi	Badapari	19.927828^{0}N	85.380030^{0}E
9.	Chilika	Sorona	19.857240^{0}N	85.380688^{0}E
10.	Bolgarh	Pichukuli	20.183547^{0}N	85.377251^{0}E

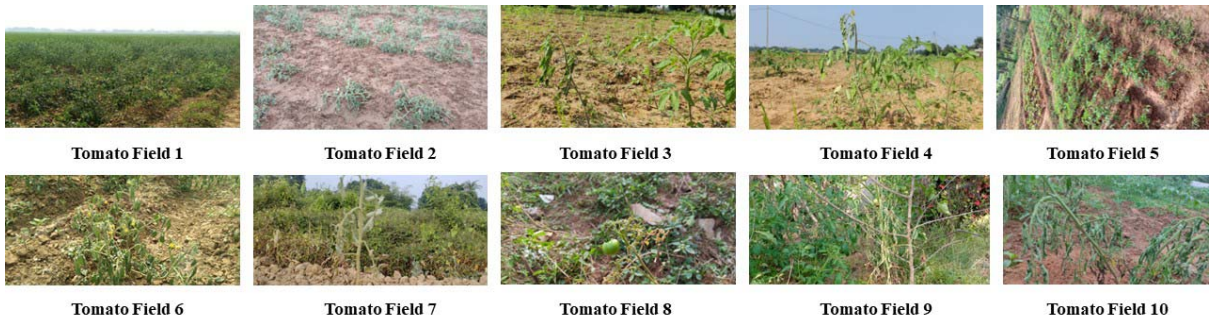


Fig. 3. Different tomato growing area of Khordha district, Odisha

trict in the state of Odisha. This district includes ten blocks: Bhubaneswar, Balianta, Balipatana, Jatni, Khordha, Begunia, Banapur, Tangi, Chilika, and Bolgarh. A total of ten villages, which are listed in the materials and methods and are clear from Table 2 and Fig. 2, were surveyed. The findings revealed that the percent disease incidence of all five districts varied from 15.52% to 25.70% in both the year (Table 2 and Fig. 4).

Blocks in the Khordha district that were examined between 2021 and 2022 revealed a range in the percent disease incidence, from 15.52% (Banapur) to 24.97% (Bolgarh). The villages of Pichukuli (24.97%), Jankia (22.96%), and Jagannathpur (21.56%) had the

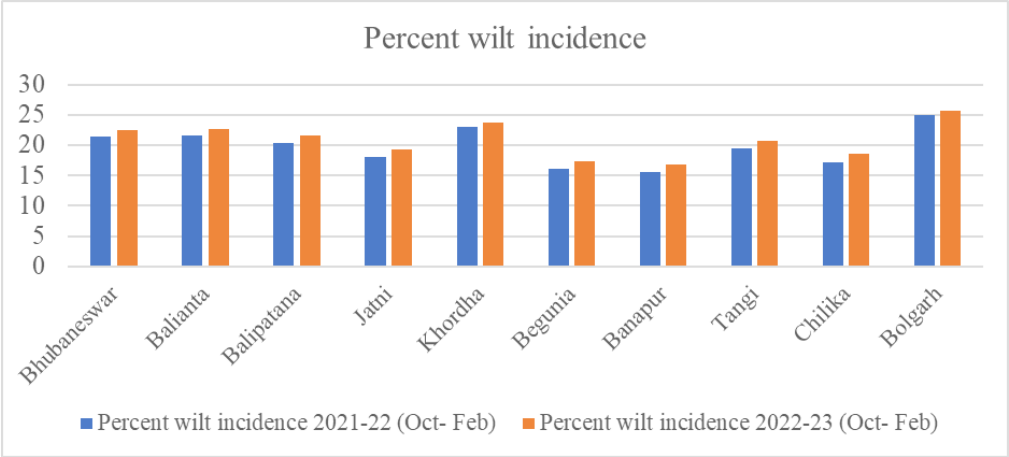


Fig. 4. Fusarium wilt incidence of tomato field in different blocks of Khordha district, Odisha.

Table 2. Fusarium wilt incidence of tomato field in different blocks of Khordha district, Odisha.

Tomato field	Block name	Village name	Percent wilt incidence	
			2021-22 (Oct- Feb)	2022-23 (Oct- Feb)
1.	Bhubaneswar	Malipada	21.39	22.43
2.	Balianta	Jagannathpur	21.56	22.59
3.	Balipatana	Pampalo	20.32	21.59
4.	Jatni	Chhatabara	18.02	19.29
5.	Khordha	Jankia	22.96	23.69
6.	Begunia	Siko	16.08	17.28
7.	Banapur	Nachuni	15.52	16.72
8.	Tangi	Badapari	19.49	20.76
9.	Chilika	Sorona	17.24	18.51
10.	Bolgarh	Pichukuli	24.97	25.70
		C.D. (P= 0.05)	1.15	1.20
		S. Em (±)	0.38	0.40

highest percentages of disease incidence. Nachuni village (15.52%) and Siko (16.08%) had the lowest percentages of disease incidence. The disease incidence in left villages ranged from 17.24% (Sorona) to 21.39% (Malipada).

Ten villages in the Khordha districts showed similar patterns in disease incidence between 2022 and 2023, with rates ranging from 16.72% (Banapur) to 25.70% (Bolgarh). Pichukuli village (25.70%), Jankia village (23.69%), and Jagannathpur village (22.59%) had the highest per cent disease incidence. Nachuni village has the lowest per cent disease incidence (16.72%), followed by Siko (17.28%). The disease incidence in left over villages ranged from 18.51% (Sorona) to 22.43% (Malipada).

Conclusion

It has been determined that one of the primary challenges to tomato production is the Fusarium wilt disease of tomatoes, which is carried by *Fusarium oxysporum* f. sp. *lycopersici* (Sacc.). The survey findings showed severity and prevalence in several tomato-growing regions in the Khordha district of Odisha.

Acknowledgement

The authors are grateful to Dr. Kartik Chandra Sahu, Professor and Head of the Department of Plant Pathology at the Faculty of Agricultural Sciences for providing the required research facilities and Dr. Raghu S., Scientist, ICAR-NRRI, Cuttack, deserve my heartfelt gratitude for their fascinating suggestions and kind companionship. I'm also grateful to my good friends for their constant support and encouragement throughout my course studies. Above all, I paid my highest respects to God for being a constant source of wisdom, strength, and courage in my life.

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