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Occurrence of different diseases of tomato under field condition in Raipur

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Abstract

Tomato is one of the most preferable and extensively grown vegetables in India as well as in Chhattisgarh. The tomato plant is infected with many diseases in its life but they do not occur simultaneously and their development varies with place and season. Therefore a study was undertaken in *rabi* season of three consecutive years (2014-15, 2015-16 and 2016-17) at Horticulture Instruction cum Research Farm, College of Agriculture, Raipur to know the prevalent diseases of tomato, their occurrence pattern and extent of infection. Five diseases *viz.* leaf curl, mosaic, tomato spotted wilt, early blight and collar rot were observed to infect the crop during the investigation. Under Raipur situations the first occurrence of leaf curl, collar rot, mosaic, early blight and tomato spotted wilt were recorded in November, December, December–January, January and January–February, respectively. Leaf curl and early blight were most serious diseases of the crop out of five commonly occurring diseases.

Keywords: Collar rot, early blight, leaf curl, mosaic, tomato.

1. Introduction

Tomato, *Solanum lycopersicum* L. belongs to family Solanaceae (Singh, 2014) [43] is one of the most popular and extensively grown vegetables (Chaudhary *et al.* 2010 and Singh *et al.* 2015) [16, 44] of tropical and subtropical countries (Govindappa *et al.* 2013) [19]. It is a herbaceous, annual, subtropical fruiting plant (Bora *et al.* 2012) [12] which is originated in Latin America and has become one of the most widely grown vegetables with ability to survive in diverse environmental conditions (Ssekya, 2006) [46]. The name tomato probably derived from the word “Tomat” in the Nahuatl tongue of Mexico (Manjunatha, 2008) [25]. In England, tomato is popularly known as “love of apple” while, in India, it is commonly referred as “poor man’s Orange” (Rai and Yadav, 2005 and Mihretu and Bhalekar, 2016) [35, 26]. Worldwide, the tomato ranks second in importance after the potato (Mihretu and Bhalekar, 2016) [26] while it ranks third in priority after potato and onion in India (Anonymous, 2017 and Nadkarni *et al.*, 2017) [6, 27]. In the world, tomato is cultivated over an area of 5.7 million ha with an annual production of 211.80 million metric tonnes and productivity of 37.16 metric tonnes ha⁻¹ (Anonymous, 2016) [7]. In India, it occupies an area of about 0.80 million ha producing over 19.54 million metric tonnes with the productivity of 21.2 metric tonnes ha⁻¹ (Anonymous, 2017) [6]. Diseases are one of the important reasons of low productivity of the crop (Kakati and Nath, 2014) [21]. Tomato is known to susceptible for more than 200 diseases (Shelat *et al.* 2014) [42]. Among them collar rot or Sclerotium wilt; *Sclerotium rolfsii* (Mahato *et al.* 2017) [22], damping off; *Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*, *Sclerotium rolfsii* (Prasad *et al.* 2017) [33], early blight; *Alternaria solani* (Roopa, 2012) [39], *Fusarium* wilt; *Fusarium oxysporum* f.sp. *lycopersici* (Manikandan and Raguchander, 2014) [23], late blight (Olanya *et al.* 2015) [30], *Septoria* leaf spot (Parker *et al.* 1997 and Blum, 2000) [31, 11], bacterial fruit canker; *Clavibacter michiganensis* subsp. *michiganensis* (Ftayeh *et al.* 2010 and Sharabani *et al.* 2013) [18, 41], bacterial wilt; *Ralstonia solanacearum* (Ayana and Fininsa, 2016) [9], bud blight; *Groundnut bud necrosis virus* (Manjunatha *et al.* 2010) [24], leaf curl; *Tomato leaf curl virus* (Shelat *et al.* 2014 and Yadav *et al.* 2014) [42, 48], tomato mosaic; *Tomato mosaic virus* (Alishiri *et al.* 2013) [4], tomato spotted wilt; *Tomato spotted wilt virus* (Sevik and Arli-Sokmen, 2012) [40] and Root knot; *Meloidogyne* spp (Naz *et al.* 2012) [28] are major diseases of tomato (Mahato *et al.* 2017) [22]. But it is not necessary that all these diseases occur at the same time with great extent in one crop season, climatic conditions and location because the climatic

conditions of a particular area favours some specific pathogens and this is the important consideration for the management of disease. Therefore a study was undertaken to know the prevalent diseases of tomato, their occurrence pattern and extent of infection in *Rabi* under Raipur conditions.

2. Material and Methods

A study was undertaken in *Rabi* season of three consecutive years (2014-15, 2015-16 and 2016-17) at Horticulture Instruction cum Research Farm, College of Agriculture, Raipur (Chhattisgarh) to know the prevalent diseases of tomato, their occurrence pattern and extent of infection. The observations on percent disease incidence and percent disease index (PDI) of each disease were recorded at fortnightly interval from ten untreated plots of tomato (cv. Pusa Ruby). Percent disease incidence was calculated by following formula suggested by Nene (1972) [29]:

$$\text{Percent incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

However the disease rating was recorded for each plant of every plot by following rating scales as described in below thereafter percent disease index (PDI) was calculated for each plot by implying formulae suggested by Wheeler (1969) [47].

$$\text{PDI} = \frac{\text{Sum of numerical disease ratings}}{\text{Number of plants observed} \times \text{maximum disease rating}} \times 100$$

2.1 Leaf curl

Disease rating of individual plants was recorded by using a slightly modified visual scale of 0-7, where: 0 = No visible disease symptom; 1 = Top leaves curled only; 3 = Top leaves curled and slight stunting of plant or All leaves curled without stunting; 5 = All leaves curled and slight stunting of plant and 7 = Severe curling of leaves, stunting of plant and proliferation of auxiliary branches (Alegbejo, 1995 and Alegbejo and Banwo, 2006) [3, 2].

2.2 Mosaic

Disease symptoms of mosaic were rated on a scale of 0-5, where: 0 = No symptoms; 1 = Light or dark green mottling or mosaic; 2 = Light or dark green mottling or mosaic with distortion or reduction of younger leaves; 3 = Dark green areas of the mottle often appear thicker and somewhat elevated giving the leaves a blister like appearance with no stunting; 4 = Dark green areas of the mottle often appear thicker and somewhat elevated giving the leaves a blister like appearance with stunting and sometimes yellow mottling of leaves and 5 = Severe stunting of plant with leaves look fern like and sharply pointed and sometimes dark necrotic streaks in stems, petioles, leaves or fruit (Cerkauskas, 2004 and Anonymous, 2012) [15, 8].

2.3 Tomato spotted wilt

A visual disease rating of 1-5 was used, where: 1 = No visible symptoms; 2 = Mild purpling, chlorosis, and limited leaf distortion; 3 = Moderate purpling, chlorosis, and leaf distortion with some plant stunting; 4 = Severe purpling, chlorosis, leaf distortion and plant stunting; 5 = Severe purpling, chlorosis, leaf distortion and extreme stunting (Canady *et al.* 2001 and Sivparsad and Gubba, 2011) [14, 45].

2.4 Early blight

The percent disease index (PDI) of the early blight was recorded according to following scale of 0-9 given by Mayee and Datar, 1986 [25]. Where: 0 = No symptoms; 1 = Small

circular, scattered, brown spots, covering 1 per cent or less of the leaf area; 3 = Spots enlarging, dark brown in colour covering 1 to 10 per cent of leaf area and infection on the lower most leaves of the plant; 5 = Spots enlarging, dark brown in colour covering 11 to 25 per cent of leaf area and infection on the lower most leaves of the plant; 7 = Spots dark brown in colour covering 26 to 50 per cent of leaf area and covering one third of the plant and 9 = Spots uniformly dark brown, coalescing, covering 50 per cent or more leaf area and severe infection on all leaves (Abdussamee *et al.* 2014) [1].

3. Results and Discussions

In field condition the occurrence of prevalent diseases were recorded for *rabi* seasons of three consecutive years (2014-15, 2015-16 and 2016-17). It was recorded starting from the second fortnight of November to the first fortnight of March (Table 1, 2 and 3). Five diseases *viz.* leaf curl, mosaic, tomato spotted wilt, early blight and collar rot appeared during the course of investigation.

3.1 Leaf curl

In *rabi* 2014-15 and 2015-16 the first appearance of leaf curl was observed in the second fortnight of November with low percent disease incidence (4.83 and 7.30) and PDI (1.46 and 2.87). However, in *rabi* 2016-17 the first symptoms of leaf curl was observed in the first fortnight of November with percent disease incidence of 1.67 and PDI of 0.81. In all three *rabi*, the disease progressed up to the first fortnight of March with maximum percent disease incidence (87.66, 79.07 and 87.91) and PDI (64.68, 59.17 and 68.80) (Tables 1, 2 and 3). The ToLCD was present in almost all fields of Belgaum, Dharwad and Haveri districts surveyed with the disease incidence ranged from 4-100 percent in *rabi* and was in severe form ranging from 60 to 100 percent during summer (Reddy, 2006 and Reddy, *et al.* 2011) [38, 37]. Ten fields of Raipur (Chhattisgarh) were selected for the pest surveillance of tomato in *Rabi* 2013-14. The average incidence of leaf curl was recorded from November 2013 to March 2014 with increasing trend and average maximum disease incidence of 10.94 percent was recorded in March 2014 under field condition (Anonymous, 2013-14) [5]. Ehsanullah, (2014) [17] recorded 10.8 to 91.3 percent disease incidence in major tomato growing districts of Karnataka with highest disease incidence of 70.81 percent in Kolar and least incidence of 21.00 percent in Ramanagara district.

3.2 Mosaic

In *rabi* (2014-15, 2015-16 and 2016-17) the first appearance of mosaic was observed in the second fortnight of December in 2014-15 whereas in 2015-16 and 2016-17 the disease was observed in the first fortnight of January and progressed up to the first fortnight of March. Initially the occurrence of the disease started with very low percent disease incidence (0.69, 0.58 and 1.11) and PDI (0.14; 0.32 and 0.38) which increased with increase in age of the plant and reached maximum in the second fortnight of February (4.18, 2.53; 6.75, 6.68; 5.06, 4.92) (Tables 1, 2 and 3).

Ten fields of Raipur (Chhattisgarh) were selected for the pest surveillance of tomato in *rabi* 2013-14. The average incidence of mosaic was recorded from December 2013 to March 2014 with increasing trend and average maximum disease incidence of 12.61 percent was recorded in March 2014 under field condition (Anonymous, 2013-14) [5]. Jalender, *et al.* (2017) [20] conducted a survey in tomato growing areas of Ranga Reddy district during *kharif* 2013 and in Guntur district during *rabi* 2013-14 and recorded natural occurrence of disease incidence which ranged from 6.9 to 15.7 among different Mandals.

3.3 Tomato spotted wilt

In *rabi* the first symptoms of tomato spotted wilt was observed in the first fortnight of January, the first fortnight of February and the second fortnight of January in 2014-15, 2015-16 and 2016-17, respectively with 0.21, 1.53 and 0.96 percent disease incidence and 0.06, 0.94 and 0.23 PDI. The disease continued up to the first fortnight of March and maximum percent disease incidence (1.52, 2.01 and 3.01) and PDI (0.76, 1.88 and 2.41) were recorded in the second fortnight of February (Tables 1, 2 and 3).

Pattaiya, (2006) [32] carried out survey and surveillance of tomato spotted wilt virus disease at fields of three locations *viz.* Panagar, Jabalpur and Indrana to determine the incidence of virus. A total of five thousand and sixty tomato plant samples from five varieties *viz.* Pusa early dwarf, JT 99, Pusa ruby, Sourabh and Abhisek were observed for tomato spotted wilt virus. Overall 18 to 34, 15 to 30 and 16 to 24 percent infection was observed in Panagar, Jabalpur and Indrana respectively in different varieties. Bòzdogan and Kamberoglu, (2015) [13] conducted a survey in Center (Antalya) district of Turkey and reported 74.28 to 92.30 percent (average 78.57%) infection of tomato spotted wilt virus in tomato crop during 2007-2009.

3.4 Early blight

In *rabi* the first occurrence of early blight was recorded in the first fortnight of January and progressed up to the first fortnight of March. Initially percent incidence (0.83, 0.59 and 3.68) and PDI of the disease were very low (0.03, 0.04 and 0.15) which rapidly increased and reached maximum in the first fortnight of March in 2014-15 (71.51 and 38.42) and the second fortnight of February in 2015-16 (70.24, 32.48) and 2016-17 (81.69, 45.15) (Tables 1, 2 and 3).

Prasad, (2002) [34] recorded 28.60 to 65.36 percent severity of early blight in northern districts of Karnataka during 2001. Roopa, 2012 [39] undertook a roving survey during 2011 to assess the severity of early blight of tomato in major tomato growing areas of Dharwad, Belgaum, Haveri, Gadag and Bagalkot districts. Disease severity was ranged from 17.30 to 37.25 percent, highest severity was recorded in Haveri (31.03%) and least in Dharwad (20.16%) districts. Ten fields of Raipur (Chhattisgarh) were selected for the pest surveillance of tomato in *rabi* 2013-14. The average severity of early blight was recorded from November 2013 to March 2014 with increasing trend and average maximum disease severity of 5.96 percent was recorded in March 2014 under field condition (Anonymous, 2013-14) [5].

4.1.1.5 Collar rot

In *rabi* the first appearance of collar rot was observed in the first fortnight of December with percent disease incidence of 1.04, 1.01 and 0.67 and continued up to the first fortnight of March and maximum percent disease incidence (2.25, 4.38 and 3.33) was observed in the first fortnight of January and February and the second fortnight of January in 2014-15, 2015-16 and 2016-17 (Tables 1, 2 and 3).

In field condition the incidence of collar rot was recorded 5 to 10 percent in Raipur, Chhattisgarh (Anonymous, 2013-14) [5], 10-45 percent in Himachal Pradesh (Banyal, *et al.* 2008) [10] and 7.61 to 21.79 percent in undulating red and lateritic zone of West Bengal (Mahato, *et al.* (2017) [22].

4. Conclusion

From the present investigation it can be concluded that in Raipur, five diseases *viz.* leaf curl, mosaic, tomato spotted

wilt, early blight and collar rot were prevalent in tomato crop under field conditions. The severity pattern of the diseases was leaf curl > early blight > mosaic > collar rot > tomato spotted wilt.

Table 1: Seasonal occurrence of prevalent diseases of tomato under field conditions (*rabi* 2014-15)

Disease	Incidence and PDI	At 15 day intervals (Days after transplanting)								
		Nov		Dec		Jan		Feb		March
		II	I	II	I	II	I	II	I	
Leaf curl	Incidence	4.83	19.41	22.17	25.33	37.18	63.63	82.53	87.66	
	PDI	1.46	8.82	10.45	13.16	24.01	44.12	60.15	64.68	
Mosaic	Incidence	-	-	0.69	1.17	2.84	4.18	4.18	4.18	
	PDI	-	-	0.14	0.33	1.08	1.84	2.53	2.53	
Spotted Wilt	Incidence	-	-	-	0.21	0.83	1.18	1.52	1.52	
	PDI	-	-	-	0.06	0.28	0.49	0.76	0.76	
Early blight	Incidence	-	-	-	0.83	7.48	22.09	54.24	71.51	
	PDI	-	-	-	0.03	0.73	9.42	22.95	38.42	
Collar rot	Incidence	-	1.04	1.05	2.25	2.25	2.25	2.25	2.25	

Table 2: Seasonal occurrence of prevalent diseases of tomato under field conditions (*rabi* 2015-16)

Disease	Incidence and PDI	At 15 day intervals (Days after transplanting)							
		Nov		Dec		Jan		Feb	
		II	I	II	I	II	I	II	
Leaf curl	Incidence	7.30	15.98	21.17	29.26	42.35	68.52	79.07	
	PDI	2.87	7.44	11.32	29.26	28.47	49.39	58.62	
Mosaic	Incidence	-	-	-	0.58	4.08	5.81	6.75	
	PDI	-	-	-	0.32	3.33	5.48	6.68	
Spotted Wilt	Incidence	-	-	-	-	-	1.53	2.01	
	PDI	-	-	-	-	-	0.94	1.88	
Early blight	Incidence	-	-	-	0.59	10.34	36.45	70.24	
	PDI	-	-	-	0.04	1.35	8.49	32.48	
Collar rot	Incidence	-	1.01	1.01	1.34	3.37	4.38	4.38	

Table 3: Seasonal occurrence of prevalent diseases of tomato under field conditions (*rabi* 2016-17)

Disease	Incidence and PDI	At 15 day intervals (Days after transplanting)							
		Nov		Dec		Jan		Feb	
		II	I	II	I	II	I	II	
Leaf curl	Incidence	1.67	8.51	17.78	27.48	45.48	67.72	83.19	
	PDI	0.81	4.36	9.90	16.90	32.24	51.47	64.37	
Mosaic	Incidence	-	-	-	-	1.11	2.51	5.06	
	PDI	-	-	-	-	0.38	1.47	3.85	
Spotted Wilt	Incidence	-	-	-	-	-	0.96	2.33	
	PDI	-	-	-	-	-	0.23	0.87	
Early blight	Incidence	-	-	-	-	3.68	16.18	48.97	
	PDI	-	-	-	-	0.15	1.92	14.13	
Collar rot	Incidence	-	-	0.67	2.00	3.00	3.33	3.33	

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