



Scenario of Early Blight and Leaf Curl of Tomato in Gwalior Districts of Madhya Pradesh

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Abstract: *Alternaria solani* causes disease of foliage (early blight), basal stems of seedling (collar rot), stem of adjust plant (stem lesion) and fruit rot of tomato. Among them, early blight is the most destructive. Present investigations were undertaken to study the disease incidence of early blight in Gwalior districts, which ranged from 12.50 to 51.30%. Maximum disease incidence was recorded in Shyawari (51.30%), while minimum incidence was recorded in Duhiya (12.50%). The leaf curl disease of tomato ranged from 15.33 to 63.20% and maximum disease incidence of tomato leaf curl disease on tomato recorded in Ganpatpura (63.20%) while minimum disease incidence was recorded in Birampura (15.33%).

Keywords: Tomato, Early blight, Leaf curl, Survey, Disease incidence

Tomato [*Lycopersicon esculentum* Mill (2n=24)] is considered as "Poor man's orange" in India. It is the most important and useful member of the family Solanaceae and is grown in tropics as well as subtropics during *Rabi* and *Kharif* season. Tomato is an annual vegetable crop grown over the world is considered as protective food as because of its nutritional value and its wide production (Somappa et al 2013). India ranks second in area and production. In Madhya Pradesh area and production of tomato is 65.72 ha and 1937.37 tons, respectively with productivity 29.5 tons ha⁻¹ (Anonymous 2014). There are several diseases known in tomato which caused by fungi, bacteria, viruses and nematodes. Early blight of tomato among all fungal diseases is one of the most important disease (Munde et al 2013). It is very destructive in temperate humid climates. Although the disease is called early blight, but can occur on the plant at all stage of development. Early blight can cause decrease in fruit quantity and quality (Kumar and Srivastava 2013). Epidemics can also occur in semiarid climates where frequent and prolonged nightly dews occur (Roten and Reichert 1964). Epidemic of early blight having coefficient of disease index (CODEX) 71.66% was noticed to cause a remarkable loss up to 78.5% in the yield of tomato (Datar and Mayee 1981). It is most prevalent and destructive throughout the tomato growing areas causing loss of millions of Dollar annually worldwide including India (Datar and Mayee 1982). In present study farmer's field surveyed for finding the status of early blight of tomato in Gwalior districts of Madhya Pradesh. Tomato is affected by several viral diseases.

Tomato leaf curl virus disease is reported to be the most devastating (quantitative and qualitative) causing heavy yield losses. Often, the loss reaches to the extent of 100 per cent during summer throughout India (Mishra et al 2014). Tomato leaf curl disease (ToLCD) was first reported in northern India by Vasudeva and Sam Raj (1948) and subsequently from central India (Varma 1959) and southern India (Govindu 1964, Sastry and Singh 1973). Symptoms of ToLCD include leaf curling, vein clearing and stunting, which can often lead to sterility (Saikia and Muniyappa 1989). Symptoms of leaf curl virus causes, are interveinal yellowing, vein clearing, and crinkling and puckering of the leaves accompanied sometimes by rolling of the leaf margins especially older leaves become leathery and brittle. The disease also induces severe stunting, bushy growth, and partial or complete sterility depending on the stage of the plant at which infection has taken place. Diseased plants bear few or no fruit. The pathogen transmitted by whiteflies but not by sap inoculation (Vasudeva and Samraj 1948, Nariani and Vasudeva 1963, Verma et al 1975, Muniyappa et al 1991). *Tomato leaf curl virus* (ToLCV) is the name given to a group of whitefly transmitted geminivirus (family *Geminiviridae*, genus *Begomovirus*) which causes leaf curl disease of tomato in many regions of India. ToLCV isolates those from northern India have two components (DNA-A and DNA-B). The ToLCV isolates from southern India (Bangalore) have a DNA-A-like monopartite genome (Muniyappa, et al 2000). Characters of begomoviruses is having small circular single stranded DNA genome that replicates via double stranded replication

intermediates by using rolling circle (RC) mechanism (Saunders et al 1991).

MATERIAL AND METHODS

Present investigations were undertaken to study *Alternaria solani* (Ellis and Martin) causing early blight of tomato (*Lycopersicon esculentum* Mill). A systematic survey was carried out for recording the incidence of early blight on tomato grown in farmer's field in villages of Gwalior districts at the time of different stage of development. Five fields in each of villages were surveyed. Using five plants from each field disease severity was assessed by using 0-5 scale based on the percentage of infected leaf area. Percent disease incidence was also estimated. Different locations were visited during *rabi* season 2020 for assessing the intensity of the disease. Some plants from each cultivars or crop were taken randomly every time from each locality. The disease samples collected during the survey and early blight severity in the field is assessed in terms of percentage defoliation and the average fraction of necrotic leaf area on the plant after that the samples were examined microscopically to conform the symptoms and prevalence of *Alternaria* sp. pathogenic on tomato. Disease scale to calculate the per cent disease incidence of *Alternaria* leaf blight of tomato is included in Table 1.

Per cent disease incidence (PDI) was worked out by using the formula given by Wheeler (1969).

$$\text{PDI} = \frac{\text{Sum of all individual disease ratings}}{\text{Total No. of plants observed} \times \text{Maximum disease grade}} \times 100$$

RESULTS AND DISCUSSION

A roving survey was carried out during the *Rabi* 2020 for there per cent disease incidence in early blight of tomato and severity of tomato leaf curl disease (ToLCD) in different tomato growing areas of Gwalior districts. The symptoms of ToLCD observed during survey were yellowing, puckering, upward curling of leaves, reduces leaf size, internodal length stunting and bushy appearance due to reduced internodal length with partial to complete sterility, purple pigment on the curled leaf margin. The early infection in plants did not produce any fruits or bear few fruits/ small fruits. The initial symptoms of early blight are small, dark necrotic lesions that usually appear on the older leaves and spread upward as the plant become older. As lesion enlarge, they commonly have concentric rings with a target like appearance, and they are often surrounded by a yellowing zone. (Sherf and MacNab 1986). In each field the incidence of early blight was recorded. The data summarized in Table 2 reveals that the disease incidence of early blight in Gwalior districts ranges from 12.50 to 51.30%. The overall mean in early blight of tomato in Gwalior district is 32.54 per cent. In Gwalior district

the maximum disease incidence was recorded in Shyawari (51.30 %) followed by Ganeshpura (46.5%), Gobai (43.5%), Siroli (41.50%), Ekehra (37.5%), Jigniya (36.5%), Chandhrapura (36.5%), Karguva (33.7%), Bijoli (31%), Badagaon (28%), Birampura (27.5%), Sonigav (24%), Ganpatpura (22.5%) and Khureri (15.7%), while minimum incidence was recorded in Duhiya (12.50%).

The incidence of tomato leaf curl disease on tomato in the surveyed areas ranged from 15.33 to 63.20 per cent. Among the surveyed villages, the maximum disease incidence of ToLCD on tomato recorded in Ganpatpura (63.2%) followed by Shyawari (57.3%), Badagaon (56.7%), Jigniya (51.3%), Gobai (45.2%), Ekehra (44.5%), Khureri (42.5%), Karguva (41.66%), Ganeshpura (37.6%), Duhiya (34.7%), Bijoli (22.6%), Sonigav (21.5%), Siroli (16.7%) and Chandhrapura (15.6%), while minimum disease incidence was recorded in Birampura (15.33%).

Our data indicates that the early blight and leaf curl disease of tomato varied with village to village. Pachori et al (2016) reported that in field surveyed in Gwalior, Bhind and Morena districts the maximum disease incidence was found in Ekeraha (34.2% PDI). In Bhind district the range of disease incidence was recorded 27.5 to 55 PDI with mean incidence of 38.2 per cent. The maximum disease incidence was found in Mehgaon (55% PDI), which was followed by Gingirkhi (47.42% PDI), Jamana (30.6% PDI), Gormi (30.5% PDI) and minimum disease incidence was found in Daboha (27.5% PDI). In Morena district, the percent disease incidence ranged from 37.40 to 61.27 with mean incidence of 47.43 per cent. The maximum disease incidence was found in Ambah (61.27% PDI), which was followed by Sirmorkapura (51.5% PDI), Dimni (45.5% PDI), Ranpur (41.5% PDI) and minimum disease incidence was found in Bharatpura (37.4% PDI). The survey also revealed that, the severity and incidence of early blight of tomato varied from location to location, obviously due to various factors like temperature, relative humidity, rainfall, sowing dates, diverse cultivars used and even it could also be attributed to existence of pathogenic variability. The higher

Table 1. Disease scale to calculate the percent disease incidence of *Alternaria* leaf blight of tomato (0-5 scale given by Datar and Mayee 1982)

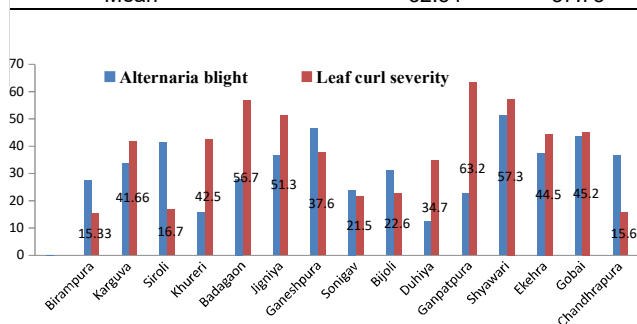
Grade	Per cent leaf area infected
0	<1
1	1-5
2	6-20
3	21-40
4	41-75
5	>75

disease incidence may be due to vulnerability of the cultivars or favourable environmental conditions. That must have helped for buildup of inoculum and subsequently resulting in increased disease severity. Such higher incidence of early blight was also recorded by Datar and Mayee (1981). Present finding is in agreement with Munde et al (2013) who carried out a survey of early blight of tomato disease at Thane, Raigad, Ratnagiri and Sindhudurg districts and showed that *A. solani* was constantly associated with early blight infected plants of tomato at all the locations. Similarly, Ganie et al (2013) also reported that the disease was prevalent in all the potato growing areas of Kashmir valley surveyed during 2009 and 2010. Kamble et al (2009) also reported early blight incited by *Alternaria solani* was found to be major disease of tomato under agroclimatic conditions of Konkan region and revealed that, early blight disease intensity in Raigad district ranged between 20.78 to 42.3 per cent and 35.12 to 55.75 per cent in Thane district. Balai et al (2013) also assessed the disease intensity of *Alternaria* blight during rabi seasons

2009-10 and 2010-11 in Azamgarh, Ballia, Bhadohi, Chandauli, Ghazipur, Jaunpur, Mau, Mirzapur, Sohanbhdra and Varanasi of Eastern Uttar Pradesh and five neighboring districts of Bihar, viz. Sivan, Buxar, Arah, Bhabhua and Aurangabad. And found disease intensity range in different areas from 16.93 to 38.59 per cent and 15.12 to 38.86 per cent. Similarly Atik (2007) and Randhawa (2004), also conducted survey in different areas and found that none of the surveyed tomato field was found to be free from early blight disease of tomato. Variations were found in disease incidence in all surveyed fields because of the variation in climatic condition of area and agronomic practices of a particular area. Tomato leaf curl disease is of major concern in the cultivation of the tomato crop. The disease is highly devastating in many states of the Indian subcontinent including Karnataka state. In Gwalior districts the ToLCD is found in every field surveyed. Survey was done to assess the incidence and severity of tomato leaf curl disease in certain major tomato growing districts of northern Karnataka. The results revealed that the per cent incidence and severity differed from location to location. However, the tomato leaf curl disease and the vector whitefly were percent in almost all the tomato fields surveyed. Tomato leaf curl disease is ranging from 5.0 to 86.6 per cent incidence and 2.0 to 45.2 per cent severity. Among the districts, Haveri district recorded the highest 86.6 per cent incidence of the disease followed by Yadgir district which recorded the disease incidence of 84.6 per cent and Bagalkot district recorded the least incidence of 39.1 per cent. The maximum disease severity of ToLCD on tomato was recorded in Yadgir (45.2%), followed by Haveri (44.1%) least severity of ToLCD was in Bagalkot district (15.6%). The reasons for the differences in the incidence and severity of disease in areas surveyed may be considered as due to the variation in the source of inoculum, vector population, climatic conditions and the area. The causes for high incidence of disease in Haveri and Dharwad districts are extensive cultivation of tomato crop and the prevalence of whitefly vector in these districts, whereas, high incidence in Yadgir and Kalburgi districts could be due to high vector population because of high temperature which favors whitefly multiplication. The another reason may be for high incidence of the disease in district is due to cultivation of mono-cropping over a larger area, introduction of *B. biotype*, *B. tabaci* has also been considered to be one of the major factors for the disease to assume epidemic proportion. Similar observations were recorded by Saikia and Muniyappa (1989), Reddy et al (2011) and Ehsanullah (2014).

Table 2. Survey of early blight of tomato in Gwalior districts of Madhya Pradesh

District	Block	Village	<i>Alternaria</i> blight (PDI)	Leaf curl severity
Gwalior	Morar	Birampura	27.50	15.33
		Karguva	33.70	41.66
		Siroli	41.50	16.70
		Khureri	15.70	42.50
		Badagaon	28.00	56.70
		Jigniya	36.50	51.30
		Ganeshpura	46.50	37.60
		Sonigav	24.00	21.50
		Bijoli	31.00	22.60
		Duhiya	12.50	34.70
		Ganpatpura	22.50	63.20
		Shyawari	51.30	57.30
		Ekehra	37.50	44.50
		Gobai	43.50	45.20
Chandrapura	36.50	15.60		
Mean			32.54	37.75



CONCLUSION

The tomato leaf curl and alternaria leaf blight diseases

are important major constraint in the cultivation of tomato crop. Survey was done to assess the incidence and severity of both diseases, the percent disease incidence and severity may differ varied might be due to the variation in the source of inoculum, vector population, climatic conditions and the area. The probable cause of high incidence of disease in Ganpatpura, Shywari and Badagoan are the prevalence of whitefly vector in these villages and also high temperature which favours whitefly multiplication. Tomato early blight is also favoured by warm temperature and extended period of leaf wetness from dew, rainfall and crowded plantation as it is noted in Shyawari, Ganpatpura and Siroli villages. An understanding of the role of environmental conditions and its consequence an infection and survival of pathogen is needed to make tomato less vulnerable to early blight pathogen.

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