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Pot Culture studies on Screening of Cultivars against Blight in Tomato

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ABSTRACT: Tomato stem blight incidence observed in major tomato growing mandals of Ranga Reddy District of Telangana state caused maximum damage to tomato crop. To manage the stem blight infection in tomato, Pot culture (soil infestation and root dip inoculation methods) studies were conducted on ten popularly grown tomato cultivars *viz.*, PKM-1, Arka meghali, Arka abha, US 440, Heemsohna, DS 800, Lyco, US 618, Bhama, 9005 Siri along with a susceptible cultivar Arka vikas were screened against stem blight pathogen *Rhizoctonia solani* in tomato. Among the tomato cultivars (11) screened, Cultivar PKM-1 was found superior with lowest per cent disease incidence in both soil infestation (25.33) and root dip inoculation (7.50) methods.

Keywords: *Rhizoctonia solani*, screening, tomato cultivars, paper towel method, soil infestation, root dip inoculation.

INTRODUCTION

The tomato (*Solanum lycopersicum* L.) is one of the most popularly grown vegetable and it belongs to the family solanaceae. In India, tomato is grown almost all over the country and ranks first with 863.98 thousand hectares of area and 20.6 million tones of production with a productivity of 23.90 MT/ha. In Telangana the crop is grown in 17.24 thousand hectares with a production and productivity of 463.65 thousand tones and 26.9 MT/Ha respectively. Tomato is considered one of the most consumable vegetable, that attack by several soil borne fungal pathogens (Morsy *et al*., 2009). *Fusarium solani* and *Rhizoctonia. solani* are the most important soil borne fungal pathogens able to show symptoms like damping off and root rot diseases. It was also reported that, the necrotrophic fungus *R. solani* is one of the most important, soil-borne pathogens and the casual organism of crown rot, root rot and damping off in tomato producing areas (Taheri and Pourmahdi 2013).

Though damping off caused by *Rhizoctonia solani* in tomato is very common to see in nurseries, an increased incidence of blight caused by *Rhizoctonia solani* was noticed in recent past in major tomato growing areas of Ranga Reddy district of Andhra Pradesh. The disease was found to appear predominantly during early transplanted to flowering and fruiting stage of the crop causing considerable loss to the crop both in terms of plant stand and yield. However, the disease incidence varied from 12.8 to 33.2% during 2011-12 rabi season under natural field conditions (Pushapavathi *et al.*, 2013). *Rhizoctonia solani* is the most important soilborne pathogen of tomato crop and in recent past it is known to cause blight symptoms on stems of tomato plants which has become a serious threat to tomato cultivation in Ranga Reddy district of Andhra Pradesh (Sumalatha *et al.*, 2018) Symptoms produced due to soil infestation and root dip inoculation appeared as typical damping off symptoms with dark brown lesions at the collar region and yellowing of leaves which lead to death of seedlings. Whereas, in case of stem application the initial symptoms appeared as water soaked lesions on stems which later became oval to irregular light brown necrotic spots. Mature spots on stems appeared as large brown blighted portion with typical cracks on the bark. In advanced stages plant collapsed at infected portion leading to death of the plant (Sumalatha *et al.*, 2018).

In view of disease incidence and yield losses due to stem blight disease in tomato the present study was framed i.e, screening of resistant cultivars against the stem blight disease in tomato caused by *Rhizoctonia solani*.

MATERIALS AND METHODS

Ten popularly grown tomato cultivars *viz.*, PKM-1, Arka meghali, Arka abha, US440, Heemsohna, DS800, Lyco, US618, Bhama and 9005 Siri along with a susceptible cultivar Arka vikas were screened against *R. solani* incidence under glasshouse conditions using pot culture technique.

Glass house conditions (pot culture experiment)

(i) Soil infestation

Multiplication on sorghum grains. The pathogen was multiplied on sorghum grains (Gupta and Kolte 1982). For this, sorghum grains were pre-soaked in two per cent sucrose solution for about overnight, drained and boiled in fresh water for 30 minutes and drained again. This was transferred into 1000 ml flasks @ 400 g per flask and autoclaved at 15 PSI (121.6°C) for 20

minutes. The flasks were allowed to cool at room temperature and inoculated with five mm discs of seven days old culture of *Rhizoctonia solani* grown on PDA and flasks were incubated for ten days at 26± 2°C. after incubation period mycelial growth completely covers the sorghum grains.

To the pots filled with sterile soil (15cm diameter) 50 g of the *Rhizoctonia solani* mass multiplied on sorghum grain and ground into a fine powder in a mixer-grinder was applied uniformly. Immediately after inoculation the pots were sprinkled with water, covered completely with a polythene sheet and tied tightly with the help of a thread. These pots were left on a glasshouse bench for incubation. On the third day the polythene sheet was removed and the pots were observed for the development of mycelial mat on the soil surface (Naz *et al.*, 2008). Seeds of eleven tomato cultivars *viz*., PKM-1, Arka meghali, Arka abha, US 440, Heemsohna, DS800, Lyco, US618, Bhama, 9005 Siri and Arka vikas were sown separately in pots (15cm diameter) containing pathogen infested soil. Fifty seeds were sown in pot. two such pots were maintained for each replication and watered regularly. After germination seedlings were observed daily for symptom expression. The typical symptoms of the disease observed were recorded. The data on total number of seedlings and number of affected seedlings were recorded to calculate per cent disease incidence (PDI). The data was recorded at 30 DAS as there was no further increase in disease incidence.

Root dip inoculation

Seedlings of eleven cultivars were raised in pots (15cm diameter) filled with sterilized soil. Twenty eight days old seedlings were uprooted from the pots carefully, washed with sterile distilled water to remove the excess soil present on the root surface and the distal one third of root system was trimmed. These trimmed seedlings were dipped in mycelial suspension of the pathogen for ten minutes and then transplanted to pots filled with sterile potting mixture. For each replication 100 trimmed seedlings were inoculated. Transplanted seedlings were watered regularly. Observations for the disease incidence were recorded on seventh day after inoculation. The data on total number of seedlings and number of affected seedlings were recorded to calculate per cent disease incidence (PDI).

RESULTS AND DISCUSSION

A total of eleven popularly grown tomato cultivars were screened against *R. solani* under pot culture experiments. Screening under pot culture conditions was done by adopting soil infestation and root dip inoculation.

Root infection. There was significant difference for per cent root infection among most of the cultivars screened. Significantly lowest per cent root infection was observed in Arka abha (14.00) followed by Arka meghali (14.67) which were found significantly different from all the other cultivars. Significantly highest per cent root infection was observed in Arka vikas (31.33) which was found to be superior over all the cultivars except Lyco (30.00) and US 618 (30.00).

Shoot infection. The data on per cent shoot infection indicated that lowest shoot infection (5.33) was observed in Arka meghali (5.33) followed by Lyco (10.00) and US 440 (11.33). Cultivar Arka vikas (16.67) recorded highest per cent shoot infection which is significantly different from that of all the cultivars except the cultivars 9005 siri (16.00) and US 618 (14.00). Heemsohna, DS 800 and Bhama were at par with each other with 12.00 per cent shoot infection and differ significantly from other cultivars except US 440 (11.33) and Lyco (10.00).

Glasshouse conditions (Pot culture experiment)

Soil infestation

Germinability. A total of eleven popularly grown tomato cultivars were `evaluated for their disease reaction against *R. solani* using soil infestation and observations on per cent germination in treated pots were recorded when all the seeds in control pot were germinated.

Persual of data in table 1 revealed that there was significant difference for per cent germination among most of the cultivars screened. However, the highest per cent of germination was recorded in Arka abha (86.00) followed by cultivars Heemsohna (84.00), Arka meghali (82.00), US 618 (80.67), Lyco (80.00), 9005 Siri (78.67), DS 800 (77.30), PKM-1 (72.00) and US 440 (69.00). Cultivar Arka vikas was found inferior in germinability with least per cent germination (68.00) and did not have significant difference with the cultivar Bhama (68.67).

Disease incidence

The lowest per cent disease incidence was observed in PKM-1 (25.33) which was found significantly superior over all other cultivars. The lowest PDI was recorded in Arka vikas (68.00) which was found significantly inferior over all other cultivars in terms of disease incidence. All the cultivars screened showed significant difference for PDI recorded except cultivars Arka abha (32.00), US 440 (31.30) and DS 800 (32.00) which did not have significant difference among them (Table 1).

Similar studies were conducted by Seth and Ownley (1988); Karima and Naida (2012); Montefalcon and Tangonan (2010); Vidhyasagar (2011) who worked on screening of tomato cultivars against *R. solani* by soil inoculation.

Root dip inoculation

Disease incidence. Significantly highest incidence was observed in Arka vikas (92.50) which was found inferior to all the cultivars screened except cultivar US 618 (77.25) and Bhama (66.25) which were not statistically different from each other. Though the lowest PDI (7.50) was recorded by the cultivar PKM-1 it is not differing significantly with cultivars Arka meghali (10.00), Arka abha (10.00) and DS800 (17.50) which are found to be at par with each other. The cultivars US 440 and Heemsohna (31.25) were significantly different from all the cultivars but were on par with each other. Cultivar DS 800 (17.50) was found significantly different from Lyco (62.50), US 618 (77.25) Bhama (66.25), 9005 Siri (62.50), Arka vikas (92.50), While the cultivar Lyco (62.50) was significantly different from US 618 (77.25) and Arka vikas (92.50). However, US 618 was significantly

different from cultivar 9005 Siri (62.50) and Lyco (62.50) for the PDI recorded. The cultivars 9005 siri (62.50) and Lyco (62.50) were at par with each other.

It is evident from the present study that the cultivar PKM-1 showed lowest disease incidence in both soil infestation and root dip inoculation methods (Table 1 and 2). However, its per cent disease incidence in both the methods tried was significantly high when compared to PKM-1. Hence, from disease point of view, the cultivar PKM-1 was found to be the superior compared with remaining cultivars.

The results are in agreement with studies of Seth and Ownley (1988) who evaluated ten tomato cultivars for their susceptibility to damping-off caused by *Rhizoctonia solani*. According to their study the cultivars with significantly higher percent seedling survival had lower disease ratings, and cultivars with lowest survival rates recorded highest disease ratings. Similar trend was reported by Karima and Naida (2012); Montefalcon and Tangonan (2010) while screening a set of tomato cultivars against *R. solani*.

Table 1: Screening of tomato cultivars against *Rhizoctonia solani* by soil infestation Method.

Sr. No.	Cultivars	Per cent Germination	Per cent Disease Incidence
1.	PKM-1	72.00 (58.06)*	25.33 (30.20)*
2.	Arka meghali	82.00 (64.89)	28.00 (31.92)
3.	Arka abha	86.00 (68.03)	32.00 (34.42)
4.	US 440	69.00 (55.52)	31.30 (34.00)
5.	Heemsohna	84.00 (66.42)	34.00 (35.60)
6.	DS800	77.30 (61.54)	32.00 (34.42)
7.	Lyco	80.00 (63.42)	40.67 (39.60)
8.	US618	80.67 (63.89)	45.33 (42.30)
9.	Bhama	68.67 (55.95)	41.33 (39.99)
10.	9005 siri	78.67 (62.50)	44.67 (41.92)
11.	Arka vikas (susceptible check)	68.00 (55.52)	49.00 (43.96)
	CD at 5% S. Em± CV %	2.91 0.98 2.79	1.81 0.61 2.86

* Figures in parentheses are angular transformed values

Table 2: Screening of tomato cultivars against *Rhizoctonia solani* by root dip inoculation method.

Sr. No.	Cultivars	Per cent Disease Incidence(PDI)
1.	PKM-1	7.50 (15.38)*
2.	Arka meghali	10.00(17.84)
3.	Arka abha	10.00 (18.13)
4.	US 440	31.25 (33.58)
5.	Heemsohna	31.25 (33.46)
6.	DS800	17.50 (24.67)
7.	Lyco	62.50 (52.47)
8.	US 618	77.25 (61.49)
9.	Bhama	66.25 (55.27)
10.	9005 siri	62.50 (52.54)
11.	Arka vikas (susceptible check)	92.50 (75.74)
	CD at 5% S.Em± CV %	12.01 4.15 20.80

* Figures in parentheses are angular transformed values

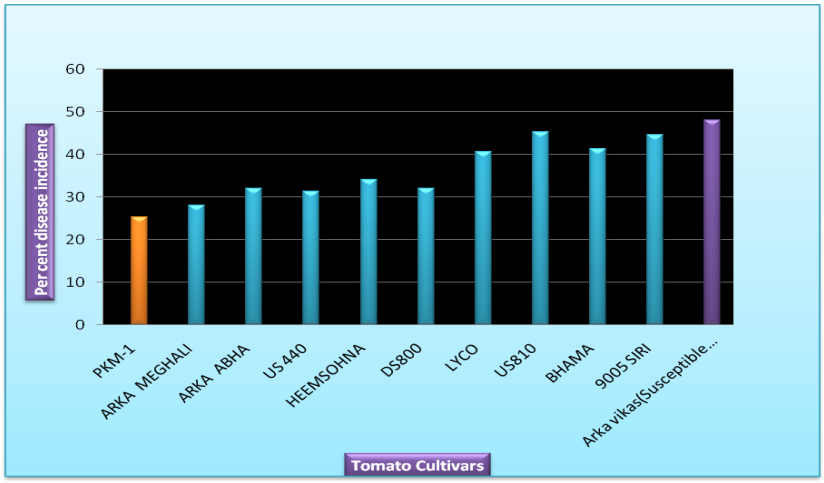

Fig. 1. Evaluation of tomato cultivars against *Rhizoctonia solani* by soil infestation method.

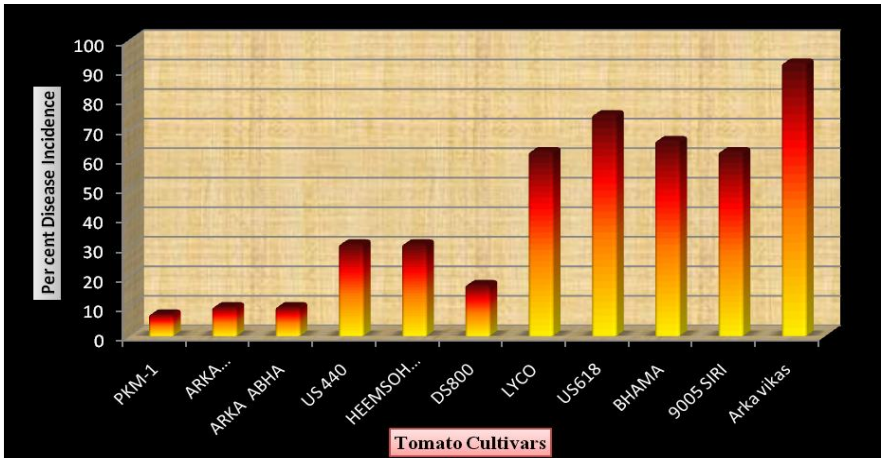

Fig. 2. Evaluation of tomato cultivars against *Rhizoctonia solani* by root dip inoculation method.

CONCLUSIONS

From the results of presented study it is concluded that, *R. solani* incidence is less in cultivars like PKM-1, Arka meghali, Arka abha compared with other popularly grown tomato cultivars. But the there is great need to work on soilborne pathogen *R. solani* incidence to manage effectively by conducting experiments especially at field level by applying different manures and identification of best biological control agents.

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Conflict of Interest. None.

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