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In vitro screening of Taro Varieties against *Phytophthora* Leaf Blight Disease

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Abstract

Four isolates of *Phytophthora colocasiae* causing leaf blight of taro were collected from different taro growing areas of Telangana and Andhra Pradesh and evaluated for their virulence on 12 varieties. The ability of an isolate to cause disease symptoms across the varieties was interpreted as virulence. The disease reaction of 12 varieties showed differences in resistance to isolates of *P. colocasiae.* Among the 12 varieties none of the variety showing immune and resistance reaction to isolates of *P. colocasiae*. Variety KCS-3 showed moderately resistant reaction to all the isolates of *P. colocasiae* and Muktakeshi also showed similar reaction to isolate PC_3 and isolate PC_4. As well RNCA-1 showed same reaction pattern to isolate PC1 and PC2. Whereas the varieties Hyderabad Local, Satamukhi and NDC-1 were showed Highly Susceptible reaction to all the four isolates. NDC-1 showed susceptible reaction to three isolates *viz*, PC_2, PC_3 and PC_4. Tenali, Hyderabad local, Jagtial local, Satamukhi, C-16, NDC-1, Kadma local varieties are shown susceptible to highly susceptible reaction to all the four isolates. Based on the resistant reaction KCS-3 was showing resistance reaction to all the isolates of *P. colocasiae*. So, it could be use alongside fungicides and farm sanitation in an integrated management system.

Key words: Taro, leaf blight, *in vitro* screening

Introduction

Taro (*Colocasia esculenta* (L)) is a tuber crop belonging to Araceae family. It is grown throughout India due to its wide adaptability, large scale acceptability and high return unit area-1 (Gurung, 2001). In India, it is grown in Andhra Pradesh, Bengal, Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra (Konkan region), Tamil Nadu, Uttar Pradesh and West Bengal (Shakywar *et al*., 2013). It grows well in lowland and upland areas. The cormel and leaves of taro are eaten as fried and cooked vegetable. Various delicious dishes are prepared by using different plant parts. Cormels are rich source of calcium, phosphorus, protein, starch and vitamin C (Fageria *et al.,* 2006).). Taro has been devastated by leaf blight disease resulting 25 – 60% yield loss in many countries. Leaf blight caused by *Phytophthora colocasiae* Raciborski is the most important disease of Taro and was recorded for the first time by Butler and Kulkarni (1913) in India. Leaf blight has become a limiting factor for production in all taro growing areas in India moderate to severe form causing 25% to 50% yield loss every year (Gadre and Joshi, 2003; Misra *et al*.,2008). Though some fungicides have been reported to be effective in managing this disease, they are generally too expensive for the majority of growers, besides. The use of resistant varieties is considered to be the best method for disease management. The present study was carried to be determining source of resistance against *P. colocasiae* causing leaf blight of taro.

Material and Methods

Screening of taro varieties

Screening of taro leaves against *P. colocasiae* was done by detached leaf method (Sahoo *et al.,* 2005). Taro leaves of 12 varieties were collected from plants of same age from

the field of Vegetable Research Station (All India Co-Ordinated Research Project (Tuber crops), (Sri Konda Laxman Telangana State Horticultural University, Rajendranagar). Different isolates of *Phytophthora colocasiae* were grown on carrot potato agar medium and incubated at 24^0 C with light at 10 h day^{-1}. Sterile distilled water was added to 15 day old cultures before chilling at 10^0C for 30 min to stimulate zoospore release from sporangia. The spore concentration was diluted about 15 min after chilling until 1 μl drops viewed under a stereomicroscope contained an average of five to seven zoospores each. Adjusting a micropipette to deliver 50 zoospores produced drops of 7 μl to 10 μl. A surfactant and dispersing agent was added to the spore suspension @ 0.1 per cent to enable uniform spread of inoculum on the leaves.

The leaves were cut into leaf discs of 4 cm diameter, placed between moist blotting papers and kept in Petri dish. The spore suspension of 10 μl was inoculated on each leaf disc with the help of micropipette. The inoculated leaf discs were kept in a moist chamber and incubated at 18 ± 2^0C for 7 days. Leaf discs inoculated with normal tap water served as control for each variety and maintained in 3 replications. Data on per cent disease intensity was recorded. The taro varieties were categorized as resistant or susceptible by using 0-5 scale (Prasad, 1982)

Table 1. Disease rating scale of leaf blight for screening taro varieties

Rating scale	Description of symptom	PDI	Disease reaction
0	Leaves free from infection	0	Immune
1	Traces of infection, less than 1% of leaf area effected	1%	Highly resistant
2	Light infection, lesions visible up to 5% of leaf area	1.01-5%	Resistant
3	Moderate infection lesions visible on 5-25% leaf area	5.01-25%	Moderately resistant
4	Heavy infection, lesions well developed coalescing on 26-50% leaf area	25.01- 50%	Susceptible
5	Severe infection, profuse coalescing lesions more than 50% leaf area damaged.	>50%	Highly susceptible

The per cent disease index was calculated by the given formula

$$PDI = \frac{\text{Sum of numerical ratings}}{\text{Total number of leaves observed} \times \text{Maximum rating}} X\ 100$$

Results and Discussion

A significant difference was observed among all the varieties screened with isolate PC_1. Out of 12 varieties none was highly resistant, Resistant to PC_1, whereas two varieties RNCA-1 (PDI 6.0) and KCS-3 (PDI 15.3) showed moderately resistant reaction (Table1). Five varieties Muktakeshi (PDI 26.7) Jagtial local (PDI 43.3), Kovvuru local (25.3), Kadma local (PDI 34.7) and Nellore (PDI 44.7) were susceptible to the disease, while five varieties Hyderabad local (PDI 52.0) and C-16 (PDI 54.7) NDC-1 (PDI 70.0), Tenali (PDI 76.0) and Satamukhi (PDI 84.0) showed highly susceptible reaction to the disease

However, different levels of resistance were observed against the isolate PC_2 collected from Bahadurguda. The varieties did not show highly resistant, resistant reaction but two varieties RNCA-1 and KCS-3 showed moderately resistance reaction with PDI of 16.3 and 8.0 respectively. Varieties Muktakeshi, C-16 and Kovvuru local and Tenali were susceptible to isolate PC_2 and the PDI was 32.7, 33.7, 35.3 and 48.7 respectively. While highly susceptible reaction was recorded in six varieties *viz.,* Hyderabad local (PDI 53.0), NDC-1 (PDI 52.3), Jagtial local (PDI 66.7), Satamukhi (PDI 73.3), Kadma local (PDI 66.0) and Nellore (PDI 80.3)

Screening of 12 taro varieties with isolate PC_3 collected from Thiruvananthapuram, Kerala did not show highly resistant and resistant reaction to the disease (Table 2). Varieties KCS-3 and Muktakeshi showed moderately resistant reaction with PDI of 17.7 and 18.0 respectively. *viz,* (PDI 32.7) and However varieties RNCA-1, Tenali and Kovvuru local showed susceptible reaction with PDI of 35.3, 49.3, and 32.7 respectively. A highly susceptible reaction was observed in Hyderabad local (PDI 80.7), Satamukhi (PDI 76.0), Kadma local (PDI 74.0) and Nellore (PDI 76.3), NDC-1 (PDI 52.0), Jagtial local (54.3), C-16 (PDI 51.4).

Disease reaction of 12 taro varieties with isolate PC_4 collected from Kovvuru

Table 2. Screening of taro varieties against *Phytophthora colocasiae* by detached leaf method

Sl. No.	Name of the Variety	Isolate PC_1		Isolate PC_2		Isolate PC_3		Isolate PC_4	
		PDI	Reaction Group	PDI	Reaction Group	PDI	Reaction Group	PDI	Reaction Group
1	Jagtial local	43.3 (41.1)*	S	66.7 (54.8)*	HS	54.3 (47.4)*	HS	53.3 (46.9)*	HS
2	RNCA-1	6 (14)	MR	16.3 (23.5)	MR	35.3 (36.3)	S	34 (35.6)	S
3	Tenali	76 (60.6)	HS	48.7 (44.2)	S	49.3 (44.6)	S	72 (58.1)	HS
4	Muktakeshi	26.7 (31)	S	32.7 (34.8)	S	18 (24.8)	MR	18 (24.8)	MR
5	Hyderabad local	52 (46.10)	HS	53 (46.7)	HS	80.7 (64)	HS	71.7 (57.9)	HS
6	Satamukhi	84 (66.40)	HS	73.3 (58.9)	HS	76 (60.8)	HS	51.3 (45.7)	HS
7	NDC-1	70 (56.70)	HS	52.3 (46.3)	HS	52 (46.1)	HS	18 (46.3)	HS
8	Kadma local	34.7 (36)	S	66 (54.3)	HS	74 (59.5)	HS	71.7 (58.2)	HS
9	Nellore	44.7 (41.9)	S	80.3 (63.7)	HS	76.3 (61.1)	HS	34 (35.5)	S
10	C-16	54.7 (47.6)	HS	33.7 (35.3)	S	51.4 (45.9)	HS	75.3 (60.5)	HS
11	Kovvur local	25.3 (30.1)	S	35.3 (36.3)	S	32.7 (34.7)	S	65 (53.7)	HS
12	KCS-3	15.3 (22.9)	MR	18 (24.8)	MR	17.7 (24.7)	MR	17.3 (24.4)	MR
	CD at 5%	3.13		6.89		7.99		8.08	
	SEm+	1.06		2.34		2.72		2.75	
	CV (%)	4.48		9.3		10.27		10.44	

* Figures in parenthesis are transformed arcsenic values.

indicated that eight varieties Tenali (PDI 72.0), Hyderabad (PDI 71.4), Kadma local (PDI 72.0), C-16 (PDI 75.3), Kovvuru local (PDI 65.0), Satamukhi (PDI 51.3), NDC-1 (PDI 52.3) and Jagtial local (PDI 53.3) were highly susceptible and two varieties RNCA-1(34.0), Nellore (PDI 34.0) showed susceptible reaction. While two varieties were moderately resistant *viz*., Muktakeshi (PDI 18.0), KCS-3 (PDI 17.3) to the disease.

Brooks (2008) also evaluated 23 taro hybrids resistant to *P. colocasiae* by detached leaf bioassay which was a fast, effective method of screening taro hybrids to *Phytophthora colocasiae* and correlated well with yield.

Studies of Rajesh Kumar and Dubey (1996) were also in agreement with our results. Genotype C189 had the highest infection rate (53.9%) as well as disease intensity (52.7%), while Telia recorded the lowest leaf infection (26.6%) to leaf blight caused by *Phytophthora colocasiae*. Highly restricted disease symptoms were observed in Jhangdi and Topi. But in Kadma local, Muktakeshi or Nadia local symptoms or infections were not observed and showed immune reactions to blight.

Sugha and Gurung (2007) made similar studies and reported that none of the genotypes evaluated were free from disease. However, thirteen lines were found to be susceptible, forty seven moderately susceptible and two lines highly susceptible against taro blight.

Deo *et al.* (2012) found that the per cent infection of *Phytophthora* leaf blight ranged from 2 - 20% in 145

genotypes of which 53 were free from *Phytophthora* leaf blight.

Conclusion

This study revealed that KCS-3 showed moderately resistant reaction to all four isolates of *P. colocasiae*. However, the identification of variety to be moderately resistant to the disease is encouraging. It is recommended that KCS-3 variety was evaluated further in taro leaf blight endemic areas to examine the durability of this moderate resistance. If this variety continues to show moderate resistance, then it could be use alongside fungicides and farm sanitation in an integrated management system.

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