***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 the 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 *Phytophthora colocasiae.* Variety RNCA-1 and Variety KCS-3 showed resistant reaction to all the isolates of *Phytophthora colocasiae* and Muktakeshi also showed similar reaction except to isolate PC2. Moderately resistant reaction was recorded by variety Kovvuru local to isolate PC1, PC2 and PC3. Variety NDC-1 showed susceptible reaction to three isolates *viz*, PC2, PC3 and PC4. 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 two varieties *i.e*., KCS-3 and Mktakeshi are showing resistance reaction to all the isolates so by using of these varieties we can reduce the incidence of the blight disease of Taro.

Key words: Taro, *Phytophthora colocasiae.* Taro Varieties, Resistance, Susceptible

**Introduction**

Taro (*Colocasia esculenta* (L.) Schott.) a tropical aroid is an important staple crop in the developing countries especially in Africa and South East Asian countries. It is widely cultivated in South Africa, Asia, Oceania, Central Africa, West Indies and the islands of the Caribbean and Central America. Its corms are rich sources of carbohydrates and minerals (Chandra, 1984). 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 (Jackson *et al.,* 1980; Misra, 1997; Gadre and Joshi, 2003; Misra, 2008). Although many resistant varieties have been developed in India the present status and availability of these varieties are not known (Thankappan, 1985)

The present study has been conducted with an objective to isolate resistant lines for Phytophthora leaf blight disease of Taro.

**Material and Methods**

**Screening of taro varieties**

Screening of taro leaves against *Phytophthora 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 240 C with light at 10 h day-1. Sterile distilled water was added to 15 day old cultures before chilling at 100C 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](mailto: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±20C 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 of disease incidence was recorded. The taro varieties were categorized as resistant or susceptible by using the 0-5 scale as given by AICRP, 2008 on tuber crops.

**Disease scale**

|  |  |
| --- | --- |
| **Rating scale** | **Description of symptom** |
| 0 | Leaves free from infection |
| 1 | Traces of infection, less than 1% of leaf area effected |
| 2 | Light infection, lesions visible up to 5% of leaf area |
| 3 | Moderate infection lesions visible on 5-25% leaf area |
| 4 | Heavy infection, lesions well developed coalescing on 26-50% leaf area |
| 5 | Severe infection, profuse coalescing lesions more than 50% leaf area damaged. |

The per cent disease index was calculated by the given formula

Sum of numerical ratings

PDI = ------------------------------------------------------------ X 100

Total number of leaves observed × Maximum rating

**Results and Discussion**

A significant difference was observed among all the varieties screened with isolate PC1. Variety RNCA-1 was highly resistant to PC1 with PDI of 6.0, whereas two varieties KCS-3 (PDI 15.3) and Muktakeshi (PDI 26.7) showed resistant reaction (table 1&2). Similarly Kovvuru local and Kadma local exhibited moderately resistant reaction with PDI 25.3 and 34.7 respectively. Four varieties Jagtial local (PDI 43.3), Nellore (PDI 44.7), Hyderabad local (PDI 52.0) and C-16 (PDI 54.7) were susceptible to the disease, while three varieties 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 PC2 collected from Bahadurguda. The varieties did not show highly resistant reaction but two varieties RNCA-1 and KCS-3 showed resistance reaction with PDI of 16.3 and 8.0 respectively. Varieties Muktakeshi, C-16 and Kovvuru local were moderately resistant to isolate PC2 and the PDI was 32.7, 33.7 and 35.3 respectively. Varieties Tenali (PDI 48.7), Hyderabad local (PDI 53.0) and NDC-1 (PDI 52.3) showed susceptible reaction, while highly susceptible reaction was recorded in four varieties *viz.,* 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 PC3 collected from Thiruvananthapuram, Kerala did not show highly resistant reaction to the disease (table 1&2). Variety RNCA-1 and Muktakeshi showed resistant reaction with PDI of 17.7 and 18.0 respectively. Moderately Resistant reaction was observed in two varieties *viz,* Kovvuru local (PDI 32.7) and KCS-3 (PDI 35.3). However varieties Jagtial local, Tenali, NDC-1 and C-16 showed susceptible reaction with PDI of 54.3, 49.3, 52.0 and 51.7 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).

Disease reaction of 12 taro varieties with isolate PC4 collected from Kovvuru indicated that five varieties Tenali (PDI 72.0), Hyderabad (PDI 71.4), Kadma local (PDI 72.0), C-16 (PDI 75.3) and Kovvuru local (PDI 65.0) were highly susceptible and three varieties Jagtial local (PDI 53.3), Satamukhi (PDI 51.3) and NDC-1 (PDI 52.3) showed susceptible reaction. While two varieties each were moderately resistant *viz*., RNCA-1, Nellore (PDI 34.0) and resistant *i.e* Muktakeshi (PDI 18.0), KCS-3 (PDI 17.3) to the disease

Similar observation was made by Khalid Pervaiz Aktar (2012) in *Solanam* sp. to *Phytophthora infestans* in Pakistan and found that none of the genotypes were disease free and only one genotype TMS-2 responded as resistant.

Brooks (2008) also evaluated 23 taro hybrids resistant to *Phytophthora 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.

**Table 1: Screening of Taro varieties against *Phytophthora colocasiae* by detached leafmethod**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S.No.** | **Name of the Variety** | **Per cent Disease Index (PDI) and Reaction groups** | | | | | | | |
| **Isolate PC1** | | **Isolate PC2** | | **Isolate PC3** | | **Isolate PC4** | |
| **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)\* | S | 53.3  (46.9)\* | S |
| 2 | RNCA-1 | 6.0  (14.0) | HR | 16.3  (23.5) | R | 35.3  (36.3) | MR | 34.0  (35.6) | MR |
| 3 | Tenali | 76.0  (60.6) | HS | 48.7  (44.2) | S | 49.3  (44.6) | S | 72.0  (58.1) | HS |
| 4 | Muktakeshi | 26.7  (31.0) | R | 32.7  (34.8) | MR | 18.0  (24.8) | R | 18.0  (24.8) | R |
| 5 | Hyderabad local | 52.0  (46.1) | S | 53.0  (46.7) | S | 80.7  (64.0) | HS | 71.7  (57.9) | HS |
| 6 | Satamukhi | 84.0  (66.4) | HS | 73.3  (58.9) | HS | 76.0  (60.8) | HS | 51.3  (45.7) | S |
| 7 | NDC-1 | 70.0  (56.7) | HS | 52.3  (46.3) | S | 52.0  (46.1) | S | 18.0  (46.3) | S |
| 8 | Kadma local | 34.7  (36.0) | MR | 66.0  (54.3) | HS | 74.0  (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 | 34.0  (35.5) | MR |
| 10 | C-16 | 54.7  (47.6) | S | 33.7  (35.3) | MR | 51.4  (45.9) | S | 75.3  (60.5) | HS |
| 11 | Kovvur local | 25.3  (30.1) | MR | 35.3  (36.3) | MR | 32.7  (34.7) | MR | 65.0  (53.7) | HS |
| 12 | KCS-3 | 15.3  (22.9) | R | 18  (24.8) | R | 17.7  (24.7) | R | 17.3  (24.4) | R |
|  | CD at 5% | 3.13 |  | 6.89 |  | 7.99 |  | 8.08 |  |
|  | SEm+ | 1.06 |  | 2.34 |  | 2.72 |  | 2.75 |  |
|  | CV (%) | 4.48 |  | 9.30 |  | 10.27 |  | 10.44 |  |

\* Figures in parenthesis are transformed arcsine value

**Table. 2: Varietal reaction of Taro to different isolates of *Phytophthora colocasiae.***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S.No.** | **Reaction of Taro varieties to isolates of *Phytophthora colocasiae*** | | | | **Disease scale** | **Disease reaction** |
| **Isolate PC1** | **Isolate PC2** | **Isolate PC3** | **Isolate PC4** |
| 1. | **-** | **-** | **-** | **-** | (0%) | Immune |
| 2. | RNCA-1 | **-** | **-** | **-** | (0.01- 10%) | Highly resistant |
| 3. | Muktakeshi, KCS-3 | RNCA-1, KCS-3 | KCS-3, Muktakeshi, | KCS-3, Muktakeshi, | (10.01- 25%) | Resistant |
| 4. | Kadma local, Kovvuru local | Muktakeshi, C-16, Kovvuru local | RNCA-1, Kovvuru local | RNCA-1, Nellore | (25.01- 40%) | Moderately resistant |
| 5. | Jagtial local, Hyderabad local, Nellore, C-16 | Tenali, Hyderabad local, NDC-1, Jagtial | Tenali,  NDC-1,  C-16 | Jagtial local, Satamukhi, NDC-1 | (40.01 -60%) | Susceptible |
| 6. | Tenali, Satamukhi,  NDC-1 | Jagtial local, Satamukhi, Kadma local, Nellore | Hyderabad local, Satamukhi, Kadma local, Nellore | Tenali, Hyderabad local, Kadma local, C-16, Kovvuru local | (> 60.01 %) | Highly susceptible |

But in Kadma local, Muktakeshi or Nadia local symptoms or infections were not observed and showed immune reactions to blight.

Deo *et al.* (2011) 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 reveals that pathogenic variation exist among the four isolates of *P. colocasiae* and also this study also revealed that KCS-3 and Muktakeshi varieties are have a wide range of durable resistant reaction against *P. colocasiae.*

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