

## Varietal Screening of Rice against Sheath Rot under Natural and Artificial Epiphytotic Conditions

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**ABSTRACT:** Rice sheath rot caused by *Sarocladium oryzae* is an emerging fungal disease is spreading over many rice growing areas in Konkan region of Maharashtra. The screening for disease resistance is essential to identify the resistant source. Thirty-five varieties were screened under artificial and natural epiphytotic conditions during Kharif, 2021 and Kharif, 2022. Among thirty-five rice varieties evaluated against sheath rot under artificial epiphytotic conditions revealed that, Ratnagiri Purple variety showed moderately resistant reaction to sheath rot with 3.55 and 4.44 per cent disease severity in Kharif, 2021 and 2022, respectively. Thirteen rice varieties were moderately susceptible, sixteen were susceptible and five rice varieties viz., Karjat 7 (78.22 % and 75.55 %), Karjat 8 (64.44 % and 65.77 %), Karjat 9 (71.11 % and 73.77 %), Palghar 2 (70.67 % and 72.44 %) and Ratnagiri 73 (74.66 % and 75.11%) were found highly susceptible during both the season in artificial and natural condition also. Among thirty-five rice varieties evaluated against sheath rot under natural epiphytotic conditions during Kharif, 2021 and Kharif, 2022, result revealed that, Ratnagiri Purple variety showed moderately resistant reaction, thirteen rice varieties were found moderately susceptible reaction, sixteen rice varieties were found susceptible reaction, five rice varieties viz., Karjat 7, Karjat 8, Karjat 9, Palghar 2 and Ratnagiri 73 were found highly susceptible reaction in Kharif, 2021 and Kharif, 2022.

**Keywords:** *Sarocladium oryzae*, Rice, Susceptible, Moderately resistant.

### INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important cereals of the world and is staple food of about 65 % of the world's population. It is grown under different agro ecological conditions viz., deep water, water logged, hills, high humidity, high temperatures, saline and alkaline soils and flood prone areas in India. Rice suffers from many of the diseases caused by fungi, bacteria, viruses, phytoplasma, nematodes and other non-parasitic disorders. Among the fungal diseases, sheath rot caused by *Sarocladium oryzae* (Sawada) Gams and Hawksworth has become more prevalent in recent decades which causes yield losses ranging from 20 to 85 per cent in most rice growing regions of the world (Naeimi *et al.*, 2003). Sheath rot pathogen mainly infects the economic part of the rice plant i.e. boot leaf sheath enclosing young panicles which retards or aborts the emergence of panicles. Seeds from infected panicles become discoloured and sterile, thereby reducing grain yield and quality significantly (Pushpam *et al.*, 2020).

At present, sheath rot of rice cannot be effectively controlled by chemical means alone. Moreover, use of fungicide to manage the disease causes several adverse effects like development of resistance in the pathogen, residual toxicity, pollution to the environment and increased input cost. Breeding for disease resistance is one of the important tool to avoid fungicide use. It was therefore planned to identify the resistant sources to this disease from the released varieties of university.

### MATERIAL AND METHODS

#### Varietal screening under artificial epiphytotic conditions.

The study was conducted to find out resistant plant sources against the disease. Thirty-five rice varieties were screened by artificial single grain insertion technique under pot culture condition during Kharif, 2021 and Kharif, 2022 at glass house condition, Department of Plant Pathology, College of Agriculture, Dapoli (Table 1). Ten seeds of each rice varieties were sown in pots and grown up to booting stage. Plants in pots were artificially inoculated with most virulent

isolate of *S. oryzae* (So2) by placing single grain of rice grain culture in between the flag leaf sheath and unmerged panicle. Five plants were randomly selected and labelled. Inoculated pots were moistened with water and covered with polythene bag for maintaining

high relative humidity for disease appearance and incubated for 15 days. The observations for sheath rot severity were recorded at maturity using of SES scale (IRRI, 2013).

**Table 1: List of rice varieties screened against sheath rot under artificial inoculation.**

| Sr. No. | Variety          | Sr. No. | Variety         |
|---------|------------------|---------|-----------------|
| 1.      | Ratnagiri 1      | 18.     | Karjat 1        |
| 2.      | Ratnagiri 2      | 19.     | Karjat 2        |
| 3.      | Ratnagiri 3      | 20.     | Karjat 3        |
| 4.      | Ratnagiri 4      | 21.     | Karjat 4        |
| 5.      | Ratnagiri 5      | 22.     | Karjat 5        |
| 6.      | Ratnagiri 6      | 23.     | Karjat 6        |
| 7.      | Ratnagiri 7      | 24.     | Karjat 7        |
| 8.      | Ratnagiri 8      | 25.     | Karjat 8        |
| 9.      | Ratnagiri 24     | 26.     | Karjat 9        |
| 10.     | Ratnagiri 73     | 27.     | Karjat 10       |
| 11.     | Ratnagiri 711    | 28.     | Karjat 184      |
| 12.     | Ratnagiri Purple | 29.     | Karjat Shatabdi |
| 13.     | Sahyadri 1       | 30.     | Palghar 1       |
| 14.     | Sahyadri 2       | 31.     | Palghar 2       |
| 15.     | Sahyadri 3       | 32.     | Panvel 1        |
| 16.     | Sahyadri 4       | 33.     | Panvel 2        |
| 17.     | Sahyadri 5       | 34.     | T K kolam       |
|         |                  | 35.     | Phondaghat 1    |

**Varietal screening under natural epiphytotic conditions.** The field experiment was conducted during *Kharif*, 2021 and *Kharif*, 2022 at Plant Pathology farm, Department of Plant Pathology, College of Agriculture, Dapoli to assess the reactions of rice varieties against sheath rot of rice. Thirty-five rice varieties were sown on raised beds nursery (Table 1). Transplanting of 25

days old seedlings of each test variety was carried out in two rows in non-replicated design at 20 × 15 cm spacing. Observations on sheath rot disease severity were recorded on five randomly selected plants starting from initiation of the disease symptoms to physiological maturity of the crop by using the standard disease rating SES scale (IRRI, 2013).

| Scale grade | Description  | Disease reaction            |
|-------------|--|-----------------------------|
| 0           | No lesion/ spot on flag leaf sheath  | Highly resistant (HR)       |
| 1           | Spots visible on the tillers upon very careful examination (less than 1% flag leaf sheath area covered)                                | Resistant (R)               |
| 3           | Spots visible on the tillers upon careful examination (1-5% flag leaf sheath area covered)   | Moderately resistant (MR)   |
| 5           | Spots easily visible on the tillers (6-25% flag leaf sheath area covered)  | Moderately susceptible (MS) |
| 7           | Spots present on almost whole the tillers parts (26-50% flag leaf sheath area covered)   | Susceptible (S)             |
| 9           | Spots very common on whole the tillers parts (51-100% flag leaf sheath area covered) death of plants common, reduced severe yield loss | Highly susceptible (HS)     |

## RESULTS AND DISCUSSION

**Varietal screening under artificial epiphytotic conditions.** In present study, thirty-five rice varieties were evaluated against sheath rot disease caused by *S. oryzae* under artificial epiphytotic conditions (PLATE I and PLATE II) by using single grain insertion method during *Kharif*, 2021 and *Kharif*, 2022 at glass house condition as well as natural condition, Department of Plant Pathology, College of Agriculture, Dapoli. Among thirty-five rice varieties screened against sheath rot caused by *S. oryzae*, it was revealed that, none of the rice variety exhibited highly resistant and resistant reaction except Ratnagiri Purple variety showed moderately resistant reaction against sheath rot with 3.55 and 4.44 per cent disease severity in *Kharif*, 2021 and *Kharif*, 2022, respectively. Thirteen rice varieties

*viz.*, Ratnagiri 1 (9.77 % and 11.55 %), Ratnagiri 2 (20.44 % and 17.77 %), Ratnagiri 4 (17.33 % and 15.55 %), Ratnagiri 6 (16.44 % and 19.55 %), Ratnagiri 7 (19.56 % and 18.66 %), Ratnagiri 8 (10.66 % and 12.88 %), Ratnagiri 24 (24.00 % and 22.66 %), Karjat 1 (14.22 % and 16.44 %), Karjat 2 (12.88 % and 15.11 %), Phondaghat 1 (22.22 % and 23.55 %), Palghar 1 (23.11 % and 21.77 %), Karjat Shatabdi (12.44 % and 10.22 %) and Sahyadri 5 (18.22 % and 16.44 %) were found moderately susceptible in *Kharif*, 2021 and *Kharif*, 2022 respectively. Sixteen rice varieties *viz.*, Ratnagiri 3 (31.11 % and 32.44 %), Ratnagiri 5 (28.88 % and 27.55 %), Ratnagiri 711 (44.44 % and 45.33 %), Sahyadri 1 (40.44 % and 39.11 %), Sahyadri 2 (35.11 % and 36.88 %), Sahyadri 3 (29.77 % and 28.44 %), Sahyadri 4 (32.88 % and 33.77 %), Karjat 3 (29.33 %

and 31.11 %), Karjat 4 (33.33 % and 34.66 %), Karjat 5 (28.00 % and 30.22 %), Karjat 6 (35.55 % and 30.66 %), Karjat 10 (37.77 % and 31.55 %), Karjat 184 (26.66 % and 27.11 %), Panvel 1 (38.22 % and 42.22 %), Panvel 2 (29.33 % and 32.00 %) and T K Kolam (28.44 % and 34.22 %) were susceptible in *Kharif*, 2021 and *Kharif*, 2022 respectively (Table 3).

Five rice varieties viz., Karjat 7 (78.22 % and 75.55 %), Karjat 8 (64.44 % and 65.77 %), Karjat 9 (71.11 % and 73.77 %), Palghar 2 (70.67 % and 72.44 %) and Ratnagiri 73 (74.66 % and 75.11%) were found to be highly susceptible in *Kharif*, 2021 and *Kharif*, 2022 respectively.



**PLATE I.** Varietal screening under artificial epiphytotic conditions (*Kharif*, 2021).



**PLATE II.** Varietal screening under artificial epiphytotic conditions (*Kharif*, 2022).

**Table 3: Screening of rice varieties under artificial epiphytotic condition against sheath rot of rice during *Kharif*, 2021 and *Kharif*, 2022.**

| Variety          | Per cent Disease Severity * |                      | Rating | Reaction |
|------------------|-----------------------------|----------------------|--------|----------|
|                  | <i>Kharif</i> , 2021        | <i>Kharif</i> , 2022 |        |          |
| Ratnagiri 1      | 9.77                        | 11.55                | 5      | MS       |
| Ratnagiri 2      | 20.44                       | 17.77                | 5      | MS       |
| Ratnagiri 3      | 31.11                       | 32.44                | 7      | S        |
| Ratnagiri 4      | 17.33                       | 15.55                | 5      | MS       |
| Ratnagiri 5      | 28.88                       | 27.55                | 7      | S        |
| Ratnagiri 6      | 16.44                       | 19.55                | 5      | MS       |
| Ratnagiri 7      | 19.56                       | 18.66                | 5      | MS       |
| Ratnagiri 8      | 10.66                       | 12.88                | 5      | MS       |
| Ratnagiri Purple | 3.55                        | 4.44                 | 3      | MR       |
| Ratnagiri 73     | 74.66                       | 75.11                | 9      | HS       |
| Ratnagiri 711    | 44.44                       | 45.33                | 7      | S        |
| Ratnagiri 24     | 24.00                       | 22.66                | 5      | MS       |
| Karjat 184       | 26.66                       | 27.11                | 7      | S        |
| Karjat 1         | 14.22                       | 16.44                | 5      | MS       |
| Karjat 2         | 12.88                       | 15.11                | 5      | MS       |
| Karjat 3         | 29.33                       | 31.11                | 7      | S        |
| Karjat 4         | 33.33                       | 34.66                | 7      | S        |
| Karjat 5         | 28.00                       | 30.22                | 7      | S        |
| Karjat 6         | 35.55                       | 30.66                | 7      | S        |
| Karjat 7         | 78.22                       | 75.55                | 9      | HS       |
| Karjat 8         | 64.44                       | 65.77                | 9      | HS       |
| Karjat 9         | 71.11                       | 73.77                | 9      | HS       |

|                 |       |       |   |    |
|-----------------|-------|-------|---|----|
| Karjat 10       | 37.77 | 31.55 | 7 | S  |
| T K Kolam       | 28.44 | 34.22 | 7 | S  |
| Karjat Shatabdi | 12.44 | 10.22 | 5 | MS |
| Palghar 1       | 23.11 | 21.77 | 5 | MS |
| Palghar 2       | 70.67 | 72.44 | 9 | HS |
| Phondaghat 1    | 22.22 | 23.55 | 5 | MS |
| Sahyadri 1      | 40.44 | 39.11 | 7 | S  |
| Sahyadri 2      | 35.11 | 36.88 | 7 | S  |
| Sahyadri 3      | 29.77 | 28.44 | 7 | S  |
| Sahyadri 4      | 32.88 | 33.77 | 7 | S  |
| Sahyadri 5      | 18.22 | 16.44 | 5 | MS |
| Panvel 1        | 38.22 | 42.22 | 7 | S  |
| Panvel 2        | 29.33 | 32.00 | 7 | S  |

\* : Mean of two replications

**Varietal screening under natural epiphytotic conditions.** In present study, thirty-five rice varieties were evaluated against sheath rot caused by *Sarocladium oryzae* under natural epiphytotic conditions (PLATE III and PLATE IV) during *Kharif*, 2021 and *Kharif*, 2022 at Plant Pathology farm, Department of Plant Pathology, College of Agriculture, Dapoli.

Among thirty-five rice varieties screened against sheath rot caused by *S. oryzae* under natural epiphytotic conditions, it was revealed that, none of the rice variety was found highly resistant and resistant reaction. Ratnagiri Purple variety showed moderately resistant reaction against sheath rot in *Kharif*, 2021 and *Kharif*, 2022. Thirteen rice varieties viz., Ratnagiri 1, Ratnagiri 2, Ratnagiri 4, Ratnagiri 6, Ratnagiri 7, Ratnagiri 8, Ratnagiri 24, Karjat 1, Karjat 2, Phondaghat 1, Palghar 1, Karjat Shatabdi and Sahyadri 5 were moderately susceptible reaction in *Kharif*, 2021 and *Kharif*, 2022.

Sixteen rice varieties viz., Ratnagiri 3, Ratnagiri 5, Ratnagiri 711, Sahyadri 1, Sahyadri 2, Sahyadri 3, Sahyadri 4, Karjat 3, Karjat 4, Karjat 5, Karjat 6, Karjat 10, Karjat 184, Panvel 1, Panvel 2 and T K Kolam were susceptible in *Kharif*, 2021 and *Kharif*, 2022. Five rice varieties viz., Karjat 7, Karjat 8, Karjat 9, Palghar 2 and Ratnagiri 73 were highly susceptible in *Kharif*, 2021 and *Kharif*, 2022 (Table 4).

The results of present investigation resembled with the findings of earlier records of many workers. Pushpam *et al.* (2020) screened 79 rice germplasm lines raised in pots in screen house conditions for sheath rot resistance and reported that 34 varieties were categorized as susceptible, 12 varieties were categorized as moderately susceptible, 11 varieties were categorized as resistant, 16 varieties were categorized as moderately resistant and 6 varieties were categorized as highly susceptible to sheath rot.



**PLATE III.** Varietal screening under natural epiphytotic conditions (*Kharif*, 2021).



**PLATE IV.** Varietal screening under natural epiphytotic conditions (*Kharif*, 2022).

**Table 4: Screening of rice varieties under natural epiphytotic condition against sheath rot of rice during Kharif, 2021 and Kharif, 2022.**

| Variety          | Per cent Disease Severity * |              | Rating | Reaction |
|------------------|-----------------------------|--------------|--------|----------|
|                  | Kharif, 2021                | Kharif, 2022 |        |          |
| Ratnagiri 1      | 8.62                        | 9.96         | 5      | MS       |
| Ratnagiri 2      | 19.94                       | 21.23        | 5      | MS       |
| Ratnagiri 3      | 33.35                       | 34.12        | 7      | S        |
| Ratnagiri 4      | 19.56                       | 17.32        | 5      | MS       |
| Ratnagiri 5      | 29.66                       | 31.22        | 7      | S        |
| Ratnagiri 6      | 18.21                       | 16.37        | 5      | MS       |
| Ratnagiri 7      | 18.52                       | 17.62        | 5      | MS       |
| Ratnagiri 8      | 11.28                       | 13.47        | 5      | MS       |
| Ratnagiri Purple | 2.15                        | 3.28         | 3      | MR       |
| Ratnagiri 73     | 75.46                       | 76.11        | 9      | HS       |
| Ratnagiri 711    | 41.36                       | 43.66        | 7      | S        |
| Ratnagiri 24     | 23.47                       | 24.62        | 5      | MS       |
| Karjat 184       | 25.52                       | 27.82        | 7      | S        |
| Karjat 1         | 13.63                       | 14.37        | 5      | MS       |
| Karjat 2         | 11.10                       | 13.76        | 5      | MS       |
| Karjat 3         | 29.62                       | 28.82        | 7      | S        |
| Karjat 4         | 32.18                       | 34.25        | 7      | S        |
| Karjat 5         | 29.12                       | 31.25        | 7      | S        |
| Karjat 6         | 36.14                       | 34.92        | 7      | S        |
| Karjat 7         | 77.10                       | 79.65        | 9      | HS       |
| Karjat 8         | 61.25                       | 63.68        | 9      | HS       |
| Karjat 9         | 69.10                       | 70.75        | 9      | HS       |
| Karjat 10        | 38.66                       | 37.34        | 7      | S        |
| T K Kolam        | 27.60                       | 29.88        | 7      | S        |
| Karjat Shatabdi  | 11.26                       | 12.59        | 5      | MS       |
| Palghar 1        | 23.59                       | 24.35        | 5      | MS       |
| Palghar 2        | 71.12                       | 72.65        | 9      | HS       |
| Phondaghat 1     | 21.63                       | 20.88        | 5      | MS       |
| Sahyadri 1       | 42.44                       | 43.66        | 7      | S        |
| Sahyadri 2       | 33.62                       | 34.71        | 7      | S        |
| Sahyadri 3       | 32.09                       | 29.94        | 7      | S        |
| Sahyadri 4       | 30.25                       | 32.52        | 7      | S        |
| Sahyadri 5       | 16.66                       | 17.85        | 5      | MS       |
| Panvel 1         | 37.12                       | 39.95        | 7      | S        |
| Panvel 2         | 26.12                       | 27.56        | 7      | S        |

## CONCLUSIONS

Based on above findings it was observed that none of the variety was highly resistant or resistant against sheath rot. Among the thirty-five rice varieties, Ratnagiri Purple variety showed moderately resistant against sheath rot of rice under natural and artificial epiphytotic conditions.

## FUTURE SCOPE

The identified sheath rot moderately resistant variety Ratnagiri Purple be further evaluated against other major diseases of rice as well as evaluated for yield and quality traits.

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**Conflict of Interest.** None.

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