Cultural and Morphological Variation in *Sclerotium oryzae* Catt. Isolates Collected from Major Rice Growing Areas of Telangana and Andhra Pradesh States, India

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Cultural and morphological characters of fifteen isolates of *Sclerotium oryzae* Catt. collected from different rice growing areas in Telangana and Andhra Pradesh states were studied. Significant differences in growth, mycelial dry weights and sclerotial characters were observed among the fifteen isolates grown on PDA and PDB. All the 15 isolates were divided into two groups based on the growth pattern on PDA. Group 1 consists of ten isolates SO2, SO3, SO5, SO6, SO7, SO10, SO11, SO12, SO14 and SO15 which exhibited fast growth rate in terms of colony diameter with a range of 80 mm to 83 mm. Group II consists of the isolates SO1, SO4, SO8, SO9 and SO13 which recorded moderate growth rate with the colony diameter ranged from 70 to 79 mm. In all the isolates the initiation of sclerotial formation was noticed after 4 to 6 days and the mycelium aggregated into a full-fledged round brown to black sclerotium after 6 to 8 days after inoculation on PDA. Significant differences were observed in sclerotial size in fifteen isolates of *S. oryzae* with a range of 308 µm to 1012 µm in diameter. In all the isolates the sclerotial formation was initiated from centre towards periphery whereas in the isolate SO1, sclerotia were scattered uniformly. The sclerotia of all the isolates were intermixed in the mycelium except in the isolate SO4 in which sclerotia were formed in circular pattern on the PDA medium.
Introduction

Rice is an important cereal food crop which serves as staple food for majority of population in Telangana and Andhra Pradesh states. Different biotic and abiotic factors affects the rice crop under field conditions leading to reduction in crop yields.

Among these, the biotic factors like fungi, bacteria and viruses are the major factors limiting the rice production. Stem rot incited by *Sclerotium oryzae* which is considered as a minor disease has become major threat in most of the major rice growing areas and causing disease in popular rice cultivars and reduces in quality and quantity of the produce (Gopika *et al*., 2011). The occurrence of the disease is observed in major rice growing districts of Mahboobnagar, Nalgonda, Warangal and Khammam of Telangana state and Nellore, East Godavari and West Godavari districts of Andhra Pradesh state.

The yield losses to an extent of 80 per cent was reported in different rice cultivars under varied agro climatic regions in India and abroad (Li *et al*., 1984; Ou, 1985; Cother and Nicol, 1999). Continuous cultivation of rice during different seasons and usage of high dosages of nitrogenous fertilizers and prevalence of graminaceous weed species and inadequate irrigation and drainage facilities increased the stem rot disease incidence (Chen, 1971 and 1973).

Knowledge on naturally occurring pathogen populations is a prerequisite for successful development of new high yielding rice cultivars possessing resistance to stem rot under varied agro climatic situations that are prevailing in Telangana and Andhra Pradesh states. The present investigation has been taken up to study the variations in cultural and morphological characters of 15 isolates of *S. oryzae* collected from rice growing tracts of Telangana and Andhra Pradesh states.

Materials and Methods

Isolation and identification of the pathogen

Extensive roving survey was conducted in major rice growing areas of Telangana and Andhra Pradesh states during *kharif*, 2015. Samples of rice cv. MTU-3626 (Prabhat), MTU-1010 (Cotondora sannalu), MTU-1001 (Vijetha), JGL- 18047 (Bathukamma), NLR-34242 (91 lavulu), WGL - 3962 (Bhadarakali) and RNR -15048 (Telangana sona) exhibiting typical symptoms of stem rot disease were collected.

The infected plant samples were cut into bits of 2-3 mm size with a sterile blade. These bits were surface sterilized in 0.1% sodium hypochlorite for 1 to 2 min and then transferred aseptically to Petri plates containing potato dextrose agar medium and incubated at 25 ± 1°C in a BOD incubator for occurrence of growth and sporulation of the pathogen. The pathogen associated with the disease was identified based on morphological and colony characters as described by Barnett and Hunter (1972). The pathogen was further sub cultured by single sclerotial isolation method on PDA slants for further studies.

Cultural and morphological variability

The Petri plates containing PDA medium were inoculated with 5 mm mycelial discs obtained from the periphery of actively growing colony of five days old culture and incubated at 25 ± 1°C in BOD incubator maintaining three replications. The observations on colony color, colony diameter, hyphal diameter and substrate color were recorded after 5 days of incubation. The mycelial dry weights of 15 *S. oryzae* isolates...
were recorded by placing 5mm mycelial discs obtained from periphery of actively growing colony of five days old cultures in 500 ml conical flasks containing 250 ml of Potato Dextrose Broth (PDB) and incubated at 25±1°C for 10 days maintaining three replications and mycelial mats were filtered on whatman no.1 filter paper and oven dried before recording mycelial dry weights. The data on morphological characters like sclerotial initiation, maturation, color of sclerotia, position and pattern of sclerotia in all the 15 isolates were recorded. The sclerotial initiation (days), sclerotial size in (µm) was recorded by measuring 100 sclerotia from each Petri plate using ocular and stage micrometer.

Results and Discussion

All 15 isolates of *S. oryzae* recorded significant differences in radial mycelial growth of colony and mycelial dry weights on PDA medium. Marked differences were observed among the isolates in cultural characters like growth pattern and pigmentation. On the basis of these characters, all the 15 isolates were divided into two groups.

Where Group 1 consist of the fast growing ten isolates of SO2, SO3, SO5, SO6, SO7, SO10, SO11, SO12, SO14 and SO15 with colony diameter ranged from 80 to 83 mm. Group II isolates are moderately growing consisting of SO1, SO4, SO8, SO9 and SO13 with colony diameter ranged from 70 to 79 mm, respectively. The maximum colony growth was recorded in SO5 isolate (86 mm) and minimum colony diameter was recorded in SO8 isolate (70 mm).

The substrate of all the 15 isolates were found whitish to brown in color with folded mycelium on PDA media whereas the mycelium was unfolded in SO1, SO4, SO8, SO13 and SO15 isolates. The hyphal diameter ranged from 8 µm to 15 µm in all the fifteen isolates (Table.1).

The formation of sclerotia was observed 4 to 6 days after inoculation on PDA and the mycelium aggregated into a full-fledged round brown to black sclerotium in all the isolates after 6 to 8 days after inoculation on PDA. Significant differences were recorded in sclerotial dimensions with a range of 308 µm to 1012 µm.

Sclerotial formation was observed from centre towards periphery whereas sclerotia were scattered uniformly on the PDA medium in the SO11 isolate. The sclerotia were mixed in the mycelium in all 15 isolates except SO 4 isolate where as sclerotia were formed in circular pattern on the medium (Table. 2).

Significant differences in sclerotial formation was earlier reported by Ahuja et al., (1987). All the isolates produced sclerotia on PDA medium but the sclerotial initiation period differed (Table. 2). Mundkur (1935) and Punter et al. (1984) who reported that sclerotia were usually produced after one week but it differed in some isolates which produced after 10 days and the large sized sclerotia in culture may be attributed to better availability of nutrition in the medium than on its natural host.

Similar findings in cultural and morphological characters among different isolates of *S. oryzae* were observed by Ali and Singh (1994).

The present study revealed the variation in cultural and morphological characteristics among isolates of *S. oryzae* collected from different districts of Telangana and Andhra Pradesh states.
**Table 1** Cultural characters of *S. oryzae* isolates collected from different districts of Telangana and Andhra Pradesh state

| Isolates | Place of Collection | Collected from Cultivar | Colony Color | Colony Diameter (mm) | Hyphal Diameter(µm) | Mycelial Dry Weight (g.) | Substrate pigmentation |
|----------|---------------------|-------------------------|--------------|----------------------|----------------------|--------------------------|------------------------|
| SO1      | Jagtial             | BPT-5204                | white        | 79.07                | 10.07                | 0.95                     | Brown and unfolded      |
| SO2      | Dharmapuri          | BPT-5204                | white        | 81.97                | 12.07                | 0.88                     | Dark brown and folded   |
| SO3      | Mahboobnagar        | RNR 15048               | white        | 81.93                | 13.97                | 0.82                     | White with Folds        |
| SO4      | Warangal            | BPT-5204                | white        | 76.07                | 10.13                | 0.74                     | White without Folds     |
| SO5      | Nizamabad           | BPT-5204                | white        | 82.90                | 14.90                | 1.72                     | White with Folds        |
| SO6      | East Godavari       | MTU 3626                | white        | 82.07                | 10.07                | 0.93                     | White with Folds        |
| SO7      | East Godavari       | BPT-5204                | white        | 81.87                | 15.10                | 1.02                     | White with Folds        |
| SO8      | Nalgonda            | BPT-5204                | white        | 69.88                | 10.13                | 0.78                     | White to Brownish without Folds |
| SO9      | Nellore             | NLR 34242               | white        | 77.93                | 8.07                 | 0.82                     | White to Brown and Folded |
| SO10     | Khammam             | MTU 1001                | white        | 79.87                | 10.00                | 0.74                     | White with Folds        |
| SO11     | Janagam             | BPT-5204                | white        | 80.07                | 12.13                | 0.73                     | White with Folds        |
| SO12     | Mahboobnagar        | RNR 15048               | white        | 79.73                | 15.10                | 0.88                     | White with Folds        |
| SO13     | Ranga Reddy         | MTU 1010                | white        | 73.93                | 12.07                | 0.96                     | White without Folds     |
| SO14     | Ranga Reddy         | BPT 5204                | white        | 80.13                | 10.07                | 0.79                     | White with Folds        |
| SO15     | Khammam             | BPT 5204                | white        | 79.13                | 10.13                | 0.76                     | White to Brownish without Folds |

|                | CD @5%              | SE (m)                  | CV          |
|----------------|---------------------|-------------------------|-------------|
|                | 0.767               | 0.693                   | 0.080       |
|                | 0.274               | 0.239                   | 0.028       |
|                | 0.578               | 3.566                   | 5.313       |
Table 2: Morphological characters of fifteen *S. oryzae* isolates collected from Telangana and Andhra Pradesh state

| S.No. | Sclerotial initiation (days) | Sclerotial maturation (days) | Sclerotial dimensions (µm) | Sclerotial color | Sclerotial position | Pattern | Sclerotial shape |
|-------|-----------------------------|------------------------------|----------------------------|------------------|---------------------|---------|-----------------|
| SO 1  | 5                           | 7                            | 979.28                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 2  | 4                           | 6                            | 818.23                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 3  | 4                           | 6                            | 308.17                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 4  | 5                           | 7                            | 535.33                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 5  | 4                           | 6                            | 791.24                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 6  | 4                           | 6                            | 868.18                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 7  | 4                           | 6                            | 1012.25                    | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 8  | 5                           | 7                            | 764.44                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 9  | 5                           | 7                            | 618.20                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 10 | 6                           | 8                            | 520.22                     | Black            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 11 | 5                           | 7                            | 888.18                     | Brown            | Scattered uniformly     | Intermixed within the mycelium | spherical |
| SO 12 | 5                           | 7                            | 380.22                     | Black            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 13 | 5                           | 7                            | 919.20                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |
| SO 14 | 4                           | 6                            | 975.23                     | Black            | Center towards periphery | Intermixed within the mycelium | irregular |
| SO 15 | 4                           | 6                            | 460.24                     | Brown            | Center towards periphery | Intermixed within the mycelium | spherical |

| CD @5% | 6.718 |
| SE (m)  | 2.315 |
| CV      | 0.555 |
References

AL-Heeti M B and El-Bahadli A H 1982. Estimation of yield losses caused by Sclerotium oryzae Catt. on rice in Iraq. College of Agricultural University Baghdad, Abu Gnarib, Iraq: 113-114.

Ali Z and Singh R A 1994. Variability in Rice stem rot incitant – Magnaporthe Salvini (Sclerotium oryzae). Indian Journal of Mycology and Plant Pathology 24(1): 38-40.

Barnett H L and Barry B Hunter 1972. Illustrated genera of imperfect fungi. Burgess Publishing Company, Minnesota.

Cother E and Nicol H 1999. Susceptibility of Australian rice cultivars to stem rot fungus Sclerotium oryzae. Australasian Plant Pathology 28 : 85-91.

Gopika K, Jagadeeshwar, Krishna Rao V and Vijayalakshmi K 2016. Salient Research findings on rice stem rot disease (Sclerotium oryzae Catt.) and its management. International Journal of Plant, Animal and Environmental sciences 6(1): 80-82

Hernandez S A 1923. Report of Plant Disease Section. Report, Philippine Bureau of Agriculture 2 : 159-172.

Srivastava M P, Maheshwari S K and Saini S S 1971. Varietal resistance of rice (Oryzae sativa L.) to stem rot. Indian Journal of Agricultural Science 41 : 93-7.

Kang M S, Srivastava M P and Maheshwari S K 1970. Studies on stem rot of paddy. Varietal reaction of certain new promising varieties. Journal of Research, PAU, Ludhiana 7 : 587-589.

Li Y G, Kang B J, Feng Y X, Huang D J, Wu D B and Li T F 1984. A brief report on the studies of rice stem rot. Guangdong Agricultural Science 5 : 35-37.

Mundkur B B 1935. Parasitism of Sclerotium oryzae Catt. Indian Journal of Agricultural Sciences 5 : 393-414.

Ou S H 1985. Rice Diseases (2nd edition). Common wealth Mycological Institute, Kew (England), 380pp.

Punter D Reid J and Hopkin A A 1984. Notes on Sclerotium forming fungi from Zizania aquatica (Wild rice) and other hosts. Mycologia 76(4) : 722-732.

Webster R K, Wick C M, Hall D H, Lindberg D and Lindberg A 1972. Effects of various methods of rice residues management on Sclerotium oryzae inoculum level stem rot disease severity and yield, a progress report. Page 59-60 in Proc. 14th Rice Technical Working Group, Univ. of California Davis, June. pp101.

Krause R A and Webster R K 1972. Sclerotial production, viability determination and sclerotial quantitative recovery of Sclerotium oryzae from soil. Ibid. 64:1333-1337.

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