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Research Article

CULTURAL AND MORPHOLOGICAL VARIABILITY OF MACROPHOMINA PHASEOLINA (TASSI) GOID CAUSING CHARCOAL ROT OF JOWAR IN SOLAPUR DISTRICT OF MAHARASTRA,INDIA

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ABSTRACT

In the present studies, eleven isolates of *Macrophomina phaseolina* incitant of charcoal rot of *Sorghum bicolor* L were obtained from different agro-ecological areas of solapur districts in Maharastra. It's varied in their cultural characteristics & pathogenic behavior. On the basis of colony colour, isolates were divided into four groups i.e. blackish grey, grey, blackish in center periphery creamish and grayish white. Maximum feathery (++++) colony appearance was found in the isolates of *Mp*4, *Mp*5, *Mp*6 and *Mp*7. The individual average radial growth of 11isolates of *M. phaseolina* ranged from 79.11 to 90.00 mm in 7 days after incubation. North solapur (*Mp*3) isolates produced highest number of Sclerotia i.e 143.8 Sclerotia/9 mm disc and 40.4/microscopic field (10X) while Mohol (*Mp*2) isolates produced minimum number of Sclerotia (57.0 sclerotia / 9mm disc & 16.4 / microscopic 10X field). Mohal (*Mp*2) and Pandharpur (*Mp*9) isolates produced largest size of sclerotia (28.6-39.6µm and 30.6-38.5µm) whereas Akkalkot (*Mp*4) produced smallest size of sclerotia (15.2-16.6µm). On the basis of Sclerotia morphology, two groups of isolates were formed, the one with oblong shape having irregular edges & the other are being round with regular edges.

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INTRODUCTION

Jowar (*Sorghum bicolor L.)* plant belongs to family poaceae is cultivated in warm climates worldwide i.e. tropic and subtropics region, Africa, Central America and South Asia, Dharwad of Karnataka [1, 2,3]. The five largest *Sorghum* producing countries in the world are United States (25%), India (21.5%), Mexico (11%), China (9%) and Nigeria (7%). These countries accounts for 73% of world production. The seed of sorghum is used as one of the staple foods for poor and rural people. Jowar varieties form important component of pastures in many tropical region. It is the fifth-most important cereal crop grown in the world. Dried leaves and stem of rabbi season crop is main source of cattle feed. The infection by *M. phaseolina* was very severe during the hot and dry season and high wind accelerated heavy losses [4]. The disease incidence was higher on hybrids than varieties [5]. *Macrophomina phaseolina* is a soil born pathogen that damages a wide range of agricultural crops [6]. It was reported dry root rot of pigeon pea caused by this pathogen possess great problem to control the disease [7]. *M. phaseolina* is a soil and seed-borne pathogenic fungus, produces cushion shaped black sclerotia [8] and was found on more than 500 hosts including several legumes and cereals plants [9,10]. There are reports from different parts of the world that populations of *M. phaseolina* showed major morphological [11], physiological [12], pathogenic [13,14] and genetic variations[15,16,17,18]. The disease is reported to be quite prevalent in India especially in Karnataka, Gujarat and Andhra Pradesh. Therefore the present work accounts to evaluate the cultural, morphological and pathogenic variability of *M. phaseolina* inciting of charcoal rot of Jowar.

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MATERIALS AND METHODS

Sample collection

A total of 11 isolates of *M. phaseolina* were collected from different agro-ecological places of Western Region of Maharashtra i.e. Mangalwedha, Mohol, North Solapur, Akkalkot, South Solapur, Barshi, Madha, Karmala, Pandharpur, Malshrius and Sangola. Samples of stems bearing microsclerotia of the fungus and characteristic symptoms of charcoal rot were collected from the farmers' fields. The diseased samples were first packed in paper bags and then in polyethylene bags with properly labeled and brought to the laboratory and stored at 4ºC until processed for identification.

Isolation, Purification and Identification of M.phaseolina

The fungus was isolated from stem bark tissues of Jowar bearing fungal sclerotia and showing characteristic charcoal

rot symptoms. The samples were cut into small pieces (3-5 mm) and surface sterilized with 1% $HgCl_2$ for 2 min and then rinsed thrice in sterilized distilled water. The pieces were placed on sterilized Potato Dextrose Agar medium (PDA) [19] in petri dishes (90 mm dia.) and incubated at 28±2ºC for 7 days.

Determination of cultural and Morphological Variability

The pathogenic nature of the isolates was ascertained by inoculating them on Potato Dextrose Agar (PDA) medium. The morphological and cultural variability of the isolates was studied on the basis of various parameters such as colony colour, texture, radial growth, branching pattern, size, shape and number of sclerotia etc. For these studies the isolates were grown and multiplied on PDA by inoculating 9mm disc of the fungus in the center of the Petri dish and incubated at 28±2ºC. The radial growth and sclerotial morphology were taken on 7th day of incubation. Numbers of sclerotia were counted under binocular research microscope [20].

RESULTS

Morphological Variability

Based on colony colour, the cultures were differentiated into four groups i.e. Blackish grey (*Mp*1) Grey (*Mp*2, *Mp8, Mp9* & *Mp*11); blackish in center periphery creamish (*Mp*4& *Mp*5) and Greyish white (*Mp*3, *Mp*6, *Mp*7 & *Mp*10). Isolates were also assigned into groups, on the basis of mycelial growth and colony texture. Mangalwedha (*Mp*1) isolates were produced blackish grey mycelial growth; lesser cottony growth was appeared in Mangalwedha(*Mp*1) and Karmala (*Mp*8) isolates. North Solapur (*Mp*3), Barshi (*Mp*6), Madha (*Mp*7), Malshirus (*Mp*10) isolates showed straight and grayish white mycelial growth. Karmala (*Mp*8) isolate had straight and compact colony appearance. Maximum feathery (++++) colony appearance was found in the isolates of *Mp*4, *Mp*5, *Mp*6 and *Mp*7. Mangalwedha *(Mp*1), Mohol *(Mp*2), North Solapur*(Mp*3), South Solapur*(Mp*5), Barshi*(Mp*8), Karmala *(Mp*8), Pandharpur *(Mp*9) and Sangola *(Mp*11) isolates had oblong shape and irregular edges whereas the other one had round shape with regular edges sclerotia. Branching pattern are found two types i.e right and acute angle. Right angle are found in the isolates of *Mp*1, *Mp*2, *Mp*6 and *Mp*10 whereas acute angle in *Mp3*, *Mp*4, *Mp*5, *Mp*7, *Mp*8, *Mp*9 and *Mp*11 (Table 1; Fig.1).

Radial Growth and Cultural Variability

The individual average radial growth of 11 isolates of *M. phaseolina* ranged from 79.11 to 90.00 mm 7 days after incubation. In respect to radial growth of isolates Mangalwedha (*Mp*1), Mohol (*Mp*2), Pandharpur (*Mp*9) and South Solapur (*Mp*5) isolates produced maximum mycelial growth whereas minimum was in Akkalkot (*Mp*4) followed by Karmala (*Mp*8) and Malshirus (*Mp*10) isolates. The number of sclerotia/ 9mm disc was varied from 15.2- 41.4. Among the isolates, North solapur (*Mp*3) isolates produced highest number of Sclerotia i.e 143.8 Sclerotia/9 mm disc and 40.4/microscopic field (10X) while Mohol (*Mp*2) isolates produced minimum number of Sclerotia (57.0 sclerotia / 9mm disc and 16.4 / microscopic 10X field).

Fig. 1: Cultural colony, Sclerotial Morphology and shape of different isolates of *M. phaseolina* (X40).

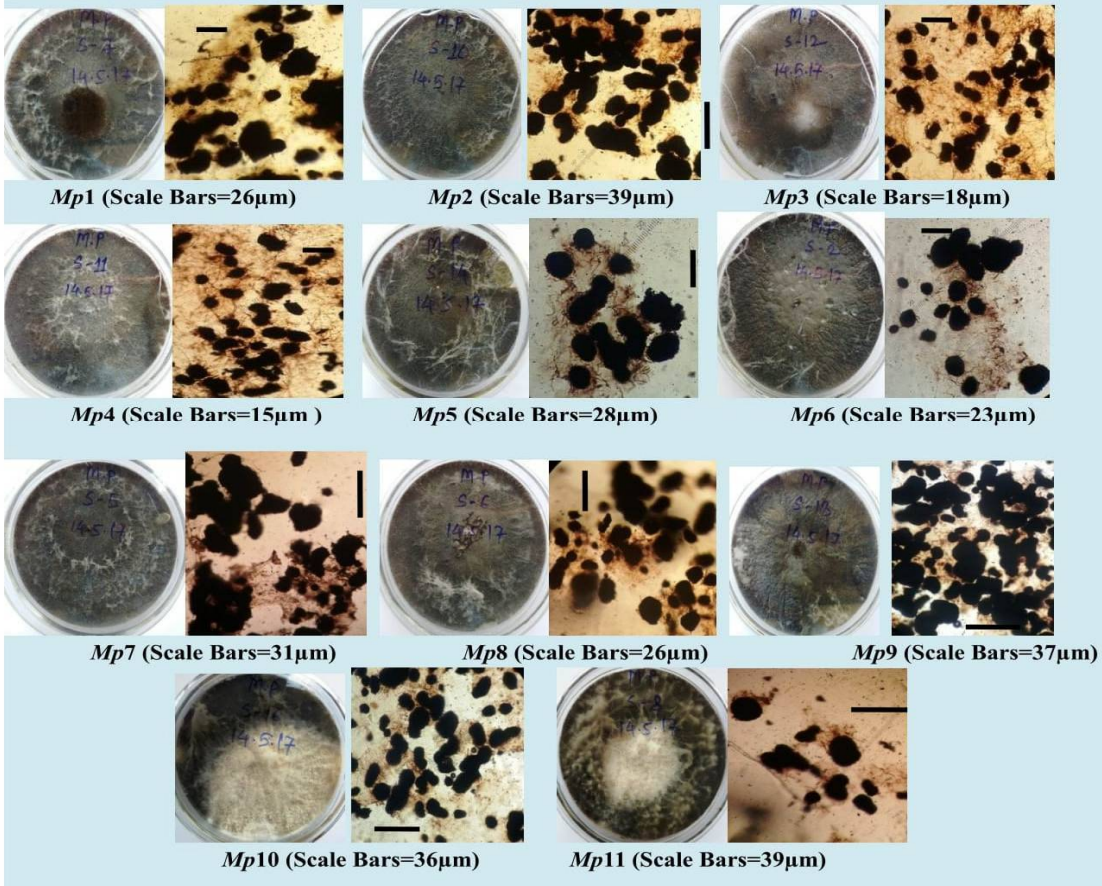

Table 1 Cultural character of eleven isolates of Macrophomina phaseolina collected from different agro-ecological areas of solapur district in Maharashtra.

Sr No.	Characters	Isolates										
		***Mp*1**	***Mp*2**	***Mp*3**	***Mp*4**	***Mp*5**	***Mp*6**	***Mp*7**	***Mp*8**	***Mp*9**	***Mp*10**	***Mp*11**
1	Colour of colony (Reverse)	Black	Black	Black	Black	Black	Black	Black	Black	Black	Black	Black
2	Colony colour	Blakish grey	Grey	Grayish white	Black in center periphery creamish	Black in center periphery creamish	Grayish white	Grayish white	Grey	Grey	Grayish white	Grey
3	Colony appearance	++	+	+	++++	++++	++++	++++	++	+	+++	+
4	Branching pattern	Right angle	Right angle	Acute angle	Acute angle	Acute angle	Right angle	Acute angle	Acute angle	Acute angle	Right angle	Acute angle
5	Construction at the point of origin	*	*	*	*	*	*	*	*	*	*	*
6	Formation of Septum in the branch near the origin	*	*	*	*	*	*	*	*	*	*	*
7	Shape of Sclerotia	Oblong	Oblong	Oblong	Round	Oblong	Oblong	Round	Oblong	Oblong	Round	Oblong

Legands:- *Mp*1 -Mangalwedha, *Mp*2-Mohol, *Mp*3- North Solapur, *Mp*4- Akkalkot, *Mp*5- South Solapur, *Mp*6- Barshi, *Mp*7- Madha**,** *Mp*8-Karmala**,** *Mp*9- Pandharpur**,** *Mp*10-Malsirus**,** *Mp*11-Sangola**, *** Presence of respective character, + Very less feathery, ++ Less feathery, +++ More feathery, ++++ Maximum feathery.

Table 2 Radial growth and Sclerotial production among different isolates of *M. phaseolina*.

Sr. No	Places	Isolates	Radial growth (mm)	*Sclerotial population / 9mm disc	*Sclerotial population / microscopic field	Sclerotial diameter** (µm)
1	Magalwedha	*Mp*1	90.00	119.7	38.0	23.8-27.7
2	Mohal	*Mp*2	89.22	57.0	16.4	28.6-39.6
3	North Solapur	*Mp*3	86.00	143.8	40.4	18.5-20.7
4	Akkalkot	*Mp*4	79.11	78.4	21.4	15.2-16.6
5	South Solapur	*Mp*5	88.11	107.0	30.8	26.4-29.7
6	Barshi	*Mp*6	87.22	111.4	36.2	20.2-24.8
7	Madha	*Mp*7	82.11	76.6	18.0	21.4-31.2
8	Karmala	*Mp*8	79.33	93.6	35.2	23.3-27.4
9	Pandharpur	*Mp*9	89.66	87.0	20.0	30.6-38.5
10	Malshirus	*Mp*10	79.66	94.6	35.4	23.8-36.6
11	Sangola	*Mp*11	88.11	103.5	34.6	22.8-41.4
CD (P=0.05)			2.95	15.82	5.98	-

Legands:* Mean for five observation ** Average of 50 Sclerotia

Mohol (*Mp*2) and Pandharpur (*Mp*9) isolates produced largest size of sclerotia (28.6-39.6µm and30.6-38.5µm) whereas Akkalkot (*Mp*4) produced smallest size of sclerotia (15.2-16.6µm) (Table.2).

DISCUSSION

Similar conclusion was drawn by different workers in case of cottony root rot incited by *M. phaseolina* [21]. These results are in agreement with those reported by [22]; where a direct correlation between sclerotial production and virulence or pathogenecity of isolates was established. It was concluded that the degree of production of sclerotia is positively correlated with the virulence of charcoal rot of maize caused by *M. phaseolina*. [23]. It was reported the cultural and pathogenic behavior are varied among the isolates of *M. phaseolina* caused by fruit rot of *Coccinia indica* [24]. It was found horde specialism in maize on the basis of pathogenic, genetic and physiological differences [25]. Morphological variability has also been reported by many workers in terms of growth, color, pycnidium production, and chlorate sensitivity among different isolates of *M. phaseolina* on different hosts [26]. It was reported 65 isolates of *Macrophomina phaseolina* from different agro ecological regions of Punjab and Khyber Pakhtunkhwa provinces of Pakistan were analyzed for morphological and pathogenic variability and observed individual average radial growths ranged from 32.00 to 87.17mm [27].

CONCLUSION

It is concluded that the degree of production of sclerotia is positively correlated with the virulence as in reflected by the North Solapur (*Mp*3) isolate where the number of sclerotia production was maximum as also this isolates incited maximum disease, on the contrary the Mohol (*Mp*2) isolate produced a minimum number of sclerotia at the same time and the disease caused by it was minimum. The variability among *M. phaseolina* isolates is basic and appropriate strategies for disease management. Therefore results will be useful in developing integrated management strategies of charcoal rot.

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