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Variability of *Macrophomina phaseolina* (Tassi) Goid in major jute growing areas of India

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Four isolates (CRIJAF, Nagaon, Kalyani and Budbud) of *Macrophomina phaseolina*, the incitant of stem rot of jute (*Corchorus olitorious* and *C. capsularis*) were tested for morphological and pathogenic variability under laboratory condition. Distinct variation in colony colour, radial growth, size of mycelia and sclerotia were noticed in different synthetic media. Pathogenic variability was tested in blotter paper method with and without inoculating the seeds with different isolates of *M. phaseolina*. The results in terms of germination [(52% (Nagaon) - 72% (Budbud)], pre-emergence rotting, PRE [(25% (Budbud) - 42% (Nagaon)] and Post emergence rotting, POE [(2% (Kalyani) - 8% (Nagaon)] indicated that Nagaon isolate is the most virulent one.

Key words: Variability, *Macrophomina phaseolina*, jute

INTRODUCTION

Jute, "the golden fibre of India", though occupies only 0.42% of gross cropped area, provides livelihood to more than 40 lac farm families in major jute growing states viz. West Bengal, Assam, Bihar, Odisha, Uttar Pradesh of India covering around 8 lac hectare. It also provides direct and indirect employment to another 10 lac people in the industrial sector. India earns 2000 crores/ annum through the export of jute goods. Stem rot of jute (*Macrophomina phaseolina*) is one of the serious disease causing yield loss to the tune of 10% in general but under severe epiphytotic condition the loss can goes upto 30-40%). The pathogen has wide host range (> 500 species) and survive in soil and seed. The pathogen is non-specific but varies in their aggressiveness (Singh *et al.*, 1990). Dhingra and Sinclair (1973) noticed variation in growth rate among the isolates from the same plant and between isolates from various plants on different media. The differences in the susceptibility of cowpea varieties to *M. phaseolina* were observed (Amusa *et al.*, 2007). Variability of *M. phaseolina* was studied by many workers in different crops but in jute- *M. phaseolina* system scanty reports are available on variability of the pathogen. In the present investigation four isolates of *M. phaseolina* collected from diverse agro-ecological zones of major jute growing areas were tested for morphological and pathogenic variability which is an important consideration for disease management system in changing climatic scenario.

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MATERIALS AND METHODS

The fungus (*Macrophomina phaseolina) was* isolated from infected jute stems collected from research field of All India Net-Work Project centres viz. Kalyani (Nadia), CRIJAF (24 pgs N), Budbud (Burdwan) and Nagaon (Assam) using standard methods of isolation, purification and maintenance. Morphological variations in terms of colony diameter, colour, sizes of mycelium, sclerotia were studied in four different synthetic culture media *viz.* Potato Dextrose Agar (PDA), Oat Meal Agar (OMA), Czapec Dox Agar (CDA) and Corn Meal Agar (CMA) using standard methods. To study the pathogenic variation, the jute seed (cv. JRO 524) were rolled with 7 days old fungal culture of each isolates kept for 3 days to infect the seeds. By using blotter paper method, germination (GER), pre emergence (PRE) rotting and post emergence rotting (POE) of seedlings was calculated based on four hundred seed samples.

RESULTS AND DISCUSSION

Morphological variability

Four isolates (CRIJAF, Nagaon, Kalyani and Budbud) of *Macrophomina phaseolina*, the incitant of stem rot of jute (*Corchorus olitorious* and *C. capsularis*) were tested for morphological and pathogenic variability under laboratory condition. Distinct variation in colony colour (deep black in Nagaon to smoky black in CRIJAF), radial growth rate (first growth - CRIJAF and Burdwan, slow growth - Nagaon isolate), size of sclerotium (large-Nagaon, small – CRIJAF) were noticed (Table 1). Among all the isolates, Nagaon isolate was compact and slow growing with dark black pigmentation and distinct white margin in all the culture media. Whereas the colony of Kalyani isolate was ash coloured with fluffy growth. Other isolates are fast growing with smoky black pigmentation. Among different culture media, growth and sclerotia formation of the pathogen was the best in PDA and OMA irrespective of isolates. The least growth was observed in CMA. The variation in morphology might be due to difference in temperature, soil type, temperature and other edaphic factors.

The micro-sclerotia of *Macrophomina* are black in color and their size varies (50-150 ìm) with the host and the media used (Short *et al.*, 1978).

Table 1 : Morphological variability of different isolates of *Macrophomina phaseolina* in different culture medium

Media	Parameters	Isolates			
		CRIJAF	Burdwan	Kalyani	Nagaon
Potato dextrose agar	Colony colour	Smoky black	Black	Light black fluffy	Charcoal with white margin
	Colony diameter (cm)	7.5	7.2	4.5	2.5
	Diameter of mycelia (µ)	4-6	3-4	2.7-3.5	4-8
	Size of sclerotia (µ)	(40-50) x (100-120)	(60-72)x(100-200)	(80-130)x(200-230)	(80-110)x(230-270)
Oat meal agar	Colony colour	Light black	Black smooth flat	White to gray, fluffy growth	Black with white border compact
	Colony diameter (cm)	5.7	6.3	5.0	2.5
	Diameter of mycelia (µ)	3-4	4-7	3-4	4-8
	Size of sclerotia (µ)	(40-55)x(120-160)	(40-40)x(120-140)	(60-100)x(180-220)	(80-100)x(120-180)
Czapec dox agar	Colony colour	Black	Black	3.5	Black, slow growth
	Colony diameter (cm)	4.7	4.5	3	3.7
	Diameter of mycelia (µ)	3	3-8	(72-98)x(160-200)	3-3.8
	Size of sclerotia (µ)	(100-40)x(140-150)	(40-80)x(180-200)	Very light to white	(40-60)x(100-180)
Corn meal agar	Colony colour	Very light growth	Very light black	Very light to white	Black to very light black
	Colony diameter (cm)	2.3	3.0	3.9	2.7
	Diameter of mycelia (µ)	3-8	3-4	2-3	4-7
	Size of sclerotia (µ)	(80-100)x(160-200)	(40-65)x(80-100)	(80-120)x(102-220)	(40-50)x(120-200)

Pathogenic variability

Pathogenic variability in terms of germination [(52% (Nagaon)-72% (Burdwan)], pre-emergence rotting, PRE [(25% (Burdwan) - 42% (Nagaon)] and post emergence rotting, POE [(2% (Kalyani)-8% (Nagaon)] clearly indicated that Nagaon isolate drastically reduces the germination of jute seed (52%) in comparison to other isolates (68-72%). Similarly maximum pre-emergence as well as post

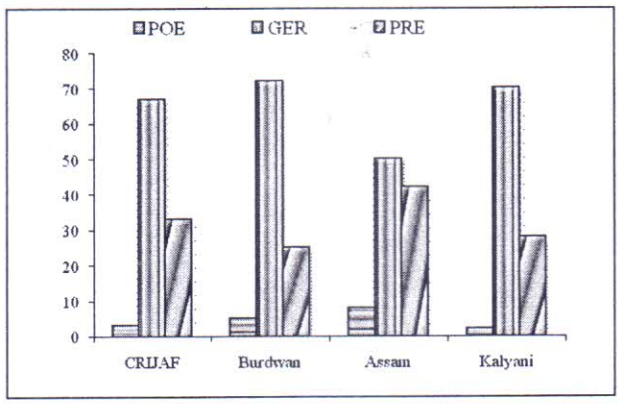

Fig. 1 : Effect of different isolates of *M. phaseolina* on germination (GER), pre-emergence (PRE) and post emergence (POE) rotting of jute seed (cv. JRO 524)

emergence rotting was also recorded in Nagaon isolate (Fig. 1). The above result indicated that Nagaon isolate is the most virulent one, however, the detail investigation on field reaction under sick plot is required for conclusion.

Macrophomina exhibits a high degree of morphological (Mayek-Perez *et al.*, 1997), pathogenic (Su *et al.*, 2001), physiological (Mihail and Taylor, 1995) and genetic (Jana *et al.*, 2003) variation.

Pathogenic variability has been reported from *Macrophomina* isolates originating from soybean, sunûower, groundnut and common bean (Dhingra and Sinclair, 1972). Several studies have been carried out to under-stand the variability on the basis of geographical origin (Reyes-Franco *et al.*, 2006).

Variability among *M. phaseolina* isolates is fundamental to develop appropriate strategies for disease management in different agro-ecological zones. The present studies clearly indicated that variability of stem rot pathogen in major jute growing areas. The results will helpful for developing integrated strategies for management of stem rot of jute as well as screening of jute germplasms against stem rot of jute to find out the source of field resistance.

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