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Colony characteristics and bioefficacy of different isolates of *Chaetomium globosum* Krunze ex Fr. against *Bipolaris sorokiniana* (Sacc.) Shoem.

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ABSTRACT: ***Chaetomium globosum*** **Krunze ex Fr. has been identified as a potential antagonist of** ***Bipolaris sorokiniana.*** **(Sacc.) Shoem. Nine isolates of this antagonist have been characterized for their colony characteristics and bioefficacy against the pathogen. Colony characters varied among the isolates on different media. Potato dextrose agar (PDA) supported maximum growth and sporulation of** ***C. globosum*****, while suppressed growth and less sporulation were observed on Czapek dox agar medium. Isolates Cg1, Cg6, Cg7, Cg8 and Cg9 were fast growing but produced less number of perithecia, while isolates Cg2, Cg3, Cg4 and Cg5 were slow growing showing profuse perithecia formation. All the nine isolates of** ***C. globosum,*** **when evaluated against** ***B. sorokiniana*** **for their bioefficacy, inhibited growth of test pathogen ranging from 40.03 to 7.02 per cent. The slow growing isolate Cg2 and Cg4 caused maximum inhibition of mycelial growth of** ***B. sorokiniana.***

KEYWORDS: Bioefficacy, *Bipolaris sorokiniana*, *Chaetomium globosum*, Colony characters

INTRODUCTION

Chaetomium globosum Krunze ex Fr., one of the commonest fungal species has the potential of biological control of a number of plant diseases. It has been reported effective in reducing damage caused by seed-rot and damping-off of several seed borne and soil borne pathogens like *Pythium ultimum, Alternaria raphani, A. brassica, Fusarium* spp. (Harman *et al.*, 1978; Vannacci and Harman, 1987; Walther and Gindart, 1988). Recent studies conducted in our laboratory have indicated its potential in the biological control of spot-blotch of wheat caused by *Bipolaris sorokiniana* (Sacc.) Shoem. (Mandal *et al.*, 1999; Biswas *et al.*, 2000). The mechanism of antagonism varies from mycoparasitism to antibiosis depending on the isolate (Aggarwal *et al.*, 1996). There is a possibility that different isolates differ in their morphological characters and bioefficacy, and there are few reports in the literature where in such studies have been conducted on *C. globosum*. Therefore, present paper reports the colony characteristics of different isolates of *C. globosum* and their comparative bioefficacy against *B. sorokiniana*.

MATERIALS AND METHODS

Establishment of *C. globosum* isolates

The isolates of *C. globosum* collected from different agro-climatic zones of North India were used in the present investigations (Table 1). Cultures were purified by single spore isolation on

Table 1. List of isolates of *C. globosum* used in the experiments

Sl. no.	Isolate	Source	Location
Cg1	ITCC 1627	Coprophilous	IARI farm, New Delhi
Cg2	WSCG 3	Wheat leaves	IARI farm, New Delhi
Cg3	ITCC 2401	Dolichos seed	Nainital, Uttaranchal
Cg4	ITCC 2034	Wheat grains	New Delhi
Cg5	WSCG 1	Wheat leaves	IARI farm, New Delhi
Cg6	WSCG 2	Wheat leaves	IARI farm, New Delhi
Cg7	WSCG 4	Wheat leaves	Dhaulakuan, HP
Cg8	WSCG 5	Wheat leaves	Samastipur, Bihar
Cg9	WSCG 6	Wheat leaves	Jammu, J & K

ITCC = Indian Type Culture Collection
WSCG = Wheat Section *Chaetomium globosum*

water agar and maintained on potato dextrose agar (PDA) slants at 28±1°C for further use. A virulent isolate of test pathogen, *Bipolaris sorokiniana* (DS-64) was also maintained on PDA.

Comparative growth studies on different media

The colony growth and morphology of isolates *of C. globosum* was studied on different media i.e. PDA, Czapek dox agar (CDA) and Richards medium in 90 mm Petri-plates. Three replicates were maintained at 28°C±1°C. The radial growth was measured on the third day after inoculation and subsequently every day till the Petri-plates were fully covered. Measurements were taken in two directions along two diameters at right angles to each other and average size was measured. The observations of three replications were recorded as the size of the colony on that day and the data were statistically analysed. After 12 days growth, the important colony characters of nine isolates on each medium were recorded.

Antagonistic activity of *C. globosum* isolates

Antagonistic potential of nine isolates of *C. globosum* against *B. sorokiniana* was tested by dual culture technique (Dennis and Webster, 1971) on PDA. One end of Petri-plate (90mm) containing PDA was inoculated with 6 mm mycelial disc of four days old *C. globosum* culture and the opposite end with 6 mm mycelia disc of four days old culture of *B. sorokiniana*. The plates were sealed with parafilm and incubated at 28±1°C for 10 days. Subsequently, the radial growth of *B. sorokiniana* were measured and per cent growth inhibition of *B. sorokiniana* was calculated.

RESULTS AND DISCUSSION

Colony growth of all the isolates was investigated on PDA, CDA and Richards medium. In all the three media, the growth of the colony varied. In general, rate of growth of *C. globosum* was faster on PDA than other two media. Isolate Cg3 showed fastest growth (83mm) on PDA while, Cg4 was slowest growing isolate, showing 65 mm diameter after 8 days of incubation. As regards colour and texture of the colony, isolate Cg1, Cg3, Cg7, Cg8 and Cg9 showed initially white cottony growth, which later turned into greyish and light brown in colour. On CDA, all the isolates showed restricted growth, where as Richards medium supported moderate growth of all the isolates

Table 2. Mycelial growth & perithecia formation by *C. globosum* on three media

Isolate	Colony diameter (mm)			Perithecia formation (12 DAI)		
	PDA	CDA	RM	PDA	CDA	RM
Cg1	80^{abc}	81^{a}	68^{d}	++	++	++
Cg2	69^{de}	62^{e}	72^{cd}	++++	++	++
Cg3	83^{a}	43^{e}	84^{a}	++++	+	++++
Cg4	65^{e}	52^{d}	75^{bc}	++++	++	+++
Cg5	78^{abc}	63^{e}	77^{abc}	++++	++	+++
Cg6	81^{ab}	72^{b}	43^{e}	+++	+++	+
Cg7	73^{cd}	75^{ab}	79^{ab}	+++	++	++
Cg8	76^{abcd}	58^{cd}	68^{d}	++	++	+++
Cg9	75^{bcd}	34^{f}	73^{bcd}	++	+	++
CD (p=0.05)	6.91	7.65	5.83			

PDA: Potato dextrose agar; CDA: Czapek dox agar; RM: Richards medium

+ Very few, ++ few, +++ moderate, ++++ profuse

DAI – Days after inoculation

Values superscripted with same letter are not significantly different at (p=0.05) according to Duncan's Multiple Range Test (DMRT).

(Table 2). In the present investigations, besides differences in colony characters of *C. globosum* isolates, the production of perithecia also varied on different media. PDA supported maximum perithecia formation followed by CDA and Richards's medium. Among the different isolates, Cg2 showed profuse perithecial production followed by Cg4. Isolates, Cg6, Cg1, Cg8 and Cg7 exhibited low pertithecia formation. The colony characteristics of all the nine isolates varied in different media (Table 3). On PDA isolates Cg1, Cg3, Cg7, Cg8 and Cg9 initially showed white cottony growth, which later turned into grayish or light brown in colour. Colonies of Cg2 and Cg4 were slow growing with uneven margins producing light to dark brown pigmentation on PDA (Table 3), while Cg6 showed white cottony growth initially later becoming dark olive grey. Colonies of all the isolates showed restricted growth having dark dull grayish brown mycelium except Cg1, which showed white growth with overlapping grayish brown patches on Czapek dox agar medium. In general, the mycelial growth on Richards's medium was cottony with dull green colour in all the isolates (Table 3).

All nine isolates were evaluated for their biocontrol efficacy *in vitro* against *Bipolaris sorokiniana*. The tests revealed that out of the nine isolates, six isolates produced more than 50 per cent inhibition zone against the pathogen at 8 DAI. Among the isolates Cg2 caused maximum inhibition of the pathogen growth (Table 4). Mandal *et al.* (1999) reported that *C. globosum* caused 47 per cent inhibition of growth of *Drechslera sorokiniana* among 16 different microorganisms tested.

Similarly Bansal *et al.* (1988) isolated 11 different fungi and tested them against *Helminthosporium sativum*. They observed 72 percent inhibition of radial growth exhibited by *C. globosum*, which was highest among all other

Table 3. Colony characters of *C. globosum* on the three media

Isolate	Colony Characteristics		
	PDA	CDA	RM
Cg1	Colony fast growing, cottony, at first white, later becoming grayish, dark olive	Mycelium white in colour with overlapping brown patches	Cottony growth overlapping with dull green colour
Cg2	Colonies slow growing, margins are uneven, dark brown in colour	Restricted growth with dark dull greyish white	Transparent, cottony growth with dull green colour
Cg3	Colony fast growing, cottony, initially white and later becoming light brown in colour	Suppressed and restricted growth with light greyish white in colour	Transparent, cottony growth whitish, dull green in colour
Cg4	Margins are uneven light to dark brown in colour	Suppressed and restricted growth with light greyish white in colour	Transparent, margin uneven, dull light green in colour
Cg5	Even growth of mycelium, light brown in colour	Suppressed and restricted growth with light greyish white in colour	Transparent, whitish dull green
Cg6	Even growth of mycelium, cottony, initially white later becoming dark olive grey in colour	Uneven growth with dark greyish colour overlapping with white cottony growth	Restricted growth with transparent light green
Cg7	Even growth of mycelium, cottony, initially white in colour later becoming light olive grey	Uneven growth with dark greyish colour overlapping with white cottony growth	Whitish light green in colour
Cg8	Mycelium white in colour, cottony and even growth	Dark dull greyish in colour	Transparent greyish in colour
Cg9	Mycelium white, cottony, even growth, light olive grey in colour	Suppressed and restricted growth with light grey in colour	Whitish light green in colour

PDA: Potato dextrose agar; CDA: Czapek dox agar; RM: Richards medium

microorganisms tested. The present dual culture result revealed that Cg2, which was best isolate, and the next best Cg4 were found slow growing on PDA when tested for their growth rates. These results are in agreement with Heller and Hedtrich, (1994) observed that the slower growing colonies of *C. globosum* were more effective in inhibition of radial expansion of *Phytophthora* species. In our present investigations, it was concluded that isolate Cg2 was the best isolate which sporulated profusely

Table 4. Effect of *C. globosum* isolates on growth of *B. sorokiniana in vitro*

Isolate	Radial growth inhibition (cm) 7 days after	Per cent inoculation over control
Cg1	3.2^{b}	59.4
Cg2	1.8^{e}	77.2
Cg3	2.9^{bc}	63.2
Cg4	2.2^{de}	72.15
Cg5	2.5^{cd}	68.35
Cg6	3.4^{b}	56.96
Cg7	4.7^{a}	43.03
Cg8	4.5^{a}	40.03
Cg 9	4.1^{a}	48.10
Control	7.9^{a}	-

Values superscripted with same letter are not significantly different at (p=0.05) according to Duncan's Multiple Range Test.

on PDA and caused more than 70 per cent inhibition of mycelial growth of *B. sorokiniana.*

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