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Efficacy of Fungal and Bacterial Bioagents against Leaf Spot/Blight of *Heliconia* Caused by *Drechslera* State of *Trichometasphaeria Holmii*

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Study on leaf spot/blight *Drechslera* state of *Trichometasphaeria holmii* (Luttrell) Subramanian & Jain. of Heliconia (*Heliconia orthotricha* L.) under south Gujarat condition was carried out to find out suitable management strategies of this newly reported disease. Due to hazardous effect of chemical fungicides, search for safer alternative to control the pathogen is better option. This led to trials on the use of bio agents to control the pathogen. The seven known bio agents were evaluated by dual culture, pathogen at periphery and pathogen at the centre technique to monitor antagonistic effect. Results revealed that out of all the seven bio agents used, three bio agents *viz., Aspergillus niger* Link. (Navsari, isolate) (85.18 %, 84.67 % and 83.68 %), *Pseudomonas fluorescens* Migula. (Navsari isolate) (81.85 %, 75.86 %, and 62.76 %) and *Trichoderma longibrachyatum* Rifai.(I.A.R.I., isolate) (76.66 %, 55.93 %, 81.56 % maximum growth inhibition in dual culture, pathogen at periphery and pathogen at the centre methods respectively), showed strong antagonistic effect to inhibit the mycelia growth of the pathogen significantly.

Keywords : Biological control, antagonists, Heliconia, *Drechslera* state of *Trichometasphaeria holmii.*

Heliconias are grown for cut flower and landscape plants and it belongs to a morphologically diverse and species rich order Zingiberales. According to Goel (2004) Heliconias are generally known as "wild plantain" or "lobster's claw" and are native to neotropical regions of Central and South America and some Caribbean countries. Heliconias are gaining importance and became popular among the florists and plant lovers almost round the world due to their diversity in both colour and form, and have good potential as commercial cut flower. (Janakiram & Kumar, 2011). Out of various factors responsible for successful growing of Heliconia, disease management is one of the most important factors and as the crop is newly introduce in India and Gujarat as well, not much research work is done. The leaf spot/ blight disease was observed in severe form on the floriculture farm of the Navsari Agricultural University, in the year 2009 on the *Heliconia orthotricha* var. she and *Drechslera* state of *Trichometasphaeria holmii* (Luttrell) Subramanian and Jain, was observed to be constantly associated with the disease. The initial symptoms of disease involved small, oval or irregular, dark brown leaf spots, later resulted into severe leaf blight covering entire leaf. In the advanced stage large, distinct yellow halo around

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the brown spots which united with other spots to form large chlorotic and necrotic areas on blighted leaves. On the stem, several distinct black spots were observed. Disease also spreads to bracts of inflorescence as faint brown to purple red spots, results into total economic loss. The symptoms observed on Heliconia during this investigation were somewhat similar to those described earlier by Luttrell (1963). Considering the seriousness of this newly introduced problem, the present investigation was carried out. The hazardous effects of chemicals used in plant disease management have diverted plant pathologists to find out the alternative techniques of plant disease control which may cause little or no adverse effect on environment. Now a day, the commercial formulation of some of the biocontrol agents has already become available in the market. In the present study, attempts have been made to identify antagonistic bio agents against *Drechslera* state of *Trichometasphaeria holmii in vitro* condition to combat the battle with this newly introduced pathogen

MATERIAL AND METHODS

Seven known fungal and bacterial bio agents (antagonists) viz., *Trichoderma viride* Pers, ex. Grey (Navsari, isolate), *Trichoderma harzianum* Rifai. (Junagadh, isolate), *Trichoderma longibrachyatum* Rifai. (I.A.R.I., isolate), *Trichoderma fasciculatum* Bissett.(Navsari, isolate), *Aspergillus niger* Link.(Navsari, isolate), *Pseudomonas fluorescens* Migula.(Navsari, isolate) and *Bacillus subtilis* Ell.(Navsari, isolate) were tested *in vitro* against *Drechslera* state of *Trichometasphaeria holmii*. The culture discs measuring 5mm diameter of test organism and pathogen were cut aseptically from the colony of pure culture grown on PDA medium and kept at different positions according to different techniques employed in the present investigation. In dual culture technique (Dennis and Webster, 1971), culture discs of test organisms and the pathogen were placed opposite to each other at 70 mm apart in the Petri plate containing 20 ml PDA aseptically and real antagonistic properties of the test bio agents were exhibited. In Pathogen at the periphery technique (Asalmol and Awasthi, 1990), the culture disc of the pathogen placed aseptically 35 mm away radially at four corners keeping one disc of test organism at centre in the plate containing 20 ml PDA aseptically. In Pathogen at the centre the culture disc of the pathogen was placed in the center and four similar discs of the test organisms were placed 35 mm away from the pathogen at the periphery in the Petri plate containing 20 ml PDA aseptically. The culture discs of the pathogens were kept at respective places of pathogen in each technique without bio agent served as control. All the treatments were incubated at room temperature (27 ± 2ºC) and after 8 days the radial growth of the test organism and pathogen was measured. CRD design with three repetitions of each treatment was employed in the present experiment. The per cent growth inhibition (PGI) was calculated by using formula given by Vincent (1927) :

$$PGI = \frac{100\ (DC-DT)}{DC}$$

Where,
PGI = Per cent growth inhibition
DC = Average diameter of mycelial colony of control plate (mm)
DT = Average diameter of mycelial colony of treated plate (mm)

RESULTS AND DISCUSSION

All the antagonists under test were significantly superior over control in all the techniques against *Drechslera* state of *Trichometasphaeria holmii*. In dual culture technique, out of seven antagonists tested *Aspergillus niger* Link. (85.18%) and *Pseudomonas fluorescens* Migula. (81.85 %) showed maximum growth inhibition of the pathogen and appeared to be the most superior over all the antagonists tested. Next best in order of merit was *Trichoderma longibrachyatum* Rifai. (76.66 %), *T. viride* Pers, ex. grey. (42.22 %) and *T. harzianum* Rifai. (35.55 %). Rest of the antagonists showed comparatively and significantly least growth inhibition (Table 1). In pathogen at periphery technique, *Aspergillus niger* Link. gave maximum growth inhibition (84.67 %) and appeared to be the most superior antagonists among all the antagonists tested. It was followed by *Pseudomonas fluorescens* Migula. (75.86 %), *T. longibrachyatum* Rifai. (55.93 %), *T. harzianum* Rifai. (44.06 %) and *Trichoderma viride* Pers, ex.

Grey. (41.01 %). While, rest of the antagonists showed comparatively least growth inhibition (Table 2). In pathogen at centre, *Aspergillus niger* Link. showed maximum inhibition (83.68 %) and appeared to be the most superior antagonists among all the antagonists tested which was statistically a par with *T. longibrachyatum* Rifai. (81.56 %) followed by *Pseudomonas fluorescens* Migula. (62.76 %) which in turn was statistically at par with *T. harzianum* Rifai. (62.05 %), followed by *T. viride* Pers, ex. Grey. (48.93 %). The rest of the antagonists showed comparatively least growth inhibition (Table 3).

DISCUSSION

It appeared from this study that all the antagonists tested by three methods proved effective against *Drechslera* state of *Trichometasphaeria holmii* and were proved to be very useful as potential biological control agents. Among them, *Aspergillus niger* Link., *Pseudomonas fluorescens* Migula., *T. longibrachyatum* Rifai. and *T. harzianum* Rifai. proved to be very effective antagonist against *Drechslera* state of *Trichometasphaeria holmii*. This may be due to undeniably its mode of action like competition, antibiosis and mycoparasitim and

Table 1. Effect of different antagonists against *Drechslera* state of *Trichometasphaeria holmii in vitro* condition under dual culture method

Sr. No.	Test organism	Average colony diameter of pathogen (mm)	Growth inhibition(%)
1.	*Trichoderma viride*	26.00	42.22
2.	*Trichoderma harzianum*	29.00	35.55
3.	*Trichoderma fasciculatum*	38.33	14.81
4.	*Trichoderma longibrachyatum*	10.50	76.66
5.	*Aspergillus niger*	6.66	85.18
6.	*Pseudomonas fluroscens*	8.16	81.85
7.	*Bacillus subtilis*	34.00	24.44
8.	Control	45	0
	S.Em. ±	0.4208	
	C.D. at 5 %	1.2614	
	C.V. %	2.94	

Table 2 . Effect of different antagonists against *Drechslera* state of *Trichometasphaeria holmii in vitro* condition under pathogen at periphery method

Sr. No.	Test organism	Average colony diameter of pathogen(mm)	Growth inhibition(%)
1	*Trichoderma viride*	25.66	41.01
2	*Trichoderma harzianum*	24.33	44.06
3	*Trichoderma fasciculatum*	33.33	23.37
4	*Trichoderma longibrachyatum*	19.16	55.95
5	*Aspergillus niger*	6.66	84.68
6	*Pseudomonas fluroscens*	10.50	75.86
7	*Bacillus subtilis*	28.00	35.63
8	Control	43.5	0
	S.Em. ±	0.4639	
	C.D. at 5 %	1.3908	
	C.V. %	3.36	

Table 3. Effect of different antagonists against *Drechslera* state of *Trichometasphaeria holmii in vitro* condition under pathogen at centre

Sr. No.	Test organism	Average colony diameter of pathogen(mm)	Growth inhibition(%)
1	*Trichoderma viride*	24.00	48.93
2	*Trichoderma harzianum*	28.16	62.05
3	*Trichoderma fasciculatum*	17.83	40.07
4	*Trichoderma longibrachyatum*	8.66	81.56
5	*Aspergillus niger*	7.66	83.70
6	*Pseudomonas fluroscens*	34	62.76
7	*Bacillus subtilis*	17.5	27.65
8	Control	47	0
	S.Em. ±	0.3908	
	C.D. at 5 %	1.1716	
	C.V. %	2.93	

it possess some important secondary metabolites and antibiotics like harzianiol and so many. The results of the present investigation are analogous to the previous findings published by several workers. Biswas *et al*. (2008) showed that in dual culture test, *Trichoderma harzianum* Rifai. and its bio-formulation reduced mycelium growth of *Drechslera oryzae* Subram. & Jain, by 55.3 % and 58.1 %, respectively. Mandal *et al*. (1999) reported inhibitory effect of *Trichoderma spp., Talaromyces flavus* (Klocker) Stolk and Samson. and *Chaetomium globosum* Kunz., on mycelial growth of *Drechslera sorokiniana* (Sacc.) Subram. & Jain with upto 92 % inhibition of conidial germination. The results of present investigation indicated *Aspergillus niger, Pseudomonas fluorescens* and *Trichoderma longibrachyatum* were found as a strong antagonists against *Drechslera* state of *Trichometasphaeria holmii* was somewhat similar to those findings of Mandal *et al*. (1999). Hence it can be recommended after rigorous testing in the pot and field condition against the pathogen for management of Heliconia leaf spot/blight disease.

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