Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8126

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2020) *8*(4), 32-36

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Study on Potential of *Trichoderma* spp. in Managing Naga King Chilli (*Capsicum chinense* Jacq) Diseases *In Vitro*

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Received: 5.05.2020 | Revised: 3.06.2020 | Accepted: 8.06.2020

ABSTRACT

The Naga King Chilli (Capsicum chinense Jacq), despite its reputation, is actually a very sensitive and vulnerable crop and like any other cultivated crops it does suffer from several diseases. To study the potentials of Trichoderma spp. in managing some diseases of Naga King Chilli, five Trichoderma spp. viz. T. asperellum, T. harzianum, T. koningii, T. virens and T. viride were screened against four fungal pathogens isolated from infected Naga King Chilli plants viz. Colletotrichum capsici (anthracnose), Fusarium oxysporum (Fusarium wilt), Sclerotium rolfsii (stem rot) and Rhizoctonia solani (damping off) in vitro using dual culture plate technique. Amongst five Trichoderma spp., T. harzianum was recorded with highest mycelial growth inhibition against Colletotrichum capsici (79.61%), T. koningii and T. viride against Fusarium oxysporum (100%), T. harzianum against Sclerotium rolfsii (85.07%) and T. koningii, T. viride, T. harzianum and T. virens were recorded with highest mycelial growth inhibition against Rhizoctonia solani (92.20%).

Keywords: *Naga King Chilli, Trichoderma*

INTRODUCTION

Capsicum species suffers from several numbers of plant pathogenic diseases. The Naga King Chilli (*Capsicum chinense* Jacq), native to Nagaland and parts of North-Eastern states. The pod is used as the edible part; it is commonly used in curry and chutney preparation. Naga King Chilli is used as an everyday food item by Nagas. The product is highly prized and accordingly, consumption is also the highest in Naga society. It is used in many forms; fresh, dried, powdered and in pickled form. But despite its reputation, is actually a very sensitive and vulnerable crop; it does not grow well in all areas and like any other cultivated crops it does suffer from several diseases. Today, there are many chemical based fungicides available in the market for the management of the diseases but extensive and inappropriate use has led to cause may undesired effects on the environment, harzardous to both animals and humans, fungicidal and residual toxicity (Anand & Bhaskaran, 2009).

Cite this article: Chakruno, P., Banik, S., Daiho, L., & Sumi, K. (2020). Study on Potential of *Trichoderma* spp. in Managing Naga King Chilli (*Capsicum chinense* Jacq) Diseases *In Vitro*, *Ind. J. Pure App. Biosci. 8*(4), 32-36. doi: http://dx.doi.org/10.18782/2582-2845.8126

Trichoderma spp. are one of the most abundantly found freely fungus living in the soil as well as in the rhizosphere region having mcyoparasitic effect on several soil borne plant pathogens *Trichoderma* spp. are reported to produce volatile and non-volatile antibiotics and enzymes that antagonistic effect on many phytopathogenic fungi for which they are among the most popularly used fungal biocontrol agents for mangament of plant diseases (Kumar & Ashraf, 2017). Keeping all this in context this investigation was carried with an aim to evaluate the antagonistic potential of *Trichoderma* spp against fungal pathogens known to cause disease in Naga King Chilli.

MATERIALS AND METHODS

Isolation of Pathogens

Surface sterilized Bits of 5.0x5.0mm^2 from diseased sample of Naga King Chilli were inoculated on the Petri plate containing PDA medium. The inoculated plates were incubated at room temperature (25±2°C). Later the fungal growth were transferred into the PDA slants and allowed to grow at room temperature (25±2°C) for 3-5 days, some isolates took longer time to grow. After the fungal isolates gained sufficient growth the slants were stored in the refrigerator at 4°C. The purified fungal pathogens were observed under the microscope and identification was done based on their morphological characteristics using a bright field compound microscope under objective lens 10x and 45x.

Dual culture evaluation of *Colletotrichum capsici, Fusarium oxysporum, Sclerotium rolfsii* and *Rhizoctonia solani* against *Trichoderma* spp.

Five locally isolated *Trichoderma* Spp. *viz. T. asperellum*, *T. harzianum*, *T. koningii*, *T. virens*, and *T. viride* were obtained from the Department of Plant Pathology, SASRD Medziphema campus, Nagaland University. These five *Trichoderma* Spp. were studied *in vitro* for their antagonistic effect on the test pathogens by dual culture technique. Mycelium of the antagonist and the pathogen measuring 10 mm in diameter was corked out with a sterile cork borer from the periphery of the actively growing culture and they were inoculated on Petri plates (90mm diameter) containing PDA medium with the help of an inoculating loop. The discs were placed upside down on the PDA plates, so that the mycelia are in direct contact with the medium. Control plates having only the test pathogen was also kept for comparison. The loaded plates were then incubated at 25±1°C and the observation was taken 3 days after inoculation. The experiment was laid in a Complete Randomized Design (CRD) and each treatment was replicated three (3) times. The per cent inhibition of growth of the pathogen was calculated by using the formula suggested by Vincent (1947). $\text{per cent inhibition} = \frac{C-T}{C} X100$ Where, C = growth in control, T = growth in treatment. The experiment was laid in a Complete Randomized Design (CRD) and each treatment was replicated three (3) times.

RESULTS AND DISCUSSION

Efficacy of *Trichoderma* spp. *in vitro* against important pathogens of Naga King Chilli:

Five *Trichoderma* spp. *viz. Trichoderma asperellum, T. harzianum, T. koningii* and *T. virens* and *T. viride* were tested *in vitro* using dual culture technique for their efficacy against some disease causing pathogens of Naga King Chilli *viz. Colletotrichum capsici* (anthracnose), *Fusarium oxysporum* (Fusarium wilt), *Sclerotium rolfsii* (stem rot) and *Rhizoctonia solani* (damping-off).

All the test bio control agents were found to have significant effect on radial growth of *Colletotrichum capsici*, as given in Table 2. The radial growth of *Colletotrichum capsici* in all the treatments ranged from 7.00-16.67mm with control having radial growth of 34.33mm. Of all the bio control agents, *Trichoderma harzianum* (79.61%) recorded highest per cent inhibition of the pathogen *C. capsici* followed by *T. viride* (77.67%), *T. virens* (74.76%), *T. koningii* (73.69%) and *T. asperellum* (66.99%). Jagtap et al. (2013) reported that *T. harzianum* was found to be the most effective antagonist against *C. capsici* causing leaf spot disease in turmeric. Das et al.

(2015) also reported that *T. harzianum* recorded the highest per cent inhibition of 83.44%, which was followed by *T. viride* with per cent inhibition of 77.62%, *in vitro* against *C. capsici*, the causal agent of leaf spot of turmeric.

Trichoderma koningii and *T. viride* recorded 100 per cent inhibition towards *Fusarium oxysporum* followed by *T. harzianum* (74.73%), *T. asperellum* (60.44%) and *T. virens* (53.85%). Thaware et al. (2017) reported that *T. koningii* and *T. viride* caused 71.88% and 75.55% inhibition respectively, *in vitro* test against *Fusarium oxysporum* f. sp. *ciceri* causing wilt disease in chickpea. Gupta et al. (2012) also reported that *T. viride*, inhibited the growth of *Fusarium oxysporum* f. sp. *melongenae* (Fusarium wilt of brinjal) by 90.30 per cent over control (Table 2).

The highest per cent inhibition was recorded from *Trichoderma harzianum* (85.07%) which was followed by *T. viride* with inhibition of 79.90%, *T. virens* and *Trichoderma koningii* with 77.61% and *T. asperellum* (75.62%). The present findings were found to be in agreement with the findings of Manu et al. (2012) who also reported that among 5 bio control agents screened *in-vitro* against *S. rolfsii* causal organism of foot rot of ragi, *T. harzianum* (GKVK) isolate was found to be the most effective. Similarly Patel and Rakholiya (2016) also reported that *T. harzianum* recorded highest growth inhibition of 54.72% against *S. rolfsii*.

The inhibitory actions of bio control agents on the growth of *Rhizoctonia solani* are presented in Table 2. *Trichoderma koningii*, *T. viride*, *T. harzianum* and *T. virens* recorded the highest per cent inhibition of 92.20% followed by *T. asperellum* (87.50). Except for *T. asperellum* other four *Trichoderma* spp. were statistically at par and recorded the highest inhibition over the mycelia growth of *Rhizoctonia solani* (control). Kumar et al. (2016) reported *Trichoderma* spp. isolated from Jharkhand showed strong antagonistic potential which inhibited more than 50% mycelia growth of *Rhizoctonia solani*. Similarly, it has also been reported that *Trichoderma* spp. are the potential biocontrol agents which inhibit *R. solani* by direct confrontation through mycoparasitic or antibiosis or competition as well as inducing plant defense responses (Abbas et al., 2017).

Table 1: Treatment combinations for dual culture technique

Treatments	***Colletotrichum capsici***	***Fusarium oxysporum***	***Sclerotium rolfsii***	***Rhizoctonia solani***
T1	*Colletotrichum capsici + Trichoderma koningi*	*Fusarium oxysporum + Trichoderma koningi*	*Sclerotium rolfsii + Trichoderma koningi*	*Rhizoctonia solani + Trichoderma koningi*
T2	*C. capsici + T. viride*	*F. oxysporum + T. viride*	*S. rolfsii + T. viride*	*R. solani + T. viride*
T3	*C. capsici + T. harzianum*	*F. oxysporum + T. harzianum*	*S. rolfsii + T. harzianum*	*R. solani + T. harzianum*
T4	*C. capsici + T. asperellum*	*F. oxysporum + T. asperellum*	*S. rolfsii + T. asperellum*	*R. solani + T. asperellum*
T5	*C. capsici + T. virens*	*F. oxysporum + T. virens*	*S. rolfsii + T. virens*	*R. solani + T. virens*
T6	*Colletotrichum capsici* (control)	*Fusarium oxysporum* (control)	*Sclerotium rolfsii* (control)	*Rhizoctonia solani* (control)

Table 2: *In vitro* test for efficacy of *Trichoderma* spp. against *Colletotrichum capsici* causing anthracnose disease of Naga King Chilli

Treatments	*Colletotrichum capsici*		*Fusarium oxysporum*		*Sclerotium rolfsii*		*Rhizoctonia solani*	
	Growth (mm)	PI (%)	Growth (mm)	PI (%)	Growth (mm)	PI (%)	Growth (mm)	PI (%)
T1= *Trichoderma koningii*	9.00 (17.46)*	73.79	0.00 (5.85)*	100.00	15.00 (22.79)*	77.61	1.04 (5.85)*	92.20
T2= *T. viride*	7.67 (16.07)	77.67	0.00 (5.85)	100.00	13.47 (21.53)	79.90	1.04 (5.85)	92.20
T3= *T. harzianum*	7.00 (15.34)	79.61	7.67 (16.07)	74.73	10.00 (18.43)	85.07	1.04 (5.85)	92.20
T4= *T. asperellum*	11.33 (19.67)	66.99	12.00 (20.27)	60.44	16.33 (23.84)	75.62	1.67 (7.42)	87.50
T5= *T. virens*	8.67 (17.12)	74.76	14.00 (21.97)	53.85	15.00 (22.79)	77.61	1.04 (5.85)	92.20
T6= (control)	34.33 (35.87)		30.33 (33.42)		67.00 (54.94)		13.33 (21.42)	
SEm±	0.84		1.36		0.79		0.53	
CD (P=0.05)	2.50		4.09		2.37		1.57	

*Figures in the parentheses are in arcsine transformed values

CONCLUSION

Among the bio control agents *Trichoderma harzianum* was found to be the most effective antagonist against *Colletotrichum capsici* (anthracnose) recording 79.61% inhibition of mycelia growth, whereas *T. koningii* and *T. viride* recorded 100 per cent inhibition over the growth of *Fusarium oxysporum* (Fusarium wilt). Highest inhibition of mycelia growth of *Sclerotium rolfsii* (stem rot) *in vitro* was recorded from *T. harzianum* (85.07%). In case of *Rhizoctonia solani* (damping-off) highest inhibition of 92.20% were recorded from *T. koningii*, *T. viride*, *T. harzianum* and *T. virens*.

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