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EFFICACY OF CHEMICAL FUNGICIDES AND PLANT EXTRACTS AGAINST ANTHRACNOSE PATHOGENS OF *CAPSICUM FRUTESCENS* L.

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Abstract

To evaluate the *in vitro* antifungal activity of five fungicides *viz.*, Capvit 50 WP, Contaf 5 EC, Greengel 72 WP, Knowin 72 WP and Score 250 EC as well as five plant extracts *viz.*, *Acalypha indica* L., *Azadirachta indica* A. Juss., *Heliotropium indicum* L., *Lippia alba* L. and *Magnolia champaca* L. at different concentrations were selected against *Colletotrichum dematium* and *C. gloeosporioides* following poisoned food technique. Among the five fungicides, Capvit 50 and Score 250 showed the complete growth inhibition of *C. dematium* whereas Contaf 5 EC showed the complete growth inhibition of *C. gloeosporioides* at all the concentrations. Contaf 5 was found as the most effective inhibitor against *C. dematium*. On the other hand, Knowin 72 and Score 250 were found as the most effective fungicides against *C. gloeosporioides. A. indica* and *L. alba* showed highest radial growth inhibition of *C. dematium* and *C. gloeosporioides* at 20% concentration. Moreover, *A. indica* and *M. champaca* also showed desired growth inhibition of the test pathogens. This study paves the way for the management of *C. dematium* and *C. gloeosporioides* causing anthracnose disease of chilli.

Chilli (*Capsicum frutescens* L.) is widely consumed crop throughout the world. It is the most important vegetable cum spice because of its colour, taste, pungency, flavour and aroma grown in tropical and subtropical regions of the world including Bangladesh. It is also extremely popular for the larger abundance of vitamin C (Durust *et al.* 1997). The people of Bangladesh use chilli in all curry preparation for its typical color, taste and flavor (BBS 2018). Chilli crop suffers from more than 40 fungal diseases (Rangaswami 1979). The most destructive disease restricting chilli production is anthracnose caused by *Colletotrichum* spp. resulting in up to 40% loss of yield (Than *et al*. 2008). Effective approaches for disease control usually involve the combined use of intrinsic resistance along with biological and chemical control (Wharton and Dieguez-Uribeondo 2004). Many research workers evaluated the efficacy of fungicides against *Colletotrichum* spp. under laboratory and field conditions (Hosen *et al*. 2016, Mamun *et al.* 2016). Recently, plant extracts play an important role in the preservation of foodstuffs against fungi and have potential to replace synthetic fungicides (Tripathi and Shukla 2007). In Bangladesh every year chilli production is very badly hampered as well as it also obsesses the economic growth of the country. Therefore, the present study was ascertained to investigate the effect of selected chemical fungicides and extracts of plant species on the anthracnose pathogens of chilli under *in vitro* condition.

This investigation was undertaken to detect the fungi associated with *Capsicum frutescens* during June, 2017 to June, 2018. Samples with anthracnose symptoms of chilli fruits were collected from Karwan Bazar and Ananda Bazar of Dhaka city and Badalgachhi, Naogaon. Fungi associated with the diseased chilli were isolated separately following tissue planting method (CAB 1968). Identifications of the isolates were determined following the standard literature (Ellis 1976, Barnett and Hunter 1972, Ellis and Ellis 1997).

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Five chemical fungicides *viz.*, Capvit 50 WP, Contaf 5 EC, Greengel 72 WP, Knowin 50 WP and Score 250 EC were collected from the Siddique Bazar, Dhaka. These fungicides at 100, 200, 300, 400 and 500 ppm concentrations were evaluated against *Colletotrichum dematium* and *C. gloeosporioides* according to Islam *et al*. (2017). A total of five plant parts *viz.*, *Acalypha indica, Azadirachta indica, Heliotropium indicum, Lippia alba* and *Magnolia champaca* were evaluated for their effect on the radial growth of test pathogens at 5, 10, 15 and 20% concentrations according to Islam *et al*. (2017). The plant parts were collected from the Botanical Garden of Curzon Hall Campus, University of Dhaka. The data were collected as inhibition percentage of the radial growth of the pathogen in mm in each replication and evaluated by ANOVA using STAR statistical program and means were compared using DMRT.

Alternaria alternata, A. tenuissima, Aspergillus flavus, A. niger, Colletotrichum dematium, C. gloeosporioides, Curvularia clavata, Fusarium semitectum and *Rhizopus stolonifer* were isolated from the infected *Capsicum frutescens*. Among the isolated fungi, *C. dematium* and *C. gloeosporioides* were selected as test pathogens owing to their pathogenic potentiality.

Table 1. Effect of chemical fungicides on the radial growth of *Colletotrichum dematium* and *C. gloeosporioides* at different concentrations.

Name of fungicides	% inhibition of radial growth at different concentrations (ppm)				
	100	200	300	400	500
	Colletotrichum dematium				
Capvit 50 WP	100^{a}	100^{a}	100^{a}	100^{a}	100^{a}
Contaf 5 EC	57.19^{c}	100^{a}	100^{a}	100^{a}	100^{a}
Greengel 72 WP	3.35^{d}	8.38^{c}	16.21^{c}	28.51^{c}	43.89^{c}
Knowin 50 WP	69.74^{b}	72.11^{b}	74.75^{b}	74.75^{b}	75.29^{b}
Score 250 EC	100^{a}	100^{a}	100^{a}	100^{a}	100^{a}
CV%	6.05	2.74	2.04	4.21	2.50
	Colletotrichum gloeosporioides				
Capvit 50 WP	11.79^{c}	20.54^{c}	21.21^{d}	26.23^{d}	26.53^{d}
Contaf 5 EC	100^{a}	100^{a}	100^{a}	100^{a}	100^{a}
Greengel 72 WP	26.22^{bc}	29.26^{c}	32.63^{cd}	37.95^{c}	44.84^{c}
Knowin 50 WP	16.49^{c}	25.20^{c}	35.57^{c}	45.65^{c}	56.96^{bc}
Score 250 EC	34.63^{b}	49.22^{b}	53.96^{b}	60.64^{b}	69.59^{b}
CV%	21.81	18.58	15.41	11.70	16.02

Mean followed by the same letter(s) within a column did not differ significantly and dissimilar letter(s) within a column differs significantly at 5% level by DMRT.

The efficacy of fungicides on the radial growth of *C. dematium* and *C. gloeosporioides* at 100, 200, 300, 400 and 500 ppm are presented in Table 1. Out of five fungicides, the complete inhibition of the radial growth of *C. dematium* was observed with Capvit 50 and Score 250 at all the treated concentrations (Table 1). Similarly, Banginwar *et al.* (2012) reported that Capvit 50 showed complete growth inhibition of *C. dematium.* Contaf 5 also showed complete growth inhibition of *C. dematium* at 200, 300, 400 and 500 ppm concentrations. The complete inhibition of radial growth of *C. gloeosporioides* was observed with Contaf 5 at all the concentrations

whereas Score 250 showed complete growth inhibition at 500 ppm concentration (Table 1). Hosen *et al.* (2016) found complete growth inhibition of *C. gloeosporioides* by Capvit 50 and Greengel 72 at 500 ppm only. Patil and Nargund (2016) reported that Contaf 5 and Score 250 completely inhibited the mycelial growth of *C. gloeosporioides* at all the concentrations except 100 ppm. Laboratory evaluation of fungicides revealed that all the fungicides caused partial or complete inhibition of *Colletotrichum dematium* and *C. gloeosporioides* at 500 ppm (Table 1). The same fungicides also showed different effects on different pathogens in the present investigation due to the selection of different strains of test pathogens.

Results of plant extracts on the radial growth of *C. dematium* and *C. gloeosporioides* at 5, 10, 15 and 20% are presented in Table 2. All the plant extracts showed varied degree of growth inhibition of the pathogens at different concentrations. Out of the five plant extracts, *Acalypha indica* showed complete radial growth inhibition of *C. dematium* at 20% concentration which was followed by *L. alba* (78.38%), *M. champaca* (43.02%), *A. indica* (42.06%) and *H. indicum* (26.63%) (Table 2). Hosen *et al*. (2016) reported 70.05% growth inhibition of *C. gloeosporioides* at 20% concentration by *A. sativum. Acalypha indica* showed highest radial growth inhibition (79.16%) of *C. gloeosporioides* at 20% concentration which was followed by *L. alba* (74.92%), *M. champaca* (59.78%), *A. indica* (50.09%) and *H. indicum* (26.44%) (Table 2).

Table 2. Effect of plant extracts on the radial growth of *Colletotrichum dematium* and *C. gloeosporioides* at different concentrations.

Name of plants	% inhibition of radial growth at different concentrations			
	5	10	15	20
	Colletotrichum dematium			
Acalypha indica	43.49^{a}	53.76^{a}	66.75^{a}	100^{a}
Azadirachta indica	29.64^{b}	32.92^{b}	38.63^{b}	42.06^{c}
Heliotropium indicum	14.72^{c}	18.48^{c}	20.30^{c}	26.63^{d}
Lippia alba	42.33^{ab}	44.55^{a}	47.02^{b}	78.38^{b}
Magnolia champaca	8.01^{c}	14.16^{c}	23.23^{c}	43.02^{c}
CV%	26.80	17.75	11.96	13.75
	Colletotrichum gloeosporioides			
Acalypha indica	34.14^{ab}	47.15^{a}	49.43^{a}	79.16^{a}
Azadirachta indica	33.97^{ab}	42.69^{a}	46.80^{a}	50.09^{b}
Heliotropium indicum	16.82^{c}	21.11^{b}	24.03^{b}	26.44^{c}
Lippia alba	39.41^{a}	43.31^{a}	46.07^{a}	74.92^{a}
Magnolia champaca	23.43^{bc}	42.09^{a}	48.11^{a}	59.78^{b}
CV%	20.97	15.40	10.45	12.73

Mean followed by the same letter(s) within a column did not differ significantly and dissimilar letter(s) within a column differs significantly at 5% level by DMRT.

The results of this study indicated that Contaf 5, Capvit 50 and Score 250 were the best chemical fungicides and *Acalyphaa indica* and *Lippia alba* were promising botanical fungicides against anthracnose pathogens of chilli.

This investigation will help the chilli producers to facilitate the optimal input use of fungicides and plant extracts that assist them to reduce the crop damage and increase the productivity of chilli in Bangladesh.

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