Effect of Botanicals and Biological Control Agents Against Anthracnose Tomato (Lycopersicum Esculantum L.)

Dr. Nilofar Bashir Pathan[1] Ashok Kadam[2]

[1]Lecturer, Botany, Shri Dnyanehwar Mahavidyalaya,Newasa
[2]Ph.d Students, Botany, Shri Muktanand College Gangapur.

Abstract

Tomato (*Solanum lycopersicum* L.) is a popular nutritious vegetable crop grown in India and other parts of the world. However, fungal diseases such as anthracnose pose significant threats to tomato production by reducing the fruit quality and food value of tomato, resulting in lower market prices of the crop globally. In the present study, the etiology of tomato anthracnose was investigated in commercial tomato farms in Marathawada, Maharashtra. A total of 22 fungal isolates were obtained from anthracnose tomato fruits and identified as *Colletotrichum* species, using morphological characteristics. The results of pathogenicity tests revealed that all *C. coccoides* isolates caused anthracnose disease symptoms on inoculated tomato fruits. To our knowledge, the present study is the first report of tomato anthracnose caused by *C.coccoides* in Marathwada region . The findings of this study will be helpful in disease monitoring, and the development of strategies for effective control of anthracnose on tomato fruits.

Keywords: Anthracnose, *Colletotrichum coccoides, Solanum lycopersicum*, morphology, Pathogenicity, etc.

Introduction

Tomato (*Solanum lycopersicum* L.) belongs to the Solanaceae family, and is popular for its huge nutritious and economic value. A variety of diseases attack tomato fruits and plants, including major fungal diseases that threaten tomato production globally, such as anthracnose, early blight, late blight, leaf mold, septoria leaf spot, powdery mildew, fusarium wilt, and verticilium wilt [Panthee D.R., Chen F.2010]. *Colletotrichum* spp. are important plant pathogens, causing anthracnose diseases in a diverse range of host plants, including vegetables, fruits, legumes, cereals, herbaceous, conifers, woody, and ornamental plants, at both developing and mature stages of plant growth [Cannon P.F., Damm U., Johnton P.R., Weir B.S.,2012. Garrido C., Carbu N., Fernandez-Acero F.J., Vallejo I., Cantoral J.M. 2009, Liao C.Y., Chen M.Y., Chen Y.K., Wang T.C., Sheu Z.M., Kuo K.C., Chang P.F.L., Chung K.R., Lee M.H.2012]. Some taxa are restricted to certain host species, or cultivars, while others have extensive host ranges [Cannon P.F., Damm U., Johnton P.R., Weir B.S. 2012, Liao C.Y., Chen M.Y., Chen Y.K., Wang T.C., Sheu Z.M., Kuo K.C., Chang P.F.L., Chung K.R., Lee M.H.2012, Sezer A., Dolar F.S.2012]. *Colletotrichum* spp. are commonly associated with tomato anthracnose of which *C.coccoides* has been reported as an emerging pathogen causing huge yield losses of tomato annually.

Differentiation of *Colletotrichum* spp. on the basis of host associations alone is not a reliable criterion for species identification, because a few taxa such as *C. acutatum*, *C. dematium*, and *C. gloeosporioides*, infect a wide range of plant hosts. However, morphological characteristics alone are also not reliable for identification of *Colletotrichum* species, due to a variety of variables such as the environment, which influences the stability of the morphological traits and the coexistence of intermediate forms in nature [Cai L., Hyde K.D., Taylor P.W.J., Weir B.S., Waller J.M., Abang M.M., Zhang J.Z., Yang Y.L., Phoulivong S., Liu Z.Y., 2009].

The disease is reported to affect almost all aerial parts of the plant. Chiefly, it causes fruit rot at both green and red stages primarily attacking ripe fruits, hence is also known by the name ripe fruit rot of tomato (Agrios, 2005). The disease is seed borne, soil borne, water borne and airborne and hence may lead to damage at the seedling stage or on the aerial parts of the plants. Many species of Colletotrichum have been associated with the anthracnose in different countries.

Anthracnose is a fungal disease in tomatoes that primarily affects ripe or overripe fruit, causing sunken, dark, and water-soaked lesions that can rot the entire fruit. The disease thrives in warm, wet conditions and is caused by fungi of the genus Colletotrichum.

METHODOLOGY:

1. The infected samples of tomato anthracnose collected from different fields of Marathwada region like Beed, Gangapur, Paithan, and Jalna during 2024-25 crop season.
2. Isolation of pathogen was done by inoculating the samples on Rose Bengal agar medium and the cultures were further purified and maintained on potato dextrose agar medium at 26+1°C.
3. The isolate of infected fruits of tomato was selected for the purpose of integrated management under antagonism by different fungal antagonistic isolates. Plant Extract and *Psuedomonas, Bacillus*. Disease control through the use of botanicals and crude extracts of medicinal plants have been explored in recent years for their effective antifungal and antimicrobial properties. Their easy decomposition, non-residual activity and non phytotoxic properties further popularize their use for controlling phytopathogens.
4. To study the antagonistic effect, an experiment was laid out in Petri plates poured with sterilized Czapek Dox Agar Solidified medium in the plates was inoculated by placing the discs (4 mm diameter) of bio-agents culture and exacting opposite to this disc of test fungus (7 days old culture) were placed in such a manner that both organisms would get equal opportunity for their growth.
5. In vitro Antagonist Test against disease fungi was carried out using the dual culture method by taking each pure culture of the characterization results belonging to the test.
6. The experiment was conducted with three replications and one control plate containing only test fungus.
7. *Several* studies using crude plant extracts have also been conducted to access the control of *Colletotrichum* spp. on Toamto (Ngullie et al., 2010; Johnny et al., 2011). They have shown different degree of effectiveness of extracts of The *in-vitro* Evaluations of Resistant of *Colletotrichum coccoides* tested against selected plant leaf extract and bulb isolates on the basis of observations and results it was recorded that, *Colletotrichum coccoides* isolated from fruits of tomato collected from different region was recorded maximum Resistant against the plants extract *Datura stramonium*71.10% followed by *Azadiracta Indica* 67.66% followed by *Murraya koenigii* 63.38% followed by *Bael(Aegle marmelos)* 62.00% is followed by *Ocimum sanctum L.* 57.71 % followed by *Parthenium hysterophrus* 57.50% followed by *Euphorbia hirta*53.52% is followed by *Lantana camera* 53.00 % followed by *Cynodon dactylon* 50.70% is followed by *Jasminum nervosum(kunda)* 45.71 %.

Per cent inhibition over control was calculated as per the formulae Eq. (1) by Vincent, (1947).

$$I = \frac{C-T}{C} \times 100$$

Where, I = Per cent inhibition over control

C=Growth of test pathogen with absence of antagonist (mm)

T= Growth of test pathogen with antagonist (mm)

Table : Effect of Plant Extracts on Radial Growth of Colletotrichum coccoides

Sr No.	Plant extracts	Family	Part used	PCE*
1	***Azadirachtaindica***	**Meliaceae**	**Leaves**	**67.66**
2	*Murrayakoenigii*	Rutaceae	Leaves	63.38
3	*Aeglemarmelos*(Bael)	Rutaceae	**Leaves**	62.00

4	***Daturastramonium***	**Solanaceae**	**Leaves**	**71.10**
5	*Lantana camera*	Verbinaceae	Leaves	53.00
6	*Ocimum sanctum L.*	Lamiaceae	Leaves	67.10
7	*Euphorbia hirta*	Euphorbiaceae	Leaves	53.52
8	*Partheniumhysterophrus*	Asteraceae	Leaves	57.50
9	*Jatropacurcas*	Euphorbiaceae	Leaves	34.00
10	*Jasminumnervosum(Kunda)*	Oleaceae	Leaves	45.71
11	*Cynodondactylon*	Gramineae	Leaves	50.70
12	***Allium sativum***	**Amaryllidaceae**	**Rhizoid**	**66.11**
13	*Z.Officinales(Ginger)*	Zingiberaceae	Bulb	64.77
14	Control	--	--	71.00

Graph show effect of Plant Extract on Radial Growth of *Colletotrichum coccoides*

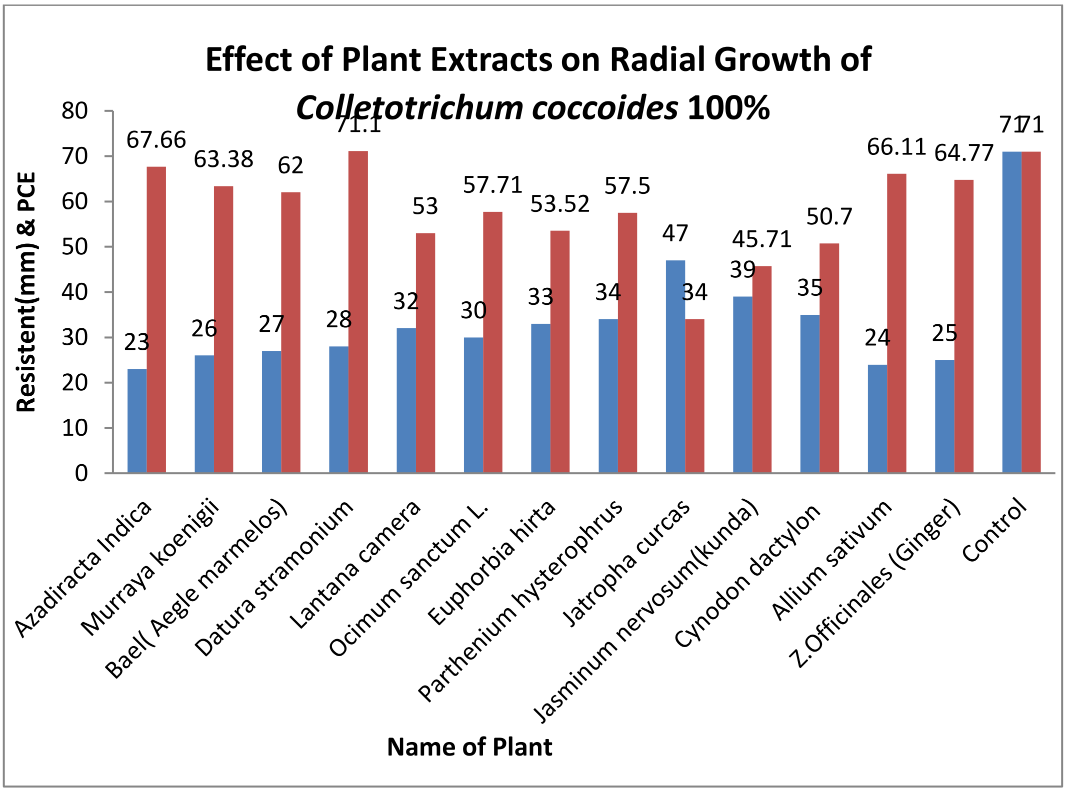


Table:02 Effect of Bacillus Spp.against *C.coccoide* on Tomato

Sr. No.	*Bacillus* spp.	Dry mycelium weight (mg/50ml)	PDI
1	***Bacillus polymyxa*-1**	**150**	**56.1**
2	*Bacillus polymyxa*-2	112	52.0
3	*Bacillus polymyxa*-3	109	51.4
4	Control	170	74.0
	C.D. (P=0.05)	25.6	50.7

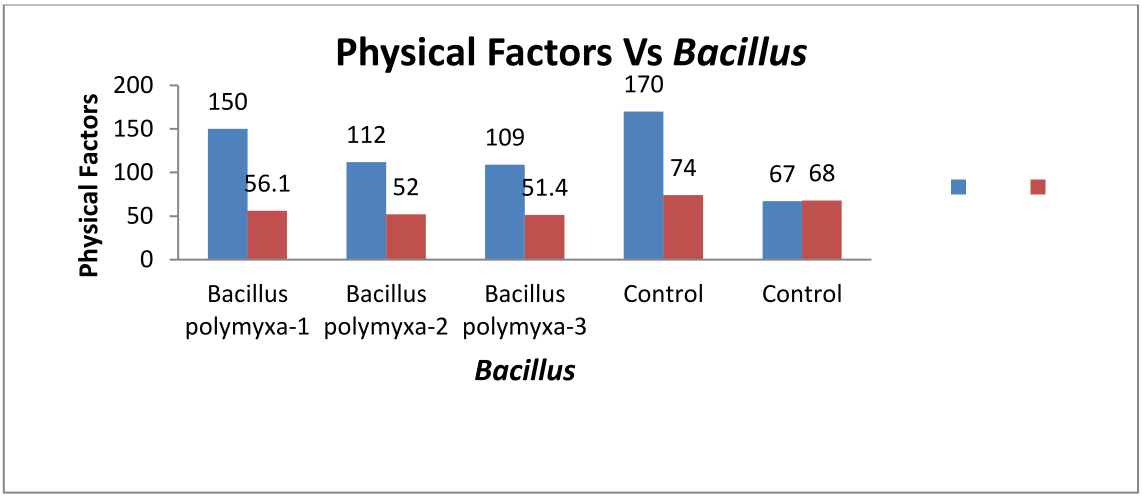
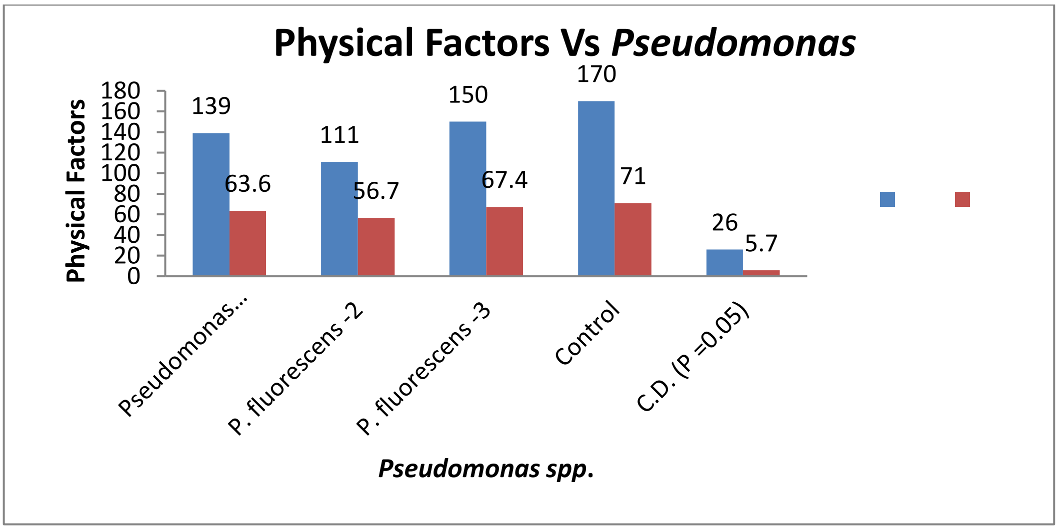


Table :03 Effect of *Pseudomonas spp*. against *C. coccoide* on Tomato

Sr. No.	***Pseudomonas* spp.**	**Dry mycelium weight (mg/50ml)**	**PDI**
1	*Pseudomonas fluorescens*-1	139	63.6
2	*P. fluorescens* -2	111	56.7
3	***P. fluorescens* -3**	**150**	**67.4**
4	Control	170	71.0
5	C.D. (P=0.05)	26.0	5.7



The results clearly indicate that, the Resistance of *Colletotrichum* sp.was recorded in leaf extract order on *Datura stramonium> Azadiracta Indica> Murraya koenigii>Ocimum sanctum> Parthenium hysterophrus> Euphorbia hirta> Lantana camera>Cynodondactylon>Jasminum nervosum (kunda)* Results clearly indicate that, *Colletotrichum coccoides* was recorded Resistant against all these of Plants extracts. Similarly thirteen plant extracts were tested against tomato anthracnose pathogen. It was observed that, leaf extract of plants like *Datura stramonium,Azadiracta Indica* and *Allium sativum* Rhizome extract *of Zingiber officinals* were found to be effective and percent control efficiency was 64.77 to 71.10.(Refer Table and graph)against the pathogen growth and spore germination.

Biocontrol strategy for disease management has stood up as a sustainable approach required for restoring the lost homeostasis of the environment. Though, for managing tomato anthracnose this particular strategy has not gained much momentum yet, the potential of using biocontrol agents (BCAs) for controlling the pathogen was elucidated way back by Lenné and Parbery (1976). The possibilities of using BCAs for controlling the post harvest loss of fruits has been illustrated by Jeger and Jeffries (1988) and Korsten and Jeffries (2000). Till date, the BCAs used for studying the antagonistic potential against *Colletotrichum* spp. affecting tomato crop include *Psuedomonas fluorescens Bacillus subtilis*

Conclusion:

For the management of anthracnose of Tomato, now a day's increasing use of chemical has challenged both public health and environment hazards. This study revealed two fungal isolates were found associated with diseased tomato fruits, collected from Marathwada region. Thus emphasis for using botanicals such as plant extract and bio agents for the management of the plant disease which is less costly and environment friendly. Recently there has been great interest in biocontrol agents for controlling plant pathogens. The present study shows that Plant Extract possess antifungal activity and can be exploited for effective management of plant diseases. Therefore, the farmers may be advised to take an integrated approach, which should be raised a profitable production without polluting the environment and adding toxins in the food chain.

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