J.Mycopathol.Res. 62(4) : 791-797, 2024, ISSN : 0971-3719 (Print), 2583-6315 (Online)
10.57023/JMycR.62.4.2024.791


# Integrated Management of Chilli Anthracnose Disease in Tamil Nadu

**B.BHARATHI, HIJAM MERONBALA DEVI*, UDHAYAKUMAR, M. AND L.H. JONATHAN VANLALRUATA**
*Department of Plant Pathology, School of Agricultural Sciences(SAS), Nagaland University, Medziphema Campus -797106, Nagaland*

Received : 17.07.2024 Accepted : 30.10.2024 Published : 30.12.2024

The sustainability of Chilli-based agriculture is menaced by anthracnose and die-back incited by *Colletotrichum capsica* (Syd) is one of the major threats. In the present investigation efforts were made with a view to find out the effective combination to manage the disease. The present study was carried out in a field located at Namakkal district of Tamil Nadu. Different combinations of bio control agent, botanicals and chemicals were tested for their effect against Chilli Anthracnose disease under field condition. Amongst the tested combinations, the one with seed treatment by Azoxystrobin @ 0.2% along with three sprays of neem oil @ 0.2% was found to be having least disease severity.This was followed closely by two other treatments followed at par with each other *viz*. the one seed treatment by *Trichoderma viride* @ 10gm along with three sprays of Azoxystrobin @ 0.2% and the one seed treatment by *Trichoderma viride* @ 10 g along with three sprays of Carbendazim 12%+ Mancozeb 63% WP@ 0.2%.The treatment with lease disease severity also possessed maximum plant height, a greater number of branches, maximum number of fruits per plant and superior yield with high Benefit Cost Ratio.

**Keywords :** Anthracnose, chilli, disease severity, disease management.

## INTRODUCTION

Chilli (*Capsicum annuum L.*) is the fourth major significant growing crop in worldwide and one of the important cultivated members in solanaceous family. The chilli crop is challenged with a lot of biotic and abiotic stresses including Fungi, Bacteria, Virus, Nematodes during its growth period. Amongst the diseases caused by fungal pathogens, Anthracnose of Chilli caused by *Colletotrichum capsici* is the most devasting and destructive problem in India and one of the most important economic constraints to Chilli cultivation worldwide, especially in tropical and subtropical regions (Than *et al.*2008). Anthracnose disease causes more than 50% crop loss in different parts of India (Ramchandran *et al.* 2007). Management practices of Chilli Anthracnose have been the burning issue among the Agriculturists and farmers till now (Saxena *et al.,* 2016). To overcome this situation, there is a need to develop an effective integrated management strategy incorporating various components such as use of natural botanical products, biocontrol agents etc. which may be efficacious at field level.

Effective control of *Colletotrichum* diseases usually involves the use of a combination of cultural control, biological control, chemical control and intrinsic resistance (cand Dieguez-Uribeondo, 2004). In view of the above facts, management of ChilliAnthracnose by different combination of Chemical, botanical and biocontrol agent in field level was done.

## MATERIALS AND METHODS

The experiment was carried out during 2021-2022 in Manikkanatham village in the area of Paramathivelur under Namakkal district of Tamil Nadu. To find out the effective strategy to manage the chilli anthracnose disease, different combination of chemical, botanical and bio control agent was tested under field conditions (Table1). Nursery bed preparation was done and healthy NS1701 Chilli seeds were used for this experiment. Based on the experimental

*Correspondence: meronbaladevi@nagalanduniversity.ac.in

objectives, seeds were treated with fungicides and biocontrol agents and untreated seeds were used as control. Treated and untreated seed were sown in separate nursery plots by line sowing method. Four weeks old seedlings were transplanted into the main field in the spacing of 75×60cm by Furrow row method of planting. The experiment was laid out in a Randomized Block Design (RBD) with three replications, thus yielding a total of 54 plots of size 60 x 45 cm with 18 plants per plot. The healthy chilli seeds were treated with recommended dose of Biocontrol agent and Fungicides and then shade dried before sowing. Three spraying of fungicides and plant extracts were done at 7 days interval starting from the first appearance of disease.Plant crude extracts were prepared according to Parvez *et al.*(2003). The stock solution of botanicals like *Ocimum sanctum* (Tulsi)*, Pongamia pinnata,* and *Lantana camera* were prepared in modified weight by volume (W/V) method. The healthy leaves were collected. washed with distilled water and kept for few minutes until they get dried then these were cut into small pieces and homogenized in a mixture grinder with distilled water @ 1:1 ratio (i.e., 50gm of plant material in 50 ml of water). The extract was filtered through a double layer muslin cloth and the filtrates were collected by Whatman No.1 filter paper. The filtrates so obtained were used as stock solution.

The data on per cent disease index, per cent disease incidence, plant growth parameters like plant height (cm), number of branches/ plants, number of fruits/ plants and yield (kg/ha) were recorded and analyzed for each and every treatment.

Disease incidence was evaluated by estimating the percentage of infected fruits in each plot. Percent disease incidence was calculated using the formula (Wheeler, 1969).

$$\text{Disease incidence (\%)} = \frac{\text{No.of leaves/ fruits showing disease symptoms}}{\text{Total no. of leaves/ fruits observed}} \times 100$$

The percent disease intensity was recorded based on the method described by (Singh *et al.*1993) on fruits from randomly selected eight tagged plants in each plot at seven days interval. An observation for disease intensity was recorded after 10 days of inoculation on 0-5 disease rating scale (Jeyalakshmi and Seetharaman, 1998).

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of all individual disease ratings}}{\text{Total no. of plants assessed x Max. rating}} \times 100$$

$$\text{Percent increase in yield} = \frac{\text{Yield in treatment} - \text{Yield in control}}{\text{Yield in control}} \times 100$$

Benefit cost ratio was calculated by formula,

$$\text{Benefit cost ratio} = \frac{\text{Gross income}}{\text{Total cost of cultivation}}$$

The data of various experiments were subjected to statistically analyze with the help of computer. The data was subjected to appropriate transformations, wherever needed as suggested by Gomez and Gomez (1984) before analysis.

### *In vivo integrated management of Chilli Anthracnose*

In this experiment the treatment was accomplished in Randomized Block Design (RBD) with three replications. The treatment combinations were as follows( Table 1):

## RESULTS AND DISCUSSION

This pathogen of Anthracnose of Chilli caused by *Colletotrichum capsici* was known to produce symptoms on all the above ground plant parts including leaves, stem and fruits as die back and fruit rot. It was observed in the nursery that the newly emerged seedlings were affected. Symptoms started off as water-soaked lesions at the collar region, leading to shriveling and browning of the tissue and thus killing the seedling. After transplantation, in the growing seedlings whole twigs were dry and manifested signs of dieback. Anthracnose signs were seen as angular or circular deep necrotic lesions with black edges on ripe chilli fruit. The fruit that has been infected loses its color and takes on a dry, straw-colored look. In extreme cases, necrotic lesions merged into concentric rings and developed black conidial masses on the lesions, as shown in Fig. 1.

The disease symptoms observed in this present experiment were in accordance with the findings of Alam *et al*. (2014) who reported that the

disease has been observed to occur in three phases *viz*. (i) seedling blight or damping off stage, prevalent in the nursery (ii) leaf spotting and die back stage which is initiated at different stages of growth and (iii) fruit rot stage affecting the ripened fruits. The observed symptoms were correlated with Gupta *et al*. (2017) who reported that under severe conditions, lesions fuse and conidial masses may form concentric rings on lesions. Similar reports also observed by Nishanthi *et al*. (2020) describing Anthracnose


**Fig. 1** :Symptoms of Chilli Anthracnose. A- Initial stage of symptom; B- Lesion on chilli fruit; C- Elongated sunken lesion; D- Coalesced lesion

symptoms on Chilli fruit has sunken necrotic tissue with concentric rings of Acervuli.

The NS 1701 Chilli cultivar was studied in field conditions for Integrated disease management. In this context the biocontrol agent *T. viride*, two fungicides *viz.* Carbendazim 12% + Mancozeb 63% @0.2% and Azoxystrobin @ 0.2% and four botanicals *viz. Ocimum sanctum*, Neem oil, *Pongamia pinnata* and *Lantana camara* were used as they were found to be the most effective against the pathogen *Colletotrichum capsici*. To find the efficacy of these components in combinations, 18 treatments were tested under field condition. In this experiment among all these treatments $T_{15}$ (Seed treatment with Azoxystrobin @ 0.2% and three sprays with neem oil @ 0.2%) was found effective against the Chilli Anthracnose disease.Results presented in Table 2 makes it clear that all treatments were found to be significantly better than controls in lowering the Percent disease index (PDI) and Disease incidence (DI). The minimum PDI 19.49% and AUDPC (460.65) was observed in treatment $T_{15}$ *i.e*., Seed treatment with Azoxystrobin @ 0.2% and three sprays with neem oil @ 0.2% followed by $T_5$ (20.39 %) which was found to be statistically at par at the time of harvest. Maximum incidence was recorded in control ($T_0$) 38.50 %.

As it is evident from Table 2, percent disease incidence in all the tested treatments was lower than that of control. The lowest percent disease incidence 40.74% was observed in $T_{15}$ treatment ($T_3$ + three sprays with neem oil @ 0.2%) and $T_5$ (40.74%) treatment ($T_1$+3spray with Azoxystrobin 23% SC @ 0.2%) followed by $T_4$ (42.59%) and $T_{11}$ (46.30%) at the time of harvest. Highest disease incidence was recorded in $T_0$ control (68.52%). Among all these treatments the maximum plant height of 78.41cm was recorded in treatment $T_{15}$ followed by $T_5$ Treatment (71.81 cm) and $T_{11}$ (70.04) were statistically at par. Subsequently no. of branches per plant also was calculated. More no. of branches was counted in treatment $T_{15}$ (12) which was statistically at par with $T_5$ (11.11) on the same way as the least no. of branches 6.50 counted in $T_9$ ($T_1$+3 Spray with *Lantana camera*) as illustrated in Table3.

Maximum number of fruits (112 fruits/plant) was recorded in $T_{15}$ treatment ($T_3$ + three sprays with neem oil at 0.2%) followed by $T_7$ (101.25 fruits/plant) ($T_1$ + 3 Spray with neem oil) and $T_4$ (99.12) fruits/plant ($T_1$ + 3 spray with Carbendazim 12% + Mancozeb 63% WP). Lowest number of fruits (71.16 fruits/plant) was observed in $T_9$. In $T_{15}$ treatment the highest yield was recorded 330.72 kg/ha followed by $T_{10}$ ($T_2$+3spray with *Ocimum sanctum*) of 281.75 kg and $T_4$ (280.31 kg) were statistically at par at the time of harvest. The maximum percentage increases in yield were recorded in $T_{15}$ (87.46%) followed by $T_{10}$ (59.71%) which was found to be statistically at par with $T_4$ (58.89%). This present study revealed that application of Azoxystrobin 23%SC increases the fruits per plant as reported by (Vincelli, 2002).This result supported by (Faisal and Tiwari, 2015) concluded neem oil give better yield similar to that use of chemicals.

According to the experiment's findings, the T15(2.93) treatment had the highest benefit to

**Table 1:** Combinations and dosages of treatment

| Treatments | Details | Dosage % |
|---|---|---|
| T0 | Control | - |
| T1 | Seed treatment with *T. viride* | 1(10g/kg) |
| T2 | Seed treatment with Carbendazim 12%+ Mancozeb 63% WP | 0.2% |
| T3 | Seed treatment with Azoxystrobin 23% SC | 0.2% |
| T4 | T1+ 3 spray with Carbendazim 12%+ Mancozeb 63% WP | 0.2% |
| T5 | T1+ 3 spray with Azoxystrobin 23% SC | 0.2% |
| T6 | T1+ 3 spray with *Ocimum sanctum* extract | 10% |
| T7 | T1+ 3 spray with Neem oil | 0.2% |
| T8 | T1+ 3 spray with *Pongamia pinnata* extract | 10% |
| T9 | T1+ 3 spray with *Lantana camara* extract | 10% |
| T10 | T2+ 3 spray with *Ocimum sanctum* extract | 10% |
| T11 | T2+3 spray with Neem oil | 0.2% |
| T12 | T2+ 3 spray with *Pongamiapinnata*extract | 10% |
| T13 | T2+ 3 spray with *Lantana camara* extract | 10% |
| T14 | T3+ 3 spray with *Ocimum sanctum* extract | 10% |
| T15 | T3+ 3 spray with Neem oil | 0.2% |
| T16 | T3+3 spray with *Pongamia pinnata* extract | 10% |
| T17 | T3+ 3 spray with *Lantana camara* extract | 10% |

Note: This extract concentrations were derived from Literature

cost ratio, meaning the benefit was 2.93 times higher than the cost. Overall, the $T_{15}$ ($T_3$ + three sprays with neem oil at 0.2%) was found to be effective than other treatments which recorded lowest percent disease incidence, minimum percent disease index and maximum plant height, a greater number of branches, a greater number of fruits and superior yield with high Benefit Cost Ratio.

Overall, the $T_{15}$ ($T_3$ + three sprays with neem oil at 0.2%) was found to be effective than other treatments which recorded lowest percent disease incidence, minimum percent disease index and maximum plant height, a greater number of branches, a greater number of fruits and superior yield with high Benefit Cost Ratio. The experimental findings were found to be supported by Ravikumar *et al*. (2017) who reported that the application of Azoxystrobin 23% SC @ 2ml/L effectively reduced the PDI 6.94% as compared to control 14.85% and minimum incidence of diseaseAnthracnose was recorded as compared to control with no phytotoxicity. This controlling effect due to the suppression of pathogen growth through the inhibition of mitochondrial respiration (Harrison and Tedford, 2002). This result also correlated with Mahapatra *et al.* (2011) who reported that combination of fungicide and neem oil was better more effective to reduce the Anthracnose of Chilli. It's due to the antifungal activity of Azadirachtin content present in the neem oil (Lokanadhan *et al*., 2012).

## CONCLUSION

Based on the aforementioned results, it can be concluded that a chemical seed treatment combined with a foliar spray of botanicals was more effective than either method alone in reducing disease severity and increasing production. When used with a combination of botanicals, second generation fungicides have low phytotoxicity and can be administered sparingly while still producing a greater yield.

**Table2:** Effect of different treatments on percent disease index and percent disease incidence of Chilli plant at different days after transplanting

| Treatments | PlantDiseaseIndex(PDI) | | | | | Disease | AUDPC |
|---|---|---|---|---|---|---|---|
| | 64 DAT | 71 DAT | 78 DAT | 85 DAT | 92 DAT | incidence% | |
| $T_0$– Control | 21.85 (27.86) | 27.38 (30.25) | 29.00 (35.16) | 32.60 (34.82) | 38.50 (38.35) | 68.52 (55.89) | 834.085 |
| $T_1$-STwith *Trichodermaviride* | 18.43 (25.42) | 23.33 (28.79) | 27.12 (31.38) | 31.07 (33.87) | 39.69 (37.28) | 64.81 (53.71) | 774.06 |
| $T_2$-STwithCarbendazim12%+Mancozeb63%WP. | 18.33 (25.34) | 22.72 (28.46) | 26.59 (31.04) | 30.21 (33.34) | 36.08 (36.92) | 64.81 (54.11) | 747.075 |
| $T_3$-STwith Azoxystrobin23%SC | 18.40 (25.39) | 21.49 (27.61) | 23.26 (28.83) | 29.54 (32.92) | 34.39 (35.90) | 61.11 (51.73) | 704.795 |
| $T_4$ –$T_1$+3SpraywithCarbandazim12%+Mancozeb63%WP | 16.69 (24.11) | 18.16 (25.21) | 19.94 (26.52) | 20.18 (26.69) | 21.80 (27.83) | 42.59 (40.69) | 542.675 |
| $T_5$-T1 +3Spray withAzoxystrobin23%SC | 15.93 (23.52) | 16.91 (24.28) | 19.57 (26.25) | 19.77 (26.40) | 20.39 (26.84) | 40.74 (39.66) | 520.87 |
| T6-T1+3SpraywithOcimumsanctum | 17.60 (24.80) | 19.21 (25.98) | 23.91 (29.24) | 26.10 (30.72) | 31.40 (34.08) | 55.56 (48.20) | 656.04 |
| T7-T1 +3 SpraywithNeemoil | 16.65 (24.08) | 18.75 (25.65) | 18.89 (25.76) | 21.69 (27.75) | 22.72 (28.47) | 50.00 (45.00) | 553.105 |
| T8-T1 +3 Spraywith *Pungamiapinnata* | 17.40 (24.65) | 19.68 (26.34) | 24.20 (29.46) | 26.56 (31.01) | 33.48 (35.35) | 59.26 (50.39) | 671.16 |
| T9-T1+3SpraywithLantanacamera | 17.86 (24.99) | 20.56 (26.96) | 25.63 (30.41) | 28.60 (32.33) | 34.35 (35.88) | 66.67 (54.86) | 706.265 |
| T10-T2+3SpraywithOcimumsanctum | 16.75 (24.15) | 19.95 (26.52) | 26.01 (30.65) | 28.23 (32.09) | 29.04 (32.61) | 51.85 (46.08) | 679.595 |
| T11-T2+3Spraywith Neemoil | 15.47 (23.16) | 17.59 (24.78) | 18.56 (25.51) | 20.70 (27.06) | 22.42 (28.26) | 46.30 (42.82) | 530.565 |
| T12-T2+3SpraywithPungamia pinnata | 17.16 (24.46) | 21.16 (27.38) | 24.87 (29.91) | 27.03 (31.32) | 33.16 (35.16) | 57.41 (49.28) | 687.54 |
| T13-T2+3SpraywithLantanacamera | 17.42 (24.66) | 21.19 (27.40) | 25.07 (30.05) | 27.39 (31.55) | 34.02 (35.68) | 62.96 (52.64) | 695.59 |
| T14-T3+3SpraywithOcimumsanctum | 14.95 (22.73) | 19.37 (26.08) | 21.99 (27.95) | 22.99 (28.65) | 24.65 (29.77) | 50.00 (45.01) | 589.05 |
| T15-T3+3Spraywith Neemoil | 13.69 (21.71) | 14.60 (22.45) | 16.74 (24.14) | 17.92 (25.05) | 19.49 (26.20) | 40.74 (39.61) | 460.95 |
| T16-T3+3SpraywithPungamia pinnata | 16.92 (24.28) | 21.67 (27.74) | 25.32 (30.21) | 25.91 (30.59) | 27.64 (31.71) | 53.70 (47.14) | 666.26 |
| T17-T3+3SpraywithLantanacamera | 17.66 (24.84) | 19.58 (26.26) | 26.42 (30.92) | 26.89 (31.23) | 30.23 (33.35) | 55.56 (48.20) | 677.845 |
| SEm± | 0.43 | 0.67 | 0.49 | 0.47 | 0.36 | 3.29 | |
| CD(P=0.05) | 1.26 | 1.93 | 1.42 | 1.35 | 1.03 | 9.48 | |

*DAT- Days after transplantation **ST- Seed treatment

**Table 3:** Effect of different treatments on growth and yield parameters of Chilli

| Treatments | Average | | | | % Increase in yield | BC ratio |
|---|---|---|---|---|---|---|
| | Plant height(cm) | Branches | No of fruits/plant | Yield (kg/ha) | | |
| T0 – Control | 51.03 | 8.04 | 75.46 | 176.42 | | 1.75 |
| T1 - ST with *Trichoderma viride* | 53.13 | 7.34 | 72.67 | 180.74 | 2.45 | 1.49 |
| T2 - ST with Carbendazim 12% + Mancozeb 63% WP. | 52.55 | 7.12 | 76.25 | 197.92 | 12.19 | 1.51 |
| T3 - ST with Azoxystrobin 23% SC | 54.94 | 8.19 | 81.12 | 213.65 | 21.11 | 1.65 |
| T4 - T1+3 Spray with Carbandazim 12% + Mancozeb 63% WP | 69.10 | 8.58 | 99.12 | 280.31 | 58.89 | 2.13 |
| T5 - T1 + 3 Spray with Azoxystrobin 23%SC | 71.81 | 11.11 | 98.46 | 257.17 | 45.77 | 1.99 |
| T6 -T1 + 3 Spray with *Ocimum sanctum* | 59.15 | 8.37 | 79.08 | 240.71 | 36.44 | 2.34 |
| T7 - T1 + 3 Spray with Neem oil | 69.07 | 9.14 | 101.25 | 244.72 | 38.72 | 2.17 |
| T8 - T1 + 3 Spray with *Pungamia pinnata* | 58.75 | 8.23 | 84.42 | 219.00 | 24.14 | 2.13 |
| T9 - T1 + 3 Spray with *Lantana camera* | 54.65 | 6.50 | 71.16 | 163.35 | 4.61 | 1.80 |
| T10 -T2 + 3 Spray with *Ocimum sanctum* | 55.05 | 8.12 | 87.29 | 281.75 | 59.71 | 2.74 |
| T11 -T2 + 3 Spray with Neem oil | 70.04 | 10.25 | 95.50 | 261.49 | 48.22 | 2.32 |
| T12 -T2 + 3 Spray with *Pungamia pinnata* | 60.41 | 9.25 | 75.25 | 229.19 | 29.91 | 2.23 |
| T13 -T2 + 3 Spray with *Lantana camera* | 55.29 | 7.37 | 71.62 | 202.85 | 14.99 | 1.98 |
| T14 -T3 + 3 Spray with *Ocimum sanctum* | 58.33 | 7.40 | 92.37 | 235.56 | 33.53 | 2.29 |
| T15 -T3 + 3 Spray with Neem oil | 78.41 | 12.00 | 112.00 | 330.72 | 87.46 | 2.93 |
| T16 -T3 + 3 Spray with *Pungamia pinnata* | 61.21 | 7.04 | 87.12 | 250.69 | 42.10 | 2.44 |
| T17 - T3 +3 Spray with *Lantana camera* | 55.87 | 6.25 | 78.62 | 192.88 | 9.33 | 1.88 |
| SE m± | 0.72 | 0.39 | 0.65 | 14.47 | | |
| CD (P=0.05) | 2.08 | 1.14 | 1.88 | 42.27 | | |

## ACKNOWLEDGEMENT

The authors would like to thank the Department of Plant Pathology, SAS, for permitting to carry out the research work in this topic.

## DECLARATION

Conflict of interest.Authors declare no conflict of interest

## REFERENCES

Alam, M.Z.,Hamim, I.,Ali, M.A., Ashrafuzzaman, M.2014.Effectof Seed Treatment on Seedling Health of Chili. *J. Environ.Sci.Nat.Resour.***7**:177- 181.

Faisal, M., Tiwari, S. 2015. Comparison of bio-agents and botanicals withfungicides against tikka and anthracnose diseases of groundnut (*Arachis hypogeal* L.) *Inter.J.Plant Prot.* **8**: 45 -48.

Gomez, K.A., Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. 2nd Ed.Wiley, NewYork, 680pp.

Gupta, V., Kaur, A., Fatehpuria, P.K., Garg, H.S. 2017.Comparative studies on isolation,identification and purification of

*Colletotrichum capsici* causing anthracnose disease of chilli. *Inter.J.Chem. Stud.* **5**:744-747.

Harrison, S.,Tedford,E.2002.Quadris,a novel fungicide for disease control in rice. In: *Proceeding of the temperate rice conference*, B. IRRI, India,pp.289-294.

Jeyalakshmi, C., Seetharaman, K. 1998. Biological control of fruit and dieback of Chilli with plant products and antagonistic microorganisms. *PlantDis.Res.***13**:46-48.

Lokanadhan,S.,Muthukrishnan,P.,Jeyaraman,S.2012.Neem products and their agricultural applications.*J.Biopesticides* **5**:72-76.

Mahapatra, S.N., Devi, S., Das, S. 2012. Efficacy of Botanical o i l s andchemicalstocontrolChilliAnthracnose.*Ind.J.PlantProt.***39**:325-326.

Nishanthi, P., Gobika, R., Charumathi, M., Suji, H.A., Raj, T.S. 2020.Management of *Colletotrichum capsici*(SYD.) Butler and Bisby causing fruit rot of chilli using fermented leaf extracts. *Plant Arch.* **20**: 250-251.

Parvez, S.S., Parvez, M.M., Fujii, Y., Gemma, H. 2003. Allelopathic competence of *Tamarindus indica* L.root involved in plant growth regulation. *Plant Growth Regul.***41**:139-148.

Ramchandran, N., Madhavi, R. K.,Rathnamma, K. 2007. Current status ofchilli anthracnose in India. *The first International Symposium on chilli Anthracnose*.25, Convention Centre,Seou lNational University,Korea, 26.

Ravikumar, N.V.,Sharma, Y., Chavhan, T. 2017. Bio-Efficacy and Phyto-Toxicty of Azoxystrobin 23% SC against Powdery Mildew (*Oidium mangiferae*) and Anthracnose(*Colletotrichum gloeosporioides*) Diseases in Mango. *Inter .J. Curr. Microbiol. Appl. Sci.***6**:314-321.

Saxena, A., Raghuwanshi, R., Gupta, V.K., Singh, H.B. 2016. Chilli Anthracnose:The epidemiology and management. *Front. Microbiol.* **7:**1527.

Singh, H.P., Kaur, S., Singh, J. 1993. Determination of infection in fruit rot (*Colletotrichum capsici*)of Chilli. *Ind. J. Agricult. Sci.***63**:310-312.

Than, P.P., Jeewon, R., Hyde, K.D., Pongsupasamit, S., Mongkolporn,O.,Taylor, P.W.J.2008.Characterization and pathogenicity of *Colletotrichum* species associated with anthracnose disease on chilli(*Capsicum* spp.)in Thailand. *Plant Pathol*.**57**: 562-572.

Vincelli, P. 2002. Qol (Strobilurin) Fungicides: Benefits and Risks. *The Plant Health Instructor*.doi: 10.1094/PHI-I-2002-0809-02.

Wharton,P.S., Dieguez-Uribeondo, J.2004.The biology of *Colletotrichum acutatum.Anales de le Jardin Botanico de Madrid* **6**: 3-22.

Wheeler, B.E.J.S. 1969. *An introduction to plant diseases.* John Wiley and Sons Ltd.,London.pp 301.