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# Efficacy of botanicals and bio-agents against leaf spot (*Alternaria brassicae*) of cabbage

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**Abstract**
Cabbage (*Brassica oleraceae* var. *Capitata* L.) is contemplated as second most important vegetable belonging to the family brassicaceae. Alternaria leaf spot of cabbage is prevalent in all the cabbage growing states and is one of the major biotic problems, which limits the production of cabbage and quality of produce. The experiment for management practices on leaf spot of cabbage using botanicals and bio-control agents was conducted during *Rabi* season (2016-2017).The minimum disease intensity was recorded in foliar sprays of *Eucalyptus globolus* (24.55 per cent) followed by *Lantana camara* (24.94 %), *Ocimum sanctum* @10% (25.86 %), *Trichoderma harzianum* @ 2.0% (27.94%), *Pseudomonas flourescens* @ 2.5% 28.02 per cent, as compared to treated (21.27%) and untreated (29.3%) checks. Maximum yield was recorded in *Eucalyptus globolus* 38.21 tonnes/ha followed by *Lantana camara* 31.32 tonnes/ha, *Ocimum sanctum* (29.33 tonnes/ha), *Trichoderma harzianum* (28.33 tonnes/ha), *Pseudomonas flourescens* (26.34tonnes/ha), as compared to treated (44.25 tonnes/ha) and untreated (22.93 tonnes/ha) checks. Maximum fresh head weight was recorded in *Eucalyptus globolus* @ 5% (1.53kg) followed by *Lantana camara* (0.94 kg), *Ocimum sanctum* (0.81 kg), *Trichoderma harzianum* (0.77kg),*Pseudomonas flourescens* (0.69 kg) as compared to treated (1.77 kg) and untreated (0.62 kg) checks.

**Key words**: *Alternaria brassicae,* Botanicals, Bio-agents, Cabbage.

## Introduction
Cabbage (*Brassica oleracea* var. *capitata* L.) is contemplated as second most important vegetable belonging to the family Brassicaceae known as a leafy green or purple biennial plant. The cabbage plant, *Brassica oleracea*, is an herbaceous annual or biennial vegetable in the family Brassicaceae grown for its edible head (Singh *et al.,* 2006).Cabbage is an superior source of vitamin K, vitamin C and vitamin B6. It is a further good source of manganese, dietary fiber, potassium, vitamin B1, folate and copper. Additionally, cabbage is a vigorous source of choline, phosphorus, vitamin B2, magnesium, calcium, selenium, iron, pantothenic acid, protein (Nilsson *et al.,*2006*;*Kusznierewicz *et al.,*2008). It is the major source of vegetable in the world and constitutes an important part of diet. Daily per capita consumption of vegetables in the country is only 145g, which is much less than the requirement of about 285g for a balance diet (ICMAR, 1998).The cabbage crop is affected by various fungal as well as bacterial diseases like damping off, club root, downy mildew, *Sclerotinia* rot, black leg, black rot, soft rot and Alternaria blight or Alternaria leaf spot. The disease Alternaria leaf spot of cabbage is prevalent in all the cabbage growing states and is one of the major biotic problems, which limits its production and also quality of produce. There are two species of *Alternaria* which cause serious damage in cabbage: *Alternaria brassicae* and *Alternaria brassicicola*, they can survive saprophytic ally outside of the host and diseased crop debris (Yadav *et al.,* 2014).Several fungicides and botanicals belonging to various groups are recommended for the management of Alternaria leaf spot of cabbage. Now-a-days farmers are using only the chemical fungicides for managing the disease, but it has the negative impact on the environment and develops resistant in pathogen. So due to these reasons use of specific chemical fungicides with recommended dosages, botanicals and bio-agents will not harm the environment and also were effective in controlling the disease (Yadav *et al.,* 2014). Plays a key role in slowing down the progression of NAFLD [21, 22].

## Materials and Methods
The present investigation was carried out at the Field Experimentation Centre, Department of Plant Pathology, SHUATS, Allahabad (U.P.) during *Rabi* (2016-2017). The experiment was conducted in Randomized Block Design with 7 treatments. The treatments were replicated three times. Treatments were randomly arranged in each replication divided into 21 plots.

The cash plot size was 2 x 1m. Foliar spray of botanicals and bio-agents were started at onsetof the disease and repeated two sprays. The seven treatments were taken as: -Mancozeb (0.2%), *Lantana camara* (10%), *Eucalyptus globulus* (5%), *Ocimum sanctum* (10%), *Pseudomonas fluorescens* (2.5%), *Trichoderma harzianum* (2.0%) and control were used for management of disease. Yield data was recorded and PDI was calculated after each spray by using 0-9 disease rating scale on the basis of percentage area of foliage infected by the pathogen.

**Isolation of the pathogen:**

The pathogen was isolated from the disease infected plants and it was identified as the *Alternaria brassicae.* Alternaria leaf spot of cabbage infected leaves were collected from experimental field of SHUATS. The infected leaves were cut into small pieces (0.5cm$^2$) surface sterilized with mercuric chloride (0.1%) for 15-30 seconds, rinsed with three changes of sterile distilled water to remove the disinfectant and blotted dry. The sterilized pieces were plated (4 pieces/dish) on potato dextrose agar (PDA) medium in Petri dishes under aseptic conditions and incubated at 25 $^0$C for 2 weeks. For obtaining sufficient quantity of inoculums, pure cultures were obtained by sub culturing. For this purpose, small bits of the fungus were taken at the tip of a sterilized needle and transferred aseptically to the centre of fresh PDA medium in Petri dishes. The dishes were incubated for 2 weeks at 25$^0$C in the dark.

**Preparation of botanicals**

For preparation of extract 50 g leaves were taken in a clean blender and blended without water, the pulverized leaves tissue was filtered through three-fold of muslin cloth and 100% pure filtrate was used as an extract in the ratio of 1:1(w/v) of seed and solution.

**Results and Discussion**

The experimental results of the present investigation reveals that minimum per cent disease intensity was recorded in$T_4$-*Eucalyptus globolus* @5% (24.55%) followed by $T_3$-*Lantana camara* @10% (24.94%), $T_2$-*Ocimum sanctum* @10% (25.86 %), $T_1$-*Trichoderma harzianum* @2.0% (27.94%), $T_5$-*Pseudomonas flourescens* @2.5% (28.02 %), as compared to $T_6$-treated (21.27%) and $T_0$-untreated (29.3%) checks. The result of present study are in accordance to the finding of Mishra *et al*., (2012) [3], Maximum yield was recorded in $T_4$-*Eucalyptus globolus* (38.21 tonnes/ha) followed by $T_3$-*Lantana camara* (31.32 tonnes/ha), $T_2$-*Ocimum sanctum* (29.34tonnes/ha), $T_1$-*Trichoderma harzianum* (28.33 tonnes/ha), $T_5$-*Pseudomonas flourescens* (26.33 tonnes/ha), as compared to $T_6$-treated 44.25 tonnes/ha and $T_0$-untreated (22.93 tonnes/ha) checks. The maximum fresh weight of head of cabbage was observed in $T_4$-*Eucalyptus globolus* treatment (1.53 kg) followed by $T_3$-*Lantana camara* (0.94 kg), $T_2$-*Ocimum sanctum* (0.81 kg) and $T_1$-*Trichoderma harzianum* (0.77kg),$T_5$-*Pseudomonas flourescens* (0.69 kg)as compared to $T_6$-treated (1.77 kg) and $T_0$- untreated (0.62 kg) checks**.** reported yield of mustard seeds was significantly highest in Eucalyptus spray. The probable reason such findings may be above *Eucalyptus globolus* control is due to fungal growth inhabitation by essential oils works in various ways such as involves prevention of hyphal growth and sporulation, interruption in nutrient uptake and metabolism, induction of lysis. They are also responsible in alternation in fungal physiology by inducing changes in cell wall compositions, plasma membrane disruption, mitochondrial structure disorganization and interference with respiratory enzymatic reactions of the mitochondrial membrane.

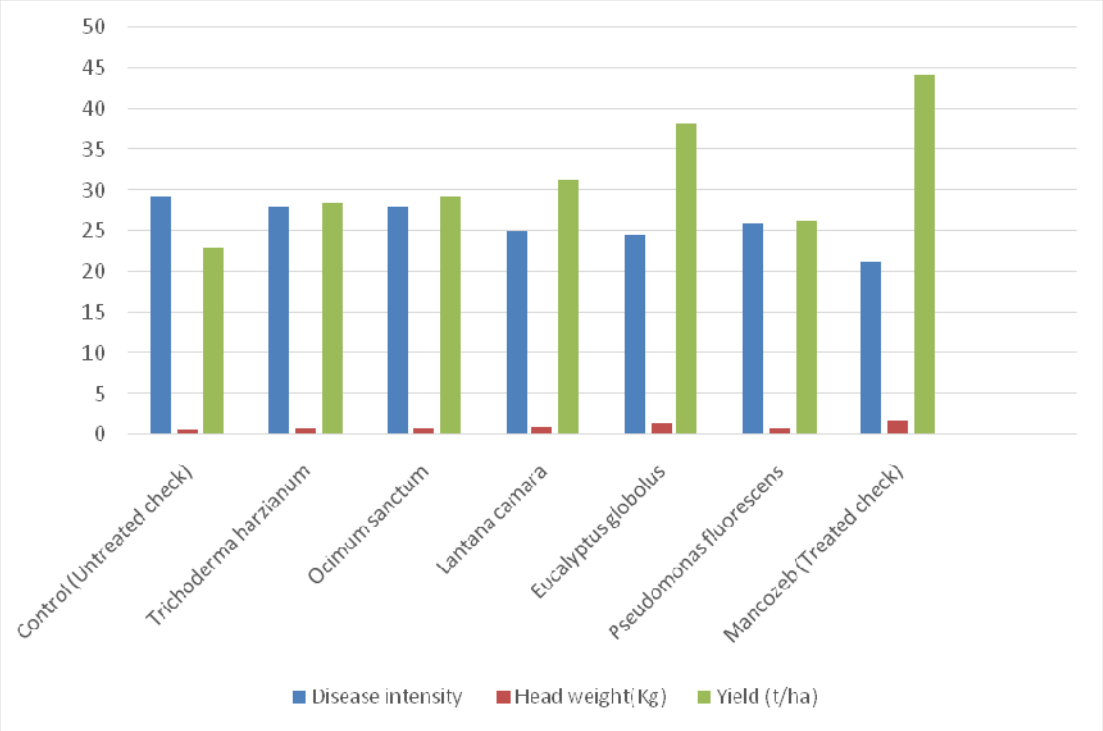

**Table 1**

| Sl. No | Treatments | Disease intensity | Head weight(Kg) | Yield (t/ha) |
|---|---|---|---|---|
| $T_0$ | Control (Untreated check) | 29.3 | 0.62 | 22.93 |
| $T_1$ | *Trichoderma harzianum* | 27.94 | 0.77 | 28.33 |
| $T_2$ | *Ocimum sanctum* | 28.02 | 0.81 | 29.34 |
| $T_3$ | *Lantana camara* | 24.94 | 0.94 | 31.32 |
| $T_4$ | *Eucalyptus globulus* | 24.55 | 1.53 | 38.21 |
| $T_5$ | *Pseudomonas fluorescens* | 25.86 | 0.69 | 26.33 |
| $T_6$ | Mancozeb (Treated check) | 21.27 | 1.77 | 44.2 |
| | C. D. (P = 0.05) | 12.77 | 1.28 | 1.68 |
| | S. Ed. (±) | 6.25 | 0.0629 | 0.797 |
| | | | | |

## Conclusion

The result allows to conclude that the improvement of local knowledge about the use of botanicals, can permit propose new alternatives of pathogen fungi management. *Eucalyptus globolus* at 5.0 % concentrations were found as best treatment to control of Alternaria leaf spot of cabbage and also gave higher yield (1.53 t/ha) as par compared with Mancozeb (Treated check).Since present day economists are advising for net return concept, *Eucalyptus globolus* can be recommended and keeping a point view of environmental safety can also *Lantana camara* be recommended to the farmers for the efficient management ofAlternaria leaf spot of cabbage.

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