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Effect of foliar sprays of bioagents on powdery mildew severity and fruit yield of cucumber during Kharif season

Brahmane PR, Deokar CD, Kolse SV, Deshmukh HV and Khaire PB

Abstract
The experiment was conducted on the experimental farm of Department of Plant Pathology and Agricultural Microbiology, Post Graduate Institute, MPKV, Rahuri during *Kharif* seasons of 2018-19 and 2019-20. Among tested six bio-control agents evaluated under field condition the disease severity recorded after first spray (50 DAS) indicated minimum disease severity (31.06%) plots protected with *Trichoderma harzianum* which was at par with *Ampelomyces quisqualis* (33.28%) followed by *Trichoderma viride* (32.30%) and *Pseudomonas fluorescence* (34.19%) and *Trichoderma hamatum* (38.60%). While maximum disease severity (46.43%) was recorded in control plots.

Keywords: Cucumber, foliar spray, powdery mildew, bioagents

Introduction
Vegetables are an essential component of human diet for maintenance of good health. Eating vegetable provides health benefits people who eat more vegetables as part of an overall healthy diet likely to have a reduced risk of some chronic diseases. Vegetables supply carbohydrates, proteins, fats, vitamins and mineral elements which are the most essential requirements of our body.

In the family of *Cucurbitaceae,* the two major species found of cucumber powdery mildew are; *Golovinomyces cichoracearum* var. *cichoracearum* (D.C.) V.P. Heluta (Syn. *Erysiphe cicoracearum* D.C.) and *Podosphaera xanthii* (Castagne) U. Braun and N. Shishkoff (Syn. *Sphaerotheca fuliginea*, formerly known as *Sphaerotheca fusca* Blumer) (Sitterly, 1978; Miazzi *et al.*, 2011). There are in total six species of powdery mildew fungi recorded on cucurbits in different parts of the world, but it is difficult to separate the species because some species have many similarities. *Leveillula* sp., is usually considered a synonym of *Golovinomyces* sp. (Sitterly, 1978).

Powdery mildew can appear in most parts of the cucumber plant, but is most common in young tissues on the upper side of the leaves (Agrios, 2005). The root is not infected and fruits are free of visible infection (Sitterly, 1978). The first signs of infection are circular white spots, in both the upper and lower surface of the leaf (Robinson and Decker-Walters, 1997). The white lesions increase in number, until they cover both leaf surface and stems (Sitterly, 1978). Leaves that are seriously affected will become brown and shrunken. When young leaves are infected it can result in chlorosis. When conditions are ideal the powdery mildew can cover the whole leaf, cause leaves to die, which results in premanture defoliation. Powdery mildew may also cause reduced yields with failed maturity and small and deformed fruits (Sitterly, 1978). Powdery mildew and downy mildew together causes up to 50 -70 per cent loss (Sitterly, 1978 and Awad, 2000).

At present cucumber is grown in an area of 2090 thousand hectares with a production of 65.33 million tonnes and productivity of 31.25 t/ha in the world (Vegetable Statistics), The total area under cucumber cultivation in India is 71000 hectare with a production of 1202000 tonnes with an average productivity of 16.92 tonnes.

In Western Maharashtra, it is mainly grown in major area Karjat, Jamkhed Tahsil of Ahmednagar district Bhor, Purander tahsil of Pune district; Kavathemahankal, Tasgaon tasil in Sangli district, Karveer, Gaganbavada tahsil in Kolhapur district in Maharashtra, research work on important aspect of this disease and pathogens previously have not been done. Pathogen survives in different forms during unfavourable environmental condition and the appearance and progress of disease is region specific. Hence, it is necessary to conduct a survey of the disease, so that it's distribution and extent of spread can be understood and hot spots may be located which also helps in natural screening for host plant resistance.

Plant disease epidemiology as a sub discipline of plant pathology is concerned with the factors that cause plant epidemics. Environment factors play important role in development of the disease. The environmental variables *viz.*, temperature, humidity, rainfall, sunshine, wind speed and number of rainy days are the most crucial, since they affect the pathogen, host or host pathogen interaction during pathogenesis. For disease development weather variables have been established in several host pathogen system. However, major information is available on the role of this climatic factor on the development of powdery mildew of cucumber. Therefore, it is important to study the correlation between meteorological factors and disease severity that affect the spread of disease in time and space.

Limited information is available on germination and survival of cucumber powdery mildew fungus *Erysiphe chichoracearum* in nature. Keeping this fact in view, it is important to study the effect of temperature on the survivability of pathogen. Considering the threat of powdery mildew to the crop, it is also important to study the effect of leaf wetness and age of plant on powdery mildew development as a part of epidemiological study. The method of survival and spread of the pathogen needs to be worked out to delink the infection chain at appropriate time to manage the disease effectively. A single method of control may not be complete to manage this disease effectively. Hence, it is important to develop suitable disease management strategies through cultural practices like effect of dates of sowing and chemical practices like sensitivity of fungicides on spore germination and effect of foliar sprays of fungicides, bioagents and botanicals on powdery mildew severity and yield of Cucumber with a view to formulate an integrated approach against the disease under field condition.

Material and Methods

Bioagents

The following bioagents with their recommended dose to be effective against powdery mildew of cucumber and allied crops were used. The bioagents required for the experimental work were obtained from Department of Plant Pathology and Agricultural Microbiology, Post Graduate Institute, MPKV, Rahuri.

Table 1: List of bioagents

Sr. No.	Bioagents
1.	*Trichoderma harzianum* (0.5%)
2.	*Pseudomonas fluorescence* (0.5%)
3.	*Bacillus subtilis* (0.5%)
4.	*Trichoderma hamatum* (0.5%)
5.	*Ampelomyces quisqualis* (0.5%)
6.	*Trichoderma viride* (0.5%)
7.	Control (water)

Experimental details

Experiment site

The experiment was conducted on the experimental farm of Department of Plant Pathology and Agricultural Microbiology, Post Graduate Institute, MPKV, Rahuri during *Kharif* seasons of 2018-19 and 2019-20.

Layout and plan

The field experiments were conducted in Randomized Block Design (RBD) with seven treatments with three replication and pot culture experiment was conducted in Completely Randomized Design (CRD) with seven treatments and three replications.

Details of layout

Design: RBD, Plot size: 2.70 x 3.40 m, Spacing: 1.0 X 0.5 m, Treatments:Seven (7), Replications: Three (3), Variety: Himangi, Sowing date: 30 June (2018-19 and 2019-20), Fertilizer dose: 100.50.50 N:P:K g/ha., After one month of sowing top dressing of 50Kg N/ha., Insecticide: Imidacloprid WG70, 0.7 gm/ 10 lit water

Bio-agents spraying schedule

The aqueous solution of required concentration of various treatments was prepared in water just before spraying. Three sprays of each solution was given, first at 50 days second at 60 days and third at 70 days after sowing during *Kharif* season of the year 2018-19 and 2019-20. The spray was done with the help of knapsack sprayer with hollow cone nozzle. During spraying of fungicide complete coverage of plant surface was ensured and the spray drifts of different treatments were avoided by taking appropriate precautions.

Interculture operation

After four weeks of germination, weeding and irrigation were done. Three weedings and two irrigations were needed.

Effect of foliar sprays of bioagents on powdery mildew severity and yield of cucumber during *Kharif* 2018-19 and 2019-20

The field trials were conducted during *Kharif* 2018-19 and *Kharif* 2019-20 crop seasons, in Randomized Block Design (RBD) with seven treatments and three replications. Row to row distance was maintained at 1 m, plant to plant distance was maintained at 0.5 m. Cultivar of cucumber was sown on 30 st June. Fertilizer basal dose 100:50:50 kg N:P:K per hectare was applied before sowing. After one month of sowing top dressing of 50 kg N/ha was applied.

Crop was sprayed twice with each bioagents at their recommended doses. The details of fungicides, bioagents and botanicals are given in Table 1. First spraying was done at the onset of disease symptoms and repated after 10 days interval. Control plots was sprayed with same volume of water. Disease severity was recorded before the beginning of first spray and subsequent subsequent observations were recorded before each spray and finally disease severity was be recorded 10 days after last spray. Before harvesting ten plants were selected randomly from each plot and total number of fruit per plot were counted. Fruit yield (kg/plot) was also recorded and finally converted in to 1/ha. Data was statistically analyzed using appropriate stastical method.

Observation

The ultimate aim of disease management is the increase in production. The yield attributes was studied as follows.

Fruit yield (q/ha)

At each harvesting the weight of all fruit from an individual treatment plot was recorded. At end of cropping the total yield of fruit summed up and average yield per plot was worked out. The net plot yield in kilogram was converted into yield in q/ha.

Data analysis

The data was statistically analyzed by using proper statistical techniques. Data recorded in percentage were first transformed to arcsin values before analysis and the treatments were compared to means of critical difference at five percent level of significance.

$$CD = \sqrt{2EMS/r}$$

Where, CD= Critical difference
r = Number of replications, t= t value at error degree of freedom, EMS = Error means of square

Result and Discussion

Effect of foliar spray of biocontrol agents on powdery mildew severity and fruit yield during *Kharif* season 2018-19 and 2019-20: The effect of foliar spray of different bioagents on severity, yield parameters during 2018-19 and 2019-20 crop seasons are presented in given Table 2 and 3.

Disease severity (%)

The results given in Table 2, 3 revealed that all the bioagents used in the experiment significantly reduced disease intensity as compared to control/check during crop season 2018-19 (Table 2).

Table 2: Effect of foliar sprays of biocontrol on powdery mildew severity and yield of cucumber *Kharif* 2018-2019

Treatment	PDI before Ist spray	PDI after spray			Mean	PDC after spray			Mean	Yield
		50 DAS	60 DAS	70 DAS	PDI	50 DAS	60 DAS	70 DAS	PDC	(qt/ha)
T. harzianum @ 0.5%	8.06 (16.48)	31.06 (33.87)	36.45 (37.13)	43.88 (41.80)	37.32	33.10	41.71	45.48	40.09	83.71 (69.57)
P. fluoresens @ 0.5%	9.17 (17.62)	34.19 (35.78)	39.95 (38.58)	45.67 (42.51)	39.94	26.36	36.12	43.99	35.46	75.92 (53.71)
Bacillus subtilis @ 0.5%	7.63 (16.02)	39.77 (39.08)	45.05 (42.15)	50.90 (45.50)	45.24	14.34	27.96	37.58	26.63	52.29 (46.32)
T. hamatum @ 0.5%	9.28 (17.73)	38.60 (38.41)	42.30 (40.54)	41.41 (42.93)	42.44	16.86	32.36	43.09	30.76	63.23 (46.86)
Ampelomyces quisqualis @ 0.5%	9.33 (17.73)	33.28 (38.22)	37.11 (38.05)	44.15 (38.71)	38.51	30.43	40.42	42.99	37.95	81.18 (78.36)
T. viride @ 0.5%	10.35 (18.75)	32.30 (34.63)	37.26 (37.56)	49.56 (43.60)	39.70	17.55	39.06	51.99	36.20	74.49 (54.36)
Control	9.00 (17.41)	46.43 (45.28)	62.54 (52.31)	81.55 (65.02)	63.51	0.0	0.0	0.0	0.0	51.49 (45.86)
S.E. +	0.546	1.70	1.71	1.66	-	-	-	-	-	2.66
CD at 5%	1.624	3.42	3.89	4.89	-	-	-	-	-	8.21
CV%	8.131	9.58	10.25	11.88	-	-	-	-	-	9.55

The disease severity recorded after first spray (50 DAS) indicated minimum disease severity (31.06%) plots protected with *Trichoderma harzianum* which was at par with *Ampelomyces quisqualis* (33.28%) followed by *Trichoderma viride* (32.30%) and *Pseudomonas fluorescence* (34.19%) and *Trichoderma hamatum* (38.60%). While maximum disease severity (46.43%) was recorded in control plots. The disease severity recorded after second spray (60 DAS) was also statistically significant over control. The result revealed that minimum severity (36.45%) was recorded plots protected with *Trichoderma harzianum* which was at par with *Ampelomyces quisqualis* (37.11%) followed by *Trichoderma viride* (37.26%), *Pseudomonas fluorescence* (39.95%) and *Trichoderma hamatum* (42.30%), *B. substilus* (45.05%). While maximum disease severity (62.54%) was recorded in control plots. Similarly, the disease severity recorded after third spray (70 DAS) at the time of maturity was minimum severity (43.88%) was recorded in plots protected with *Trichoderma harzianum* which was found *Ampelomyces quisqualis* (44.15%), followed by *Trichoderma viride* (49.56%), *Pseudomonas fluorescence* (45.67%), *Trichoderma hamatum* (41.41%) and *B. substilus* (50.90%), while maximum disease severity (81.55%) was recorded in control plots. The data on powdery mildew severity on cucumber plant results during crop season 2019-20 (Table 2). The data on powfery mildew it was revealed that disease severity recorded after first spray (50 DAS) indicated minimum disease severity (31.35%) plots protected with *Trichoderma harzianum* which was at par with *Ampelomyces quisqualis* (33.85%) followed by *Trichoderma viride* (35.62%) and *Pseudomonas fluorescence* (38.55%) and *Trichoderma hamatum* (42.03%). While maximum disease severity (52.98%) was recorded in control plots. The disease severity recorded after second spray (60 DAS) was also statistically significant over control. From the results it was revealed that minimum severity (35.32%) was recorded plots protected with *Trichoderma harzianum* which was at par with *Ampelomyces quisqualis* (38.34%) followed by *Trichoderma viride* (41.83%), *Pseudomonas fluorescence* (42.11%) and *Trichoderma hamatum* (43.63%), *B. substilus* (44.87%). While maximum disease severity (65.43%) was recorded in control plots. Similarly, the disease severity recorded after third spray (70 DAS) at the time of maturity was minimum severity (40.10%) was

Table 3: Effect of foliar sprays of biocontrol on powdery mildew severity and yield of cucumber *Kharif* 2019-20

Treatment	PDI before Ist spray	PDI after spray			Mean	PDC after spray			Mean	Yield
		50 DAS	60 DAS	70 DAS	PDI	50 DAS	60 DAS	70 DAS	PDC	(qt/ha)
T. harzianum @ 0.5%	8.00 (16.42)	31.35 (33.87)	35.32 (38.13)	40.10 (42.16)	35.59	37.83	39.43	42.58	39.94	83.71 (66.75)
P. fluoresens @ 0.5%	9.72 (18.15)	38.55 (38.14)	42.11 (39.29)	48.31 (40.56)	42.32	27.24	38.70	48.95	35.09	63.15 (52.68)
Bacillus subtilis @ 0.5%	7.19 (15.54)	40.86 (39.15)	44.87 (42.03)	51.69 (45.98)	45.47	20.67	33.31	39.31	31.09	52.61 (46.51)
T. hamatum @ 0.5%	9.28 (17.73)	42.03 (40.40)	43.63 (41.32)	50.30 (45.17)	44.32	24.76	31.42	37.63	33.27	57.93 (47.26)
Ampelomyces quisqualis @ 0.5%	9.33 (17.73)	33.85 (38.14)	38.34 (38.20)	42.88 (45.63)	39.36	36.11	39.40	42.64	38.33	75.08 (60.71)
T. viride @ 0.5%	9.45 (19.00)	35.62 (36.59)	41.83 (40.85)	45.92 (44.38)	40.46	32.76	34.54	40.97	36.30	71.70 (53.34)
Control	9.20 (17.62)	52.98 (51.75)	65.43 (54.00)	82.88 (68.90)	68.66	0.0	0.0	0.0	0.0	51.20 (45.69)
S.E. +	0.478	1.93	1.84	2.85	-	-	-	-	-	2.95
CD at 5%	1.420	5.97	5.75	8.78	-	-	-	-	-	9.10
CV%	8.53	10.62	11.01	13.16	-	-	-	-	-	9.60

recorded in plots protected with *Trichoderma harzianum* which was found *Ampelomyces quisqualis* (42.88%), followed by *Trichoderma viride* (45.92%), *Pseudomonas fluorescence* (48.31%), *Trichoderma hamatum* (50.30%) and *Bacillus subtilis* (51.69%), while maximum disease severity (82.88%) was recorded in control plots.

The results given in (Table 3) it was revealed that all the bioagents used in the experiment significantly reduced disease intensity as compared to control/check during both crop season pooled data revealed that disease severity recorded after first spray (50 DAS) indicated minimum disease severity (31.21%) plots protected with *Trichoderma harzianum* which was at par with *Ampelomyces quisqualis* (33.92%) followed by *Trichoderma viride* (34.91%) and *Pseudomonas fluorescence* (37.43%) and *Trichoderma hamatum* (40.32%). While maximum disease severit (49.71%) was recorded in control plots. The disease severity recorded after second spray (60 DAS) was also statistically significant over control. The result revealed that minimum severity (37.39%) was recorded plots protected with *Trichoderma. harzianum* which was at par with *Ampelomyces quisqualis* (39.18%) followed by *Trichoderma viride* (40.39%), *Pseudomonas fluorescence* (4.69%) and *Trichoderma hamatum* (43.97%), *Bacillus subtilis* (45.96%). While maximum disease severity (63.99%) was recorded in control plots. Similarly, the disease severity recorded after third spray (70 DAS) at the time of maturity was minimum severity (44.78%) was recorded in plots protected with *Trichoderma harzianum* which was found *Ampelomyces quisqualis* (45.52%), followed by *Trichoderma. viride* (47.30%), *Pseudomonas fluorescence* (49.94%), *Trichoderma. hamatum* (50.36%) and *Bacillus subtilis* (52.30%), while maximum disease severity (82.22%) was recorded in control plots.

Fruit yield

The data on fruit yield (q/ha) it was indicated that affected by foliar sprays of biocontrol agents resulted in significant increase in fruit yield as compared to control during 2018-19 and 2019-20.

Among bioagents results recorded that, three sprays of *Trichoderma harzianum* was resulted in maximum fruit yield (83.71 q/ha) which was at par with three folira spray of *Ampelomyces quisqualis* (81.18 q/ha) while minimum fruit yield (51.49 q/ha) was recorded in control plot during 2018-19. Similar observation observed regarding yield were recorded during 2019-20 crop season.

Table 4: Effect of foliar sprays of biocontrol on powdery mildew severity and yield of cucumber *kharif* pooled

Treatment	PDI before Ist spray	PDI after spray			Mean PDI	PDC after spray			Mean PDC	Yield (qt/ha)
		50 DAS	60 DAS	70 DAS		50 DAS	60 DAS	70 DAS		
T. harzianum @ 0.5%	7.61 (16.00)	31.21 (33.87)	37.39 (37.63)	44.78 (39.40)	36.79	37.22	41.57	43.54	40.44	80.71 (68.16)
P. fluoresens @ 0.5%	9.49 (17.93)	37.43 (36.39)	41.69 (38.43)	49.94 (43.06)	42.02	28.73	39.54	45.34	35.87	70.80 (53.85)
Bacillus subtilis @ 0.5%	7.35 (15.72)	39.82 (39.12)	45.96 (42.09)	52.30 (45.58)	45.36	19.89	29.74	37.61	29.08	62.45 (46.42)
T. hamatum @ 0.5%	8.83 (17.27)	40.32 (39.40)	43.97 (40.93)	50.36 (43.32)	43.83	18.88	32.85	41.18	30.76	57.58 (47.06)
Ampelomyces quisqualis @ 0.5%	8.73 (17.14)	33.92 (38.18)	39.18 (38.13)	45.52 (41.86)	38.87	27.44	40.33	48.29	39.95	78.63 (61.04)
T. viride @ 0.5%	9.39 (18.40)	34.91 (36.19)	40.39 (39.72)	47.30 (42.83)	40.2	30.77	36.32	42.47	37.85	74.04 (53.20)
Control	8.44 (16.83)	49.71 (48.52)	63.99 (53.16)	82.22 (63.23)	65.31	0.0	0.0	0.0	0.0	51.35 (45.78)
S.E. +	0.41	1.29	1.14	1.50	-	-	-	-	-	2.81
CD at 5%	1.31	3.89	3.43	4.65	-	-	-	-	-	8.66
CV%	9.53	10.62	11.01	13.16	-	-	-	-	-	9.60

Three sprays of *Trichoderma harzianum* resulted in maximum fruit yield (83.71 q/ha) which was at par with three foliar spray *Ampelomyces quisqualis* (75.08 q/ha). While minimum fruit yield (51.20 q/ha) was recorded in control plots. Critical statistical analysis of data revealed that the biocontrol agents belonging to Trichoderma group was found effective in increasing fruit yield as compared to other bioagents. Similar observation observed regarding yield were recorded during both crop crop season pooled data reveled that three sprays of *Trichoderma harzianum* resulted in maximum fruit yield (80.71 q/ha) which was at par with three foliar spray *Ampelomyces quisqualis* (78.63 q/ha). While minimum fruit yield (51.35q/ha) was recorded in control plots. Critical statistical analysis of data revealed that the biocontrol agents belonging to *Trichoderma* group was found effective in increasing fruit yield as compared to other bioagents.

References

1. Abd-El-Moity TH, Abed-El-Moneim ML, Tai MMM. Biological control of some cucumber diseases under organic agriculture. J Hort. Sci. Botech 2004;22:79-82.
2. Anand T, Chandrasekara A, Kuttalam S, Senthilraja G, Samiyappan R. Integrated control of fruit rot and powdery mildew of chilli using the biocontrol agent *Pseudomonas fluorescens* and a chemical fungicide. Biological Control 2010;52:1-70.
3. Choudhary NL, Zacharia S, Manoj K, Meena, Sita Ram Bana. Efficacy of fungicides and bio-agents in management of powdery mildew in Fenugreek. Ann. Pl. Protec. Sci 2015;23(2):358-360.
4. Elad Y, Krishner B, Yehuda N, Sztejnberg A. Management of powdery mildew and greay mold of cucumber with *Trichoderma harzianum* T39 and *Ampelomyces quisqualis* AQ 10. Biocontrol 2000;43(2):241-251.
5. Genge G. Efficacy evaluation of microencapsulated new strains of *Trichoderma* and *Bacillus* from Cornell to control powdery mildew on greenhouse cucumber. Phytopathol 2006;93(6):537.
6. Krishner B, Elad Yehuda N, Sztesnberg A. Management of powdery mildew and gray mold of cucumber by *Trichoderma harzianum* T39 and *Ampelomyces quisqualis* AQ 10. Bio control 1998;43(2):241-251.
7. Patel NR, Jaiman RK, Patel KD, Agalodiya AV, Patel PK. Integrated management of coriander powdery mildew. J Mycol. Pl. Pathol 2008;38(3):643-644.
8. Rakhonde PN, Koche Mina D, Harne AD. Management of powdery mildew of green gram. Journal of Food Legumes 2011;24(2):120-122.
9. Romero D, Devicente A, Zeriouth H, Carzola FM. Evalution of biological control agents for managing cucurbits powdery mildew on green house grown melon Pl. Pathol 2007;56(2):976-986.

10. Shafat Raja A. Management of powdery mildew, *Phyllactinia corylea* (Pers.) Karst of Mulberry (*Morus* sp.) using chosen biocontrol agents. Journal of Biopesticides 2010;3(2):483-486.
11. Sudha A, Lakshmanan P. Integrated disease management of powdery mildew (*Leveillula taurica* (Lew) of chilli (*Capsicum annum* L.). Archives of Phytopathora Plant Protection 2009;42:299-17.
12. Surwase AG, Badgire DR, Suryawanshi AP. Ann. Pl. Protec. Sci 2009;17:384-388.
13. Wahul SM, Jagtap GP, Rewale KA, Bhosale RP. Survey on Powdery Mildew of Cucumber in Aurangabad and Jalna Districts, India. Int. J Curr. Microbiol. App. Sci 2018;7(10):1618-1624.