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Journal homepage: [www.Sjournals.com](http://www.Sjournals.com)**Original article****Integrated management of pea powdery mildew caused by *Erysiphe Polygoni* DC.****G.P. Jagtap<sup>a,\*</sup>, P.V. Khalikar<sup>a</sup>**<sup>a</sup>Department of Plant Pathology, Marathwada Agricultural University, Parbhani- 431 402 Maharashtra<sup>\*</sup>Corresponding author; Department of Plant Pathology, Marathwada Agricultural University, Parbhani- 431 402 Maharashtra

## ARTICLE INFO

## ABSTRACT

*Article history:*

Received 05 July 2012

Accepted 19 July 2012

Available online 30 July 2012

*Keywords:*

Pea

Powdery mildew

*Erysiphe Polygoni* DC.

Pea (*Pisum sativum* L.) occupies a prominent place in the vegetable cultivars in India. Powdery mildew disease on pea (*Pisum sativum* L.) incited by fungus *Erysiphe polygoni* DC is an important limiting factor in pea cultivation in Marathwada region of Maharashtra state. In the integrated disease management trial application of different bioagents showed reduced disease severity. The disease severity ranges 13.84 to 27.68 per cent. Treatment *Trichoderma hamatum* was most effective followed by *Trichoderma viride* and *Pseudomonas fluorescences*. In Chemical management experiment the fungicide Bayleton (0.05 %) showed significantly lowest disease severity (15.93 %) with maximum (26.87 %) disease control. On the basis of effectiveness in controlling the powdery mildew disease of pea the most effective fungicide recorded in the order of merit were Bayleton (0.01 %), Tridomorph (0.05 %) and Dinocap (0.05%).

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**1. Introduction**

Pea (*Pisum sativum* L.) is a valuable vegetable crop all over the world belonging family *Leguminoceae*. Major states growing pea in India are Uttar Pradesh, Assam, West Bengal and Maharashtra. Production and productivity of pea has been very low. The most important constraint is powdery mildew of pea caused by *Erysiphe polygoni* f. *psi* (Linford), Snyder and Hentan. (Anonymous, 1979). Amongst the diseases the Powdery mildew alone results in

to a huge economical loss. In the past few years disease has been continuously observed to occur in Marathwada region. It becomes severe under dry weather and responsible for heavy losses. Considering the economic importance of the powdery mildew disease studies were undertaken with the objective to manage the disease with the help of chemicals and bioagents.

## 2. Materials and methods

### 2.1. Efficacy of different fungicides against powdery mildew of pea

A field experiment was carried out to study efficacy of different fungicides against powdery mildew of pea (*Erysiphe polygoni*) with eight treatments in Randomized Block Design. In all four treatment sprays were undertaken, after disease initiation and subsequent sprays at an interval of 10 days. The disease severity was recorded 10 days after each spray. Eight treatments [Bayleton (Triademofon 25 % WP) 0.1 %, Karathane (Dinocap 46 % EC) 0.1 %, Bavistin (Carbendazim 50 % WP) 0.1%, Thiovit (Wettable sulphur 80 % WP) 0.3 %, Hexaconazole (0.05 %), Kavach (Chlorothalonil 75 % WP) 0.2 %, Calixin (*Triademorph* 50 % WP) 0.05 %] with one control (unsprayed) treatment where powdery mildew disease was allowed to develop. Four successive spraying were done at 10 days interval after 45 days. The first spraying was done at disease initiation (45 DAS), then subsequent spraying done at 55 DAS, 65 DAS and 75 DAS. Observation on disease incidence and severity were recorded at 55 DAS, 65 DAS, 75 DAS and 85 DAS i.e. ten days after each spray. For measuring disease severity lower leaves, middle leaves and upper leaves were observed, five plants were selected randomly from each plot and labelled for subsequent evaluation. The five leaves of each plant were counted for disease rating. Powdery mildew disease severity was recorded in 0 to 5 disease rating scale. The five leaves at lower, middle and upper were rated as per scale to determine the disease severity. The per cent disease severity (PDS) or (intensity) was calculated on the basis of following formula

$$\text{PDS} = \frac{\text{Sum of observed numerical rating}}{\text{No. of leaves observed} \times \text{maximum rating}} \times 100$$

Per cent disease control (PDC) was worked out by applying formula.

$$\text{PDC} = \frac{\text{PDI in control} - \text{PDI in treatment plot}}{\text{PDI in control plot}} \times 100$$

### 2.2. Effect of bioagents on disease severity

A experiment was conducted in Randomized Block Design with four replication during the *rabi* season 2006-2007 to observe various effects of bioagents [*Trichoderma viride*, *Trichoderma hamatum*, *Pseudomonas fluorescens*] on severity of powdery mildew. Three successive sprays were taken at 10 days interval after 35 days. The first spraying was done at 35 days after sowing then successive spraying was done at 45 DAS and 55 DAS. Observations were taken 10 days after each spraying. Five plants per plot were tagged in field experiment carried out for management of powdery mildew and following yield attributing observations were recorded to estimate the yield losses. In each plot five plants were selected at random and labelled for subsequent evaluation. The observations of plant height measured at 45, 55, 65 and 75 DAS. Total four observations were recorded. The observations of average pods per plant were taken on labelled five observational plants at last picking. The observations on 5 pods /plot, total 20 pods of four replication were taken for weight. 5 pods from each plot, total 20 pods of 4 replication were taken for measuring length of pods. A sample of 15 pods was drawn from each plot, sun dried and then number of seeds per pod were counted. A 15 pods sample drawn at random from each plot when they matured. The pods were sundried, after drying 1000 seed weight was taken. The results were compiled experiment wise and statistically analyzed for various designs of experiments as per need of the experiment, to find out standard

error/plot and critical difference for comparison of treatment means, the procedure for this was followed as given by Panse and Sukhatme (1967). The statistical analysis was carried out on computer programmed for such work.

### 3. Results and discussion

#### 3.1. Efficacy of different fungicides against powdery mildew of pea

Data on disease severity are presented in Table 2. The disease severity of powdery mildew was recorded at initiation was ranges from 2.30 to 5.89 per cent. Data presented in Table 1 and Fig.1 clearly indicated that disease severity recorded after all the sprays were significant. Disease severity recorded after first spraying was ranged from 6.73 to 10.40 in treatments and significantly superior over unsprayed control. Treatment T<sub>1</sub> i.e. fungicide Bayleton (0.05%) was significantly superior over rest of the treatment Disease severity after second spraying showed similar trend. The disease severity ranges from 25.74 to 40.73 per cent as against 47.73 per cent in control. The treatment Bayleton was effective in reducing disease severity over other. Minimum disease intensity was observed in fungicide Bayleton followed by Tridemorph (28.87), Dinocap (30.80) and Carbendazim (33.47). Disease severity after third treatment spraying was recorded significantly minimum disease severity and ranged from 19.77 to 32.20 per cent as against 49.13 per cent in control. Treatment i.e. fungicide Bayleton (0.05 %) was found most effective in reducing disease severity (19.77 per cent) followed by fungicide Tridemorph (23.00 per cent), Dinocap (24.13 %), Carbendazim (26.73 per cent), Chlorothalonil (28.53 %), Hexaconazole (30.40 per cent) and (32.20 per cent) in order of merit of effectiveness. Treatment Tridemorph (T<sub>7</sub>) and Dinocap (T<sub>2</sub>) were statistically at par with each other. However, all treatments were significantly superior over unsprayed control treatment. Disease severity after fourth treatment ranging from 15.93 to 26.87 per cent as against 53.20 per cent in control. Treatment T<sub>1</sub> i.e. Bayleton (0.05 %) was significantly superior over rest of the treatments. All treatment were significantly effective over unsprayed control treatment. Thus, the mean PDC data presented in Table 2 clearly indicated that all the treatments significantly reduced the powdery mildew disease severity after third and fourth sprayings over unsprayed control. However, fungicide Bayleton (0.05 %) was found most effective with lowest mean PDI (16.92 per cent). The next best fungicides recorded were Tridemorph (19.59 per cent), Dinocap (20.93 per cent), Carbendazim (23.13 per cent), Chlorothalonil (24.60 per cent), Hexaconazole (25.75 per cent) and Wettable Sulphur (27.55 per cent), respectively over unsprayed control. Per cent disease control achieved after first and second spraying was ranged from 11.86 per cent to 42.97 per cent and 14.67 per cent to 59.62 per cent respectively. After third spraying, maximum disease control was recorded in fungicide Bayleton (0.05 %) to the tune of 60.79 per cent followed by Tridemorph (53.90 per cent) and Dinocap (50.89 per cent). Similar trend of disease control was observed after fourth spraying. Fungicides Bayleton (70.06 per cent), Tridemorph (63.91 per cent) and Dinocap (60.02) and were ranked first, second and third in order of merit of disease control. Maximum mean disease control was obtained in Bayleton (58.36 per cent) followed by Tridemorph (48.87 per cent) and Dinocap (45.64 per cent). Mean per cent disease control (PDC) achieved with all the treatments (Table 2) ranged from 27.62 to 58.36 per cent. The highest mean disease control of 58.36 was recorded in fungicide Bayleton. The second and third best fungicides were Tridemorph (48.87 per cent) and Dinocap (45.64 per cent), respectively. Results obtained in respect of the efficacy of fungicide in effectively controlling the powdery mildew of pea are in confirmity with those reported earlier in pea, mungbean, urdbean, cucurbits and black gram. Zote *et al.* (1982), Panja and Chaudhary (1994) Upadhyay and Gupta (1994), Sindhan *et al.* (1999), Shrivastava (1996), Singh and Prithviraj (1997), Kapoor and Thakur (1997) and Singh *et al.* (2002).

#### 3.2. Effect of bioagents on severity of powdery mildew

An experiment was conducted to study the effect of *Trichoderma viridae*, *Trichoderma hamatum* and *Pseudomonas fluorescens*. A total three observations were made and data are presented in Table 2. The data presented in Table 2 revealed that bioagent treatments significantly reduced powdery mildew disease severity over sprayed control. Results showed that, the bioagent *T. hamatum* was most effective than all other treatments (Plate IX).

In case of 45 DAS, lowest disease severity was observed in treatment with *Trichoderma hamatum* (2%) followed by *Trichoderma viridae* (2.53) and *Pseudomonas fluorescens* (4.27). All the treatments were superior over control. However, treatments with *T. hamatum* and *T. viridae* were at par with each other. Data after 55 DAS showed that disease severity ranges from 11.33 to 25.73.

**Table 1**

Effect of fungicides on disease severity of new pea cultivar Khaperkheda

Sr. NO.	Treatment Details	PDI after spraying				Mean PDI	PDC after spraying				Mean PDC
		I	II	III	IV		I	II	III	IV	
T1	Bayleton (0.05%) (Tridemefon)	6.73 (3.86)	25.74 (14.91)	19.77 (11.11)	15.93 (9.17)	16.92 (9.78)	42.97 (25.79)	59.62 (37.12)	60.79 (38.07)	70.06 (49.77)	58.36 (36.19)
T2	Dinocap(0.05%) (Karathane)	7.53 (4.31)	30.80 (17.44)	24.13 (13.96)	21.27 (12.78)	20.93 (11.88)	36.19 (21.13)	35.47 (20.76)	50.89 (30.28)	60.02 (37.89)	45.64 (27.51)
T3	Carbendazim (0.1%) (Bavistin)	8.20 (4.70)	33.47 (9.55)	26.73 (15.50)	24.13 (13.96)	23.13 (13.71)	30.51 (7.86)	29.87 (17.16)	45.59 (27.12)	54.64 (34.11)	40.15 (23.27)
T4	Wettable Sulphur (0.02%) (Thiovit)	10.40 (5.97)	40.73 (24.04)	32.20 (18.78)	26.87 (16.58)	27.55 (16.11)	11.86 (6.81)	14.67 (9.72)	34.46 (20.14)	49.49 (29.53)	27.62 (17.92)
T5	Hexaconazole(0.02%) (Contaf)	9.73 (5.59)	37.33 (21.92)	30.40 (17.70)	25.53 (15.30)	25.75 (15.4)	17.54 (9.97)	21.79 (12.64)	38.12 (22.11)	52.01 (31.27)	32.37 (19.56)
T6	Chlorothalonil (0.7%) (Kavach)	8.93 (5.12)	35.73 (20.94)	28.53 (16.52)	25.20 (14.60)	24.60 (14.07)	24.32 (14.11)	25.14 (15.11)	41.93 (24.16)	52.63 (32.26)	36.01 (21.84)
T7	Tridemorph (0.05%) (Calexin)	7.27 (4.17)	28.87 (16.78)	23.00 (13.30)	19.20 (11.07)	19.59 (11.26)	38.39 (22.27)	39.51 (24.12)	53.9 (32.72)	63.91 (39.92)	48.87 (28.17)
T8	Control (Water spray)	11.80 (6.78)	47.73 (28.52)	49.13 (29.42)	53.20 (32.14)	40.47 (23.94)					
S.E.±		0.098	0.646	0.27	0.227						
CD at 5%		0.288	1.898	0.793	0.667						

PDI, Per cent disease intensity.

PDC, Per cent disease Control.

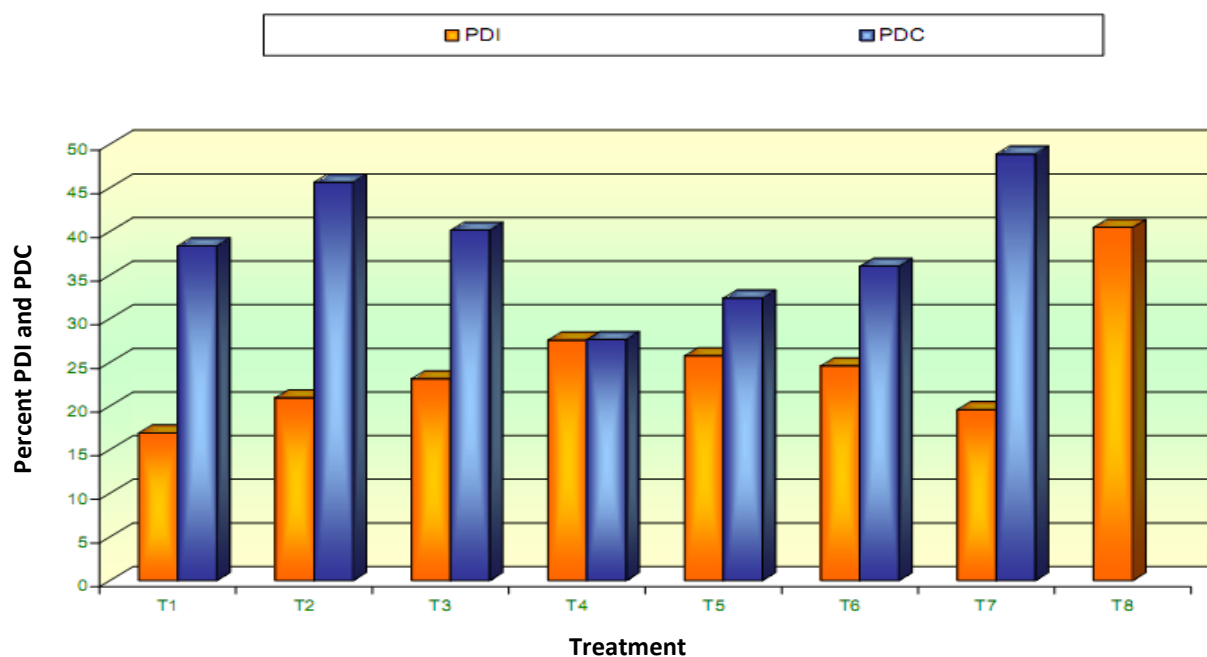
Figures in parenthesis are arcsine transformed values.

**Table 2**

Effect of different bioagents on disease severity of pea.

Treatment	Treatment details	Disease severity			Mean	PDC		Mean PDC
		45 DAS	55DAS	65DAS		II spray	III spray	
T1	<i>Trichoderma viride</i>	2.53 (9.14)	17.90 (24.99)	39.55 (38.96)	19.99 (24.67)	48.72 (40.64)	49.68 (42.12)	34.36 (36.13)
T2	<i>Trichoderma hamatum</i>	2.00 (8.07)	11.33 (19.67)	28.20 (32.07)	13.84 (22.48)	67.54 (56.12)	64.12 (53.08)	40.69 (39.82)
T3	<i>Pseudomonas fluorescens</i>	4.27 (11.90)	25.73 (30.47)	53.04 (46.73)	27.68 (33.62)	26.29 (39.04)	32.51 (34.17)	29.40 (33.42)
T4	Control	6.00 (14.17)	34.91 (36.21)	78.60 (62.44)	39.84 (42.38)			
S.E.±		0.43	0.45	0.27				
CD at 5 %		1.37	1.43	0.86				

Figures in parenthesis are arcsine transformed values.



**Fig. 1.** Effect of fungicides on PDI and PDC of pea CV. Khaperkheda.

Lowest powdery mildew severity was observed with *T. hamatum* (11.33) followed by *T. viridae* (17.90) and *P. fluorescence* (25.73). Highest disease severity was observed in unsprayed control (34.91). Data after 65 DAS indicated that treatment *T. hamatum* was again superior over all other treatment. Disease severity with *T. hamatum* (28.20) was significantly lower than *T. viridae* (39.55 per cent) and *P. fluorescens* (53.04 per cent). However, all treatments were significantly superior over unsprayed control (78.60 per cent). Mean PDI showed similar trend of disease severity. Lowest disease severity was observed in *T. hamatum* (13.84 per cent) followed by *T. viridae* (19.99 per cent) and *P. fluorescence* (27.68 per cent). Highest disease severity was to the tune of 39.84 per cent in unsprayed control. After second spraying highest per cent disease control was observed in treatment with *T. hamatum* (67.54 per cent) followed by *T. viridae* (48.72 %) and *P. fluorescence* (26.29 per cent) over unsprayed control. Same trend continues after third spraying. The per cent disease control ranges from 32.51 per cent to 64.12 per cent. Highest per cent disease control was observed in case of *T. hamatum* (64.12%) followed by *T. viridae* (49.68 per cent) and *P. fluorescens* (32.51 per cent) over unsprayed control. Mean per cent disease control was highest in *T. hamatum* (40.69 per cent) followed by *T. viridae* (34.36 per cent) and *P. fluorescence* (29.40 per cent) over unsprayed treatment. Results obtained in respect of efficacy of bioagents in effectively controlling the powdery mildew in pea are in conformity with those reported earlier. Cook and Baker (1983), Rajappan and Yesuraja (2000), Deore and Sawant (2000), and Schmidtt *et al.* (2002).

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