



Official publication of Pakistan Phytopathological Society

# Pakistan Journal of Phytopathology

ISSN: 1019-763X (Print), 2305-0284 (Online)

<http://www.pakps.com>



## SCREENING OF CUCUMBER VARIETIES AGAINST DOWNY MILDEW (*PSEUDOPERONOSPORA CUBENSIS*) AND ITS CHEMICAL MANAGEMENT

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### ABSTRACT

Cucumber is the most important vegetable that is being affected by many biotic and abiotic factors, but the downy mildew is most fatal. Seven cucumber varieties were screened for resistance against downy mildew and five fungicides were evaluated for their efficacy to control the disease. Disease severity data was recorded according to Jenkins-Wehner scale. The statistical analysis of data was done by using Fisher's technique, analysis of variance and least significant difference test (LSD) evaluated for comparing of means of different treatments at 5% probability level. The result of the present study suggested that "Super green special" variety was graded 3 and other varieties Beithoalfa, Marketmore-76, Cucumber 363, Anmol, Marketmore and Desi graded 6,6,6,7,7 and 8 respectively against the downy mildew. Among different fungicide only the "Moral" (Azoxytrobilin) fungicide presented the effective control of disease followed by Agrohut (Mancozeb + Dimetamorph), Acute (Azoxytrobilin), Antracol (propineb) and Cabriotop (metiram + pyraclostrobin). The present study will be effective in order to manage the downy mildew disease of cucumber.

**Keywords:** Cucumber, downy mildew, screening, fungicide.

### INTRODUCTION

Cucumber (*Cucumis sativus* L.) originated in India. In western Asia cucumber has been cultivated for at least 3,000 years and it was introduced from Romans to other parts of Europe (Hedrick, 1919). Total area of world under cultivation of cucumber is 2.09 million hectares while the total production of cucumber is 0.31 million tons. Despite the fact that cucumber is an important vine crop of Pakistan its yield is quite low. It is cultivated in Pakistan on area of 3397 ha with a total production of 142876 tons (FAO, 2011). The factors responsible for low yield of cucumber are diseases, cultivation of inferior varieties and lack of appropriate cultural practices (fertilization, irrigation and hoeing etc.) Among these, the most common cause of low productivity is the cultivation of low standard varieties (Silva *et al.*, 1979). The *Pseudoperonospora* (genus), includes

five morphologically similar species: *P. urticae*, *P. cubensis*, *P. celtidis*, *P. humuli*, and *P. cannabina* (Choi *et al.*, 2005). According to Lebeda and Widrlechner (2003) *P. cubensis* has a broad host range that includes approximately 50 species of 20 genera. Downy mildew has been reported from 70 countries on species belonging to *Cucumis* genus throughout the world (Cohen, 1981). Downy mildew caused by *Pseudoperonospora cubensis*, economically is the most damaging among the diseases that affect cucurbitaceous crops (Lebeda and Cohen, 2011). It is destructive cucumber disease and causes 40 % losses around the globe (Colucci *et al.*, 2006). Keeping in view the importance of cucumber crop, the present study was planned to find out the resistant source of germplasm by performing the screening of different varieties and evaluation of different fungicides carried out in order to manage the disease.

### MATERIALS AND METHODS

Seven varieties of cucumber were sown in the field

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(Table 1) and each variety was replicated thrice in order to identify the resistant cucumber material. Plots were exposed to natural conductions relevant to growing season of crop. Susceptible cultivar long green cucumber was grown along the borders around the field and in spreader rows spaced every third row in order to increase inoculum in the field. Downy mildew infected leaves were collected from the previously existed tunnel crop sown in Horticulture vegetable area, University of Agriculture, Faisalabad-Pakistan and was stored in a refrigerator. In the

laboratory, five heavily infected leaves were soaked in distilled water and rubbed gently with a glass rod to dislodge sporangia. The spore concentration was determined by the use of a haemocytometer. The suspension was adjusted to a final concentration between 8000-12000 sporangia/ml. Before inoculation, Tween 20 (0.06 g/L) was added to the inoculum suspension to keep the spores well dispersed in the solution. Plants were inoculated at the one- to two true leaf stage with a hand-pumped spray bottle (1 L size, Delta Industries).

Table 1. Cucumber varieties screened against downy mildew.

Sr. No.	Varieties	Source
1	Super green special	Market
2	Beithoalfa	AARI
3	Marketmore-76	Market
4	Cucumber-363	Market
5	Anmol	AARI
6	Marketmore	Market
7	Desi	AARI

**Disease ratings:** After the development of disease plots crops were rated weekly using a 0 to 9 (1= 3%, 2=6%, 3=12%, 4=25%, 5=50%, 6=75%, 7=87%, 8=94% and 9=97%) scale that was based on percentage of symptomatic leaf area; a method developed by Jenkins and Wehner (1983).

**Evaluation of fungicides against downy mildew of cucumber (*in-vivo*):** Five different fungicides (Table 2) were used to study in order to observe the effect of

fungicide to manage the downy mildew disease. The experiment was designed in randomized complete block design (RCBD) with three replications. Fungicides with recommended doses were sprayed on all studied varieties and the same techniques followed to enhance the disease development as employed in screening trial.

Disease severity data was recorded according to the Jenkins and Wehner (1983) scale.

Table 1. Details of treatments employed in experiment along with name of fungicides.

Trade name and formulation	Chemical name	Dose per litre
Cabrio top 60% WDG*	Metiram	2.0 gm
Antracol 70% WP**	Dithiarcobomate	2.0 gm
Acute 50% SC***	Azoxystrobin	2.5 ml
Agrohut 50% WP	Mancozeb+Dimethamorph	2.4 gm
Moral 50% WDG*	Azoxystrobin	2.5 gm
Control	-	-

WDG\*: Water dispersible granules; WP\*\*: Wettable powder; SC\*\*\*: Suspension concentrate.

**Statistical Analysis:** The collected data was analysed statistically by employing the Fisher analysis of variance technique (Steel *et al.*, 1997) and treatment means were compared by using Least Significance Difference (LSD) test at 5% probability level (software M. Stat C).

**RESULTS AND DISCUSSION**

**Performance of Cucumber varieties against downy mildew:** The data recorded on the basis of symptoms on cucumber plants in field against downy mildew for

various levels of susceptibility and resistant presented in Table 3. All cucumber varieties in screening experiment showed various levels of resistance. The screening results of cucumber varieties against downy mildew showed that not a single variety of cucumber out of seven studied varieties was completely resistant against *P. cubensis*, while Super Green Special variety scored moderately resistant. The results of present study suggested that other varieties Beithoalfa, Marketmore-76, Cucumber

Table 3. Grading of cucumber varieties against downy mildew after screening.

Grade	Percent disease severity	Level of Resistance / Susceptibility	No. of varieties
0	No symptoms	completely resistant	Nil
1	0-3	disease highly resistant	Nil
2	3-6	disease highly resistant	Ni
3	6-12	disease moderately resistant	1
4	12-25	disease intermediate	Nil
5	25-50	disease intermediate	Nil
6	50-75	disease moderately susceptible	3
7	75-87	disease highly susceptible	2
8	87-94	disease highly susceptible	1
9	94-99	Plant dead	Nil

***In vivo* evaluation of fungicides for management of Downy mildew of cucumber**

363, Anmol, Marketmore and Desi graded 6, 6, 6, 7, 7 and 8 respectively (Table 3).

**Effect of fungicide against downy mildew on different varieties (First spray):** Different fungicides showed (Table 4) different response in regards to minimizing the effect of pathogen on different varieties. As far as effect of fungicide on different varieties is concerned the fungicide "Moral" showed the most effective control of disease on

Beithoalfa and Marketmore -76 followed by cucumber 363, Anmol, Marketmore and Desi. Agrohut showed 2nd most effectiveness in controlling disease on Beithoalfa and on all other varieties followed by Acute, Antracol, Cabriotop and Control. In check variety disease incidence was very high and Desi variety showed more than 74% disease incidence. In addition to these, Cabriotop represented least effective results on all varieties.

Table 4. Effect of fungicides against different varieties of cucumber after first spray.

Treatment	Beithoalfa	Marketmore-76	Cucumber 363	Anmol	Maketmore	Desi
Cabriotop	63.7 K	65.0 J	66.8 H	68.6G	70.4 F	72.2 D
Antracol	60.2 P	61.4 O	62.7 M	64.0 K	65.3 I	66.6 H
Acute	56.5 U	57.8T	59.1 R	60.4 P	61.7 N	63.0 L
Agrohut	52.9 Z	54.2 X	55.5 V	56.8 U	58.1 S	59.4 Q
Moral	54.7W	51.9 a	51.9 a	54.2 X	54.8 W	55.6 V
Control	68.5 G	70.3 F	71.6 E	72.9C	74.2 B	75.5 A

Means sharing the similar letters are statistically non-significant. LSD=0.2827

**Effect of fungicide against downy mildew on different varieties (2<sup>nd</sup> spray):** All varieties showed different level of disease after applications of different fungicides (Table 5). As far as effect of fungicide on different varieties is concerned the fungicide Moral after statistical analysis showed the most effective control against downy mildew on Beithoalfa followed by cucumber 363 Marketmore-76, Anmol, Marketmore and

Desi. Agrohut is 2nd most effective in controlling disease on Beithoalfa and on all other varieties followed by Acute, Antracol, Cabriotop and Control. The control varieties disease incidence was at high level, Marketmore and Desi variety showed symptoms more than 75%. Cabriotop was found least effective fungicide on all varieties against downy mildew disease as compare to other mentioned fungicide.

Table 2. Effect of fungicides against different varieties of cucumber after 2<sup>nd</sup> spray.

Treatment	Beithoalfa	Marketmore-76	Cucumber 363	Anmol	Maketmore	Desi
Moral	49.05 B	50.30 A	51.00 C	51.9 Z	53.40 X	54.85 V
Acute	55.40 U	56.40 T	57.70 S	59.00 R	60.30 P	61.60 N
Antracol	59.10 R	60.00 Q	61.300	62.60M	63.90K	65.20J
Cabriotop	62.60 M	63.60 L	65.900 I	68.20H	70.500 F	72.80 D
Agrohut	51.80 Z	52.80 Y	54.08 W	55.37 U	56.65 T	57.93 S
Control	69.083 G	71.55 E	72.85D	74.15 C	75.45 B	76.750 A

Means sharing similar letters are statistically non-significant. LSD=0.2834.

In order to control the downy mildew disease in cucurbits and onions chlorothalonil @ 2.4 pounds per hectare was used successfully (Jones, 1978). The low incidence of the disease was recorded by the spray Ridomil (9%), Success (9%) and Alliet (11%) compared to control (78%). Size of fruits, number of fruits per plant and fruit yield was significantly higher in Ridomil, Success and Alliet treated plots with compared to control and other fungicides treated plot (Chaudhry *et al.*, 2009). Cohen (1979) suggested that systemic fungicides of the phenylamides group were effective in controlling the disease. The experiment conducted by Sharma *et al.* (2003) determined that Ridomil MZ (mancozeb+ metalaxyl; 1000ppm) caused the highest reduction in sporangial formation followed by Acrobat MZ (dimethomorph; 1000ppm). Ridomil MZ (0.25%) also showed the highest antispore activity, i.e. up to 7 days. In a study conducted to determine the efficacy of mancozeb; metalaxyl+mancozeb; cymoxanil+mancozeb; copper oxychloride; and chlorothalonil for the control of *Pseudoperonospora cubensis*, metalaxyl+mancozeb was the most effective, recording disease severities of 0.0 – 0.9%.

Results of the present study suggest that only one variety out of seven i.e., Super green Special variety of cucumber is moderately resistant against downy mildew while all the other varieties is susceptible to *P. cubensis*. After first spray of fungicide “Moral” showed the most effective control of disease followed by Agrohut, Acute, Antracol, Cabriotop and Control. After 2<sup>nd</sup> spray “Moral” remained most effective fungicide to control the disease on all varieties and in check varieties disease incidence were much high.

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