Journal of Ecobiotechnology 2/6: 29-43, 2010
ISSN 2077-0464
Journal of Ecobiotechnology
http://journal-ecobiotechnology.com/

Incidence of Powdery Mildew on Cucurbit Plants and its Ecofriendly Management

Vasant P. Pawar[1]* and Ashok M. Chavan[2]
[1]Department of Botany, ARTS and science college, Bhalod, tq. Yawal, Dist. Jalgaon (M.S.), India
[2]Seed Pathology and Fungal Biotechnology Laboratory, Department of Botany, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad- 431004 (M.S.), India

**Corresponding author, Email: ram_mango@yahoo.com*

Keywords

Powdery mildew
Cucurbits
Erysiphe cichoracearum
Sphaerotheca fuliginea

Abstract

Present paper deals with the study of powdery mildew incidence on different cucurbits hosts in different seasons and its biocontrol. In Kharif season *Sphaerotheca fuliginea* was dominantly present on *Cucurbita maxima*, *Lageneria siceraria* and *Cucurbita pepo*, where as *Erysiphe cichoracearum* noted on *Citrullus lanatus* was not reported in 2005 and 2006.*Cucurbita maxima*, *Lageneria siceraria*, *Luffa acutangula* and *Luffa cylindrica* showed maximum occurrence of *Sphaerotheca fuliginea* in the rabbi season. Incidence of powdery mildew was mainly reported on the mature leaves followed by stem. Where as in some cases it was reported on tendril, flower and fruit. Dominant association of powdery mildew was mainly reported on basal leaf. However the incidence of powdery mildew was less on the younger leaves of cucurbits. Incidence of powdery mildew is more at post flowering and fruiting stage. However powdery mildew also reported at seedling stage of *Cucurbita pepo* and *Cucurbita maxima*. Neem leaf extract at15% concentration, *Parthenium* leaf at 10% concentrations. *Ocimum* leaf at 20% concentration, Citrus leaf at 20% concentration, *Annona squamosa* leaf at 10% concentration, Ipomea at 15% and Jowar leaf at 20% control the powdery mildew of cucurbits. Cow urine at 15% concentration proved to be effective to control powdery mildew on cucurbit. 20% to 25% of Butter milk spray successfully controlled the powdery mildew of cucurbit. Similarly 20% ash spray also found to be successful to control the growth of powdery mildew of cucurbits. Spray of Dashparni ark, a bi-product of plant and animal at 10% concentration inhibited the growth of *Erysiphe cichoracearum* and *Sphaerotheca fuliginea*.

1. Introduction

Powdery mildew occurring on the wild as well as cultivated plants are due to fungi belongs to the order erysiphales and family erysiphaceae. The fungi grow ectoparasitically on the surface of the plant parts. The superficial mycelium of the fungi produce enormous number of conidia, usually on the leaf surfaces and other aerial part, which appear like a mass of white powder, hence the disease is popularly known as powdery mildew. Powdery mildew is more common on cultivated plants and grow luxuriantly in dry and cool climate. It grows abundantly in low temperature with high humidity. Germination of conidia of the fungi in dry season supports the production of dark superficial perithecia, cleistothecia present in group. Depending upon the environmental conditions the powdery mildew diseases cause significant destruction and loss in crop plants and ultimately to the production. With the onset of summer, they began to disappear and the plants become free from the infection during scorching heat and rainy season.This disease was dominantly reported on members of families like asteraceae, cruciferae, leguminosae and cucurbitaceae. Cucurbit is a common term used for all the wild and cultivated members of family Cucurbitaceae. This family represents with 90 genera and 700 species. Most of the cucurbits are cultivated as a fruit and vegetable in all over the world. The cucurbits in the field are affects by several pathogens like bacteria, virus, mycoplasma, nematodes and fungi. However, powdery mildews of cucurbits are very wide in its distribution. It occurs everywhere in cucurbit growing area of the world, (Salmoon, 1900).

These are biotroiphic parasites growing principally on the foliage of angiosperms and cause damage to a variety of crop plants. These are cosmopolitan in origin, prevailing from the tropics to the polar areas and from sea level to 4,000 meters altitude. Maximum reports of their occurrence are from the temperate regions of northern hemisphere, whereas in subtropics and tropics they are sparsely represented (Braun, 1987).

The losses caused by powdery mildews in India are tremendous particularly in the yield of peas, grapes, cereals and cucurbits (Munjal *et al.,* 1963). Northern India bordering the mid Himalayan region experiences diverse set of climatic

conditions with comparatively low temperature and high humidity and is adorned with turnover of vegetation almost all the year round. All this provides congenial conditions for growth and development of fungi in general and powdery mildews in particular.

Powdery mildew fungi produce a conspicuous white to grayish growth of mycelium on the surface of diseased plant parts. Conidia or spores of the fungi are produced on the mycelium (Sharma, 1984). Among powdery mildew diseases on several crops and wild plants have been reported to be caused by species of *Erysiphe, Uncinula, Phyllactinia, Podosphaera, Microsphaera, Sphaerotheca, Leveillula, Oidium* and *Ovularioposis* on plants of family cucurbitaceae (Sharma and Khan, 1991;), Caesalpinaceae (M. Bappamal, 1995).

Powdery mildews are easily recognized as parasitic fungi having superficial mycelium with haustoria in the epidermal cell of the host. Similarly are with abundant growth during comparatively at low temperature and high humidity, germination of conidia without external water supply to their high water content and production of dark superficial perithecia.

In India cucurbits are mainly infected due to *Erysiphe cichoracearum* and *Sphaerotheca fuliginea* however in northern part of India, *Leveillula taurica* was also reported on the cultivated plants, which reduce the yield considerably. In the literature cited very little information was available regarding the host range of the pathogen; biochemical changes occur due to the pathogen and the eco-friendly management of the disease. Considering the fact attempt were made to study the powdery mildew of cucurbits and its ecofriendly management.

2. Materials and Methods

Collections of materials

The powdery mildew infected plants were collected from different localities of 'Khandesh region of Maharashtra state, India

Incidence of powdery mildew

An extensive survey on powdery mildew diseases of plants in last three years (2004-2006) was undertaken. The repeated visits were made to observe disease incidence at different age of the crops or plants during rainy, winter and summer seasons. The stage of the crops or plants at the time of incidence of powdery mildew stage or perfect stage were recorded along with the climatic conditions.

Identification of powdery mildews

Powdery mildews fungi were identified by using the standard literature of Hirata (1942), Boesewinkel (1980), Zheng (1985), Braun (1987), Eriksson and Hawksworth (1987), Patil (1991), Bappamal *et al.* (1995) and Hosagoudar (1997).

Ecofriendly Management of powdery mildew of cucurbits

Fungitoxicity of plant extracts was studied by the poisoned food technique described by Nene and Thapliyal (1993). Glucose nitrate medium was prepared in flasks and sterilized. To this medium, the requisite quantity of the plant extract war added. Plant extract was prepared by collecting fresh plant parts, washed thoroughly in distilled water and grinned in distilled water. The plant extract was thoroughly mixed by stirring. The medium war then autoclaved at 15 lb pressure for 20 minutes. After cooling the medium, fungi were inoculated in aseptic condition and incubated for 6 days at room temperature. Suitable checks were kept where the fungi were drown under the same conditions on glucose nitrate without plant extract. Mycelial growth and sporulation of the test fungi was meant after harvesting. The mycelial growth of the fungi compare with check was taken as a measure of the fungitoxicity.

Preparation of dashparni ark extract

An aqueous extract of seven plant leaves, bio-product like Buttermilk and cow urine was used to prepare a bioproduct named dashparni ark. All the composition of the bio-product is kept for 15 days for degeneration and used at different concentration to spray on the cucurbits proportion of dashparni ark.

3. Results and Discussion

Incidence of occurrence of powdery mildew on different host of cucurbit in kharif season was studies in detail directly in the field for continuous three year and result are summarized in Table 1. It was observed that *Citrullus lanatus* and *Cucumis melon* showed the infection in November 2004. However these plants did not show any infection in the year 2005 and 2006. Cucurbits crops cultivated mainly June and July showed the infection in October and November in the entire crop studied in all three years. It was interesting to note that *Cucurbita maxima* showed maximum percentage of infection were as *Momordica charantica* and *Citrullus fistulosus* showed minimum percentage of infection.

Table 1 Incidence of powdery mildews on different hosts of cucurbits in Kharif season

Sr. No	Name of crop	Common Name	Year 2004			Year 2005			Year 2006		
			Period of cultivation	Period of Infection	% of Infection	Period of cultivation	Period of Infection	% of Infection	Period of cultivation	Period of Infection	% of Infection
1	*Citrullus fistulosus*	Round gourd	July-Aug	Nov	34	July-Aug	Nov	40	July-Aug	Nov	48
2	*Citrullus lanatus*	Water melon	July-Aug	Nov	28	-	-	-	-	-	-
3	*Cucumis sativus*	Cucumber	June-July	Nov	36	Jun-July	Nov	48	Jun-July	Nov	45
4	*Cucumis melon*	Musk melon	July-Aug	Nov	25	-	-	-	-	-	-
5	*Cucurbita pepo*	Red pumpkin	June-July	Oct	86	Jun-July	Oct	84	Jun-July	Nov	88
6	*Cucurbita maxima*	Pumpkin	June-July	Oct	100	July-Aug	Oct	98	Jun-July	Oct-Nov	100
7	*Lagenaria siceraria*	Bottle gourd	June-July	Oct-Nov	94	July-Aug	Nov	88	Jun-July	Oct	94
8	*Luffa acutangula*	Ridge gourd	June-July	Nov	74	July-Aug	Nov	72	Jun-July	Oct	64
9	*Luffa cylindrical*	Sponge gourd	June-July	Nov	78	Jun-July	Nov	80	Jun-July	Oct	72
10	*Momordica charantica*	Bitter gourd	June-July	Nov	20	Jun-July	Nov	28	Jun-July	Oct	29

Table 2 Incidence of powdery mildews on different host of cucurbits in rabbi season

Sr.No.	Name of crop	Common Name	Year 2004			Year 2005			Year 2006		
			Period of cultivation	Period of Infection	% of Infection	Period of cultivation	Period of Infection	% of Infection	Period of cultivation	Period of Infection	% of Infection
1	*Citrullus fistulosus*	Round gourd	Dec-Jan	Jan-Feb	38	Nov-Dec	Jan-Feb	56	Dec	Feb	62
2	*Citrullus lanatus*	Water melon	Dec	Jan	78	Dec	Jan-Feb	54	Dec	Feb	58
3	*Cucumis sativus*	Cucumber	Nov	Jan	75	Nov-Dec	Jan	60	Nov	Feb	68
4	*Cucumis melon*	Musk melon	Dec	Jan	100	Dec	Jan	82	Dec	Jan	86
5	*Cucurbita pepo*	Red pumpkin	Nov	Dec-Jan	75	Oct-Nov	Dec	68	Nov	Jan	68
6	*Cucurbita maxima*	Pumpkin	Nov	Dec-Jan	100	Nov-Dec	Jan	100	Nov	Jan	100
7	*Lagenaria siceraria*	Bottle gourd	Nov	Dec-Jan	76	Oct-Nov	Dec	96	Oct-Nov	Dec	96
8	*Luffa acutangula*	Ridge gourd	Nov	Dec-Jan	78	Oct-Nov	Dec	97	Oct-Nov	Dec	94
9	*Luffa cylindrical*	Sponge gourd	Nov	Dec-Jan	85	Oct-Nov	Dec	94	Oct-Nov	Dec	98
10	*Momordica charantica*	Bitter gourd	Nov	Dec-Jan	37	Oct-Nov	Dec	42	Oct-Nov	Jan	44

It was found that December to January was susceptible period of infection for powdery mildew *Cucumis melon* and *Cucurbita maxima* followed by *Luffa cylindrica, Luffa acutangula, Citrullus lanatus, Cucumis sativus* and *Cucurbita pepo*. However *Momordica charantica* and *Citrullus fistulosus* showed less infection as compared with other crops (Table 2)

The incidence of powdery mildew varies from September to February was observed on *Luffa acutangula, Melothria maderaspatane* and *Cucurbita moschata* caused to *Sphearotheca fuliginea* (Khan and Khan, 1970). Mclean (1970), reported occurrence of powdery mildew during the period of December to May on *Citrullus lanathus*. Whereas Munjal and Kapoor (1973), reported severely attack of powdery mildew due to *Sphaerotheca fuliginea* on *Cucurbita pepo* during the month of February. It was noticed that during March to April powdery mildew reported on bottle guard (*Momordia charantica*) and as incitant was identified as *Sphareotheca fuliginea* (Gupta and Singhvi, 1979). Patel *et. al.,* (1990) reported appearance of powdery mildews on bottle gourd during rabbi season on *Lagenaria siceraria, Cucurbita moschata, Cucurbita maxima, Luffa cylindrica, Cucumis memo, Cucumis sativus* and *Cocconia grandis* due to

Sphaerotheca fuliginea. In the month of April to June powdery mildew was reported on *Citrullus vulgaris* and *Cucumis sativus* due to *Sphaerotheca fuliginea* by Branzanti and Brunelli (1992). The disease was severe during March to May and September to November, mild to moderate during December to February and altogether absent during June to August on *Citrullus lanathus , Momordica charantia,* and *Trichosanthes cucumerina* (Khan and Khan, 1992) while on *Cucumis melo* disease incidence was reported during the month of April to September in Himachal Pardesh (Bharat 2003). Powdery mildew on *Cucumis sativus* occured generally epidemic in the mid hills of Himachal Pradesh during August to September every year (Sharma and Sharma 2004). Recently Pawar (2005) isolated *Erysiphe ornotii* on *Coccinia grandis*. Whereas *Sphaerotheca fuliginea* on *Cucumis sativus, Cucurbita maxima, Cucurbita pepo, Luffa cylindrica, Legenaria sicereria* and *Luffa acutangula* from Marathwada region of Maharashtra State.

Fig. 1 Powdery mildew on crops of *Luffa acutangula*, *Cucurbita pepo, Cucurbita maxima* and *Lagenaria siceraria*

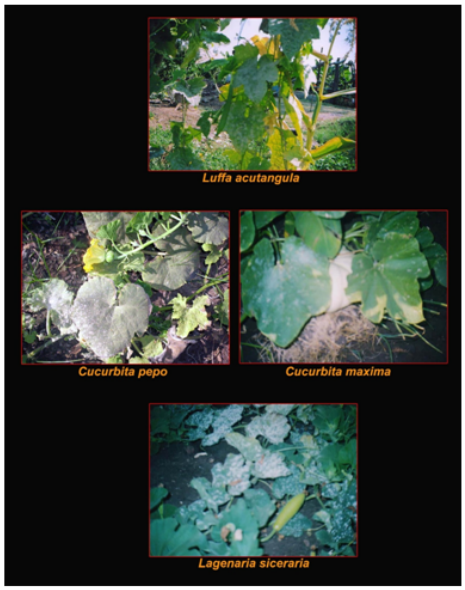

Fig. 2 Powdery mildew on crops of *Luffa cylindrica* and *Momordica charantica*

It is clear from the table 3 that the entire host crop showed maximum infection on the leaves followed by stem, tendril, flower and fruit. It was also observed that the flowers and fruits did not showed infection in case of *Citrullus fistulosus, Cucumis sativus* and *Momordica charantica*.

Fig. 3 Powdery mildew on different plant parts of *Citrullus lanatus , Cucumis sativus, Cucumis melon, Citrullus fistulosus* and *Cucurbita pepo*

Fig. 4 Powdery mildew on different plant parts of *Luffa cylindrica*, *Cucurbita maxima*, *Momordica charantica, Lagenaria siceraria* and *Luffa acutangula*

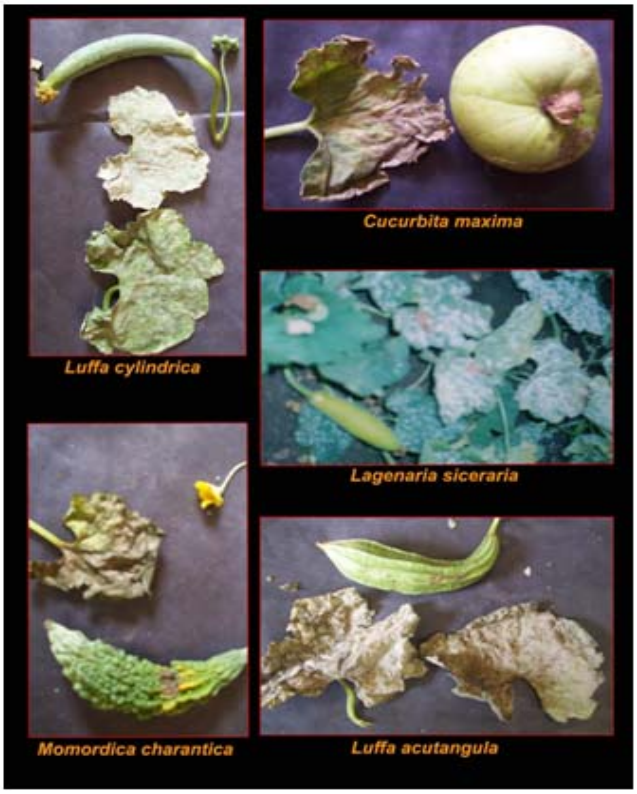

Table 3 Incidence of powdery mildews on plant parts of cucurbits

Sr.No.	Name of crop	Common Name	Leaves	Stem	Flower	Fruit	Tendril
1	*Citrullus fistulosus*	Round gourd	++	++	-	-	-
2	*Citrullus lanatus*	Water melon	++	++	-	++	+
3	*Cucumis sativus*	Cucumber	+++	++	-	_	+
4	*Cucumis melon*	Musk melon	++++	++	+	++	+
5	*Cucurbita pepo*	Red pumpkin	++++	+++	+	+	++
6	*Cucurbita maxima*	Pumpkin	+++	++	+	+	+
7	*Lagenaria siceraria*	Bottle gourd	++++	+++	+	-	+
8	*Luffa acutangula*	Ridge gourd	++++	+++	++	-	+
9	*Luffa cylindrical*	Sponge gourd	++++	+++	++	+	++
10	*Momordica charantica*	Bitter gourd	++	+	-	-	-

Area – nil , + = 25%, ++ = 50%, +++ = 75%, ++++ = 100%

Table 4 Percent incidence of powdery mildews on different parts of leaves on cucurbits

Sr.No.	Name of crop	Common Name	Whole Plant	Basal-leaf	Middle-Leaf	Top-leaf
1	*Citrullus fistulosus*	Round gourd	34	28	18	-
2	*Citrullus lanatus*	Water melon	36	29	19	-
3	*Cucumis sativus*	Cucumber	84	72	68	56
4	*Cucumis melon*	Musk melon	88	78	62	48
5	*Cucurbita pepo*	Red pumpkin	100	94	78	69
6	*Cucurbita maxima*	Pumpkin	100	100	92	75
7	*Lagenaria siceraria*	Bottle gourd	100	100	88	78
8	*Luffa acutangula*	Ridge gourd	92	82	74	58
9	*Luffa cylindrica*	Sponse gourd	88	72	59	48
10	*Momordica charantica*	Bitter gourd	32	32	22	-

Table 5 Incidence of powdery mildew at different stages of cucurbit crops

Sr. No.	Name of crop	Common Name	Stages of the host			
			Seedling	Pre-Flowering	Post-Flowering	Fruiting
1	*Citrullus fistulosus*	Round gourd	--	--	+	+
2	*Citrullus lanatus*	Water melon	--	--	+	+
3	*Cucumis sativus*	Cucumber	--	+	+	+
4	*Cucumis melon*	Musk melon	--	-	+	+
5	*Cucurbita pepo*	Red pumpkin	+	+	+	+
6	*Cucurbita maxima*	Pumpkin	+	+	+	+
7	*Lagenaria siceraria*	Bottle gourd	--	+	+	+
8	*Luffa acutangula*	Ridge gourd	--	+	+	+
9	*Luffa cylindrica*	Sponse gourd	--	+	+	+
10	*Momordica charantica*	Bitter gourd	--	--	+	+

Table 6 Incidence of powdery mildews on Fruits of Cucurbits

Sr.No.	Name of crop	Common Name	No. of Fruits observed	No. of Fruits Infected	% of Fruit Infected	No. of field observed
1	*Citrullus fistulosus*	Round gourd	14	-	-	14
2	*Citrullus lanatus*	Water melon	16	5	75	16
3	*Cucumis sativus*	Cucumber	10	-	-	10
4	*Cucumis melon*	Musk melon	10	3	30	10
5	*Cucurbita pepo*	Red pumpkin	16	5	75	16
6	*Cucurbita maxima*	Pumpkin	10	2	20	10
7	*Lagenaria siceraria*	Bottle gourd	10	-	-	10
8	*Luffa acutangula*	Ridge gourd	10	-	-	10
9	*Luffa cylindrica*	Sponge gourd	10	4	40	10
10	*Momordica charantica*	Bitter gourd	14	-	-	14

Table 7 Effect of Neem leaf extract on powdery mildew of different cucurbits

Sr. No.	Name of crop	Name of Pathogen	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	60	80	100	-	-
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	40	60	80	100	-
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	40	60	80	100	-
4	*Cucumis melon*	*Sphaerotheca fuliginea*	20	40	60	80	100
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	40	60	80	100	-
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	20	40	60	80	100
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	20	40	80	100	-
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	20	40	80	100	-
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	20	40	60	80	100
10	*Momordica charantica*	*Sphaerotheca fuliginea*	60	80	100	-	-

Values expressed in % grades of control

Table 8 Effect of *Parthenium* leaf extract on powdery mildew of different cucurbits

Sr. No.	Name of crop	Name of pathogen	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	60	80	100	-	-
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	40	60	80	100	-
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	60	80	100	-	-
4	*Cucumis melon*	*Sphaerotheca fuliginea*	40	60	80	100	-
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	40	40	60	80	100
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	40	60	80	100	-
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	40	60	80	100	-
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	20	40	60	80	100
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	20	40	60	80	100
10	*Momordica charantica*	*Sphaerotheca fuliginea*	80	100	-	-	-

Values expressed in % grades of control

Table 9 Effect of Ocimum leaf extract on powdery mildew of different cucurbits

Sr. No.	Name of crop	Common Name	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	40	60	80	100	-
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	20	40	60	80	100
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	40	60	80	100	-
4	*Cucumis melon*	*Sphaerotheca fuliginea*	20	40	60	80	100
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	20	40	60	80	100
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	20	40	60	80	100
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	20	40	60	80	100
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	20	40	60	100	-
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	20	40	60	80	100
10	*Momordica charantica*	*Sphaerotheca fuliginea*	40	80	100	-	-

Values expressed in % grades of control

Table 10 Effect of citrus leaf extract on powdery mildew of different cucurbits

Sr. No.	Name of crop	Common Name	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	40	60	80	100	-
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	20	40	60	80	100
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	20	40	60	80	100
4	*Cucumis melon*	*Sphaerotheca fuliginea*	30	50	70	100	-
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	40	60	80	100	-
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	40	60	80	100	-
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	40	60	60	80	100
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	40	60	60	80	100
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	40	60	60	80	100
10	*Momordica charantica*	*Sphaerotheca fuliginea*	40	60	60	100	-

Values expressed in % grades of control

Table 11 Effect of *Annona* leaf extract on Powdery Mildew of different cucurbits

Sr. No.	Name of crop	Name of pathogen	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	40	60	80	100	-
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	60	80	100	-	-
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	60	80	100	-	-
4	*Cucumis melon*	*Sphaerotheca fuliginea*	40	60	80	100	-
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	40	60	80	100	-
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	20	40	60	80	100
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	20	40	60	80	100
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	20	40	60	80	100
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	20	40	60	80	100
10	*Momordica charantica*	*Sphaerotheca fuliginea*	40	60	80	100	-

Values expressed in % grades of control

Table 12 Effect of Ipomea leaf extract on powdery mildew of different cucurbits

Sr. No.	Name of crop	Name of Pathogen	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	60	80	100	-	-
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	60	80	100	-	-
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	60	80	100	-	-
4	*Cucumis melon*	*Sphaerotheca fuliginea*	40	60	80	100	-
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	20	40	60	80	100
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	20	40	60	100	-
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	20	40	60	80	100
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	20	60	60	80	100
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	40	80	80	100	-
10	*Momordica charantica*	*Sphaerotheca fuliginea*	80	100	-	-	-

Values expressed in % grades of control

Table 13 Effect of Jowar leaf extract on Powdery Mildews of cucurbits

Sr. No.	Name of crop	Name of Pathogen	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	20	40	60	80	100
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	20	40	60	80	100
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	40	60	80	100	-
4	*Cucumis melon*	*Sphaerotheca fuliginea*	20	40	60	80	100
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	20	40	60	80	100
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	20	40	60	80	100
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	20	40	60	80	100
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	20	40	60	80	100
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	40	60	80	100	-
10	*Momordica charantica*	*Sphaerotheca fuliginea*	60	80	100	-	-

Values expressed in % grades of control

Table 14 Effect of cow urine on powdery mildew of different cucurbits

Sr. No.	Name of crop	Name of Pathogen	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	80	100	-	-	-
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	60	80	100	-	-
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	60	80	100	-	-
4	*Cucumis melon*	*Sphaerotheca fuliginea*	40	60	80	100	-
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	40	60	80	100	-
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	40	60	80	100	-
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	60	80	100	-	-
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	60	80	100	-	-
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	60	80	100	-	-
10	*Momordica charantica*	*Sphaerotheca fuliginea*	80	100	-	-	-

Values expressed in % grades of control

Table 15 Effect of butter milk extract on Powdery Mildew of different cucurbits

Sr. No.	Name of crop	Name of Pathogen	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	20	40	60	80	100
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	40	60	80	100	-
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	20	40	60	80	100
4	*Cucumis melon*	*Sphaerotheca fuliginea*	20	40	60	80	100
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	40	60	80	100	-
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	40	60	80	100	-
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	20	40	60	80	100
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	20	40	60	80	100
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	20	40	60	80	100
10	*Momordica charantica*	*Sphaerotheca fuliginea*	40	60	80	100	-

Values expressed in % grades of control

Table 16 Effect of ash on Powdery Mildew of different cucurbits

Sr. No.	Name of crop	Name of Pathogen	% concentration applied				
			5	10	15	20	25
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	40	60	80	100	-
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	40	60	80	100	100
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	40	60	80	100	-
4	*Cucumis melon*	*Sphaerotheca fuliginea*	20	40	60	80	100
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	20	40	60	80	100
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	40	60	80	100	-
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	20	40	60	80	100
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	20	40	60	80	100
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	20	40	60	80	100
10	*Momordica charantica*	*Sphaerotheca fuliginea*	40	60	80	100	-

Values expressed in % grades of control

Table 17 MIC of powdery mildew to leaves and bio-products

Sr. No.	Name of crop	Name of Pathogen	Leaves of							Bio-produc		
			Neem	Parthenium	Ocimum	Citrus	Annona	Ipomoea	Jowar	Cow urine	Butter milk	Ash
1.	*Citrullus fistulosus*	*Erysiphe cichoracearun*	12.5	12.5	18.0	18.0	20.0	15.0	23.0	10.(	22.(	18.0
2.	*Citrullus lanatus*	*Erysiphe cichoracearun*	16.0	17.0	23.0	21.0	15.0	15.0	23.0	13.(	20.(	18.0
3.	*Cucumis sativus*	*Sphaerotheca fuliginea*	16.5	13.0	19.0	21.0	15.0	15.0	20.0	13.(	22.(	18.0
4.	*Cucumis melon*	*Sphaerotheca fuliginea*	21.0	16.0	22.5	19.0	20.0	17.0	22.0	17.(	22.(	21.0
5.	*Cucurbita pepo*	*Sphaerotheca fuliginea*	17.0	22.0	22.5	18.5	20.0	21.0	22.0	17.(	20.(	21.0
6.	*Cucurbita maxima*	*Sphaerotheca fuliginea*	21.5	18.0	22.5	18.5	23.8	20.0	22.0	17.(	20.(	20.0
7.	*Lagenarria siceraria*	*Sphaerotheca fuliginea*	16.5	18.0	22.5	21.0	21.0	21.0	22.0	15.(	21.(	21.5
8.	*Luffa acutangula*	*Sphaerotheca fuliginea*	16.5	21.0	19.0	21.0	21.0	21.0	22.0	15.(	21.(	21.5
9.	*Luffa cylindrical*	*Sphaerotheca fuliginea*	20.5	21.0	22.0	21.0	20.0	20.0	20.0	15.(	21.(	21.5
10.	*Momordica charanti*	*Sphaerotheca fuliginea*	11.5	9.0	18.0	18.5	10.0	10.0	15.0	10.(	20.(	18.5

Table 18 Effect of Dashparni ark on powdery mildew of different cucurbits

Sr. No.	Name of crop	Name of Pathogen	% concentration applied					MIC
			5	10	15	20	25	
1	*Citrullus fistulosus*	*Erysiphe cichoracearum*	80	100	-	-	-	8.5
2	*Citrullus lanatus*	*Erysiphe cichoracearum*	80	100	100	-	-	7.5
3	*Cucumis sativus*	*Sphaerotheca fuliginea*	80	100	100	-	-	7.5
4	*Cucumis melon*	*Sphaerotheca fuliginea*	60	80	100	-	-	7.5
5	*Cucurbita pepo*	*Sphaerotheca fuliginea*	60	80	100	-	-	10.0
6	*Cucurbita maxima*	*Sphaerotheca fuliginea*	80	100	-	-	-	8.5
7	*Lagenaria siceraria*	*Sphaerotheca fuliginea*	60	80	100	-	-	11.00
8	*Luffa acutangula*	*Sphaerotheca fuliginea*	60	80	100	-	-	12.00
9	*Luffa cylindrica*	*Sphaerotheca fuliginea*	80	100	-	-	-	8.5
10	*Momordica charantica*	*Sphaerotheca fuliginea*	80	100	-	-	-	6.5

Values expressed in % grades of control

It was found that *Cucurbita pepo, Cucurbita maxima* and *Lagenaria siceraria* crop were totally infected, were as *Citrullus fistulosus, Citrullus lanatus* and *Momordica charantica* showed less infection on either crop. It is interesting to note that maximum infection on powdery mildew occurred on older leaves that is basal leaves were as young leaf that is top leaf do not show any infect at early stage in cases of *Citrullus fistulous, Citrullus lanatus* and *Momordica charantica*. However basal leaf shows moderate occurrence of powdery mildew (Table 4).

Powdery mildew of different stages was observed in the survey and the results are given on table 5. It was observed that the infection mainly dominant at post flowering stage and fruit stages of the crop. Where as in case red pumpkin and pumpkin the occurrence of powdery mildew reported from seedling stage. Similarly cucumber red pumpkin, pumpkin, bottle gourd, ridge gourd and sponge gourd showed occurrence of powdery mildew at pre-flowering stage of the host plant.

Sixteen different fields at different location were observed when the crop was fruiting condition. It is observed that the heavily infected crop showed less fruiting as compared with healthy crop. The infection also covers on fruits. Water melon and red pumpkin showed maximum incidence of powdery mildew. Muskmelon, Sponge gourd and pumpkin fruit were also infected by powdery mildew (Table 6).

Neem leaf extract at 15% control 100 percentage powdery mildew of *Citrullus fistulosus* and *Momordica charantica*, whereas at 20 % concentration it control the rest of the cucurbits crop (Table 7).

Five different aqueous concentrations of Parthenium (*Parthenium hysterophorus*) leaf extract were used to control the powdery mildew of cucurbits and results are summarized in table 8. It was observed the aqueous leaf extract of Parthenium at ten percentage concentration proved to be highly inhibited for the growth of powdery mildew of cucurbits crops. It was observed from the result that twenty percentage aqueous concentration of *Ocimum* was successfully control the growth of powdery mildew of cucurbits (Table 9). Five different concentration of Citrus leaf extract were used for the management of powdery mildew of powdery mildew of cucurbits and the results are given in table 10. It was observed that citrus leaves at twenty percentage concentration were proved to be inhibitory.

Annona squamosa leaf extract was proved to be inhibition for powdery mildew of *Citrullus fistulosus*, *Citrullus lanatus*, *Cucumis sativus*, *Cucumis melon, Cucurbita pepo* and *Momordica charantica.* Whereas other host showed the results at twenty to twenty five percentage concentration (Table 11).

Leaf extract of *Ipomoea* at five different concentrations were used for the management of powdery mildews on ten cucurbits crops and the results are given in table 12. *Ipomoea* leaf extract at 15 % concentration control powdery mildew of *Citrullus fistulosus, Citrullus lanatus* and *Cucumis sativus*.

Aqueous leaf extract of jowar at 15% was proved to be inhibitory for powdery mildew of *Luffa cylindrical, Cucumis sativus* and *Momordica charantica*. Where as other host showed the results at twenty to twenty five percentage concentrations. (Table 13).

It is clear from table 14 that cow urine at 10 % concentration control the powdery mildews of *Citrullus fistulosus* and *Momordica charantica* where as at 15% concentration of cow urine proved to be effective to control the same of *Citrullus lanatus*, *Cucumis sativus*, *Lageneria siceraria*, *Luffa acutangula* and *Luffa cylindrica*.

At 20 and 25 % concentrations of Butter milk control the powdery mildews of cucurbits (Table 15). It was also observed from the results that twenty percentage ash contain spray was effective against the growth of powdery mildew of cucurbits. However, in *Citrullus fistulosus, Citrullus lanatus, Cucumis sativus, Cucurbita maxima* and *Momordica charantica* control the same at 10 to 15 % concentrations (Table 16).

In order to study the combination effect of different plant extract combination of eight plant leaf extract along with ash, butter milk and cow urine is used to prepare a multi leaves extract. This solution was named as dashparni ark. This spray of dashparni ark at five different concentrations was applied directly in the field where the infection of powdery mildew was severing to the cucurbits crop and results are given in table 17 and 18.

At ten percentage Dashparni ark extract was proved to highly inhibitory to the powdery mildews of *Citrullus fistulosus, Citrullus lanatus, Cucumis sativus, Cucurbita maxima, Luffa cylindrica* and *Momordica charantica.* Where as 15 % percentage dashparni ark extract control the powdery mildew of *Cucumis melon, Cucurbita pepo, Lageneria siceraria* and *Luffa acutangula.*

Acknowledgements

Authors are thanks to Professor and Head of Department, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.), for giving research facilities. Senior author is also grateful to Principal of Arts and Science College Bhalod (M.S.), for their moral support.

References

Bappamal, M., V.B. Hosagoudar and K. Udaiyan (1995). Powdery mildews of Tamil Nadu, India. *New Botanist*, 22: 81-175.

Bharat, N.K. (2003). Morphological characterization of causal organism of sarda melon (*Cucumis mela* var. *reticulatus*) powdery mildew. *Pl. Dis. Rept.* 18(2): 201.

Branzanti, B. and A. Brunelli (1992). Study of etiology of powdery mildew of cucurbits in Emila Romanjna. *Informatore Eitopthologiea* .42: 37-44.

Braun, U. (1987). A monograph of the Erysiphales (powdery mildews). *Beiheft Zur Nova* Hedwigia, 89:1-700.

Boesewinkel, H.J. (1980). The morphology of the imperfect states of powdery mildews (Erysiphales). *The Bot. Rev.* 46: 167-224.

Eriksson, Ove. E. and D.L. Hawksworth (1987). Outline of the Ascomycetes. Ibid., 6(2): 259-338.

Gupta, R.B.L. and A. Singhvi (1979). Occurrence of powdery midew of bittergourd and its chemical control in Rajasthan. *Indian J. Mycol and Pl. Pathol.* 10:190.

Hirata, K. (1942). On the shape of germ tube Erysiphaceae-I. Bull. Chiba Coll. Hort. 15: 34-49.

Hosogoudar, V.B., M. Buppamal and K. Udaiyan (1997). Indian Powdery Mildews. J. Swamy Bot. Cl. 14: 1-14.

Khan, M.W. and A.M Khan (1970). Studies on cucurbit powdery mildew-I. perithecial production in cucurbit powdery mildew in Northern India. *Indian Phytopath.* 23: 497 – 502.

Khan, A.V. and A.M. Khan (1992). Incidence and severity of cucurbit powdery mildew in Uttar Pardesh (U.P) *Indian Phytopath.* 45: 190-193.

Mclean, D.M. (1970). Powdery mildew on water melon fruits. Plant disease reporter, 54(5): 372-373.

Munjal, R.L. and J.N. Kapoor (1973). *Carica papaya* a new host of *Sphaerotheca fuliginea*. *Indian Phytopath.* 14: 13-15.

Munjal, R.L, V.V. Chenula and T.C. Vora (1963). Assessment of losses due to powdery mildew on pea. *Indian Phytopath.* 16: 268-270.

Nene, Y.L. and P.N. Thapliyal (1993). Fungicides in plant disease control oxford and I pH Publishing Co. Pvt. Ltd. New Delhi PP. 531.

Patel, J.G; K.J. Prajapti and S.T, Patel (1990). Effected of fungicides against powdery mildew of bottlegourd. *Plant Pathology* 43: 247.

Pawar, S.M. (2005) Studies on the occurrence of powdery mildew diseases on crops and wild plants in Marathwada. Ph. D. Thesis December 2005.

Salmon (1900). A monograph of the Erysipheae. *Mem. Torr. Bot. Club.* 9: 1-292.

Sharma S.K. and Anju Sharma (2004). Effect of fungicides on spore production powdery mildew pathogen (*Spharotheca fuliginea*) in cucmber *Cucumis sativus J. Mycol. Pl. Pathol* 34(2) 350-353.

Sharma, A.K. (1984). Systematic on some species of *Uncinula* from Jammu and Kashmir State. *Indian Phytopath.* 37: 362-363.

Sharma G.K. and M.W. Khan (1991). Observation on occurrence and identify of powdery mildew of cucurbit in Tamil Nadu. *Indian Phytopath. 44.*

Zheng, R.Y. (1985). Genera of the Erysiphaceae. *Mycotaxon.*22(2):209-263.

Please Cite This Article As:

Vasant P. Pawar and Ashok M. Chavan. 2010. Incidence of Powdery Mildew on Cucurbit Plants and its Ecofriendly Management. J. Ecobiotechnol. 2(6):29-43.