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MANAGEMENT OF POWDERY MILDEW OF MUSKMELON THROUGH CHEMICALS AND PLANT EXTRACTS

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A B S T R A C T

A highly susceptible variety "Toma" of watermelon was srown in the experimental area, Department of Plant Pathology, University of Agriculture, Faisalabad, to check the efficacy of five plant extracts (*Azadirachta indica, Allium sativa, Eucalyptus camaldulensis, Zingiber officinale* and *Allium cepa*) at 5,10 and 15% and five chemicals (Difnoconazole, Baytan Foilar, Mancozeb, Aliette and Sulfex gold) at 1.75, 2 and 2.5% against powdery mildew disease in Randomized Complete Block Design (RCBD). Among plant extracts, *Allium sativa* expressed minimum disease incidence (16.57%) at 15%concentration after third spray, followed by *A. indica* (19.45%), *E. camaldulensis* (26.75%), *A. cepa* (30.47%), *Z. officinale* (33.12%), disease incidence as compare to control while in case of chemicals Score (Difnoconazole) expressed significant results, after third spray and expressed 15.35% disease incidence followed by Baytan Foilar(Triadimimenal) 18.45%, Mancozeb (Mancozeb) 25.43%, Aliette (Fosetyl-aluminium) 29.40%, Sulfex gold(Sulphur) expressed 31.51% disease incidence as compare to control.

Keywords: *Cucumis melo*, *Allium sativa, Azadirachta indica, Eucalyptus camaldulensis, Allium cepa, Zingiber officinale*

INTRODUCTION

Muskmelon is one of the important summer cucurbits fruit and vegetable native to Africa and India. It is grown in tropical and subtropical regions of the world, most preferably in warm climate. It belongs to family *Cucurbitaceae* with 118 genera and 825 species (Milind and Kulwant, 2011). It ranked 4th among the fruits in the world and serves as major food source *(*Parveen *et al*., 2012). In Pakistan, it is grown on an area of 197.00 thousand hectares with an average production of 3805.0 million tons (GOP, 2011).

Muskmelon is an outstanding source of β-carotene (8 %), amino acids (3%), 90 % water, and 5 % carbohydrate. It also contains medicinal properties such as anti-diabetic, anti-microbial and anti-cancer activity (Milind and Kulwant, 2011; Parveen *et al*., 2012.)

Muskmelon is attacked by a number of bacterial, fungal and viral diseases. Among all diseases, powdery mildew caused by *Sphaerotheca fuliginea* is one of the most destructive disease causing high economic losses worldwide (Ahmed and Ashour 2009; Abada et *al*., 2009). Characteristic symptom of this disease includes the occurrence of prominent white to grayish mycelial growth of pathogen on infected parts of the plant, reduction in foliar canopy, burning of fruits, chlorosis, and severely infected leaves turn brown, dehydrated and sunburned (Pawar and Chavan, 2010).

Researchers recommended different management strategies for this disease and concluded that use of resistant source is the principle one but due to non-availability of resistant cultivars, Application of fungicides is the principal tool for the management of powdery mildews around the world (Hollomon and Wheeler, 2002). Systemic and translaminar fungicides are especially important for controlling powdery mildew because they provide adequate protection to leaf surfaces, where conditions are more favorable for

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disease development as compared to abaxial surfaces. These fungicides have site specific mode of action, because they are active at specific point of metabolic pathway of the pathogen (McGrath, 2001). So in the present study efforts were directed to find out suitable fungicide against powdery mildew disease.

No, doubt use of chemicals expressed pronounced results for management of diseases but on the other hand it adds pollution to the environment and accumulated as toxic substances in human food chain, especially in fresh vegetables and fruits (Sedlakova and Lebeda, 2008). So, It is the need of the hour to investigate alternative of chemicals. That is why five plant extracts at different concentrations were evaluated for management of powdery mildew disease of watermelon. Plant extracts contains anti-microbial compounds which are injurious for pathogens but are safe for environment (Dik *et al.,* 1998).

MATERIAL AND METHODS

Seeds of susceptible variety "Toma" were collected from Vegetable research institute, AARI, Faisalabad. Seeds were sown on beds with (P×P) distance 45 cm and (B×B) distance 120cm in research area, Department of Plant pathology, University of Agriculture Faisalabad under Randomized complete block design (RCBD). Recommended dose of fertilizers and irrigations were applied to grow good and healthy crop and intercultural operations were done when needed.

The leaves of test plants were collected and surface disinfected with 70% ethanol for two minutes. Then samples were washed twice with distilled and dried at room temperature for 21 days. After drying the leaves were grounded to powder form separately. Then dry powder of each plant was soaked in distilled water at 1:1 w/v .Then this mixture was vigorously stirred and left for 24 hours. After passing this suspension through 4 ply muslin cloth ,it was filtered through Whitman's filter paper no.41. These filtrates were further purified by passing through Millipore filter of 0.2 µm pore size. For avoiding bacterial contamination plant extracts were stored at 4°C until use. The extracts prepared in this way are randomly known as 'S'(100%).Then further dilutions were prepared by adding distilled water. Five, 10 and 15% concentrations were prepared by adding 5,10 and 15 ml of plant extracts in 95.90 and 85 ml of water and applied three sprays of each concentration of every plant extracts with seven days interval. Similarly three concentrations (1.75. 2 and 2.5%) of five chemicals (Score, Mancozeb,, Aliette, Baytan Foilar, Sulfex gold) were sprayed thrice with one week interval.

DATA ANALYSIS

Data regarding disease incidence (%) was collected on weekly bases by using following formula:

$$\text{Disease incidence}(\%) = \frac{\text{No. of infected plants}}{\text{Total No. of plants}} \times 100$$

and was analyzed by using analysis of variance and treatments means were compared by using Least Significant Difference (LSD) test (Steel *et al.,* 1997).

TRESULTS

a. *In-vivo* management of powdery mildew of muskmelon through plant extracts:

Among five plant extracts, *A. sativa* expressed minimum disease incidence (16.57) followed by *A. indica* (19.45), *E. camaldulensis* (26.75%), *A. cepa* (30.47%), *Z. officinale* (33.12%), disease incidence as compare to control (table.1). Among three concentrations of plant extracts, minimum disease was observed at 15% concentrations (31.1) followed by at 10% and 5% (32.8%, 34 %) Figure 1 while in case of sprays minimum disease was observed after third spray of all plant extracts (Figure 2). Interaction between treatments and concentrations (TxC) expressed significant results. *A. sativa* expressed minimum disease incidence (18.51, 16.42,14.80) at 5, 10 and 15% concentrations followed by *A.indica* (21.48, 19.41, 17.44), *E. camaldulensis* (28.80, 26.71, 24.76), *A. cepa* (32.46,30.45,28.50), *Z. officinale* (35.13, 33.13,31.10) % respectively as compared to control (Table.2). Similarly interaction between treatments and spray (T x S) exhibited that all treatments after third spray reduced disease significantly. Minimum reduction in disease was exhibited by *Z. officinale* (38.44, 33.46,27.45) % while minimum disease incidence was expressed by *A. sativa* (21.46, 16.46, 14.46)% respectively at three concentrations of all the sprays of plant extracts as indicated in Table.3 and figure 3. Figure 4 clearly explained impact of interaction berween, treatments, concentrations and spray (TxCxS) against powdery mildew disease of muskmelon.

b. In-vivo management of powdery mildew of muskmelon through fungicides:

Among five fungicides **(**Score 250 EC, Baytan Foilar, Mancozeb, Aliette, Sulfex gold) were evaluated against powdery mildew disease of muskmelon on susceptible variety. Among these fungicides, Score 250 EC expressed (15.35 %) disease incidence. followed by Baytan Foilar 18.45% ,Mancozeb (25.43%), Aliette (29.40%) and

Sulfex gold (31.51%) percentage disease as compared to control. Among three concentrations of fungicides, minimum disease was observed at 2.5% concentrations followed by at 2 and 1.75% while in case of sprays minimum disease was observed after third spray of all fungicides (Figure 2). Interaction between treatments and concentrations (TxC) expressed significant results. Score expressed minimum disease incidence (18.47, 15.44, 13.15) at 1.75, 2 and 2.5% concentrations followed by Bayton foliar (21.46, 18.46, 16.46), Mancozeb (18.8, 25.37, 23.45), Aliete (32.47, 29.35, 27.65), Sulfex gold (34.5, 31.41, 29.65) % respectively as compared to control (Table. 4). Similarly interaction between treatments and spray (T x S) exhibited that all treatments after third spray reduced disease significantly (Figure. 5). Minimum reduction in disease was exhibited by Sulfex gold (36.38, 31.70, 26.44) % while minimum disease incidence was expressed by Score (20.44, 15.48, 10.13)% respectively at three concentrations of all the sprays of fungicides as indicated in Table 3 and Figure 3. Figure 6 clearly explained impact of interaction between, treatments, concentrations and spray (TxCxS) against powdery mildew disease of muskmelon.

Table 1: Response of different plant extracts against powdery mildew of muskmelon under field conditions

Treatments	Disease Incidence (%)
Allium sativa	16.57 f
Azadirachta indica	19.45 e
Eucalyptus camaldulensis	26.75 d
Allium cepa	30.47 c
Zingiber officinale.	33.12 b
Control	71.13 a
LSD	0.037

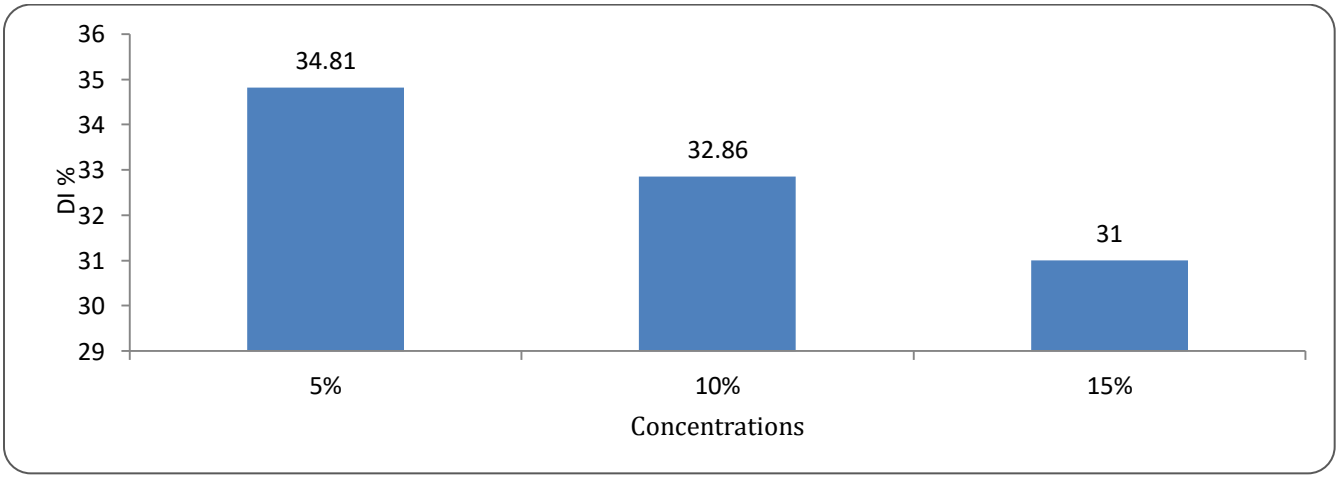

Figure 1: Impact of plant extracts against powdery mildew of muskmelon at different concentrations

Table 2: Impact of Interaction between treatments and concentration against powdery Mildew of muskmelon

Treatments	Disease Incidence (%)		
	Concentration 1	Concentration 2	Concentration 3
Allium sativa	18.51 p	16.42 q	14.80 r
Azadirachta indica	21.48 m	19.41 n	17.44 o
Eucalyptus camaldulensis	28.80 i	26.71 k	24.76 l
Allium cepa	32.46 f	30.45 h	28.50 j
Zingiber officinale.	35.13 d	33.13 e	31.10 g
Control	72.46 a	70.91 b	70.01 c
LSD	0.0648	0.0648	0.0648

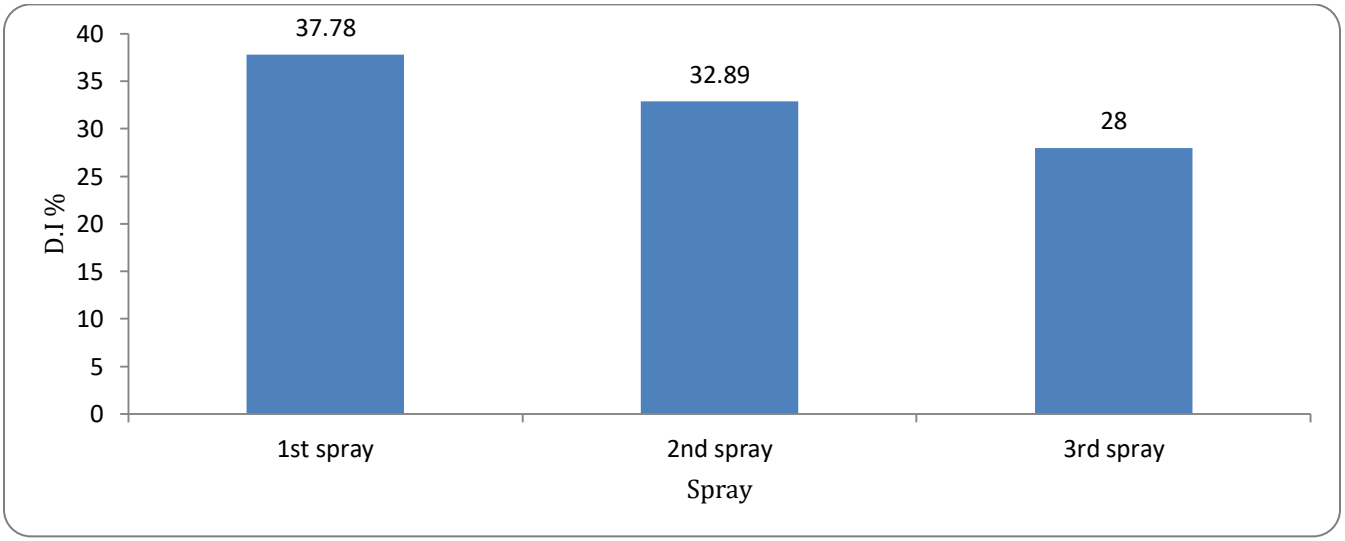

Figure 2: Impact of different plant extracts spray against powdery mildew of muskmelon

Table 3: Impact of Interaction between treatment spray against powdery mildew of muskmelon

Treatments	Disease Incidence (%)		
	1st Spray	2nd Spray	3rd Spray
Allium sativa	21.46 n	16.46 p	14.46 q
Azadirachta indica	24.46 l	19.44 o	11.80 r
Eucalyptus camaldulensis	31.42 g	26.76 j	22.08 m
Allium cepa	35.47 e	30.48 h	25.46 k
Zingiber officinale.	38.44 d	33.46 f	27.45 I
Control	75.37 a	70.66 b	67.34 c
LSD	0.0648	0.0648	0.0648

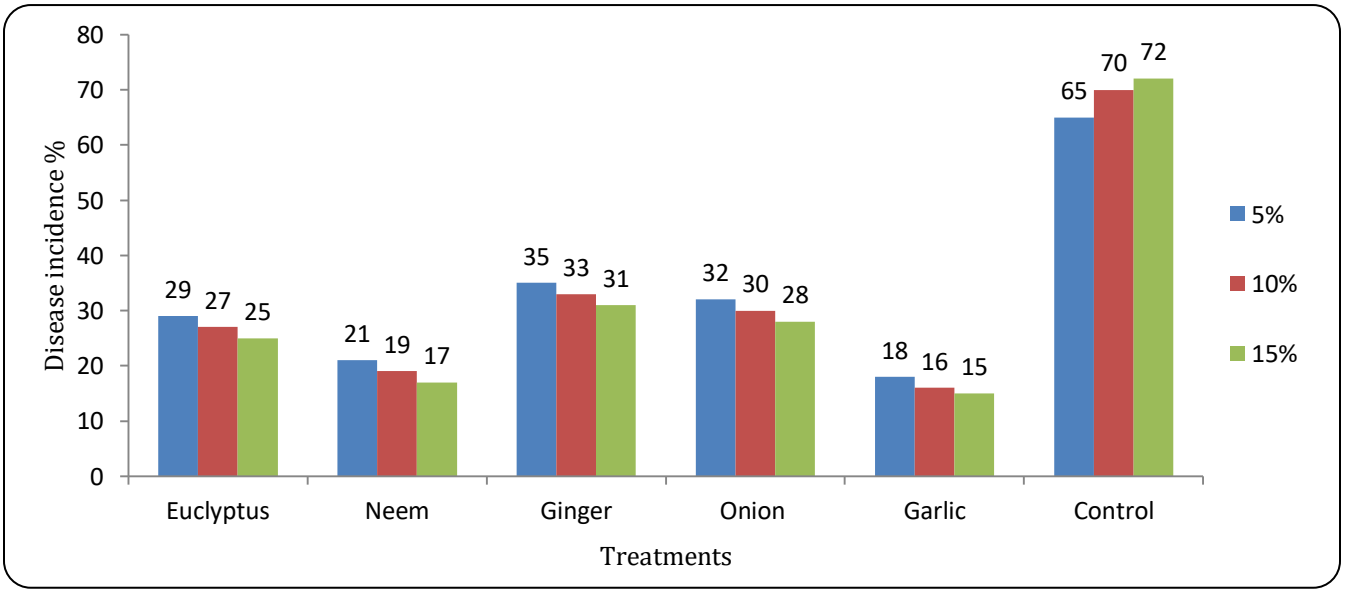

Figure 3: Impact of Interaction between treatment and concentration against powdery mildew of muskmelon

Table 4: Impacts of chemicals interactions between treatment and concentrations against powdery mildew of muskmelon

Treatments	Disease Incidence (%)		
	Concentration 1.75	Concentration 2	Concentration 2.5
Score	18.47 m	15.44 p	13.15 q
Baytan Foilar	21.46 l	18.46 n	16.43 o
Mancozeb	28.48 i	25.37 d	23.45 k
Aliette	32.47 e	29.35 h	27.40 j
Sulfex gold	34.50 d	31.41 f	29.65 g
Control	71.80 a	75.44 b	68.9 c
LSD	0.099	0.099	0.099

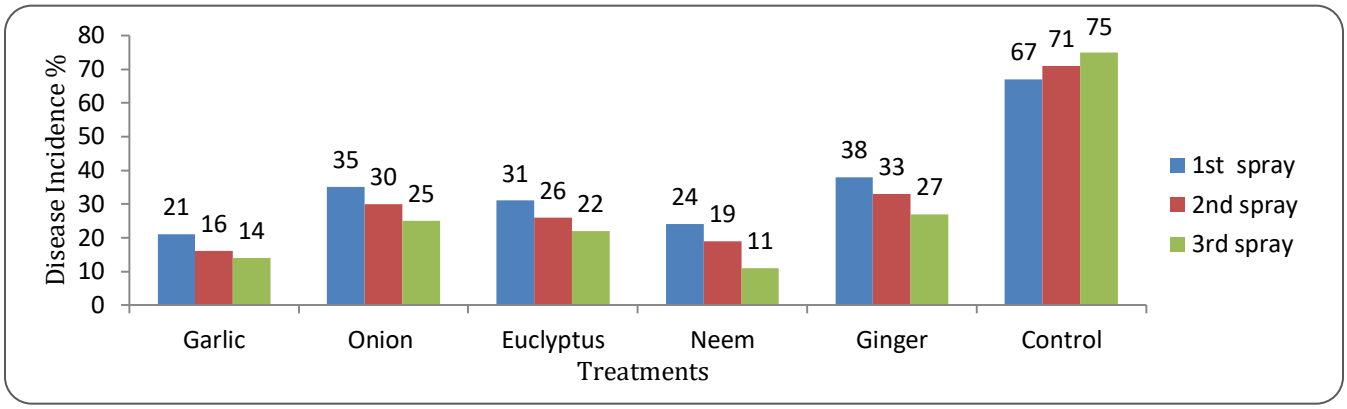

Figure 4: Impact of Interaction between treatment, concentration and spray of plant extracts against powdery mildew of muskmelon

Table 5: Impact of different chemicals interactions between treatment and spray against powdery mildew of muskmelon

Treatments	Disease Incidence (%)		
	1st spray	2nd spray	3rd spray
Score	20.44 m	15.48 p	10.13 q
Baytan Foilar	23.44 l	18.45 n	13.46 o
Mancozeb	30.43 g	25.44 j	20.42 m
Aliette	34.45 e	29.30 h	24.46 I
Sulfex gold	36.38 d	31.70 f	26.44k
Control	73.73 a	70.38 b	67.07 c
LSD	0.099		

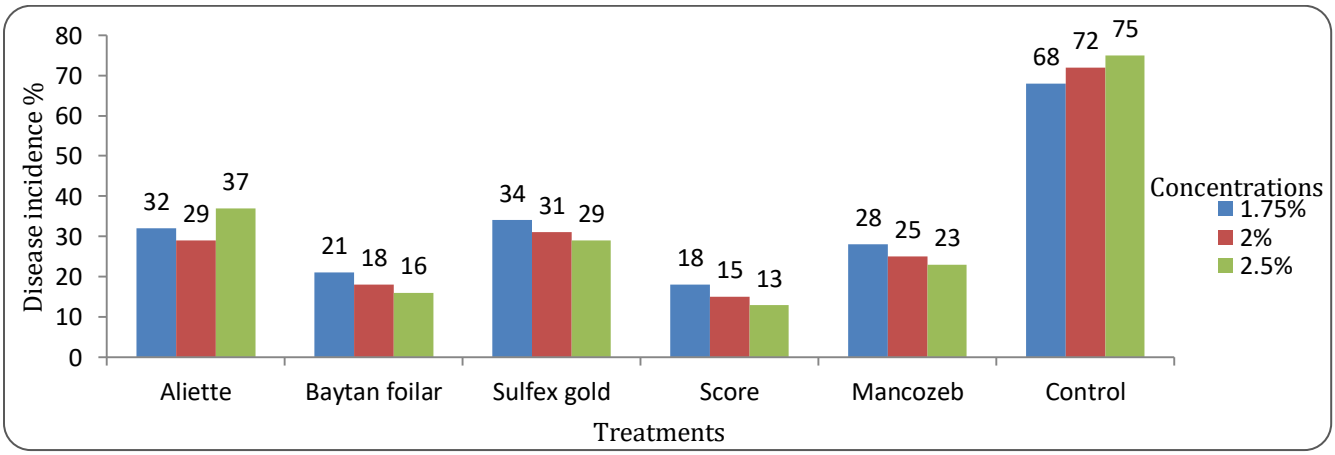

Figure 5: Impact of chemicals interactions between treatment and concentrations against powdery mildew of muskmelon

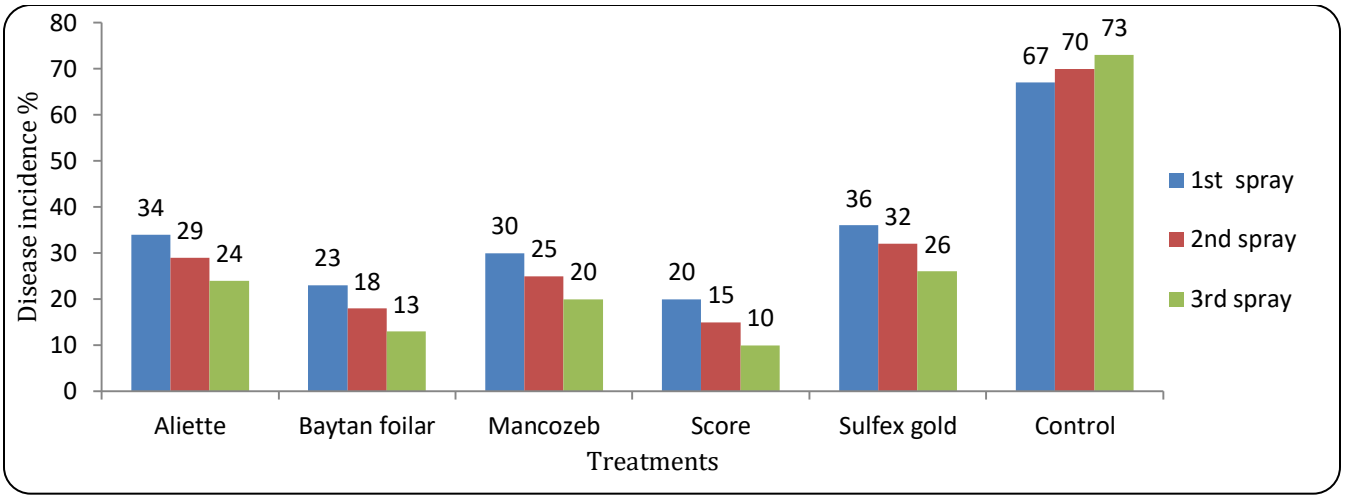

Figure 6: Impacts of different chemicals interactions between treatment and spray against powdery mildew of muskmelon

DISCUSSION

Muskmelon (*Cucumis melo* L.) is an important fruit and vegetable native to Africa and India, which belongs to the family *Cucurbitaceae* (Milind and Kulwant, 2011). Muskmelon is affected by a variety of insects, pests and diseases. Among diseases, Powdery mildew is the most destructive one and cause high economic losses worldwide (Abada et *al.*, 2009; Ahmed and Ashour 2009). So present study was conducted to find out suitable management strategy.

Use of resistant cultivars is the most significant but due to non-availability of resistant varieties, farmers are with no option except use of chemicals as they expressed quick response against diseases and save farmers from heavy losses. Although use of chemicals is quick method to manage the disease but they have very harmful effect on environment. So, plant extracts can also use to manage the disease because they are eco-friendly and have no hazardous effects on environment or on human health. That is why in present study three sprays of five plant extracts at three concentrations were evaluated. Out of these plant extracts *A. sativum*, expressed minimum disease incidence at all concentration and sprays followed by *A. indica*, *Eucalyptus camaldulensis*, *Allium cepa* and *Zingiber officinale* as compared to control.

Gangwar *et al.*, (2000) evaluated twenty one plant extracts against powdery mildew disease found that *A. indica* was effective followed by *A. sativum, Adhatoda zelanica* as antifungal agent present in extract which damage the fungal pathogen of powdery mildew disease. Similarly Ahmed and Din, (2006) tested antifungal potential of Turmeric, Garlic, Neem and Pepper and observed that neem extracts showed paramount results against powdery mildew disease under field conditions but current study *A. sativum* expressed pronounced results. Biochemical analysis of *A.sativum* indicated that it contained such type of compounds which have strong antifungal activity.

As plant extracts are slow in action and when disease appeared in field in epidemic form then farmers have no option except application of fungicides. So in present study five chemicals at three concentrations were evaluated in field conditions. Among these chemicals, Score expressed minimum disease incidence after third spray, followed by Baytan Foilar, Mancozeb, Aliette, and Sulfex gold as compare to control. The results of present study are supported by the work of Kiran and Ahmad, (2005) who evaluated carbendazim, difenconazole, hexaconazole, propiconazole and triadimefon against powdery mildew disease and found difenconazole the most effective which is active ingredient of Score (Sharma *et al.*, 2006). Dhruj *et al.*, (2000) evaluation of different chemicals triadimefon, tridemorph, dinocap and sulphur significantly reduced powdery mildew in fenugreek and among all the fungicides, penconazole was the most effective followed by hexaconazole and propiconazole.

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