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MANAGEMENT OF POWDERY MILDEW OF OKRA THROUGH PLANT EXTRACTS AND CHEMICALS UNDER FIELD CONDITIONS

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A B S T R A C T

Different plant extracts and chemicals were evaluated against powdery mildew of okra under field condition, in experimental area of Department of Plant Pathology, University of Agriculture Faisalabad. A highly susceptible variety Click-5769 was grown in field to check the efficacy of different plant extracts and chemicals against powdery mildew disease (*Saccharum erysiph*) of okra. In chemicals at standard dose, Score (Diphenoconazole, 0.2%) expressed significant results, after third spray disease incidence was 21% followed by Topsin-M (Thiophenate Methyle, 0.1%) 32.3%, Clipper (Copper oxychloride, 0.5%) 47.67%, Systhane (Michlo Butanil, 0.05%) 54.3%, Benomyl (Cymoxinil, 0.5%) 59% disease incidence as compare to control. Three concentrations 5, 10 and 15% of five plant extracts were used to manage the disease. Among them Neem gave best results at each concentration. After third spray at 15% concentration Neem (*Azadirachta indica*) reduced 23.2% disease incidence, followed by Garlic (*Allium sativum*)36.89%, Ginger (*Zingiber officinale*) 42.1%, Dhatura (*Datura stramonium*) 48.4%, Onion (*Allium cepa*) 52.33% disease incidence as compare to control.

Keywords: Phytobiocides, *Zingiber officinale*, *Azadirachta indica, Datura stramonium*.

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) generally known as lady finger, belongs to family *Malvaceae* (Bayer & Kubitzki, 2003). Origin of okra is Aecian and African countries but now a days it is cultivated in various parts of the world like Florida, Albama, Georgia and Pakistan (Thompson and Kelley, 1937). A number of fungal diseases attack on okra crop but powdery mildew disease caused by *Erisiphae cichoracearum* is an emerging potential threat to okra crop which causes huge losses in yield up to 90 % (Ghanem, 2003) and continuously hammering economics of formers. Researchers recommended different management strategies for this disease and concluded that use of resistant source is the principle one but due to non-availability resistant cultivars, use of chemical for quick control of powdery mildew disease is highly desirable. That is why in present study five chemicals are evaluated to search out most suitable fungicide. Triadimefon (Baleton), Tridemorph (Calixin), Dinocap (Karathane) and sulphur (sulfex) were tested against powdery mildew disease. Triadimefon and Tridemorph expressed most promising results (Upadhyay and Gupta, 1994; Shivanna *et al.,* 2006). Saxena and Saxena (2002) reported that penconozole, carbendazim and tridemorph expressed promising results against powdery mildew disease while Alam *et al.,* (2007) examined efficacy of eight fungicides against powdery mildew disease and reported that chemical Seozole 5EC not only reduced percent disease index (PDI) but also improve yield, pod height, pods per plant, length of pod, breadth of pods and seeds per plants.

Abundant use of chemicals is neither economical nor beneficial for environment. Plant extracts which consist of anti-microbial compound are safe for environment. A

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number of plants posse's antifungal agents which were disease of okra (Culter and Hill, 1994). Hot and cold water extracts of papaya leaves were effective in reducing the powdery mildew disease of okra (Kumar, 2010) but cold water extracts were more effective than hot water extracts as bioactive extracts were sensitive to heat. Twenty one plant extracts tested against powdery mildew of mulberry, under *in-vivo* and *in-vitro* conditions and found that *A. indica* was effective followed by *Chromolaena odorata*, *A.sativum*, *A. zelanica* and *M. jalapa (*Gangwar *et al*., 2000). Neem oil, neem cake and Neem seed kernel, leaf extracts of *P. juliflora* against *E. polygoni* (Amadioha, 1998; Rettinassababady *et al*., 2000). Similarly turmeric, garlic and pepper extracts expressed significant results against powdery mildew disease Kiran and Ahmed (2005). No doubt fungicides expressed prompt results in controlling plant diseases but continuous use of chemicals exhibited health hazard effects as well as it resulted evolution of new races of pathogens. So there is dire need to search out alternate of chemicals. So efforts were directed to evaluate different plant extracts at different concentrations under field conditions because plants enclose a number of antifungal, anti-viral and anti-bacterial agents.

MATERIAL AND METHODS

Five chemicals (Score, Systhane, Topsin-M, Clipper, Benomyl) with standard dose and five plant extracts Ginger (*Zingiber officinale*), Onion (*Allium cepa)*, Garlic (*Allium sativum*), Dhatura (*Datura stramonium*) and Neem (*Azadirachta indica)* @ 5, 10 and 15% concentration sprayed at 15 days interval were evaluated against powdery mildew disease under field conditions. For this purpose seeds of susceptible variety i.e Click-69 were collected from Vegetable research institute, AARI, Faisalabad. Experiment was done on an area of 18 meter length and 14 meter width. Seeds were sow on ridges with (P×P) distance 2-4 cm and (R×R) distance 75cm in research area of 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. Data was collected on weekly bases by using following formula:

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

The leaves of test plants were collected and surface sterilized with 70% ethanol for two minutes. Then samples were rinsed twice with distilled and dried at room temperature for 21 days. After drying the leaves were grounded to powder form separately. The 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 Whatsman's filter paper no.41.These filtrate were further purified by passing through Millipore filter of 0.2 µm pore size for avoiding bacterial contamination and stored at 4^{o}c until use. The extracts prepared in this way are arbitrarily known as 'S'(100%).Then further dilutions were prepared by adding distilled water. Data was analyzed by analysis of variance and treatments were compared by using Least Significant Difference (LSD) test (Steel *et al.,* 1997).

RESULTS

***In-vivo* management of powdery mildew of okra through fungicides:** All treatments expressed significant results. Among all treatments, score expressed paramount results. After 1stspray of score, disease incidence reduced to 32, 2nd spray 27.3 and 3rd spray 21% respectively followed by Topsin-M 45.67, 40 and 32.3%, Clipper 61.3, 55.3 and 67.67%, Systhane 68.67, 60.67 and 54.43%, Benomyl 74.3, 66 and 59% respectively as compared to control as shown in table 1 and figure 1.

Table 1. Evaluation of different fungicides against powdery mildew disease of okra.

Treatments	Spray		
	First	Second	Third
Score	32.0 h	27.3 i	21.0 j
Topsin-M	45.67 f	40.0 g	32.3 h
Clipper	61.3 d	55.3 e	47.67 f
Systhane	68.67 c	60.67 d	54.3 e
Benomyl	74.3 b	66.0 c	59.0 d
Control	85.67 a	83.67 a	84.3 a
LSD		3.57	

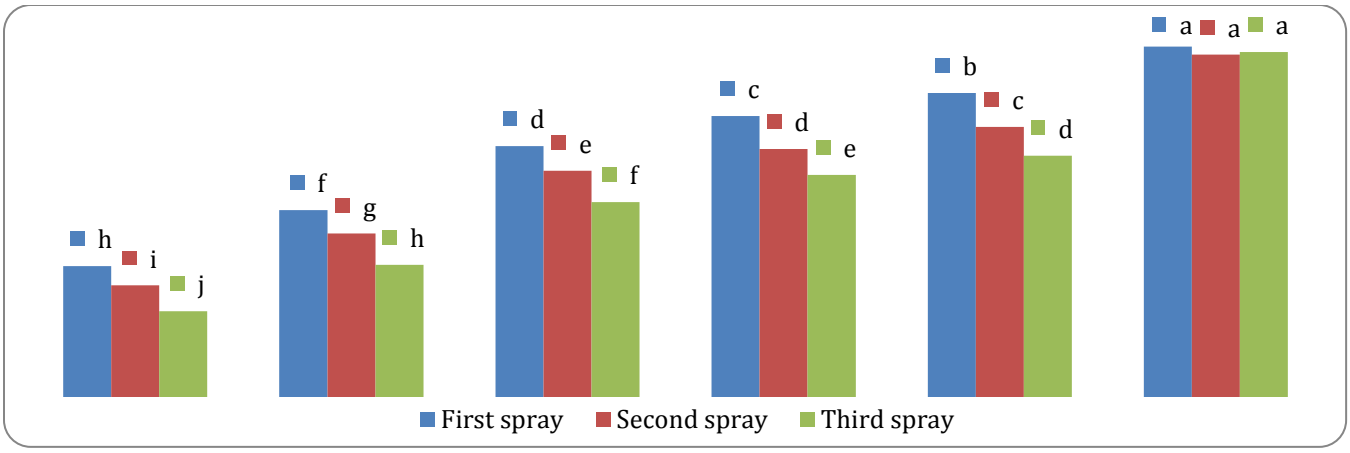

Figure 1. Evaluation of different fungicides against powdery mildew disease of okra.

***In-vivo* management of powdery mildew of okra through plant extracts:** All treatments, concentrations and sprays alone and their interactions expressed significant results. All treatments after 1st, 2ndand 3rd spray @ 5% concentration reduced disease incidence (62.3, 57.8and 52.83%) and at 10% concentration 58.38. 54.9 and 51% while at 15% concentration 53.38, 47.5 and 42.56% (fig. 2). Among three concentrations, 15% concentration expressed significant results as compared to other two. In interaction between concentration and treatments *A. indica* at 5, 10 and 15% concentration suppressed the disease incidence i.e., 40.8, 36.78 and 23.2%. Similarly Garlic curbed the disease incidence to 46.67, 45.56 and 36.89%, Ginger 53.56, 49 and 42.1%, Dhatura 57.89, 54.1 and 48.4%, Onion 61.67, 58.1 and 52.33% as compare to control respectively (Table.2) and fig.3. In interaction of treatments and spray after 1st, 2nd and 3rd spray *A. indica* suppressed the disease to 41, 34 and 25.89%, Garlic 48.44, 43 and 37.67%, Ginger 53.1, 47.78 and 43.78%, Dhatura 58, 53.78 and 48.67%, Onion 62.56, 57.22 and 52.33% as compare to control as shown in table.3 and fig. 4 respectively.

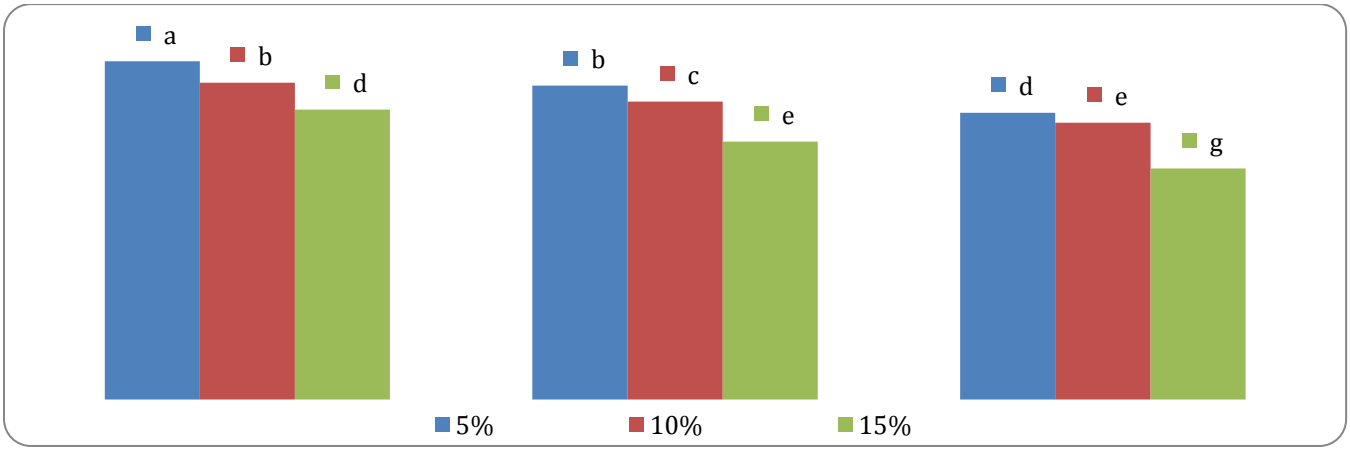

Figure 2. Effect of interaction of treatments and sprays at different concentrations against powdery mildew disease.

Table 2. Evaluation of interaction b/w treatments and concentrations (TxC) against powdery mildew disease of okra under field conditions.

Treatments	Concentrations		
	5 %	10 %	15 %
A. indica	40.8 h	36.78 i	23.2 j
A. sativum	46.67 fg	45.56 g	36.89 i
Zingiber officinale	53.56 d	49.0 e	42.1 h
Datura stramonium	57.89 c	54.1 d	48.4 ef
Alium cepa	61.67 b	58.1 c	52.33 d
Control	85.333 a	85.1 a	83.89 a
LSD		2.03	

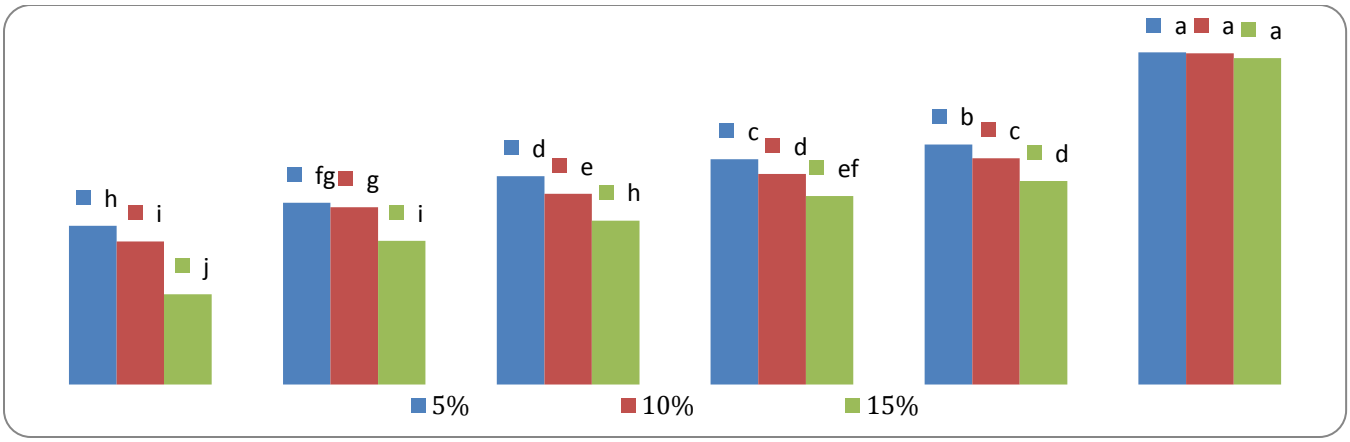

Figure 3. Impact of interaction b/w different treatments and concentration against powdery mildew disease of okra.

Table. 3 Influence of interaction b/w treatments and sprays on powdery mildew disease.

Treatments	Disease incidence (%) after sprays		
	I	II	III
A. indica	41.0 g	34.0 i	25.89 j
A. sativum	48.444 e	43.0 fg	37.67 h
Zingiber officinale	53.1 d	47.78 e	43.78 f
Datura stramonium	58.0 c	53.78 d	48.67 e
Alium cepa	62.56 b	57.22 c	52.33 d
Control	85.1 a	84.78 a	84.4 a
LSD		2.04	

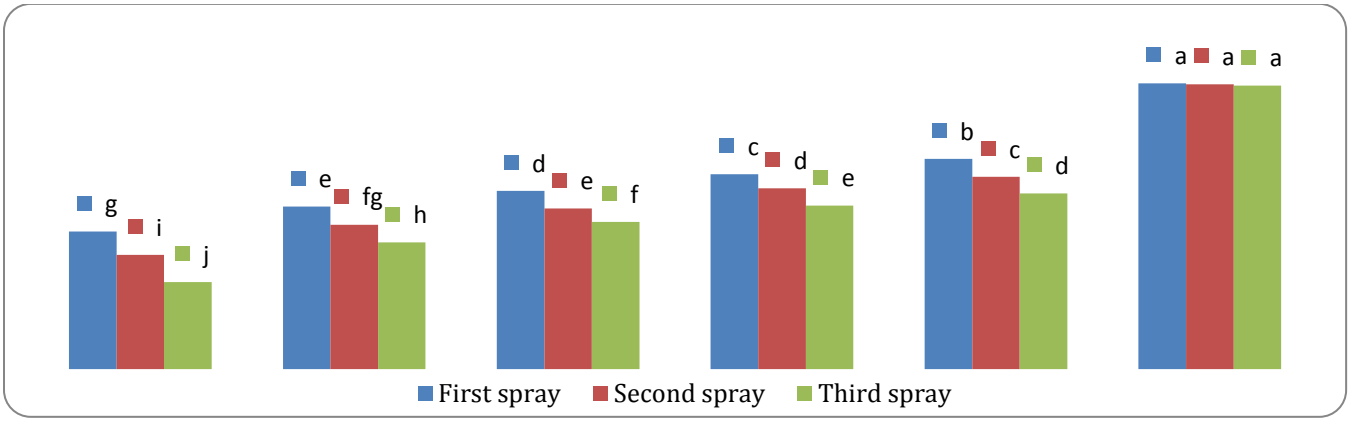

Figure 4. Influence of interaction b/w treatments and sprays on powdery mildew disease.

DISCUSSION

Okra (*Abelmoschus esculentus* L. Moench) is an important vegetable crop which belongs to the family Malvaceae. It is very popular in Indo-Pak subcontinent. Okra is affected by variety of insects, pests and diseases. Among diseases, Powdery mildew is the most destructive one and cause huge loss of yield (Shivanna, 2006).

Numerous management strategies are available for the management of plant diseases but use of resistant cultivars is the most significant but due to non-availability resistant varieties formers are with no option except use of chemicals as they expressed quick response against diseases and save formers from heavy losses. So in present study five chemicals at their were evaluated. Among these chemicals, Score (Diphenoconazole, 0.2%) expressed minimum disease incidence (21%) after third spray, followed by Topsin-M (Thiophenate Methyle, 0.1%) 32.3%, Clipper (Copper Oxychloride, 0.5%) 47.67%, Systhane (Michlo Butanil, 0.05%) 54.3%, Benomyl (Cymoxinil, 0.5%) 59% as compare to control. The results of present study are in

line with Kiran and Ahmad (2005) who evaluated different fungicides and plant activators against powdery mildew disease and found Score the most effective fungicide. Sharma *et al.,* (2006) checked the efficacy of carbendazim, difenconazole, hexaconazole, propiconazole and triadimefon against powdery mildew disease and found difenconazole the most effective which is active ingredient of Score. The results are also in agreement with Nofal *et al.,* (2005) who conducted experiment to evaluate four fungicides under RCBD with nine replication against powdery mildew disease and found Score 25 EC (Difenconozole) @ 0.01 % most effective.

Although use of chemicals is quick method to manage the disease but they have very harmful effect on environment. So, plant extracts can also used 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. indica* expressed minimum disease incidence at all concentration and sprays followed by *A. sativum*, *Z. officinale*, *Datura stramonium*, *A.cepa* as compared to control. The results of the study at hand are in agreement with Gangwar *et al*., (2000) who evaluated twenty one plant extracts against powdery mildew disease found that *A. indica* was effective followed by *Chromolaena odorata*, *A. sativum*, *Adhatoda zelanica* and *Mirabilis jalapa* while Xuan *et al.,* (2004) found that nimbidin which is antifungal agent present in extract which damage the fungal pathogen of powdery mildew disease. Similarly Ahmed and Din (2006) tested antifungal potential of Tumeric, Garlic, Neem and Pepper and observed that neem extracts showed paramount results against powdery mildew disease under conditions. So it is recommended that Score (Diphenconozole) should be used along with *A. indica* extract for better management of powdery mildew disease of okra.

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