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RESEARCH ARTICLE

ALLELOPATHIC POTENTIAL OF *LANTANA CAMARA* L. TO CHECK SEED BORNE FUNGAL INFECTION IN MUSTARD (*BRASSICA CAMPESTRIS*) AND CHICKPEA (*CICER ARIETINUM*)

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ABSTRACT

Infections caused by pathogens (fungus, bacteria or viruses) during germination are known as Seed-borne diseases. They cause infection on the surface or interior of seed and results as crop loss. Dried powder of leaves of *Lantana camara L.* was used for preparation of extract. Three concentrations (10, 20 and 30%) of extracts were tested. Blotter methods was performed to investigate the fungal incidence. Seeds soaked in distilled water treated as control. Percent seed germination and fungal pathogen incidence were recorded after seven days. The increasing concentrations of aqueous extract of *L. camara* reduced the germination rate in both the crops, mustard (*Brassica campestris*) and chickpea (*Cicer arietinum*). Fungal incidence decreased with increasing concentrations of extract.

INTRODUCTION

The health of seed is very important for the crop production because seeds are considered as highly effective means for transporting plant pathogens over long distances. Pathogen free healthy seeds are required to reduce enormous crop losses. Seed-borne fungi are significant slayers of grains during storage. It has also been confirmed that seed-borne fungi are responsible for the reduction of health of seeds (Neergaard, 1979) and cause reduction in plant growth and productivity of crops (Williams and McDonald, 1983; Kubiak and Korbas, 1999; Dawson and Bateman, 2001). The seed-borne pathogens associated with seeds externally or internally may cause various infection viz., seed rot, seed necrosis, reduction or elimination of germination capacity, as well as seedling damage resulting in development of disease at later stages of plant growth by systemic infection (Bateman and Kwasna, 1999; Asif *et al.*, 2001, Ijaz, *et al.*, 2001, Khanzada *et al.*, 2002).

Richardson (1990) recorded about 40 seed-borne fungal pathogens responsible for the low yield of the crop. Galvano *et al.*, (2001) reported that more than 25% of the world cereals are contaminated with more than 300 fungal metabolites and cause toxic effect to man and animals. In human various diseases like hepatotoxicity, carcinogenicity, genotoxicity, terratogenicity, nephrotoxicity, reproductive disorders and immunosuppression are caused (Lacey, 1988; Desjardins *et al.*, 2000).

Various synthetic chemical fungicides available commercially can be used to effective and efficient control of seed borne fungi, but due to their pesticide toxicity they cannot be applied to grains (Ferrer and Cabral, 1991; Harris *et al.*, 2001; Dukic *et al.*, 2004). Hence, there is a need of alternative eco-friendly approaches to store grains for human consumption without toxicity problems that are not capital intensive. The extract of different parts of higher plants have been reported to exhibit antifungal properties under laboratory trails (Mohana *et al.*, 2006, Bouamama *et al.*, 2006; Ergene *et al.*, 2006; Okigbo and Ogbonnaya, 2006; Kiran and Raveesha, 2006).

Lantana camara L. (Synonyms: *Lantana scabrida, Camara vulgaris*) is an artificial hybrid sp. belonging to family Verbenaceae. It is commonly called as Wild sage and Sleeper weed. It is considered as the ten most toxic (Holm and Herberger, 1969) and worst weed (Holm *et al.*, 1977; Cronk and Fuller, 1995) in the world. *L. camara* has been used for ecological pest management. The present study was conducted to identify and investigate the seed borne mycoflora of two crop species i.e. Chickpea (*Cicer arietinum*) and Mustard (*Brassica campestris)* collected from the field of Sawai Madhopur district of Rajasthan (India).

MATERIAL AND METHODS

Collection of fresh leaves of L. camara

The fresh leaves of *L. camara* were collected from the Department of Botany, University of Rajasthan, Jaipur. They were washed with tap water by applying continuous water supply to remove soil particles. The leaves were kept for shade dried (10 days). The dried plant material was powdered with the help of grinder and stored into poly bag.

Preparation of aqueous extract of dry leaf powder

Three concentrations viz., 10, 20 and 30% were prepared by crushing 10, 20 and 30g leaf powder and dissolving them in 100 ml distilled water respectively. After complete extraction, aqueous leaf powder extract was filtered through two layer

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Table1 Percent seed germination and percent seed-borne fungal infection in *Cicer arietinum*(Chickpea) during germination by using plant extract of weedicidal plant-*Lantana camara* L.

	Treatments				
	Control	10%	20%	30%	r
% Seed germination	96.0±0.07	80.0±0.22	42.0±0.32	46.0±0.16	-0.9045
% of fungal infected seeds	68.0±0.11	66.0±0.12	56.0±0.07	50.0±0.10	-0.9719*
% Reduction of infected seeds	32.0±0.11	34.0±0.12	44.0±0.07	50.0±0.10	-0.9755

Mean ± SE, r- Correlation coefficient, - = no activity,* and **- significant at 0.05% and 0.01 % level where $t = r\sqrt{n-2/1-r^2}$

Table 2 Percent seed germination and percent seed-borne fungal infection in mustard (*Brassica campestris*) during seed germination by using plant extract of weedicidal plant-*Lantana camara*

	Treatments				
	Control	10%	20%	30%	r
% Seed germination	63.0±0.13	60.0±0.10	44.0±0.20	44.0±0.19	-0.9221*
% of fungal infected seeds	48.0±0.18	40.0±0.10	28.0±0.14	24.0±0.09	-0.9879**
% Reduction of infected seeds	52.0±0.18	60.0±0.10	72.0±0.14	76.0±0.09	-0.9811**

muslin cloth. This filtered extract was used for the experimental study.

Antifungal activity* assay *(Blotter method)

The fungal incidence and seed germination was studied by Blotter method following international rules for seed testing (ISTA, 1974). Seeds collected from the field of Sawai Madhopur district of Rajasthan (India), were tested for the presence of fungal incidence. The seeds of mustard (*Brassica campestris*) and chickpea (*Cicer arietinum*) were soaked in 10, 20 and 30% aqueous extract for 6 hour at room temperature. The seeds soaked in distilled water served as control. Treated seeds (20 for mustard and 10 for chickpea) were transferred into sterilized Petri dishes lined with blotter paper (single layer). Impact of aqueous extract of *L. camara* on fungal incidence and percent seed germination were investigated after seven days.

DATA ANALYSIS

The raw data obtained, was further subjected to data analyses for mean, Standard deviation (SD), Standard error (SE), Correlation Coefficient (r) and Student t-test (t), and percent seed germination. The following formula/statistics were applied in various experiments:

Percent germination

Percent germination was calculated using the formula described by Kil and Lee (1987).

$$\left[\%\ \text{Germination} = \frac{\text{No. of germinated seeds}}{\text{Total number of seeds taken}} \times 100\right]$$

Correlation coefficient (r)

Correlation between two variables, the concentration of extract and incidence of fungal pathogen was assessed by calculating Pearson's correlation coefficient (r) using the computational formula $\sum xy / \sqrt{\sum_{x^2} \sum_{y^2}}$. Significance of r values, in between -1 to +1 were further tested by t test using $t = r\sqrt{n-2/(1-r^2)}$.

RESULTS

The data presented in Table 1 shows the efficacy of aqueous extract of *L. camara* on seed germination and seed borne fungal incidence in *Cicer arietinum* (Chickpea). The aqueous extract of leaves reduced the germination of chickpea seeds. The percent germination in control was 96% while at 10, 20 and 30% extract, it was 80, 42 and 46% respectively. In control, 68% fungal infected seeds were present. This varied from 66.0 to 50.0% at 10-30% concentration of extract in treated sets. Among all the concentrations, 30% concentration was found most effective in controlling fungal infection on germinated seeds. The percent reduction of fungal infected seeds (Table 1) in comparison to control varied from 34-50% at 10-30% concentration of extract. The correlation coefficient (r) at -0.9719 indicates significant (0.05% level) negative linear relationship between concentration of extract and reduction in fungal infected seeds.

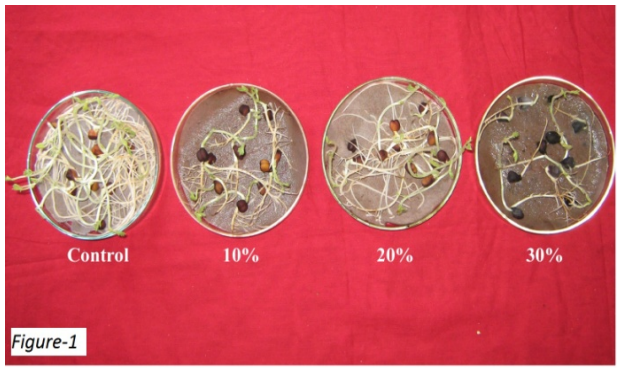

Figure 1 Reduction in fungal infection of seeds of *Cicer arietinum* during germination in the presence of aqueous extract of *L. camara*

Table 2 shows allelopathic impact of aqueous extract of leaves on seed germination and fungal incidence on *Brassica compestris* (Mustard, Variety 59) seeds. The plant extract exhibited positive effect on seed germination. Seed germination percent was reduced with increase in extract concentration. In control the percent germination was 63 whereas it was 60, 44 and 44 % at 10, 20 and 30% concentration respectively. The percent incidence of fungal infected seeds was reduced with increasing concentration of the extract. In control 48% incidence of fungal infected seeds were seen. It was found 40.0, 28.0 and 24.0% in treated seeds at 10, 20 and 30% concentration of extract respectively. There was considerable reduction in fungal infected seeds in all the treated sets in comparison to control. The correlation coefficient (r) at -0.9221 showed a significant (0.05% level) negative linear relationship between concentration of extract and germination of seeds.

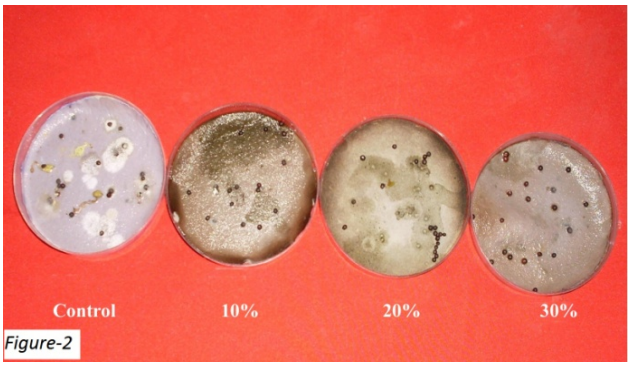

Figure 2 Reduction in fungal infection of seeds of *Brassica campestris* during germination in the presence of aqueous extract of *L. camara*

DISCUSSION

Healthy seed is very important input in any agricultural production system because of high germination and purity. Latif *et al.*, (2006) reported efficacy of various concentrations of four plant extracts prepared from garlic, Neem leaf, ginger and onion and found that garlic extract was most effective in controlling the seed-borne fungal infection of mustard among all the plant extracts studies.

The extract of leaves of *Lantana camara* was found inhibitory (*Brassica campestris*) against six species of seed borne fungal pathogens viz., *Aspergillus, Rhizopus, Alternaria, Curvularia, Fusarium* and *Penicillium.* In Chickpea (*Cicer arietinum*) four seed borne fungal pathogens were identified *(Alternaria, Fusarium* and Rhizopus). Verma (2012) has also confirmed inhibitory efficacy of leaves and flower of *L. camara* against five fungal species (*A. niger, R. stolonifer, A. solani, F.oxysporum* and *A. flavus*).The increasing concentrations of extract decrease the rate of germination in both crop (Chickpea and Mustard). The higher concentration of extract of weedicidal plant *L. camara* also decrease the fungal incidence in both crops.

The present investigation clearly demonstrated that aqueous extract of weedicidal plant i.e. *L. camara* is effective in controlling the seed borne fungi in Mustard and Chickpea. It may be a cheap and readily available weed used by people, could be used by farmers to reduce the incidence of diseases of mustard and chickpea.

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