

Impact of Homeopathic Drugs to Control Powdery Mildew of Chilli

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Abstract: Fungal diseases cause heavy economic losses in the agricultural field. Fungal pathogens survive in the soil for years leading to the economically important crops. *Capsicum annum* (chilli) is an important vegetable crop and is affected by a variety of fungal diseases. Anthracnose and Powdery mildew are common. The present study investigates the fungal pathogens on chilli with special reference to certain homeopathic drugs as controlling agents. Chemical based techniques are usually used to control the fungal pathogens which results in harmful residues. The present investigation aimed to evaluate in vivo antifungal effects of homeopathic drugs on chilli crop. Four homeopathic drugs Aconite, Arnica montana, Belladonna and Thuja occidentalis in 200CH dynamizations were tested. We assessed planta incidence and disease severity. The results showed that all homeopathic drugs tested at 200CH dynamization positively reduced the intensity of the fungal diseases compared to control treatment. Among all four homeopathic drugs Aconite at 200CH showed positive effect in reducing both disease incidence and disease severity.

Keywords: Homeopathy, Dynamizations, *Capsicum annum*, Anthracnose, Powdery mildew

1. Introduction

Chilli is one of the most important and valuable spice crops in India, also the largest produced spice crop in Asia. Capsaicin is produced by the plant as a defense against predators and microbes, particularly against *Fusarium* fungus that attack certain species of chilli peppers. Peppers increased the quantity of capsaicin in proportion to the infection caused by the fungal organisms on the plant's seed. Chilli crop is vulnerable to various diseases such as bacterial, fungal and viral. The diseases affect the yield and economic production.

Anthracnose disease has been reported to be a major constraint in chilli production causing huge losses. In India, a calculated loss of 10 to 54% has been reported in the yield of the crop due to anthracnose disease. Anthracnose (fruit rot) of chilli is caused by the fungus *Colletotrichum spp.* (Than, P. P., et. al, 2008). Powdery mildew of chilli is infected by the fungus *Leveillula taurica* (lev.) G. Arnaud. The disease causing heavy yield loss ranging from 14 to 30%, due to severe defoliation and reduction in size and number of fruits per plant. (Mathur, R. L., et al, 1972).

The fungal pathogens which cause disease survive in crop debris and infect other vegetable crops. The disease has the potential to spread rapidly and damage the crop vigorously. The causal fungal pathogens damage the leaves, stems and finally lead to the tuber rot. (Jones et al., 2014). M. Wenneker and J. Kanne (2010). In a field trial the effect of *Potassium bicarbonate* (Armcarb) on powdery mildew of gooseberry was evaluated. Four treatments; i. e. two preventive strategies and two curative strategies, were applied. Plants were sprayed until runoff. The percent of infected berries, shoots and disease severity was assessed. High percentage of disease was observed in the untreated control. All *Potassium bicarbonate* treatments significantly reduced the powdery mildew severity in leaves and fruits compared to the untreated controls.

Thus, it is necessary to defend the crop by using low cost,

easy to use by farmers and eco - friendly management strategies. Homeopathy, science developed by Hahnemann for over 200 years, offers an alternative of low cost and environmental friendly strategy for the control of crop diseases. (Modolon et. al., 2012). Homeopathic drugs involves in biological processes of plants due to secondary metabolites production which act as an environmental friendly without producing toxicity and leaving no residue (Bonato & Silva, 2003). Homeopathic drugs fulfill the promise due to antifungal properties (Sinha & Singh, 1983). Saxena et. al. (1987) observed inhibition of 22 genera of fungi associated with Okra seed treated with *Thuja occidentalis*, *Nitric acidum* and *Sulphur* in dynamization 200CH. Toledo (2009) showed reduction of 43% and 73% in severity of early blight (*Alternaria solani*) on tomato by spraying *Sulphuricum* 12 and 30 CH, respectively. *Arnica Montana* and *Thuja occidentalis* (30C) by using seed treatment and soil drenching methods showed significant suppression of *Rhizoctonia solani*, *Fusarium spp.* and *Macrophomina phaseolina* but also promote plant growth at 100% followed by 75 and 50% v/v concentration (prepared by 30C) on leguminous and non – leguminous crops (Hanif and Dawar, 2015).

Based on the previous aspects, safer and eco - friendly approaches of homeopathic drugs, the present research work aimed to control fungal diseases of Potato in vivo. The field experiment was conducted to study the antifungal activity of certain homeopathic drugs.

2. Material and Methods for Homeopathic Treatments

The homeopathic drugs selected for the present study were *Arnica Montana*, *Aconite*, *Belladonna* and *Thuja occidentalis*. The homeopathic drugs were purchased in a specialized homeopathic pharmacy at a dynamization of 200CH (Centesimal Hahnemannian). Distilled water was used to control such issues.

Field Experiment

Field experiment was conducted at the screen house of Botany department M. M. H College, Ghaziabad (C. C. S University, Meerut). The experimental design was completely randomized blocks with four different treatments of homeopathic drugs namely *Aconite* 200CH, *Arnica montana* 200CH, *Belladonna* 200CH and *Thuja occidentalis* 200CH. The control treatment was carried out simultaneously by using distilled water. The field was appropriately leveled with 2.5x2.5 microplots. Soil consists of natural infestation having *Colletotrichum spp.* and *Leveillula taurica* with PH 7.5 was used for the experiment. The intercrop distance maintained between the plants was 45 cm. For treatment, the chilli seeds were soaked for 30 minutes in all four homeopathic drugs separately. While, non - treated seeds were served as control. Treated and non - treated seeds were sown and covered with soil. Each treatment was replicated thrice. Watering of plants was done as per requirements. Observations are taken till the plants reach its fruiting stage. Experiment was completed after 180 days.

Evaluated Parameters

Disease incidence

Disease incidence percentage was calculated after 120 days of the experiment, according to the number of plants with and without symptoms of the fungal disease (powdery mildew). Disease incidence was calculated as:

Disease incidence = No. of diseased plants / Total no. of plants x 100

Disease severity

Disease severity was calculated according to the area of the plant tissue affected by the disease. To evaluate disease severity, the infected leaves were collected from the field and assessed after observation of disease symptoms on them. The evaluation was performed according to the disease severity scale proposed by Sa (2009): 0 – no disease symptoms; 1 – slight infection; 3 – mild infection; 5 – moderate infection; 7 – heavy infection; 9 – severe infection.

Data from severity scale was computed by disease severity index formula (DSI) proposed by McKinney (1925):

DSI = $\sum (\text{scale grade} \times n) \times 100 / \sum \text{plants} \times \text{maximum scale grade}$

Data Analysis

The calculated data were subjected to analysis of variance (ANOVA). The data were analyzed using a one - way ANOVA as per experimental design separately for each considered parameter i. e. disease incidence and disease severity. The analysis of variance was performed using OP stat software at 5% significance level.

3. Results

In vivo experiment, four homeopathic drugs namely *Aconite*, *Arnica Montana*, *Belladonna* and *Thuja Occidentalis* were elected and tested for the control of fungal diseases of the chili crop. The selected dynamizations were *Aconite* 200 CH *Arnica montana* 200CH, *Belladonna* 200CH and *Thuja*

occidentalis 200 CH. All four homeopathic drugs are amended in soil for the control of fungal diseases. Significant effects were observed in the application of homeopathic drugs comparatively to control treatments (Table 1). In control treatment, 61.00 % of plants revealed disease symptoms, while in *Thuja* 200 CH and *Belladonna* 200CH, only 46.93% and 44.16 % of the plants were infested. *Arnica montana* 200CH, among the homeopathic drugs tested, was the one that exhibited higher disease incidence in plants 61%. While *Aconite* 200CH exhibited least disease incidence with 49.83 % infestation in chilli plants.

Besides disease incidence, the results showed that disease severity was significantly reduced ($P < 0.05$) comparatively to control treatments (Table 2). In control treatments, 65.03 % disease severity was recorded. When treated with *Aconite* 200CH, 45.33 % of disease severity was observed, while plants treated with *Thuja occidentalis* 200CH showed disease severity with 38.84 %. Other two homeopathic drugs tested namely *Arnica Montana* 200CH and *Belladonna* 200CH exhibited 46.36 % and 37.36 % disease severity in chilli plants. It was concluded that *Arnica Montana* showed highest disease severity and *Belladonna* exhibited least disease severity in chilli plants under field conditions.

The results showed significant effects of all four homeopathic drugs to reduce the intensity of fungal pathogen (*Leveillula taurica*) of powdery mildew disease in chillies, comparatively to control treatments.

Table 1: Showing disease incidence percentage (DI %) for treated (with homeopathic drugs at 200CH dynamization) and non - treated (control) plants of chilli (*Capsicum annum*).

| Treatments | Mean |
|--------------------------|-------|
| Control | 61 |
| Aconite 200CH | 49.83 |
| Arnica montana 200CH | 61 |
| Belladonna 200CH | 44.16 |
| Thuja occidentalis 200CH | 46.93 |
| CD | 5.43 |
| SE (m) | 1.64 |

Mean values for each homeopathic drug tested at 200CH dynamization, differ significantly ($p < 0.05$). Where; CD = Critical difference and SE (m) = Standard error (mean).

Table 2: Showing disease severity index (DSI %) for treated (with homeopathic drugs at 200CH dynamization) and non - treated (control) plants of chilli (*Capsicum annum*)

| Treatments | Mean |
|--------------------------|-------|
| Control | 65.03 |
| Aconite 200CH | 45.33 |
| Arnica montana 200CH | 46.36 |
| Belladonna 200CH | 37.36 |
| Thuja occidentalis 200CH | 38.84 |
| CD | 2.79 |
| SE (m) | 0.84 |

Mean values for each homeopathic drug tested at 200CH dynamization, differ significantly ($p < 0.05$). Where; CD = Critical difference and SE (m) = Standard error (mean).

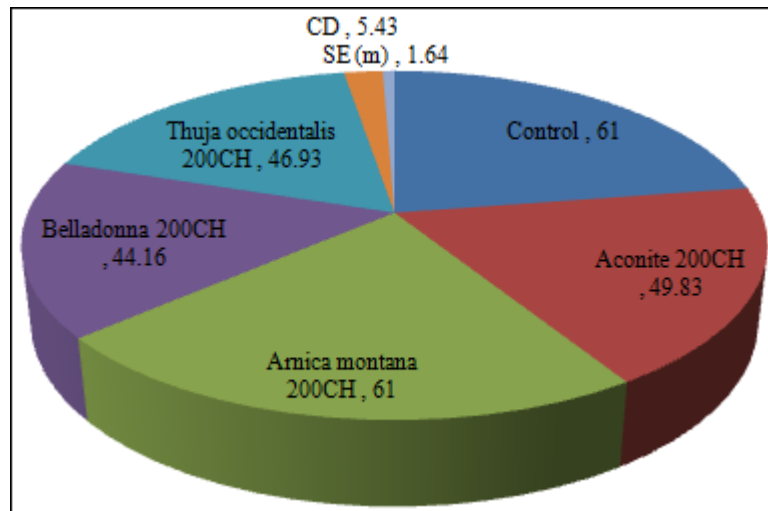


Figure 1: Graphical representation of disease incidence (%) for different homeopathic drugs at 200CH dynamization and control treatments for chilli (*Capsicum annuum*) plants

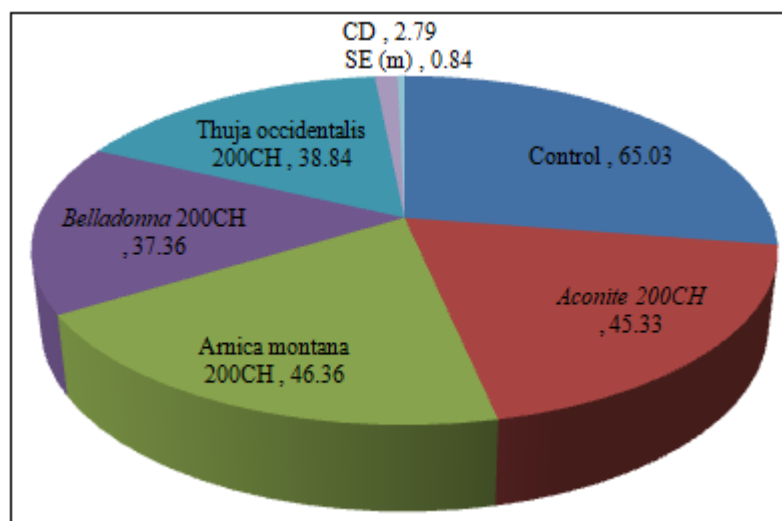


Figure 2: Graphical representation of disease severity (%) for different homeopathic drugs at 200CH dynamization and control treatments for chilli (*Capsicum annuum*) plants

4. Discussion

Results showed that homeopathic drugs significantly reduced the disease infection based on the evaluated parameters i.e. disease incidence and disease severity. (Bonfim et al 2008) reported that *Arnica montana* of 3, 6 and 12 CH potencies were used to improve and increase plant growth. *Kali iodatum* (149) and *Thuja occidentalis* (87 CH) when applied in pre and post - harvest conditions, significantly control the fruit rot caused by *Fusarium roseum* (Khanna and Chandra, 1992). Carneiro et al. (2010) discovered that the application of biotherapeutic of *Alternaria solani* at 27 CH and 28CH controls the blight of tomato plant in 57 and 62 %, respectively in greenhouses, and besides that no studies were conducted over mycelia growth and spore germination. Toledo, Stangarlin, and Bonato (2009) tested the *Sulphur* homeopathic medicine in the control of *Alternaria solani*, a fungus responsible for tomato early blight, inoculated in tomato plants. Ten days after *Alternaria solani* inoculation, the authors observed that *Sulphur* at the dynamization of 12CH and 60CH reduced the disease severity in 48.82 % and 56.47 % respectively, when compared to the control treatment. Ashraful Alam, Sanjoy

kumar Adhikary and Mahtalat Ahmed (2017), design appropriate control measures against *Cola* and *Colletotrichum gleosporoides* by using selected 72 homeopathic medicines of different potencies containing anti - fungal properties. The experiment was laid out in CRD with five replications. The results showed that drugs are effective against *C. gleosporoides* followed by the order of *Arsenicum album* < *Selenium* < *Nux vomica* < *Belladonna* < *Calcarea fluorica* respectively. *Arsenicum album* (64.62 %) and Q potency (16.52 %) was significantly effective against *C. gleosporoides*. Ma and Zhu (2006) studied the effect of BTH (*Benzothiadiazole*) and MeJA (*Methyl jasmonate*) at various concentrations against *Colletotrichum musae* infecting bananas. Application of BTH (50.00mM) gave the lowest incidence of anthracnose (4.00%) followed by MeJA (0.5mM) (10%). Treatment with BTH and MeJA before storage significantly reduced the lesion diameter and disease incidence in bananas inoculated with *C. musae*.

5. Conclusion

The homeopathic drugs *Arnica montana*, *Aconite*, *Belladonna* and *Thuja occidentalis* showed antifungal

activity and positively reduced the infestations in plants. From plant studies, it was concluded that disease incidence is lowly reduced; however disease severity results showed high reduction disease inhibition. In field experiment, all four homeopathic drugs tested at 200CH dynamization showed significant inhibition of fungal diseases compared to control treatment. The application of homeopathic drugs showed a promising potential for alternative and sustainable management of fungal diseases of chili crops.

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