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Seed Treatment of Capsicum annuum with Two Different Fungicides to Evaluate the Seed Germination Rate

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Abstract
Chili (*Capsicum annuum L.*) is the fruit of plants, the Chili is susceptible for several diseases and seed borne fungi *Phytophthora capsici* which produces collar rot and root of chili. Seed borne pathogens are associated with untreated seeds of chili which are also significantly reduced the germination of seed. This experiment was conducted to find out the seed borne fungi and enhanced the germination of chili (*Capsicum annuum*) with two fungicides known as Mancozeb 80% WP and Carbendazim 50% WP. Effectiveness of these two fungicides were measured when the seeds planted on blotter paper in petri plates at 27^0C under lab conditions. These two fungicides significantly reduce the effect of seed borne fungi associated with chili seeds. Mancozeb 80% WP was found most effective to reduce the effect of seed borne fungi and increase the seed germination. Considering the results of the experiment, Mancozeb 80% WP was noted to be a best fungicide against the seed borne fungi.
Keywords*: Capsicum annuum*, Mancozeb, Carbendazim, seed borne fungi, blotter paper.
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1. Introduction

Chili (*Capsicum annuum L.*) is the fruit of plants from the genus 'Capsicum', members of the nightshade family**,** 'Solanaceae' (Asaduzzaman *et al***.** 2010), widely growing in all season and all areas of Pakistan**.** Chili (*Capsicum annum L.*) is an important vegetable crop planted over an estimated area of 47.3 thousand hectares with an annual production of 69.5 thousand tones, with an average yield of 1902 kg/ha in Pakistan (Anon 2006)**.** Chilies are widely grown as cash crop**,** spice and vegetable crop in the tropical and subtropical regions. (Hemannavar 2008 & Than *et al***.** 2008). *Capsicum annum* (frutescens) exists as an annual herbaceous vegetable or perennial shrub of the Solanacae (Amusa *et al***.** 2004). Pepper is suitable for diets of the overweight and is also useful in the control of cancer of the stomach and colon (Pamplona-Roger 2007)**.** Globally chilies production of 7.18 million tons over an area of 1**.**7 million ha (Anon 2014). *Capsicum* spp. are rich in Vitamin A, Vitamin C and Vitamin D (T.R. Chauhan *et al*. 2018) and are also very good source of potassium, folic acid, vitamin E and low in sodium and cholesterol free (Than *et al*. 2008).

Seed is important for crop production and increase the yield of crop about 90% world food crop is *Capsicum annuum L* (Maude 1996). Seeds of chili or other crop is the passive input of carrier of seed borne pathogens like as bacteria, fungi, nematode and viruses can be carried with the seed (E. Chigoziri & E.J. Ebenezer 2013). Chili is susceptible for several diseases and seed borne fungi *Phytophthora capsici* produces collar rot and root of chili (Ahmed *et al*. 1989; Saleem *et al*. 1996; 1998 & Hussain *et al*. 1990), *Collectotrichum* spp caused fruit rot and die-back or anthracnose of *Capsicum annuum L* (Khaleeque & Khan 1991; Sultana *et al*. 1992 & Amusa 2004) *Fusarium* spp produces wilt, root rot and powdery mildew is caused by the Leveillula taurica (Hafeez 1986; Mushtaq & Hashmi 1997)**.** Seed borne and air borne diseases of chili affects the seed germination and vigour to a greater extent (Ahmed 1982; Perane & Joi 1988; Mesta 1996 & Asalmol *et al*. 2001)**.**

Seed treatment of chilies is a progression of treating seeds by chemical, physical, biological and other agent(s) to terminate harmful seed-borne fungi and to protect the seeds against infection. It is done to prevent germination failure and seedling infection, to destroy external and internal seed borne fungi and to develop a protective zone around the seed in the soil which protects the germinating seed, health of the seed and seedling from the attack of certain soil borne fungi. To increase the production of chili both qualitatively and quantitatively; farmer requires healthy and quality seeds with high percentage of germination and purity.

2. Materials and Methods

This experiment was performed during 01-05-2019 to 21-05-2019 in Microbial lab of Plant Pathology Department University of Agriculture, Faisalabad, Pakistan. Seeds of Desi chili variety were collected from the certified seed merchant. To find out the efficacy of different fungicides to control the seed borne fungi (pathogens) in chilies seed, fungicides namely Mancozeb 80% WP and Carbendazim 50% WP. The Seeds were sown on wet blotter paper; 15 seed in an outer most line, 9 seed in middle line and 1 seed at center of Petri plate (Islam. S. S., *et al.* 2007). Incubate the plates inside the incubator at 27-30^{oC} and keep the blotter paper moist.

Make the dilution of two fungicides Mancozeb 80% WP at concentration (conc.) (1.562gm, 0.781gm, 0.39gm and 0.195gm) and Carbendazim 50% WP at conc. (1gm, 0.5gm, 0.25gm and 0.125gm). Seeds of chilies were treated with prepared dilution of fungicides separately by dipping method for 15 minutes. The treated seeds were soaked with blotter paper and placed on moist blotter paper to determine the seed germination.

2.1.1. Seed health test by blotter paper method:

Detection of the seed borne pathogens by blotter paper method by International rule of seed testing method (ISTA 1996)**.** Blotter paper were soaked into sterilized water and placed at the bottom of 9cm diameter of petri plates, 25 seeds were placed in each petri plates. In each treatment, 15 replications (petri plates) were used and 375 seeds were placed. These seeds in petri plates were incubated at 27^{oC} under microbial lab condition. The occurrence of *Aspergilla nigrais, Aspergilla's fulvous* and *Alternaria* spp. and germination were recorded by following blotter method designated earlier (Anon 1976).

2.1.2. Detection of pathogens:

Fungal species *Aspergilla's flavous* and *Aspergilla's nigras* were identified by preparing slides and viewing spores under compound microscope (X 40-X 100 magnifications) for the presence of fungi (E. Chigoziri & E.J. Ebenezer *et al*. 2013), identification of these fungal pathogens on the base of spores, morphology and colony of characters (Barnett & Hunter 1972, & Ellis 1971).

2.1.3. Statistical analysis:

The experiment was conducted by following the CRD (complete randomized design). The data collected from experiment was analyzed by the appropriate statistical software.

3. Results and Discussion

Seed borne pathogens are associated with untreated seeds of chili which are significantly reduced the germination of seed. All type of treated seed completely eliminates the seed borne fungi and improves the germination of seed and ultimately increases the yield of crop. Table.1. Highest seed germination was recorded in Mancozeb 80% WP, 82% germination and lowest germination was recorded in control condition 53%. The seed germination was obtained about 29%. Significant differences were observed between treatments and control as well as among the treatment. Highest healthy seed germination was recorded in Mancozeb 80% WP at conc. (1.562gm 100% and 0.39gm 97.32% healthy plants and 1.562gm 0% and 0.39gm 2.68% infected plants) infected plants in control condition was 46.68%. Table.2. Similarly healthy and infected percentage of chili seeds treated with Carbendazim 50% WP 1gm and 0.25gm gives similar result upto 92% and 93.36% healthy plants and 8% & 6.68% infected plants. In control conditions 40% infected plants were recorded.

Fig.1. chili seeds treated with Mancozeb 80% wp with different conc. (1.562mg, 0.781mg, 0.39mg, 0.195mg and control) gives Germination percentages of 76%, 82.67%, 82.67%, 80% and 53.3%. Data analyzed from Fig.1. revealed that chilli seeds treated with the application of Mancozeb 80% wp (Conc./mg) 0.782gm and 0.39mg gives higher Germination percentage. Fig.2. the chilli seeds treated with Carbendazim 50% wp (Conc./mg) (0.125mg, 0.25mg, 0.5mg, 1mg and control) gives germination percentages of the chilli seeds upto 80%, 80%, 53.3%, 74.7% and 70.7%. Data analyzed specified that at conc. of (0.125mg and 0.25mg) higher germination percentages 80% were recorded. Fig.3. it has been shown that healthy and infected percentage of chili seeds treated with Carbendazim 50% WP 1gm and 0.25gm gives higher germination of seed upto 92% and 93.36% healthy plants and 8% & 6.68% infected plants. In control condition, the 40% infected plants were recorded. Fig.4. Data presented revealed that highest seed germination was recorded in Mancozeb 80% WP, 82% germination and lowest germination was recorded in control condition 53%. The seed germination was obtained about 29%. Highest healthy seed germination was recorded in Mancozeb 80% WP at conc. (1.562gm 100% and 0.39gm 97.32% healthy plants and 1.562gm 0% and 0.39gm 2.68% infected plants) infected plants in control condition was 46.68%. Fig.5. Infection levels of two fungal species *Aspergilla's flavous* and *Aspergilla's nigras* were recorded as the percentage of the infected seeds in a sample as shown in fig A and B after germination.

(Suthin Raj & Christopher 2009), revealed that seed treatment with Trichoderma harzianum (10g/kg) and Pseudomonas fluorescens (5g/kg) reduces 24.10% and 25% occurrence of *Colletotrichum capsici* and enhanced seedling vigour of chilli by 12.10% and 13.70% respectively. *P. fluorescens* showed higher antagonistic activity against *C. capsici* under in-vitro conditions and also less seedling rot was gained in *P. fluorescens* treated seeds compared to T. harzianum (Hegde *et al*. 2001, Srinivas *et al*. 2006 & Azad *et al*. 2013). (Choudhary *et al*. 2013), reported that seed treatment with thiram, carbendazim and T. viride control seedling rot caused by *C. capsici.* (Adiver *et al.* 1987), observed that in chilli the most commonly occurring seed borne fungi are *Colletotrichum*, *Cladosporium*, *Alternaria, Curvularia*, and *Drechslera* species which affect root elongation utterly than shoot elongation. (Koteshwar-Rao *et al.* 1962), reported that seed treatment of chilli with thiram enhanced in emergence. (Grover & Bansal 1970), reported that the seeds treated with thiram, captan and brassicol were found to be more better in controlling *Colletotrichum capsici*. (Narein & Panigrahi 1971), tested eight fungicides and observed that among of them, zirum was the most effective fungicide for the conidial emergence of *Colletotrichum capsici* in chilli. (Dhawale 1975), revealed that the seed dressing fungicides *viz.*, thiram, thiovit

and captafol @ 2.0 g per kg were effective in eradicating chilli seed mycoflora. (Jharia *et al.* 1977), tested nine fungicides, found that thiram + captan (1:1) per cent by weight was highly effective in testing the pre and post emergence losses and mortality at adult stage in chillies and also resulted in higher yields. (Siddique *et al.* 1977), revealed that with thiram at 0.20 per cent concentration, the best control of *Colletotrichum dematium* on *capcicum* was achieved. (Srivastava & Gupta 1981), found that seed treatment with dithane M 45 at 0.30 per cent, cerason dry at 0.40 per cent or Aureofungin at 0.01 per cent gave good control of seed borne fungi and enhanced the seed germination in chilli. (Kumar & Mahmood 1986), to control the infestation of *Colletotrichum capsici* in chilli, they tested seed with 12 different fungicides. They found that highest values noted in case of *Aureofungin* followed by thiram, bavistin, defolaton and captan. (Dhyani *et al.* 1991), found that chilli seed treated with thiram, aureofungin, captafol, vitavax and topsin each at 0.3 per cent concentration enhanced the seedling length and germination. (Gupta *et al.* 1992), found that chilli seeds treated with captan 2g per kg of seed and kept in tin container after 12 months of storage retained higher germination (86%) than the untreated seeds stored in cloth bag (55%). (Sitara & Hasan 2011), reported that chilli seed treated with 8 fungicides *viz.*, Ridomyl Gold (68% WP), Mancozeb (80% w/w Dithiocarbamate), Antracol (70%WP Propineb), M*et al.*axyl + Mancozeb (72% w/w), Derosol (60% WP Carbendazim), Aliette (80% WP Fosetyle aluminium), Thiophonate methyl (70% WP), and Copper oxychlorite (50% WP) and four seed powders of herbicides *viz.*, mustard *(Brassica campestris*), black cumin (*Nigella sativa*), asafetida (*Ferula assafoetida*) and neem (*Azadirachta indica*) were used. Ridomyl Gold @ 0.15% & 0.25% found to be effective one which inhibited the fungal growth whereas *Nigella sativa* powder and asafetida @ 0.25% were found to be more effective. However, reduced fungicidal activity toward *Fusarium moniliforme* was observed. So that their results cannot be compared with the present study results due to the difference in fungicide treatments.

4. Conclusion

Highest healthy seed germination was recorded in Mancozeb 80% WP (1.562gm 100% and 0.36gm 98% healthy plants and 1.562gm 0% and 0.36gm 0.2% infected plants). Infected plants in control condition was 46.68 %. Similarly healthy and infected percentage of chili seeds treated with Carbendazim 50% WP 1gm and 0.25 gm gives similar result 92% healthy plants and 8%, 6.67% infected plants. In control conditions 40% were infected plants. Based on results obtained from the present study, it was concluded that among two fungicides; Mancozeb 80% WP and Carbendazim 50% WP. Mancozeb 80% WP found to be the best for controlling the seed-borne fungi and also enhanced the seed germination rate.

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Conflict of interest:

There is no conflict of interest.

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Tables:

Table 1: Healthy and infected percentage of chili seeds treated with Mancozeb 80% WP

	Mancozeb 80% WP Conc./mg				
	1.562	0.781	0.39	0.195	Control
Healthy	100	80	97.32	80	53.36
Infected	0	20	2.68	20	46.68

Table 2 : Healthy and infected percentage of chili seeds treated with Carbendazim 50% WP

	Carbendazim 50% WP Conc./mg				
	0.125	0.25	0.5	1	Control
Healthy	78.68	93.36	81.36	92	60
Infected	21.33	6.68	18.68	8	40

Figures:

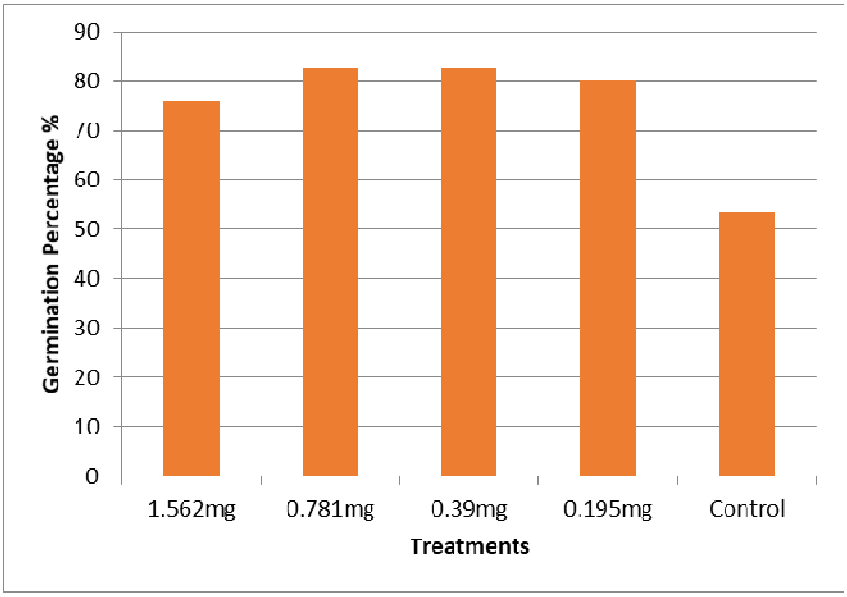


Fig 1: Germination %age of chili seeds treated with Mancozeb 80% wp

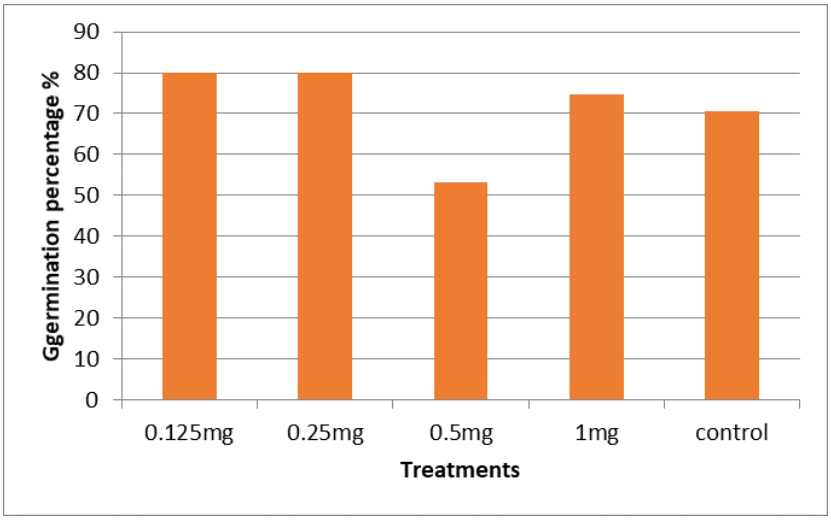


Fig 2: Germination %age of chili seeds treated with Carbendazim

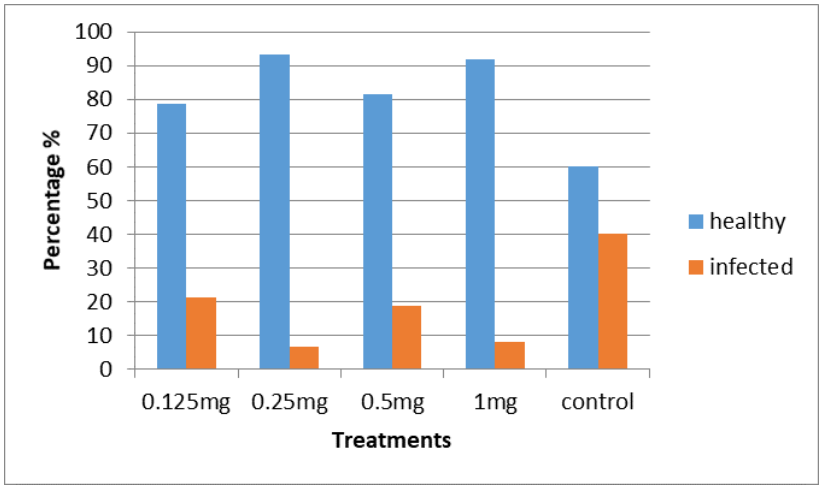


Fig 3: Healthy and infected percentage of chili seeds treated with Carbendazim 50% WP

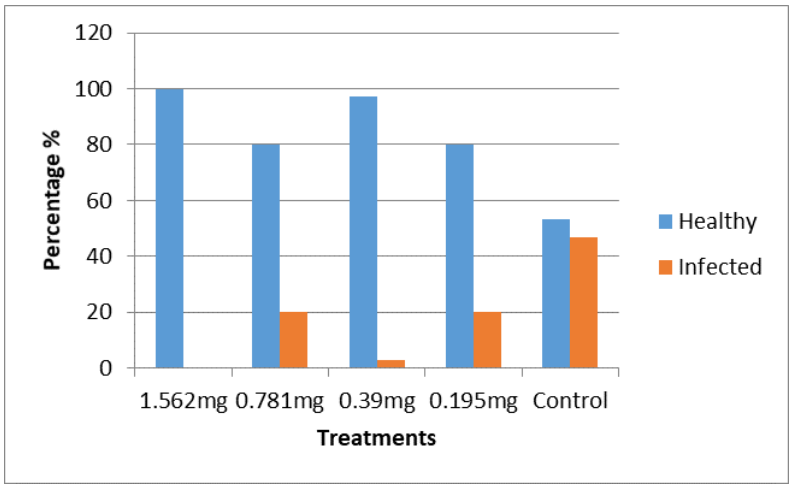
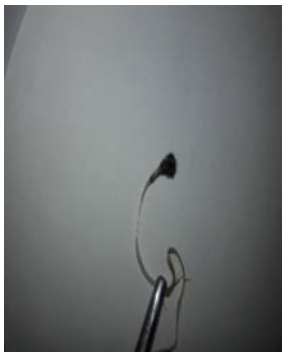


Fig 4: Healthy and infected percentage of chili seeds treated with Mancozeb 80% WP



(A) *Aspergillus niger* **(B) *Aspergillus flavous***

Fig 5: Infection levels of two fungal species (A) *Aspergilla's nigras* and (B) *Aspergilla's flavous*