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Field assessment of carrot germplasm against ALB (*Alternaria* leaf blight) and its chemical management

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Abstract: The study was conducted for the management of ALB of carrot. Eight carrot genotypes were assessed against ALB incidence under RCBD with three replications. From infected fields diseased samples were collected and fungus *Alternaria dauci* was isolated by using PDA media. By inoculation in healthy crop disease was established. Field screening experiment was performed to evaluate their resistance against *A. dauci*. These genotypes were checked based on disease incidence. The results of screening trials concluded that G5 and G8 showed resistant response while G2, G4 and G7 showed moderately resistant response. G1 and G6 showed moderately susceptible response. The G3 showed susceptible response. For the chemical management of *Alternaria* blight of carrot, four chemicals, were applied at their standard doses in the field on the standing carrot crop. The results revealed that the Equus reduced the incidence of the disease more than other groups of chemicals. After this Chisel followed by champ, and Cuprofix dispress showed less incidence of *A. dauci*. The disease incidence was higher without application of chemicals.

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Key words: Alternaria leaf blight (ALB), carrot

Introduction

Carrot (*Daucus carota* subsp. "sativus") is an important world vegetable crop providing a significant source of beta-carotene, vitamins C and K to the human diet. In addition to being an edible root vegetable with a desirable taste, carrots have a medicinal use. The largest carrot producer worldwide is China, wherein the vegetable is cultivated mainly in the northern, northeastern, central, and southwestern parts of the country to generate 43% of the global carrot yield (Zhang et al. 2020). Carrots can be grown under a wide range of soil and climatic conditions, though carrot production is notoriously difficult due to many biotic and abiotic stress factors that can negatively affect the productivity and quality of its edible taproots. For example, Alternaria leaf blight, caused by the pathogen *Alternaria dauci*, is widely recognized as one of the most common and destructive carrot diseases (Boedo et al. 2010). Characteristic symptoms of this infection are greenish-dark colored sores on petioles and appendages. In preliminary stages these sores are unpredictable fit as a fiddle and size which are normally shaped along the edge of handout. With the progression of time these injuries move toward becoming water soaked. More seasoned injuries end up noticeably dim dark colored and encompassed by chlorotic corona. At temperature of 28˚C with long wetness period prompts contamination improvement and injuries turn into various, extend and combine, giving the cursed appearance to the leaf tissue (Strandberg, 1984). Pathogen executes the leaves by supporting petioles, in this manner significantly decreasing the photosynthetic action (Farrar et al., 2004). The injuries created by *Alternaria dauci* are unpredictable fit as a fiddle having dark colored to dark shading and generally shows up on the edges and tips of the develop leaves of the carrot plant (Farrar et al., 2004). Different ways to protect carrots from ALB are available, but none of them is really efficient, particularly when infection is severe. Agricultural practices such as seed and foliage treatment, crop rotation, and foliage destruction after harvesting could help to control the disease. Fungicides are intensively sprayed on fields, but this approach is costly and not always effective (Ben-Noon et al. 2001). Field and greenhouse screening using a disease rating scale is the routine procedure for the identification of resistant genotypes (Gugino et al. 2007). Adequate management of plant diseases is a prerequisite for stable and profitable production of food. Numerous control measures are available for this purpose, including chemical, cultural, biological, and genetic. ones. In most cases, growers rely on a single measure for disease suppression (Ben-Noon et al. 2003). However, joint application of two or more control measures may be advantageous, for several reasons. The simultaneous implementation of more

than one control measure may enable the use of potentially environmentally harmful measures such as chemical fungicides or fumigants to be minimized, either by reducing their rates or by decreasing the number of applications. Resistance germplasm is an essential source that confines its spread (Boedo et al., 2010). Keeping in view all the above actualities display study was intended to assess the impacts of various fungicides and to find out the source of resistance against *Alternaria* leaf blight disease in carrot under field condition.

Material and method

Eight carrots genotypes G1-G12 were evaluated against ALB. The experiment was conducted under RCBD with three replications. To keep the crop in sound, condition every social practice were performed timely. From infected fields diseased samples were collected and fungus *Alternaria dauci* was isolated by using PDA media. Pathogenicity test of diseased plants was performed to check whether relevant pathogen is present or not. The disease was established in healthy carrot crop after inoculation. For chemical management, four chemicals viz. Chisel (Chlorothalonil), Cuprofix Dispress (Basic Copper Sulphate), Eqqus (Chlorothalonil + Carbendazim), and Champ (Copper Hydroxide) were tested in liquid formulations to control the disease of the carrot on susceptible genotypes of carrot.

Sickness Incidence was ascertained by the accompanying recipe

Disease Incidence (%)= (Number of observed contaminated plants)/(Total number of plants observed) ×100

The appraisal of illness was done by ailment rating scale created by Gugino et al. (2007).

3. Result and discussion:

3.1. Screening of carrot varieties against *Alternaria dauci*

Eight carrot genotypes were evaluated for resistance against *A. dauci*. These genotypes were checked based on disease incidence. The results of screening trials concluded that G5 and G8 showed resistant response while G2, G4 and G7 showed moderately resistant response. G1 and G6 showed moderately susceptible response. The G3 showed susceptible response. These results are depicted in Fig. 1.

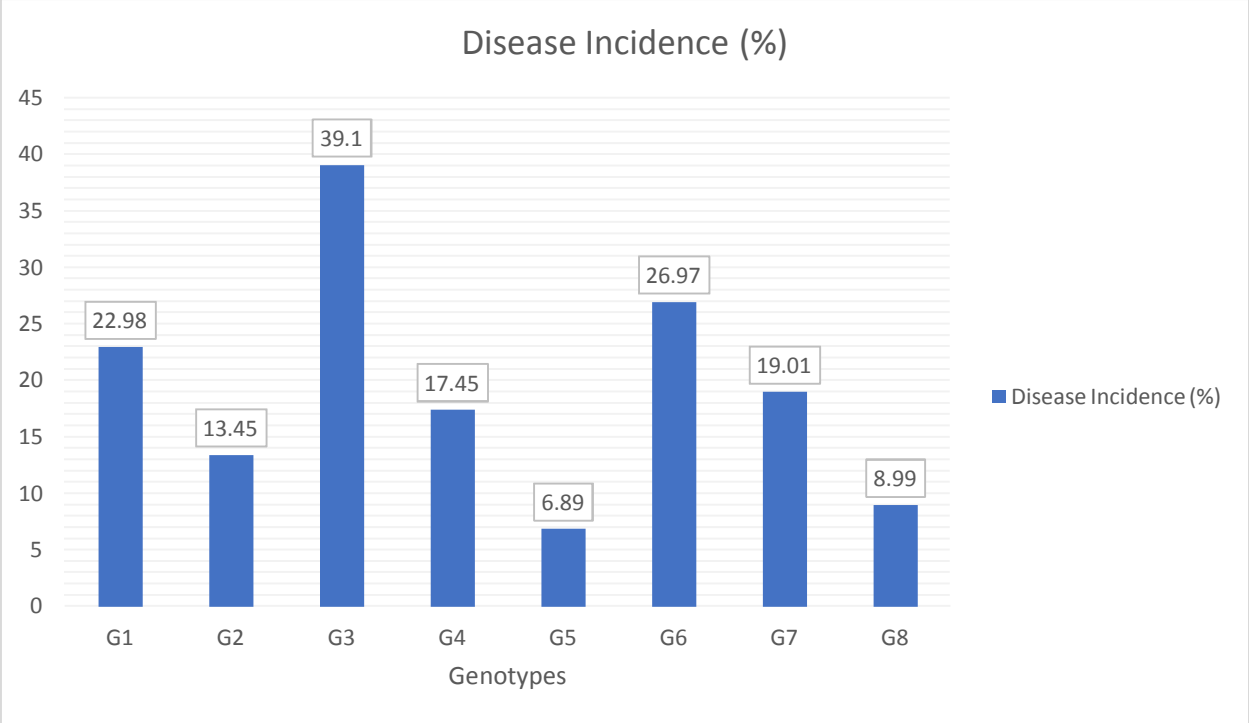

Fig. 1. Screening of carrot varieties against *Alternaria dauci*.

Table 1. Mean square values for evaluation of chemicals against *Alternaria dauci* under field conditions after 1st, 2nd and 3rd spray.

Source of Variation	DF	1st spray	2nd spray	3rd spray
Replication	2	13.055 ns	15.78 ns	13.055
Treatments	4	190.88*	497.23*	195.755
Error	8	1.60	4.87	1.724
Total	14			

Analysis of variance showed significant impacts of all treatments performed in this experiment. Four chemicals viz. Chisel (Chlorothalonil), Cuprofix Dispress (Basic Copper Sulphate), Eqqus (Chlorothalonil + Carbendazim), and Champ (Copper Hydroxide) were applied at their standard doses in the field on the standing carrot crop. After first spray, Eqqus, showed promising results followed by Chisel, Champ and Cuprofix Dispress. Without application of chemical the disease incidence was higher as compared to chemical application.

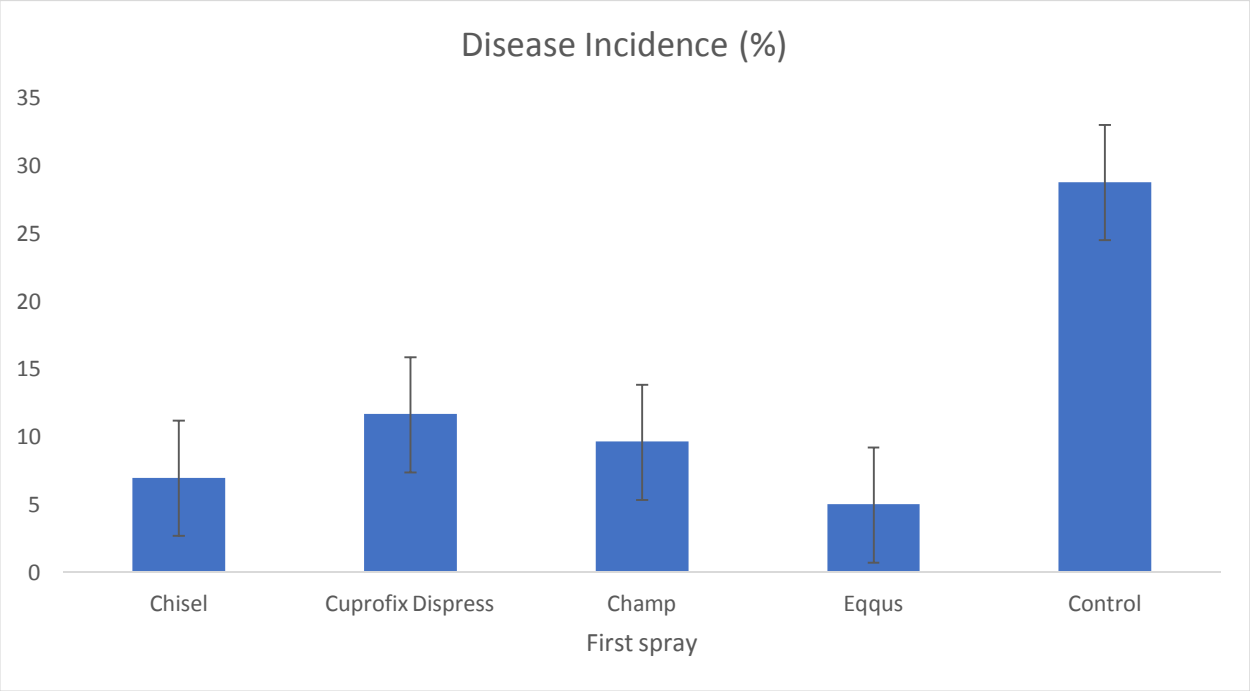

Fig. 2. Effects of chemicals against *Alternaria dauci* under field conditions after 1st spray

After 2nd spray, Equus reduced the incidence of the disease more than other groups of chemicals. After this Chisel followed by champ, and Cuprofix dispress showed less incidence of *A. dauci*. The disease incidence was higher without application of chemicals.

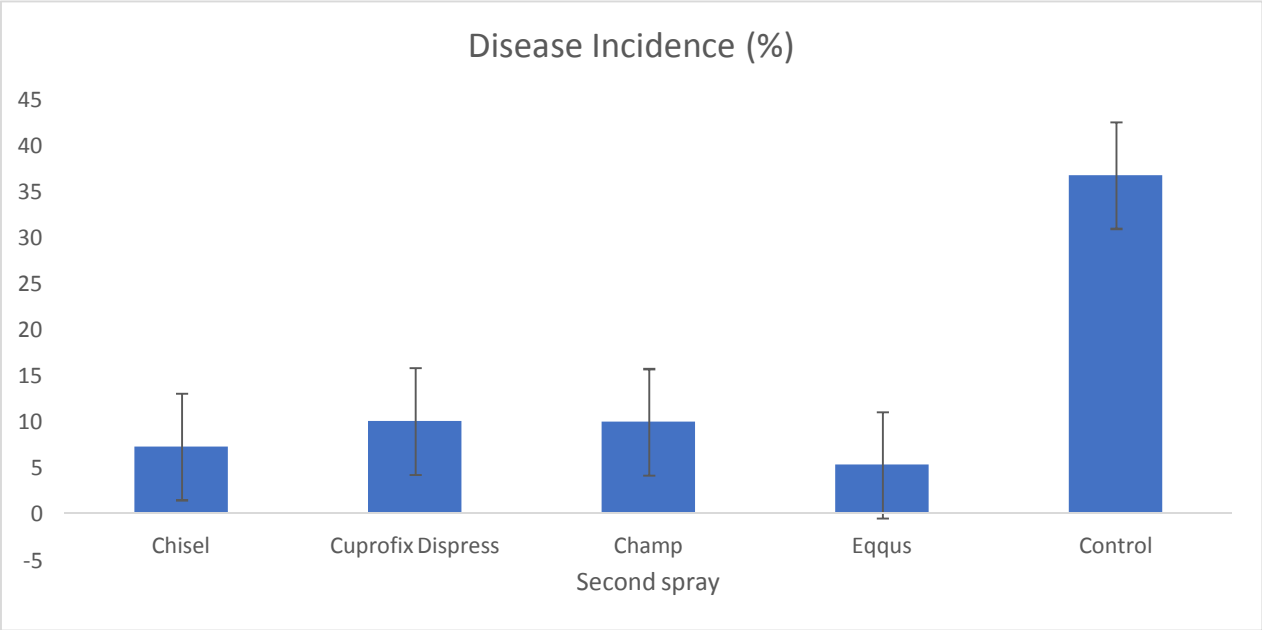

Fig. 3. Effects of chemicals against *Alternaria dauci* under field conditions after 2nd spray

After 3rd spray, Equus reduced the incidence of the disease more than other groups of chemicals. After this Chisel followed by champ, and Cuprofix dispress showed less incidence of *A. dauci*. The disease incidence was higher without application of chemicals.

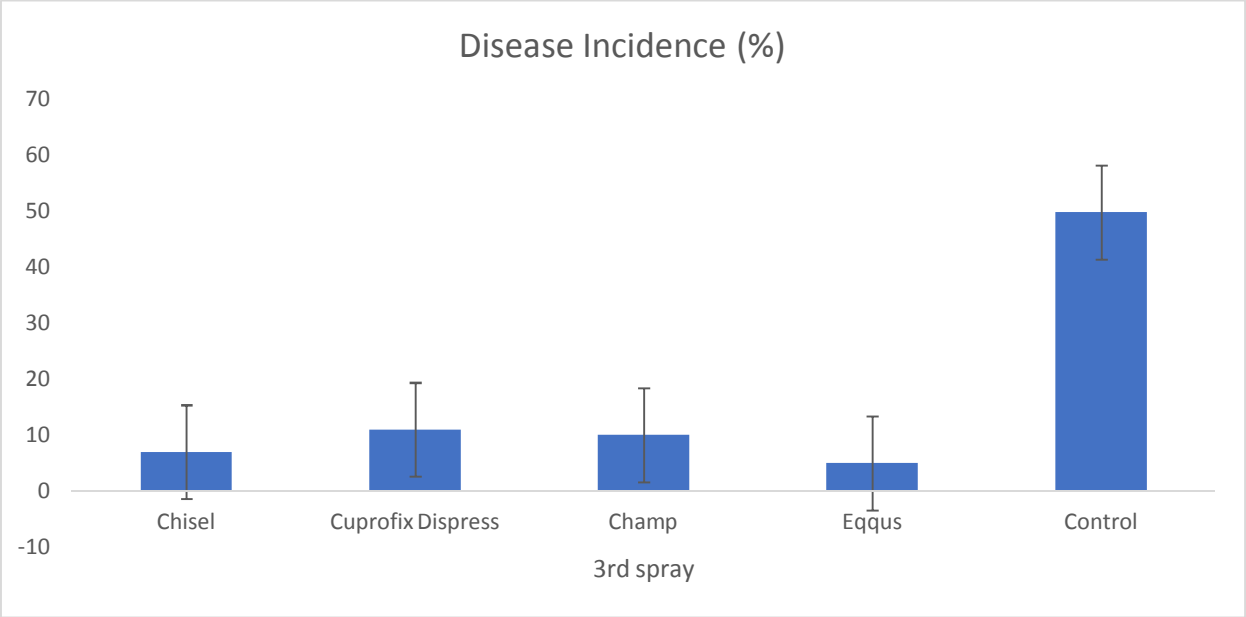

Fig. 4. Effects of chemicals against *Alternaria dauci* under field conditions after 3rd spray

Discussion

The present experiment was focused on the screening of carrot germplasm against *Alternaria* blight of carrot. Eight carrot genotypes were evaluated for resistance against *A. dauci*. These varieties were checked on the basis of disease incidence. The results of screening trials concluded that G5 and G8 showed resistant response while G2, G4 and G7 showed moderately resistant response. G1 and G6 showed moderately susceptible response. The G3 showed susceptible response. These results show some resemblance with (Gugino et al. 2007) in which 11 varieties of carrot were evaluated against *Alternaria* leaf blight disease. The various chemicals used in this study had differing effects on incidence of Alternaria leaf blight. In all cases, use of any one of the tested measures alone did not result in an acceptable level of disease suppression. Effects of Alternaria leaf blight on carrot yield are devastating. Yield in fungicide treated plots was increased as compared with untreated plots. The final severity of Alternaria leaf blight in plots those protected solely by chemical control was lower than in unsprayed plots. The less susceptible cultivars, can be used in commercial production as a significant part of an IPM program aimed at reducing the number of fungicide applications. The planting of less susceptible cultivars is a strategy frequently incorporated into IPM programs for many different crops ranging from potato (Elad et al. 1980) to deciduous fruit trees (Sutton 1996). These results show some similarity with Farrar *et al*. (2004) in which it was recommended that for the proper management of *Alternaria* blight of carrot, routine based fungicidal application is very much necessary for reducing the incidence. Under the high inoculum pressure, a single management strategy may not be suitable so multiple fungicidal application is essential in order to reduce the disease incidence and increase the economic yield and quality of the produce.

Conclusion

Proper forecasting of disease along with the use of resistant varieties and post-infection treatment of chemicals is favorable for the proper management of *Alternaria* blight of carrot.

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