



Effect of Seed Mycoflora on Seed Germination and Seedling Vigour of Chick Pea (*Cicer arietinum* L.)

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Article Info

Article History:

Published: 13 April 2026

Publication Issue:

Volume 3, Issue 4
April-2026

Page Number:

148-153

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Abstract:

Chickpea (*Cicer arietinum* L.) is the world's third most important pulse crop and regarded as the "King of pulses". It contributes significantly to nutritional security and soil fertility control through extensive cropping worldwide. The quality of seeds is critical to producing a healthy crop. Seed-borne infections cause seed degradation, reduced viability, germination, and vigor, as well as aberrant seedling growth. Research using artificial seed inoculation revealed that all seven of the fungus seriously impaired the health status of the seed. In comparison to healthy seeds, fungus reduced seed germination by 17 to 48, shoot length by 16.84 to 56.47, and root length by 27.86 to 62.63 percent, respectively. Seed inoculation with *Macrophomina phaseolina* significantly lower the germination (52.00%), minimum shoot length (4.47 cm), root length (5.47 cm) and seedling vigour index (516.88) among the evaluated different treatments. The maximum germination (100%), maximum shoot length (10.27 cm), root length (14.64 cm) and seedling vigour index (2491).

Keywords: Chickpea, Mycoflora, Fungi, Germination(%), Vigour

1. Introduction

Chickpea (*Cicer arietinum* L.), is the "King" of pulses and world's third most important food legume. It is an important legume crops grown extensively in India. Chickpea is mainly cultivated in rabi season on marginal lands under rainfed conditions. There are 2 types of chickpeas grown around the world: desi chickpeas and Kabuli chickpeas. Kabuli type shows a larger cream-colored seed with a thin seed coat, desi type is the one type of chickpea has a smaller, reddish brown-coloured seed with a thick seed coat. The global chickpea production is made up of approximately 75% desi and 25% Kabuli types (Karthick *et al.*, 2017). Chickpea after dehulling is valued for its nutritive seeds with high protein content (12.3-31.5%).

Chickpeas are becoming increasingly popular due to their nutritional value. When compared to other important pulses, it is a better source of carbohydrates and proteins (Chibbar *et al.*, 2010). It is cholesterol-free and contains a variety of vitamins and minerals. Chickpea seed has 58.9% carbohydrate, 3% fiber, 5.2% oil, 3% ash, 0.2% calcium, and 0.3% phosphorus. Digestibility of protein varies from 76-78% and its carbohydrate from 57-60%. Among the food legumes, chickpea is the most nutritive pulse extensively used as protein adjunct to starchy diet (Agarwal *et al.*, 2011). The chickpea crop is attacked by 172 pathogens (67 fungi, 3 bacteria, 22 viruses, 80 nematodes and mycoplasma) all over the world. Chickpea suffers from a large number of fungal diseases namely Fusarium wilt (*Fusarium oxysporum* f. sp. *ciceri*), dry root rot (*Rhizoctonia bataticola*), Ascochyta blight (*Ascochyta rabiei*), powdery mildew (*Leveillula taurica*), Alternaria blight (*Alternaria alternata*), Colletotrichum blight (*Colletotrichum dematium*), Stemphylium blight (*Stemphylium sarciniforme*), wet root rot (*Rhizoctonia solani*), Sclerotinia stem rot (*Sclerotinia sclerotiorum*) and foot rot (*Operculella padwickii*). Healthy seeds are the foundation for healthy crop plants, which is a necessary condition for high yields and outputs.

The quality of seeds has a major role in promoting agricultural productivity and quality, and the yield is frequently determined by the seed. One of the most crucial requirements for safe conservation is seed health, which has been regarded as a high-quality trait (Duan *et al.*, 2007). Due to rising need for high yields and agricultural cooperation, seed an inactive, dormant stage of future crop plants is receiving attention on a global scale. The most significant factor affecting seed health is seed-borne fungus flora, which lowers seed vigor and germination. Plant diseases are thought to spread through seeds. A seed-borne pathogen can be present externally, internally, or as a contaminant in the seed. It can harm the seed in a number of ways, including decreasing its viability, germination capacity, vigor, resulting in physiological alterations and reducing the duration of conservation. Every crop starts and ends with seeds, which also act as a passive pathogen carrier. A new plant begins with a viable seed. Fungi are the largest category of microorganisms that have a significant impact on seed quality. Seed deterioration and discolouration are caused by fungi linked to seeds. Seed-borne fungal infection is important because it contaminates the soil by permanently establishing its inoculum, in addition to its association with seeds, which reduces or fails germination and causes illness in newly emerging seedlings or developing plants. When seeds are harvested, transported, processed, and stored, they undergo a number of unfavorable modifications that render them unfit for human eating and planting. Seed-borne fungus can cause systemic or local infections as well as damage to seedlings, seed rot, and seed abortion. Aflatoxins, which damage the liver and cause carcinogenesis, mutagenesis, and teratogenesis, are produced by several of these fungi. Controlling seed-borne fungus is therefore essential, and integrated strategies can lessen the negative impacts. In the view of the above facts, the present study was undertaken to find out the mycoflora associated with the seeds of chickpea and its effect on seed germination and seedling vigour.

2. Material and Methods

To assess the impact of mycoflora on germination percentage and seedling vigor, 250 g of chickpea seeds were collected from the local market in Mysuru, Karantaka. For a more thorough assessment, the seeds were dried and stored in polyethene at room temperature. The seed germination (%), root and shoot length (cm) and seedling vigour index was measured using below standard procedures.

Germination (%) (Rolled paper towel method) : From each seed sample, four replications of 100 seeds were taken, (Each replication: 25 seeds) numbered at randomly, and arranged in rows with normal spacing on the germination paper. The seeds are started rolling and arranged vertically in a seed germinator that maintains a constant temperature of 25 °C and a relative humidity of 90 %. The germination percentage was determined on the tenth day and expressed as a percentage of normal seedlings utilizing normal seedlings as well as abnormal seedlings, hard seeds, fresh ungerminated seeds, and dead seeds. The following techniques were used to calculate the germination rate, which was then represented as a percentage up to a whole number.

Root and shoot length (cm) : Ten healthy seedlings were cautiously selected at random from each replication of the germination test on the eighth day (final count) and used for determining root and shoot length. The shoot length was taken from the cotyledonary node to the tip of the apical bud. The distance between the cotyledonary node and the tip of the major root was evaluated. The average length of the roots and shoots was measured in centimeters.

Seedling Vigour Index : Seedling vigour index was determined on the basis of seed germination as well as shoot and root length of seedlings. Vigour index were calculated by using following formula (Malleth *et al.*, 2008) :

Vigour index (VI) = Germination (%) x Mean seedling length (cm)

3. Results and Discussion

Assessment by artificially inoculation of chickpea seeds separately by seven different fungi revealed significant effect on seed germination, shoot and root length and thereby seedling vigour index. It is revealed from the data presented in Table-1 that minimum seed germination was observed in *Macrophomina phaseolina* inoculated seeds at 52 per cent over the rest of the treatments. Whereas, maximum seed germination (83%) observed in seed inoculated by *Curvularia lunata*. Seed germination after the inoculation of *Aspergillus niger*, *Penicillium* spp., *Fusarium moniliforme*, *Fusarium udum* and *Alternaria alternata* were 59.00, 64.00, 67.00, 70.00 and 71.00 per cent, respectively and seed germination in control was 100.00 per cent. In terms of percent reduction over control, maximum (48.00%) reduction was observed in seed inoculated with *Macrophomina phaseolina* fungi.

The result in terms of shoot and root length, all the treatments showed smaller shoot length and root length as compared to control. *Macrophomina phaseolina* had the shortest shoot (4.47 cm) and root length (5.47 cm), whereas *Curvularia lunata* had the longest shoot (8.54 cm) and root length (10.56 cm). On the contrary, significantly highest shoot length (10.27 cm), root length (14.64 cm) and seedling were obtained in control (healthy seeds). Maximum root and shoot length in descending order was control > *Curvularia lunata* > *Alternaria alternate* > *Fusarium udum* > *Fusarium moniliforme* > *Penicillium spp.* > *Aspergillus niger* > *Macrophomina phaseolina*. All the treatments reduced the seedling vigour of the chickpea seeds compared to the control. Seeds inoculated with *Macrophomina phaseolina* showed lowest vigour index (516.88), whereas *Curvularia lunata* inoculated seeds observed comparatively higher vigour index (1585.30). A Minimum reduction of vigour index were observed in *Fusarium udum* and *Curvularia lunata*.

The present results are similar in finding with Agarwal and Malhotra (2011), Trivedi and Rathi (2015) and Rathod *et al.* (2021) who found that *Aspergillus flavus* and *Aspergillus fumigatus* significantly reduced seed germination and seedling vigour index in chickpea crop. The present results are further similar as reported by Patel (2016) who reported that artificial inoculation of chickpea seeds separately with seven different fungi revealed smaller shoot length, root length and seedling vigour index as compared to control. Kumar and Singh (2004) observed a minimal seed germination rate (12%) in pigeonpea inoculated with the cultural filtrate of *Aspergillus*. These dominant seed-borne fungi are known to produce mycotoxins, adversely affecting seed germination as well as the shoot and root length of chickpeas to varying degrees. Jalander and Gachande (2012) noticed a similar outcome and discovered that *Aspergillus niger* cultural filtrates reduced seed germination and elongation of the roots of several pulse crops. Similarly, Kandhare (2015) concluded that The common fungal seed mycoflora such as *Aspergillus* and *Penicillium* are mostly known to produce mycotoxins that adversely affect the seed germination, shoot and root length of all test pulses in variable quantity.

Table 1: Effect of various seed mycoflora on germination and seedling vigour index of chickpea

Fungi	Seed germination (%)	Decrease in seed germination over healthy seed (%)	Shoot length (cm)	Decrease in shoot length over healthy seed (%)	Root length (cm)	Decrease in root length over healthy seed (%)	Seedling vigour index
<i>Alternaria alternate</i>	71.00	29.00	7.85	23.56	8.41	42.55	1154.46
<i>Aspergillus niger</i>	59.00	41.00	5.93	42.25	7.63	47.88	800.04
<i>Fusarium moniliforme</i>	67.00	33.00	7.25	29.40	8.47	42.14	1053.24
<i>Curvularia lunata</i>	83.00	17.00	8.54	16.84	10.56	27.86	1585.30

<i>Fusarium udum</i>	70.00	30.00	7.78	24.24	9.89	32.44	1236.90
<i>Penicillium</i> spp.	64.00	36.00	6.87	33.10	8.32	43.16	972.16
<i>Macrophomina phaseolina</i>	52.00	48.00	4.47	56.47	5.47	62.63	516.88
Control (Healthy seed)	100.00	-	10.27	-	14.64	-	2491.00

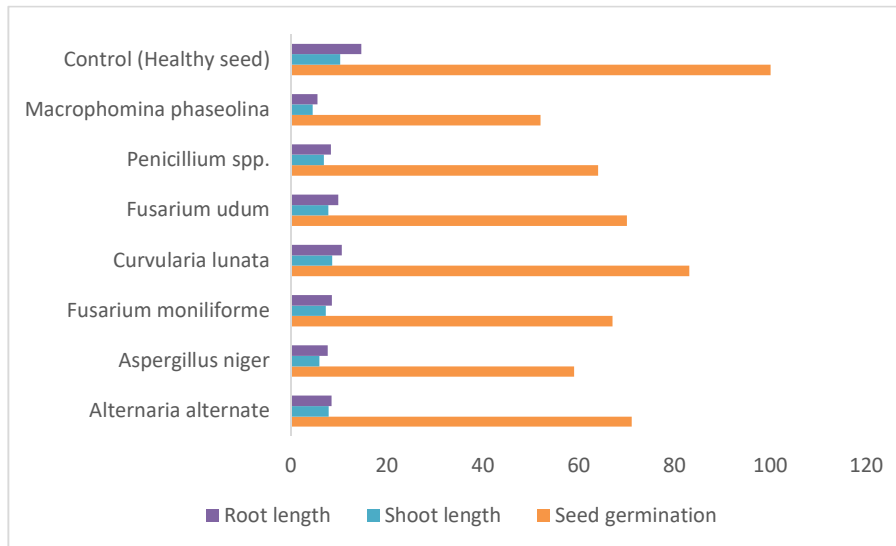


Fig.1 : Effect of various seed mycoflora on seed germination and root-shoot length

4. Conclusion

One significant legume crop that is widely cultivated in India is the chickpea. One of the main obstacles to the chickpea crop developed during a specific season is seed mycoflora. The root and shoot length, seed germination percentage, and seedling vigor index are all hampered by seeds inoculated with various fungal filtrates. Control > *Curvularia lunata* > *Alternaria alternate* > *Fusarium udum* > *Fusarium moniliforme* > *Penicillium* spp. > *Aspergillus niger* > *Macrophomina phaseolina* was the order of maximum germination (%) and seedling vigor index.

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