Control of Foot and Root Rot of Lentil by using Different Management Tools

K. M. Khalequzzaman

Senior Scientific Officer (Plant Pathology), Spices Research Centre, BARI, Shibganj, Bogra, **BANGLADESH**

*Corresponding Contact:
Email: zaman.path@gmail.com

ABSTRACT

The experiment was conducted at the sick plot, Pulses Research Centre, Ishurdi, Pabna, Bangladesh during 2011-12 to find out the effect of chemical, botanicals, biocontrol agents and healthy looking seeds against foot and root rot of lentil. Chemical, botanicals, biocontrol agents and healthy looking seeds were used as treatments in this experiment. The lowest foot and root rot (21.67%) was obtained from when seed treatment with Provax 200 (2.5 g/kg seed) which was followed by seed treatment with Trichoderma harzianum compost (1:5) and apparently healthy looking seeds, and the highest incidence (41.50%) was obtained from untreated control. The highest number of pod/plant (45.26), number of seeds/plant (87.80), weight of seeds/plant (2.44 g) and yield (1845 kg/ha) were recorded in seed treatment with Provax 200 (2.5 g/kg seed) which were followed by seed treatment with Trichoderma harzianum compost (1:5) and apparently healthy looking seeds, and the lowest of these parameters were obtained from untreated control.

Keywords: Control, foot and root rot, yield, lentil

3/29/2016 **Source of Support:** Nil, **Conflict of Interest:** None Declared

How to Cite: Khalequzzaman KM. 2016. **Control of Foot and Root Rot of Lentil by using Different Management Tools** *ABC Journal of Advanced Research*, 5, 35-42.

INTRODUCTION

Lentil (*Lens culinaris*) occupies a unique position in the world of agriculture. It is the oldest crop in the world as it has been grown since 8000 years ago. Pulses are the major food component along with the cereal in Bangladesh. Lentil is the second major pulse crop of Bangladesh in respect of acreage and production. It is cultivated as sole and intercrops. Total production of lentil in Bangladesh is about 124,000 metric tons (BBS, 2011). Lentil covers 40% of the production (Sattar *et al.*, 1996). Lentil is also used for human consumption as a protein source in a diverse range of product and is an excellent source of vitamin A and provides fiber, potassium, B vitamins, and iron (Kochhar, 2009). It is a cheap source of protein for human beings and also for animals in country (Sattar *et al.*, 1996). As the price of animal protein is increasing day by day, the protein storage in the diet system of the people in the country can be met up through improvement and increasing the production of lentil. In Bangladesh pulses constitute an integral part of the daily diet as a direct source of protein for human beings (Sattar *et al.,* 1996). It supplies also protein for animals. Lentil, a member of the legume family, Leguminosae, which is capable of fixing and utilizing atmospheric nitrogen through symbiotic relationship with *Rhizobium* at the root nodule of the crop.

Lentil suffer from attack of a number seed borne diseases such as vascular wilt, collar rot, root rot, stem rot, rust, powdery mildew and downy mildew, which are caused by *Fusarium oxysporum f.sp. lentis, Sclerotium rolfsii*, *Rhizoctonia solani, Uromycis fabae*, *Erysiphe polygoni* and *Peronospora lentis*, respectively (Khare *et al*., 1979; Sugha *et al*., 1991; Singh and Tripathy, 1999). Average yield of lentil is low due to various diseases. Among the diseases, foot and root rot of lentil caused by *Fusarium oxysporum* and *Sclerotium rolfsii* (Dey *et al*., 1993) are common and the most serious disease in Bangladesh. In Bangladesh about 44% lentil plants are infected by foot and root rot disease (Anonymous, 1986). It causes seedling death at early stage resulting very poor plant stand which ultimately produces very low yield. *Fusarium oxysporum* and *Sclerotium rolfsii* are soil-borne pathogens commonly occurs in the tropics and sub-tropics regions of the world causing root and foot rot of many crops (Aycock, 1966). The fungi can attack the crop during any time from seedling to flowering stage and are comparatively more destructive at the seedling stage. The pathogenic fungi are soil-borne in nature; hence, seed treatment with chemical, botanicals and biocontrol agents might be effective to control foot and root rot disease and to increase yield of lentil. Moreover, by seed treatment, very low quantities of seed treating materials are required compared to foliar application. Again, it reduces the risk of environmental pollution, health hazard and not much costly to the growers. Benomyle, Corbendazim and Vitavax showed occurrences against seed borne fungi *viz*., *Aspergillus spp*, *Penicillium spp*, *Alternaria alternata*, *Rhizopus* and *Fusarium spp* followed by Neem, Garlic and *T. harzianum* (Singh *et al*., 2014). All *Trichoderma* isolates tested under in-vitro conditions significantly inhibited the growth of *S. rolfsii* (Jegathambigai *et al*., 2010). Provax 200 was the most effective followed by Bavistin 50 WP, Neem leaf extract and Garlic extract with respect to disease reduction and increase of seed yield (Rahman *et al*., 2012). Seed treated with Provax 200 showed least foot and root rot incidence of lentil at Madaripur and Jessore in Bangladesh (Anonymous, 2010). From the above facts, these types of research work are needed in Bangladesh. So, the present study was undertaken to find out the effect of different management tools viz. chemical, botanicals, biocontrol agents and healthy looking seeds against foot and root rot of lentil.

MATERIALS AND METHODS

The experiment was conducted in the sick plot, Pulses Research Centre, Ishurdi, BARI, Pabna, Bangladesh during 2011-12. The experimental plot was prepared with five ploughings and cross ploughings followed by laddering to break the clods as well as level the soil. The weeds and stubbles of previous crops were collected and removed from the soil. Urea @ 50 kg/ha, TSP @ 90 kg/ha, MP @ 40 kg/ha and Boric acid 5 kg/ha were applied during final land preparation (Anonymous, 2011). The experiment was carried out following Randomized Complete Block Design with three replications. Size of the plots was 2.0 m × 1.6 m and plant spacing was 30 cm with continuous sowing.

Eight treatments were T_1=Seed treatment with Neem leaf extract (1:5), T_2=Seed treatment with Neem oil (1:5), T_3=Seed treatment with Garlic extract (1:5), T_4=Seed treatment with *Trichoderma viride* compost (1:5), T_5=Seed treatment with *Trichoderma harzianum* compost (1:5), T_6=Seed treatment with Provax 200 (2.5 g/kg seed), T_7=Apparently healthy looking seeds and T_8=Untreated Control. The susceptible lentil variety was used BARI Lentil-1. Seeds were sown on November 15, 2011. Intercultural operations were done as per needed and to maintain the normal hygienic condition of crop in the field. Insecticide (Tufgor @ 0.2%) and fungicide (Rovral 50 WP @ 0.2%) were sprayed after flowering when aphid infestation and Stemphylium blight disease were observed, respectively. During the growing period the plots were inspected regularly to record the incidence of foot and root rot disease from seedling to maturity stage of the crop. Dead plants were removed from the field after counting. Disease plant parts were collected in laboratory for identifying foot and root rot pathogens. The crop was harvested on February 28, 2012. Data were recorded on foot and root rot, plant survival, plant height number of pods/plant, number of seeds/plant, weight of seeds/plant and yield. The incidence of foot and root rot of lentil was recorded at every alternate day. The incidence of foot and root rot disease of lentil was calculated by the following formula:

$$\text{Incidence of foot and root rot (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

The recorded data were analyzed statistically to find out the level of significance and the variations among the respective data were compared following Duncan's New Multiple Range Test (DMRT) according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effect of chemical, botanicals, biocontrol agents and healthy looking seeds on foot and root rot and plant survival of lentil

Results of chemical, botanicals and biocontrol agents on foot and root rot and plant survival of lentil are presented in Table 1. Foot and root rot incidence was significantly influenced by the treatments. The lowest foot and root rot (21.67%) was obtained from when seed treatment with Provax 200 (2.5 g/kg seed) which was followed by seed treatment with *Trichoderma harzianum* compost (1:5) by 26.67% and apparently healthy looking seeds (27.33%), and the highest incidence (41.50%) was obtained from untreated control. The highest plant survival (78.33%) was recorded in seed treatment with Provax 200 (2.5 g/kg seed) and the lowest (58.50%) was recorded in untreated control. Provax 200 (2.5 g/kg seed) resulted the highest disease reduction over control (47.78%), and seed treatment with Neem oil (1:5) resulted the lowest disease reduction over control (14.29%) which was followed by seed treatment with *Trichoderma viride* compost (1:5) by 21.28%, seed treatment with Neem leaf extract (1:5) by 23.68% and seed treatment with Garlic extract (1:5) by 27.71%.

Table 1: Effect of chemical, botanicals, biocontrol agents and healthy looking seeds on foot and root rot and plant survival of lentil

Treatments	Foot and root rot (%)	Plant survival (%)	Disease reduction over control (%)
Seed treatment with Neem leaf extract (1:5)	31.67 abc	68.33	23.68
Seed treatment with Neem oil (1:5)	35.57 ab	64.43	14.29
Seed treatment with Garlic extract (1:5)	30.00 abc	70.00	27.71
Seed treatment with *Trichoderma viride* compost (1:5)	32.67 abc	67.33	21.28
Seed treatment with *Trichoderma harzianum* compost (1:5)	26.67 bc	73.33	35.74
Seed treatment with Provax 200 (2.5 g/kg seed)	21.67 c	78.33	47.78
Apparently healthy looking seeds	27.33 bc	72.67	34.15
Untreated Control	41.50 a	58.50	-
LSD ($p \geq 0.01$)	10.80	-	-

Similar letters in a column indicate non-significant difference at 1% level of probability.

Effect of chemical, botanicals, biocontrol agents and healthy looking seeds on yield contributing characters of lentil

Number of pod/plant, number of seeds/plant, weight of seeds/plant and yield of lentil under different treatments varied significantly from one to another but plant height was non-significant (Table 2). The highest number of pod/plant (45.26), number of seeds/plant (87.80) and weight of seeds/plant (2.44 g) were recorded in seed treatment with Provax 200 (2.5 g/kg seed) which was followed by seed treatment with *Trichoderma harzianum* compost (1:5), apparently healthy looking seeds and seed treatment with Garlic extract (1:5), and the lowest of these parameters were obtained from untreated control.

Table 2: Effect of chemical, botanicals, biocontrol agents and healthy looking seeds on yield contributing characters of lentil

Treatments	Plant height (cm)	No. of Pods / Plant	No. of Seeds /Plant	Wt. of Seeds / Plant
Seed treatment with Neem leaf extract (1:5)	30.93	34.17 d	63.32 e	1.75 abc
Seed treatment with Neem oil (1:5)	32.27	30.33 f	58.11 g	1.50 bc
Seed treatment with Garlic extract (1:5)	30.87	40.37 c	68.04 d	1.85 abc
Seed treatment with *Trichoderma viride* compost (1:5)	31.83	32.56 e	60.77 f	1.72 bc
Seed treatment with *Trichoderma harzianum* compost (1:5)	31.55	42.06 ab	84.23 b	2.03 ab
Seed treatment with Provax 200 (2.5 g/kg seed)	32.57	45.26 a	87.80 a	2.44 a
Apparently healthy looking seeds	30.73	41.37 bc	78.94 c	1.96 ab
Untreated Control	32.40	28.33 g	53.77 h	1.17 c
LSD ($p \geq 0.01$)	NS	1.524	2.202	0.6367

Similar letters in a column indicate non-significant difference at 1% level of probability.

Effect of chemical, botanicals, biocontrol agents and healthy looking seeds on yield of lentil

Yield of lentil under different treatments varied significantly from one to another (Fig. 1). Seed treatment with Provax 200 (2.5 g/kg seed) gave the highest yield (1845 kg/ha) which was followed by seed treatment with *Trichoderma harzianum* compost (1:5) by 1705 kg/ha and apparently healthy looking seeds (1631 kg/ha), and the lowest was obtained from untreated control (1236 kg/ha).

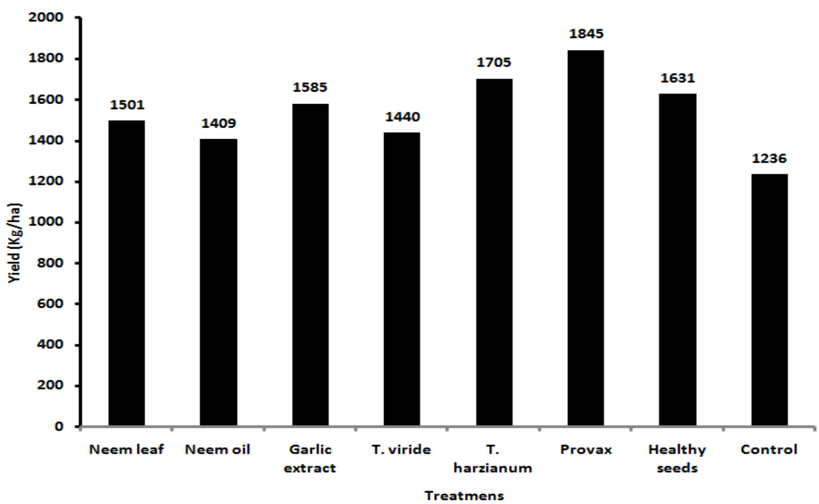

Fig. 1: Effect of chemical, botanicals, biocontrol agents and healthy looking seeds on yield of lentil

From the above study, it has been revealed that the lowest foot and root rot incidence, highest plant survival and highest disease reduction over control were obtained from when seed treatment with Provax 200 (2.5g /kg seed) which was followed by seed treatment with *Trichoderma harzianum* compost (1:5) and apparently healthy looking seeds, and the highest incidence and lowest plant survival was obtained from untreated control. Anonymous (1986) evaluated of various fungicides as seed treatment revealed Captan and Vitavax 200 found to be effective against collar rot of lentil. Khalequzzaman *et al*. (2003) reported that the highest foot and root rot (plant mortality) of Bush bean was reduced by Vitavax 200 (0.3%) in the field. Anonymous (2010) also found that the lowest mean (%) foot and root rot of lentil was observed in Provax 200. Sharma and Sohi (1981) found from field trials with 10 seed dressing fungicides against foot and root rot, the best protection was given by Bavistin (Carbendazim) and Vitavax (Carboxin) and mortality was reduced from 56-14 %. Khalequzzaman (2008) stated the best treatment for controlling foot and root rot of lentil and chickpea was dipping seeds in 0.25% suspension of Vitavax 200 for 3 hours. Gupta (2006) found that Vitavax 200 reduced chickpea wilt caused by *Fusarium oxysporum* f.sp. *ciceris* and improved seedling emergence which was at par with the standard fungicide Bavistin (carbendazim). Vitavax 200 significantly decreased damping off disease and increased percentage of surviving plants of faba bean, lentil and chickpea (Zeid *et al*., 2003). Kaur and Mukhopadhyay (1992) reported that seeds treated with Vitavax 200 and Ziram resulted in 29.9% disease control, and Carboxin for seed treatment was the best to reduce wilt incidence (44.1-60.3%) during experimentation. Seed treated with Provax 200 showed least foot and root rot incidence of lentil at Madaripur and Jessore in Bangladesh (Anonymous, 2010). Singh *et al*. (2014) found that Vitavax showed occurrences against seed borne fungi *viz*., *Aspergillus spp*, *Penicillium spp*, *Alternaria alternata*, *Rhizopus* and *Fusarium spp* followed by Neem, Garlic and *T. harzianum*. Provax 200 was the most effective followed by Bavistin 50 WP, Neem leaf extract and Garlic extract with respect to disease reduction and increase of seed yield (Rahman *et al*., 2012). Bhuiyan *et al*. (2012) screened fungicides Provax 200 at 100, 200 and 400 ppm concentration for their efficacy against the radial colony growth of *Sclrotium rolfsii*. The complete inhibition was obtained with Provax 200 at all the selected concentrations. They also screened isolates of *Trichoderma* spp. showed significantly variable antagonism ranging from 65.01 to 83.06% reduction of radial growth of *S. rolfsii*. Among the screened antagonists, the isolate TH-18 of *T. harzianum* showed the highest (83.06%) inhibition of radial growth of *S. rolfsii*. Jegathambigai *et al*. (2010) found that *Trichoderma* isolates significantly inhibited the growth of *S. rolfsii* under in-vitro conditions. Shaigan (2008) tested efficiency of *Trichoderma* bio control agent against *Sclerotium rolfsii* in vitro condition. Results showed that these species with different mechanism such as lysis of sclerotia, inhibited mycelial growth of *Sclerotium rolfsii* with volatile metabolites producing and parasitized the hyphal trends of disease agent were showed its antagonistic effects against causal agent of white foot and root rot in tea seedling. *Trichoderma viride, Trichoderma harzianum* and *Trichoderma hamatum* after 30 days destructed and lysis the sclerotia 98.5, 86.5 and 85%, respectively. Hannan *et al*. (2012) conducted an experiment to evaluate efficacy of cowdung, BINA biofertilizer (peat soil-based *Rhizobium* leguminosarum) and BAU biofungicide (black gram bran-based *Trichoderma harzianum*), alone or in combination, for controlling foot rot disease of lentil. The results exhibited that BINA biofertilizer and BAU biofungicide are compatible and have combined effects in controlling the pathogenic fungi *Fusarium oxysporum* and *Sclerotium rolfsii*, which cause the root rot of lentil. Post-emergence death of plants due to foot rot disease were significantly reduced after combined seed treatment with BINA biofertilizer and BAU biofungicide.

Among the treatments used, only BAU biofungicide as the seed treating agent resulted in higher plant survival (84.82%) which supports the results of present study. Hannan *et al.* (2013) applied cowdung in soil and treated seed with BAU Biofungicide and found that field emergence was higher up to 26.47%, post-emergence death of plants due to foot rot disease were also successfully reduced in grasspea. Kashem *et al.* (2011) found that the isolate TG-2 of *T. harzianum* showed the highest inhibition of the pathogen in field condition. The lowest foot and root rot incidence (6.9%), highest seed germination (82.08%) and maximum plant stand (93.12%) of lentil were recorded in plots where the isolate TG-2 was applied. Hoque *et al.* (2015) evaluated *Rhizobium leguminosarum* and *Trichoderma harzianum* against foot and root rot pathogens *Fusarium oxysporum* and *Sclerotium rolfsii* of lentil. In dual culture method, mycelia growth of *S. rolfsii* was inhibited 37.85% by *T. harzianum*. In paper towel test, no diseased seedling was found from *T. harzianum* treated seeds.

In case of yield and yield attributes, the highest number of pod/plant, number of seeds/plant, weight of seeds/plant and yield of lentil were recorded in seed treatment with Provax 200 (2.5 g/kg seed) which was followed by seed treatment with *Trichoderma harzianum* compost (1:5), apparently healthy looking seeds and seed treatment with Garlic extract (1:5), and the lowest of these parameters were obtained from untreated control. Shaban and El-Bramawy (2011) stated that the *Rhizobium* spp. and *Trichoderma* sp. can be used as biological control of some soil-borne fungal diseases causing significant yield losses in legumes field crops. Khalequzzaman *et al*. (2003) found that the maximum yield was obtained from Vitavax 200 (0.3%) in Bush bean. Gupta (2006) found that Vitavax 200 improved yield of chickpea which was at par with the standard fungicide Bavistin (carbendazim). Kaur and Gupta (2003) found that Vitavax 75 WP resulted the maximum increase in yield (86.14%) of lentil. It was observed that Poultry litter applied for soil treatment and Provax (carboxin + thiram) for seed treatment performed highest yield in both the year 2009-10 and 2010-11, which was followed by Provax for seed treatment (Siddique *et al*., 2013). Carboxin, Thiram and Bavistin singly or in combination has great effect on reducing wilt, protection of seedlings and increasing yield under pots and field condition has been observed by different authors (Gupta *et al*., 1997; Singh and Jha, 2003). Sharma and Sohi (1981) conducted experiment in field trials with 10 seed dressing fungicides against foot and root rot and found Bavistin (Carbendazim) and Vitavax (Carboxin) resulted maximum yield. Kashem *et al.* (2011) found that the isolate TG-2 of *T. harzianum* showed the highest seed yield (3726.67 kg ha^{-1}) of lentil was recorded in plots where the isolate TG-2 was applied.

Conclusion

From the above study, it may be concluded that seed treatment with Provax 200 (2.5 g/kg seed) showed better performance followed by seed treatment with *Trichoderma harzianum* compost (1:5) and apparently healthy looking seeds to control foot and root rot and increase yield of lentil.

References

Anonymous. 1986. Annual report 1985-86. Plant Pathology Division, BARI, Gazipur. p. 19.

Anonymous. 2010. Annual report 2009-10. Pulse research centre. BARI, Gazipur. pp. 89-90.

Anonymous. 2011. Krishi Projukti Hatboi (Handbook on Agro-technology) Part 1. 5th edition. Bangladesh Agricultural Research Institute, Gazipur-1701. pp. 123-124.

Aycock, R. 1966. Stem rot and other diseases caused by *S. rolfsii*. Tech. Bull. No. 174. Agric. Expt. Station, North Carolina State University, Raleigh. p. 202.

BBS. 2011. Bangladesh Bureau of Statistics. Ministry of Planning. Dhaka, Bangladesh.

Bhuiyan, M. A. H. B., M. T. Rahman and K. A. Bhuiyan. 2012. *In vitro* screening of fungicides and antagonists against *Sclerotium rolfsii*. African Journal of Biotechnology, 11(82): 14822-14827.

Dey, T.K., M.S. Ali and N. Chowdhury. 1993. Vegetative growth and sporangia production in *Phytopthora colocaseae*. Indian J. Root crops, 17 (2): 142-146.

Gomez, K. A. and A. A. Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd ed., Intl. Rice Res. Inst., John Willy and Sons, New York, Chichester, Brisbane, Toronto, Singapore. pp. 187-240.

Gupta S.K., J.P. Upadhyay and K.H. Ojha. 1997. Effect of fungicidal seed treatment on the incidence of chickpea wilt complex. Ann. Pl. Prot .Sci., 5: 184-187.

Gupta, A. 2006. Efficacy of bio-agents vs. fungicides on disease incidence in chickpea. Ann. Plant Protec. Sci., 14(2): 496-497.

Hannan, M A,, M. M. Hasan, I. Hossain, S. M. E. Rahman, Alhazmi Mohammed Ismail, Deog-Hwan Oh. 2012. Integrated management of foot rot of lentil using biocontrol agents under field condition. Journal of Microbiology and Biotechnology, 22(7): 883-888.

Hannan, M. A., Hasan M. M. and Hossain, I. 2013. Impact of Dual Inoculations with *Rhizobium* and *Trichoderma* on Root Rot Disease and Plant Growth Parameters of Grasspea under Field Conditions. Persian Gulf Crop Protection, 2(1): 1-9.

Hoque, S., N. Sultana, A.N. Faruq, M.Z.R. Bhuiyan and N. Islam. 2015. *In-vitro* evaluation of selected bio-control agents against foot and root rot pathogens of lentil. Scholarly Journal of Agricultural Science, 5(1): 8-15.

Jegathambigai, V., R.S. Wilson Wijeratnam and R.L.C. Wijesundera. 2010. Effect of Trichoderma *sp. on* Sclerotium rolfsii*, the Causative Agent of Collar Rot on* Zamioculcas zamiifolia *and an on Farm Method to Mass Produce* Trichoderma *species. Plant Pathology Journal, 9 (2): 47-55.*

Kashem, M.A., I. Hossain and M.K. Hasna. 2011. Use of trichoderma in biological control of foot and root rot of lentil (*Lens culinaris* Medik). International Journal of Sustainable Crop Production, 6(1):29-35.

Kaur N.P. and A.N. Mukhopadhyay. 1992. Integrated control of 'chickpea wilt complex' by *Trichoderma* and chemical methods in India. Tropical Pest Management, 38(4): 372-375.

Kaur, A. and V.P. Gupta. 2003. Evaluation of seed-dressing fungicides for management of *Sclerotium* collar rot in lentil. Indian J. Pulses Res., 16(1): 75-76.

Khalequzzaman KM, Uddin MK, Hossain MM and Hasan MK. 2016. Effect of Fungicides in Controlling Wilt Disease of Cumin *Malaysian Journal of Medical and Biological Research,* 3, 69-74.

Khalequzzaman, K. (2015). Management of Anthracnose of Hyacinth Bean for Safe Fresh Food Production. *Asian Journal Of Applied Science And Engineering, 4*(2), 102-109.

Khalequzzaman, K. (2015). Screening of BARI Rhizobium Biofertilizers against Foot and Root Rot of Chickpea. *ABC Journal Of Advanced Research, 4*(2), 97-104.

Khalequzzaman, K. (2016). Effect of Fungicides in Controlling Alternaria Blight of Cumin. *Asian Journal Of Applied Science And Engineering, 5*(1), 7-14.

Khalequzzaman, K. M. 2008. Effect of seed treating fungicides and biofertilizers in the incidence of foot and root rot disease of lentil and chickpea. Annals of Bangladesh Agriculture, 12(2): 39-44.

Khalequzzaman, K.M., M.K. Uddin, M.A. Rahman, M.A. Rouf and A.K.M.Z. Rahman. 2003. Effect of fungicides in controlling foot and root rot of French bean by seed treatment. Bangladesh Journal of Agricultural Sciences, 30(1): 9–14.

Khare, M. V., S. C. Agrawal and A. C. Jain. 1979. Diseases of lentil and their control. Technical bulletin. Jabalpur, Madhya Pradwsh, India: Jawaharlal Nehru Krisi Viswa Vidyalaya.

Kochhar, S. L. 2009.'Economic Botany in the Tropics. MacMillan India Ltd., Daryaganj, New Delhi. p. 658.

Rahman, M. Z., A.H. M. Mafuzul Haque, M. A. Zaman, M. F. Amin, and A. K. Das. 2012. Efficacy of two fungicides and two botanicals to control foot and root rot disease *(Sclerotium rolfsii)* of cowpea. Bangladesh J. Plant Pathol., 28 (1&2): 29-32.

Sattar, M.A., A.R. Podder, M.C. Chandra and M. Rahman. 1996. The most promising BNF technology for green legume production in Bangladesh. BNF Association, Dhaka, BD. 28, Nov. 1994. pp. 15-20.

Shaban, W. I. and M. A. El-Bramawy. 2011. Impact of dual inoculation with *Rhizobium* and *Trichoderma* on damping off, root rot diseases and plant growth parameters of some legumes field crop under greenhouse conditions. International Research Journal of Agricultural Science and Soil Science, 1(3) : 98-108.

Shaigan S., A. Seraji and S. A. Moghaddam. 2008. Identification and investigation on antagonistic effect of Trichoderma spp. on tea seedlings white foot and root rot (*Sclerotium rolfsii* Sacc.) in vitro condition. Pakistan Journal of Biological Sciences, 11(19): 2346-2350.

Sharma, S.R. and H.S. Sohi. 1981. Effect of different fungicides against root rot of French bean. Indian J. Mycol. & Plant Path., 11(2): 216-220.

Siddique, S. S., F. Khatun, K. M. Khalequzzaman, R. Momotaz and M. R. Uddin. 2013. Integrated disease management of wilt in chickpea by organic amendment. International Journal of Sustainable Crop Production, 8(1): 5-10

Singh D.K. and M.M. Jha. 2003. Effect of fungicidal treatment against chickpea wilt caused by *F. oxysporum* f.sp. *ciceris*. J. of Applied Biology, 13(1/2): 41-45.

Singh, J. and S. C. Tripathy. 1999. Mycoflora association with stored seeds of *Lens esculenta*. Herbal Pesticide Lab., Dept. of Botany, Gorakhpur Univ. Gorakhpur, India.

Singh, S., A. Sinha and J. Mishra. 2014. Evaluation of different treatment on the occurrences of seed borne fungi of Mungbean Vigna radiata *(L.) Wilczek seed. African Journal of Agricultural Research, 9(44): 3300-3304.*

Sugha, S. K., B. K. Sharma and P. D. Tyagi. 1991. A modified Technique for screening chickpea varieties against collar rot caused by *Sclerotium rolfsii*. Indian J. Agril. Sci., 63(6): 382-385.

Zeid, N.M.A., M.K. Afafa and S. Attia. 2003. Biological control of pre and post-emergence diseases of faba bean, lentil and chickpea in Egypt. Egyptian J. Agrilc. Res., 81(4): 1491-1503.

--0--