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EFFECT OF LIGHT OF DIFFERENT COLOURS ON GROWTH AND COLONIZATION OF ROOT ROT PATHOGENS OF MUNG BEAN

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ABSTRACT

Present research conducted to explore the role of different light rays such as green, blue, red, yellow on growth promotion and in reduction of root rot fungi like, *Macrophomina phaseolina, Rhizoctonia solani* and *Fusarium* spp. on mungbean plants. Blue and green treated light rays for 8 hours enhanced the length and weight of root and shoot as compared to the natural light (control). However, *Macrophomina phaseolina, Rhizoctonia solani* and *Fusarium* spp. colonization were reduced on mungbean plants treated with all light rays at 16 and 24 h time duration particularly green and red light.

Key words: Colored light, pathogenic fungi, pot experiment, time intervals.

INTRODUCTION

Mung bean (*Vigna radiata* L.) Wilczek, belongs to Fabaceae family, considered to be an important pulse crops which was grown in different countries like Pakistan, China, Australia, America and India (Zhang *et al.,* 2011; Clarry, 2016; Fery, 2002). It is a good source of protein with high levels of vitamins and minerals (Nair *et al.,* 2015; Keatinge *et al.,* 2011). Root pathogens infect mung bean plants at different stages like during vegetative stage, reproductive stage, during emergence, at seedling. By this damage, yield loss occurs with complete failure in production. Some of the economically important soil borne vascular diseases like wilt diseases (produce by *Fusarium* species), dry root rot, and charcoal rot (by *Macrophomina phaseolina*) may affect plant at all stages and produce significant loss in yield. *M. phaseolina* rating as most of the devastating disease where pathogen attack all parts including leaves, stem, roots, seeds, branches of plant. According to Dhingra and Sinclair (1978), microsclerotia considered to be the primary inoculum in soil which either embedded in plant tissue or scattered in soil. Another important root infecting fungi is *Rhizoctonia solani* Kuhn, found worldwide which produces a reddish brown lesion at or below soil level results in collar rot symptoms (Basandrial *et al.,* 2016). It is also called as web blight as it produce spider web like mycelial growth with white to brown microsclerotia which is responsible to produce rots in above ground plant parts (Jhamaria and Sharma, 2002). Another root rot disease is caused by *Fusarium* species which enters root system by wounds or root hairs, move towards vascular tissue and can infect any stage of mung bean plants (de Borba *et al.,* 2017). The affected part produces wilt with stunting, leaf yellowing, defoliation and die (Pottorff *et al.,* 2012).

Light is an important factor for all organisms which use light for generating energy. Filamentous fungi maintains signal transduction and regulate network of light sensitive proteins in light (Rodriguez-Romero *et al.,* 2010). However very little information is present regarding role of light in plant pathogens. Those plant fungi which infecting aerial plant organs are faced with an exceptional light regime due to depletion of red and blue light (absorbed for photosynthesis) while surplus of green and far red light (reflected by plant tissue).

Therefore, present research is carried out to study the effect of different light rays against the root rot pathogens and growth of crop plants.

MATERIALS AND METHODS

Seeds of mung bean after washing with sterilized distilled water, treated with Led light of different colors like green (495-570 nm), blue (450-495 nm), red (620-750 nm) and yellow (570-590 nm) separately at different time intervals such as 8, 16 and 24 hours. White natural light was taken as control. Plastic pots were filled with sandy loam soil containing; 74% sand, 9% clay and 17% silt (Gee and Bauder, 1986) having pH 7.6 (Brady, 1990) were placed in screen house of Department of Botany, University of Karachi. Soil was examined for natural infestation

with *R. solani* 27% (Wilhelm, 1955), 8-11 sclerotia g^{-1} of *M. phaseolina* (Sheikh and Ghaffar, 1975), *Fusarium* spp. 3700 cfu g^{-1} (Nash and Synder, 1962). Seeds of mung bean were treated with various color light such as green, blue, red and yellow respectively at different time duration (8, 16 and 24 hours). Each treatment were replicated three times and untreated seeds served as control. Experiments were terminated after thirty days of germination. The data of growth and colonization by root infecting pathogens were recorded.

RESULTS AND DISCUSSION

Seeds treated with green light for 8 h produced better root length while red light treated seeds for 8 h promoted root length and shoot weight in mung bean ($P<0.001$). However, significant ($P<0.001$) root weight was recorded when yellow light used to treat seeds for 8 h (Table 1). According to Paradiso *et al*., (2011), less-efficient lights like green, far-red, and UV light enhanced photosynthesis, phytochemicals and biosynthesis of pigments in few plants. Combination of red and blue light improved net photosynthetic rate in leaves and crop yield by improving phenolic compound accumulation but exceeded level of blue light decreased yield among plant species and cultivars (Amaki *et al*., 2011; Bugbee *et al*., 2016).

Table 1. Effect of rays of different colors rays on growth and colonization of root infecting fungi on mung bean.

Treatments		Shoot length (cm)±SE	Root length (cm) ± SE	Shoot weight (g) ± SE	Root weight (g) ± SE	*Fusarium* spp ± SE	*R. solani* ±SE	*M. phaseolina* ±SE
Color light	Time (hours)							
Control	8	16 ± 0	9.36 ± 0.16	1.73 ± 0.03	0.9 ± 0	66.66 ± 6.66	26.66 ± 6.66	60 ± 11.54
Control	16	18 ± 0	3.26 ± 0.13	0.7 ± 0	0.27 ± 0.003	33.33 ± 6.66	0 ± 0	33.33 ± 13.3
Control	24	14.13 ± 0.08	3.0 ±0	0.3 ± 0	0.6 ± 0	20 ± 0	0 ± 0	33.33 ± 6.66
Green	8	27.03 ± 0.20	6.36 ± 0.03	2.0 ± 0	0.7 ± 0	6.66 ± 6.66	6.66 ± 6.66	40 ± 0
Green	16	18.1 ± 0.1	4.0 ± 0	0.76 ± 0.03	0.20 ± 0.003	46.66 ± 6.66	0 ± 0	0 ± 0
Green	24	20 ± 0	1.83 ± 0.03	1.06 ± 0.03	0.7 ± 0	20 ± 0	0 ± 0	0 ± 0
Blue	8	18.33 ± 0.33	7.9 ± 0.1	1.86 ± 0.03	2 ± 0	13.33 ± 6.66	13.3 ± 6.66	13.33 ± 6.66
Blue	16	25 ± 0	9.23 ± 0.23	1.0 ± 0	0.4 ± 0	66.66 ± 6.66	0 ± 0	20 ± 0
Blue	24	17.8 ± 0.11	6.03 ± 0.03	0.5 ± 0	0.36 ± 0	73.33 ± 6.66	0 ± 0	20 ± 0
Red	8	25 ± 0.5	10.83 ±0.12	3.0 ± 0	0.6 ± 0	6.66 ± 6.66	26.6 ± 13.3	6.66 ± 6.66
Red	16	17.9 ± 0.1	4.33±0.33	0.66 ± 0.03	0.22 ± 0.03	33.33 ± 6.66	0 ± 0	20 ± 11.54
Red	24	16.86 ± 0.46	3.0±0	0.53 ± 0.03	0.5 ± 0	20 ± 11.5	0 ± 0	0 ± 0
Yellow	8	18.83 ± 0.16	7.53±0.26	2.56 ± 0.03	0.9 ± 0	26.66 ± 6.66	26.66 ± 6.66	6.66 ± 6.66
Yellow	16	18 ± 0	2.13±0.06	0.4 ± 0	0.20 ± 0.003	33.33 ± 6.66	0 ± 0	33.3 ± 6.66
Yellow	24	20 ± 0	1.93±0.03	0.5 ± 0	0.4 ± 0	20 ± 0	0 ± 0	60 ± 0
$LSD_{0.05}$	Treatment	0.357	0.241	0.037	0.014	10.73	8.11	11.11
Time		0.276	0.187	0.029	0.011	8.317	6.28	8.610

Presently, colonization of roots by *Fusarium* species was reduced when green and red light used for 8 hours ($P<0.001$). *R. solani* was completely reduced when all light used for 16 and 24 hours. Green light at 16 and 24 hours and red light for 24 hours completely inhibited the colonization of *M. phaseolina* in mung bean roots ($P<0.001$; Table 1). Bansod *et al.* (2017) observed that blue and red LEDs are highly effective to Pigeon pea plants from fungal attacks due to production of osmo-protectants and antioxidants including ROS scavenging enzymes. It was observed that red light reduced lesion development of *Phytophthora capsici* on detached leaves of eggplant, pepper, pumpkin and water melon (Umezu *et al.*, 1999).

Different light rays used as seeds treatment showed profound results in the improvement of growth but also controlled root pathogens but best results was achieved by the treatment with green, red and yellow light at 16 hours followed by 8 and 24 hours as compared to natural light (control). Therefore, it is strongly recommended that it can be used in larger scale due to ecofriendly, inexpensive and non-toxicity to the soil environment.

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