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Effect of Endophytic Fungi on the Growth of Vegetable Plants

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ABSTRACT

There are various weeds at the road sides and in the agriculture field that having endophytes and makes resistant to their hosts. Now-a-day farmers are more shifting towards the use of the bio-fertilizers (organic fertilizer) rather than the chemical fertilizers. Endophytic bacteria and fungi with media directly used as bio-fertilizers. In present investigation, endophytes isolated from weeds *Achyranthes aspera* L. and *Amaranthus cruentus* L. Isolated Endophytic fungi were applied on the chili and tomato seeds. These vegetables have showed positive response to samples used.

***Key words*:** Weeds, Bio-fertilizers, Endophytic fungi, *Achyranthes, Amaranthus*

Endophytes are the microbes that live in plant body without any harm. Most of plants having bacteria and fungi with mutual nature i.e., both host plants and microbes beneficial to each other. Plants become resistance against diseases, abiotic stresses like drought, salinity, nutrient deficiency, metal toxicity etc., while endophytic microbes getting food and shelter from their host [1-2]. There are various weeds at the road sides and in the agriculture field that having endophytes. These endophytes make resistant to their hosts. Various investigations show that endophytes promote plant growth by improving the soil structure, increasing the nutrient availability, secreting stimulating enzymes, induced the defence mechanism of plant and production of phytohormones [3]. The endophyte *Aspergillus fumigatus* isolated from soybean root released different bioactive gibberellic acids in significant amount like GA3 (8.38 ng/ml), GA4 (2.16 ng/ml) and GA7 (1.56 ng/ml) and inactive GA7 (0.5 ng/ml), GA19 (1.2 ng/ml) and GA24 (0.8 ng/ml) in its cultural filtrate. Hence highest speed (4.087) of soybean seed germination was revealed [4].

With the progress in the agriculture field, bio-fertilizers are very common in use. Now a day more farmers are shifting towards the use of bio-fertilizers rather than the chemical fertilizers. Endophytic bacteria and fungi with media directly used as bio-fertilizers. A biofertilizer is an inoculant which contains living microorganisms [5-6].

Achyranthes aspera L., belongs to family Amaranthaceae, is an erect and much diffuse branched herb, having much medicinal value, frequently found in tropical and warmer regions as weed [7]. *Aspergillus flavus*, *Cladosporium sp.*, *Xylaria sp*. likes endophytes were isolated from *A. aspara*. The plant growth-promoting activities of endophytic fungi isolated from various parts of a Chinese medicinal plant *Sophora flavescens* have been revealed and investigated. Plant growth-promoting abilities of fungal isolates were evaluated in plate assays [8]. In present investigation endophytes isolated from weeds *Achyranthes aspera* L. and *Amaranthus cruentus* L. Isolated Endophytic fungi were applied on the chilli and tomato seeds.

MATERIALS AND METHODS

Healthy *Achyranthes aspera* L. and *Amaranthus cruentus* L. plants were collected from Dr. Babasaheb Ambedkar Marathwada University, Aurangabad campus. Roots, stems and leaves of the plant were washed under tap water for 10–15 min separately. Surface sterilization was done in four steps. First, samples were rinsed in tap water. Then, the samples were immersed in 70% alcohol for 1 min, followed by 3.5% sodium hypochlorite for 2 min, 70% ethanol for 30 sec and washed with sterile water until no trace of the previous solution was left [9]. Isolation process of endophytic fungi from *Achyranthes aspera* L. and *Amaranthus cruentus* L. was done using Potato Dextrose Agar. The surface-sterilized sample was placed in Petri dishes that containing the PDA medium and incubated for 1 week at 27°C. After one week of incubation, all fungi isolates were transferred into another PDA plates.

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Prior to germination the selected isolated fungal strains were inoculated in a potato dextrose broth medium (250ml) and afterwards incubated for 14 days at 26-28°C temperature [10]. Black cotton soil + Coco pit + Vermi compost mixed well in 1:1:1 ratio and filled in double different autoclavable polythene bags and autoclaved two times at 120ºC and 15 Lb pressure for 20 min. Made two holes at bottom of plastic trays that steriled with ethanol. After that unpacked to the autoclaved soil pack in that tray and sprayed double sterile distilled water. Now soil was ready to sow the seeds. The seeds were collected from ripened chili and tomato. We were avoiding use of certified seeds because these seeds may be coated with different fungicides and antibiotics. Under the sun light all seeds were dried and their viability was checked for the germination. Hundreds of seeds were selected and surface sterilized by using sodium hypochlorite. Treated seeds were washed three times with sterile distilled water and dried on sterile tissue paper before sowing. The treated seeds were immersed into 10 ml broth of fungi as bio-fertilizer [11]. For the adherence of spores over the seeds sterilized liquid jaggery was used. Seeds dried again on sterile tissue paper.

After the seed treatment five seeds were sowed in each tray with the help of sterile forceps. Hide the seeds with soil and sprayed distilled water daily in the morning. There are some crops which need to perform uprooting and root dipping for more yield, tomato and chili are the example of them. After the 25th days of sowing uprooted seedlings collected from trays and root dipping were done in buckets. We used same soil Black cotton soil + Coco pit + vermi compost mixed well in 1:1:1 ratio to perform root dipping. At the time of root dipping, we were performed treatment of root using broth inoculated with endophytic fungi [11].

RESULTS AND DISCUSSION

A total of 19 isolates were obtained from different tissue fragments from *Achyranthes aspera* L. and *Amaranthus cruentus* L. plants (Table 1)

Table 1 Isolates of *Achyranthes aspara* L. and *Amaranthus crucient* L.

	Achyranthes aspera L.	*Amaranthus cruentus* L.
Root	*Fusarium coffiactum*	*Macrophomina pseudophaseolina*
	Ectophoma multirostrata	*Fusarium nygamai*
	Aspergillus aflatoxiformans	*Fusarium falciforme*
	Chaetomium globosum	
	Chaetomidium arxii	
	Aurvularia americana	
Stem	*Nigrospora hainanensis*	*Ovatospora senegalensis*
	Chlamydosporum fuscum	*Chaetomium globosum*
	Ectophoma multirostrata	
	Cholletotrichum chlorophyti	
Leaves	*Diaporthe melonis*	*Chaetomium globosum*
	Epicoccum pneumonia	
	Nigrospora pyriformis	

In first experiment, Chili crop were used as host and total 19 strains were used as bio-fertilizer. Observations showed that out of 19 samples, eight samples were showed positive response (Table 2).

Table 2 Chili crop response to endophytic fungal strains

Sample code	Response	Sample code	Response
Ach/R/3,	0	Ach/L/5,	+
Ach/R/4,	0	Ach/L/6	+
Ach/R/5,	0	Am/R/2	0
Ach/R/7,	0	Am/R/3,	+
Ach/R/8,	0	Am/R/4,	+
Ach/S/1,	+	Am/R/5,	+
Ach/S/4,	0	Am/L/2,	0
Ach/S/6,	0	Am/S/2	+
Ach/S/7,	0	Am/S/4	0
Ach/L/3,	+	controlled	0

In second experiment, tomato crop were used as host and there was total 8 samples used as bio-fertilizer. Some of them showed long height as compared to controlled but there was no fruit. Some of them were short in height but there were fruits present (Table 3).

CONCLUSION

Endophytic fungi are symbiotically associated with plants. They can help to plants for survival in biotic and abiotic stresses. Hence in modern agriculture it may be used as bio-fertilizers. In present investigation endophytic fungi were isolated from the roadside weed *Achyranthes aspera* L. and Agricultural weed *Amaranthus cruentus* L. and apply of the Chili and Tomato crops. Here we did the artificial inoculation of endophytic fungi on crops as bio-fertilizer. We were used autoclaved soil for these experiments hence physically plant growth and development were not observed very well. But it may be concluded that due to treatment with these endophytic fungi, crop plants were showed

satisfactory growth and fruit development. In future experiments we will perform field trials.

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Table 3 Tomato crop response to endophytic fungal strains

Sample code	Response	
	Height	Fruits
Ach/S/1	+	0
Ach/S/6	+	0
Ach/L/3	+	+
Ach/L/5	+	0
Am/R/2	+	+
Am/R/3	+	+
Am/R/5	+	+
Am/S/2	+	0
Controlled	0	0

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