EFFECT OF FOLIAR APPLICATION OF SULPHUR ON RHIZOPLANE MYCOFLORA OF EH-3 AND VARUNA

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Abstract:

Effect of foliar application of sulphur on rhizoplane mycoflora Brassica juncea cv EH-3 and Varuna was determined by serial–root washings technique. Foliar application of sulphur was given at different stages of plant growth (seedling, flowering and maturity) by using Bensulf (Deepak fertilizers) and the doses were made of 1% and 3% respectively. During the investigation it was observed that the number of fungi was comparatively more at flowering stage than seedling and at maturity stages. It was observed that specific fungi were observed at different stages of plant growth. Fungi like Aspergillus sp., Cuvularia sp., Alternaria sp. and Fusarium sp were dominant in rhizoplane of both the cultivar plants.

Keywords: Foliar application, rhizoplane sulphur, serial-root washing, *Aspergillus* sp.& *Alternaria* sp.

Introduction:

The growth and development of the plants are controlled by both biotic and abiotic factors. Abiotic factors include pH of soil and irrigation water, nutrient availability, temperature and light-intensity while the biotic factors include microbes, pathogens, weeds etc. In soil, thousands of bacteria, actinomycetes, fungi, protozoa, slimy molds, algae, nematodes, chytrids, earthworms, millipedes, centipedes, insects, mites, snails, small animals and soil viruses compete constantly for water, food, and space and all these organisms play a vital role in disintegrating and decomposition of plant residues and animal wastes. Disintegration and decomposition of animal and plant waste are converted into the harmless or inert substances.
The term rhizoplane was proposed by Clark (1949) and described the immediate external surface of plant roots together with closely adhering soil particles or root debris. Vuurde (1978) studied the rhizoplane microflora of wheat and due to the urea leaf treatment he found that the bacteria and actinomycetes were stimulated after seven and nine days but the total number of fungi reduced after nine days. Soil being loaded with millions of microorganisms directly affects the plant growth. As a result in a given location the interaction between the soil and microorganisms becomes dynamics and distinct. According to Rangaswami (1988) the effect of a growing plant on the microorganisms depends broadly on Age of plants, Physical and nutritional conditions, Depth and maturity of the root system, Nature of the soil and its various physicochemical and biological properties.

Addition of plant nutrients or foliar application to the soil or plant causes exudation of some chemicals by the plant roots. The altered root exudation also alters the pattern of rhizosphere microflora both qualitatively and quantitatively. Attempts have been made in recent years to influence the rhizosphere microflora through various extraneous means like soil amendments with organic matter and fertilizers, foliar applications of various nutrients,

antibiotics, growth regulators and fungicides (Annapurna and Rao, 1982). Such changes are readily reflected in the plant rhizosphere (Dublish, 1986).

Material and Method :

To investigate the rhizoplane mycoflora of *Brassica juncea* var. Varuna and cultivar line EH-3 was selected for experimental study. Out of these two materials EH-3 is a quality material having zero erucic acid and low glucosinolate with 37% of oil content whereas, Varuna is a non-quality material having high erucic acid and high glucosinolate with 41% of oil content. The seeds were procured from the Dhara Vegetable Oil and Foods Company Ltd. sponsored project, Department of Botany, R.T.M. Nagpur University, Nagpur.

The seeds were grown in the field and the foliar applications were made to alter the rhizoplane mycoflora. The data was recorded at different stages of growth of the plant i.e. seedling stage, flowering stage and maturity stage. Mycoflora isolated from rhizoplane were identified and maintained in pure culture.

Foliar application of sulphur was given at different stages of plant growth (seedling, flowering and maturity) by using Bensulf (Deepak fertilizers) and the doses were made of 1% and 3% respectively.

Mycoflora of Rhizoplane was isolated by serial–root washings technique (Harley and Waid, 1955).

Isolated fungi were identified with standard literature (Nagmani et. al. 2006, Booth, 1977, Rapr and Fennel, 1965 & Raper and Thom, 1949) available in the Mycology Department, University Campus Nagpur.

Result and discussion :

Rhizoplane mycoflora of control as well as treated plants was isolated at different stages of plant growth i.e. seedling, flowering and maturity. During the investigation it was observed that the number of fungi was comparatively more at flowering stage than seedling and at maturity stages.

Rhizoplane mycoflora of control plants :

In all 12 fungi were isolated from rhizoplane of EH-3 at different stages of plant growth. Amongst the 12 fungi *Aspergillus niger*, *A. fumigatus*, *A. nidulans*, *A. flavus*, *Curvularia lunata*, and *Fusarium oxysporum* were isolated throughout the growing season from rhizoplane of EH-3. In addition to these, *Aspergillus terreus* occurred at maturity stage and *Alternaria alternata* and *Alternaria* sp. was isolated at flowering and maturity stage. Occurrence of fungal species varied according to growth of the plants. At seedling stage *Aspergillus niger* was found to be the most dominant fungus followed by *Aspergillus fumigatus*, *Curvularia lunata* and *Fusarium oxysporum*. At flowering stage *A. niger* and *A. fumigatus* were the most dominant fungi. While at maturity, *Curvularia lunata* dominated the rhizoplane (Table 1).

In all 10 fungi were isolated from rhizoplane of Varuna plants at different stages of plant growth. *Aspergillus niger*, *A. fumigatus*, *A. flavus*, *Curvularia lunata*, *Fusarium oxysporum* and *Fusarium sp. 1* were isolated throughout the growth of plants. Occurrence of fungi varied according to the growth stages. At seedling stage *Aspergillus niger* and *Curvularia lunata* were the most dominant fungi. At flowering stage *Curvularia lunata* was the most dominant fungus while, at maturity *Fusarium oxysporum* was dominant fungus (Table 1).

Effect of foliar application Sulphur on rhizoplane mycoflora :

Sulphur was sprayed at the concentration of 1 and 3%. *Aspergillus niger*, *Alternaria alternata* and *Curvularia lunata* were isolated throughout the plant growth of EH-3 and Varuna (Table 1).

Total 20 and 18 fungi were isolated from the rhizoplane of 1 and 3% S treated plants of EH-3 respectively. Apart from these fungi *Aspergillus nidulans*, *Alternaria alternata* and *Curvularia lunata* were isolated throughout the growth of EH-3 when they were sprayed with 1 and 3% S. In addition to these, *Alternaria* sp. was isolated throughout the growth of plants when it was treated with 1% sulphur. Similarly, *Aspergillus fumigatus*, *A. flavus*, *Fusarium* sp. 1 and *Drechslera* sp. were isolated throughout the growth of plants when plants were sprayed with 3% sulphur.

Occurrence of fungi varied according to the growth of plants and concentration of sulphur sprayed on plants. Due to the foliar application of 1% S, at seedling stage *Aspergillus niger* dominated the rhizoplane mycoflora. At flowering stage *Aspergillus niger*, *Alternaria alternata*, and *Phoma* sp. were the most dominant fungal species. While, at maturity stage *Curvularia lunata* was observed as the most dominant fungus. While in 3% sulphur treated plants *Aspergillus fumigatus* dominated the rhizoplane. At flowering stage, *Alternaria* sp. and *Fusarium* sp. 1 were found to be the most dominant whereas, at maturity stage *Aspergillus nidulans*, *Aspergillus terreus* and *Alternaria alternata* were the most dominant fungi at 3% S sprayed plants (Table 1).

Total 18 fungi were isolated from the rhizoplane of Varuna plants when it was sprayed with sulphur at the concentration of 1% and 3% (Table 1). Apart from *Aspergillus niger*, *Alternaria alternata*, *Curvularia lunata* other fungi like *Rhizopus* sp. was isolated throughout the growth of plants. Apart from these fungi *Aspergillus fumigatus* and *Phoma* sp. were isolated throughout the growth period from rhizoplane of Varuna plants when sprayed with 1% S. Similarly, *Fusarium* sp. 1 was isolated throughout the growth of plants from rhizoplane of Varuna when sprayed with 3% S. Occurrence of fungi varied with the growth of plants and concentration of sulphur sprayed on the plants. At seedling stage, when sulphur was sprayed at the concentration of 1%, *Alternaria alternata*, *A. flavus*, *Fusarium graminearum* and *Phoma* sp., were the most dominant fungi. At flowering stage, *Aspergillus niger* and *Alternaria* sp. were found to be the dominant fungi while at maturity stage, again *Aspergillus niger* was the dominant fungus. Similarly when Varuna plants were sprayed with sulphur at the concentration of 3% occurrence of fungal species varied at different stages of plant growth. At seedling stage *Aspergillus niger*, *Aspergillus flavus* and *Fusarium oxysporum* were the most dominant fungi. At flowering stage *Alternaria* sp. and *Fusarium* sp. 2 were dominant while at maturity stage *Alternaria alternata* was the most dominant (Table 1). It was observed that specific mycoflora was present in rhizoplane during different growth stages. Wadhwani and Mehrotra (1982) have also reported the specific mycoflora in rhizosphere and rhizoplane of smut infected plants of *Cynodon dactylon*. Schroth and Hilderband (1964) reviewed the influence of plant exudates on root infecting fungi and concluded that the phenomenon of exudation from plant parts affected a vast variety of interaction in the rhizoplane and rhizosphere. At seedling stage of EH-3, *Aspergillus* species occurred as most dominant fungi in control as well as foliar treated plants. Upadhyay and Rai (1983), Pandey and Upadhyay (2000), also reported the highest number of *Aspergillus* colonies in rhizosphere soil of pigeon pea. Apart from this, Curvularia lunata (1% P) was dominant while at maturity *Aspergillus niger* and *A. fumigatus* were found to be

dominant in both control as well as foliar treated plants. Apart from these fungi several other fungi *Alternaria alternata* (0.5% P), *Rhizopus sp*. (1% P), were also dominant at flowering stage with particular foliar application. Similarly, at maturity *Alternaria alternata* and *Aspergillus* sp. were the most dominant in most of the foliar applications while Dhedhi et al. (1990) have reported *Penicillium funiculosum, P. pineophilum, Trichoderma harzianum* and *T. viride* throughout the growth of healthy plants of chickpea.

Rhizoplane of Varuna also showed specific fungi at different stages of plant growth. During the study, *Aspergillus* sp. were found to be the most dominant fungus. Abdel-Wahid and Ibrahim (1997) also reported the highest mycoflora of *Aspergillus* and *Penicillium* in rhizoplane of Tomato. Mishra (1978) reported the rhizoplane mycoflora of *Corchorus capsularis, C. oltoritus* and *Hibiscus cannabinus*. He found that most of the rhizoplane mycoflora belonged to Deuteromycetes out of which *Fusarium* sp., *Sclerotium* sp., sterile dark mycelia and *Aspergilli* were fairly constant from seedling to the fruiting stage of plants.

Foliar application of Sulphur altered the rhizoplane mycoflora. The qualitative changes occurred in rhizoplane of foliar treated plants at different stages of plant growth, this might be attributed to the physiological specialization and nutritional requirements of the particular fungi.

Table 1: Rhizoplane mycoflora of *Brassica juncea* cv EH-3 and Varuna at different stages of plant growth when sprayed with sulphur.

S. No.	Fungal isolates	Control						EH-3						Varuna					
		EH-3			Varuna			1% S			3% S			1% S			3% S		
		S	F	M	S	F	M	S	F	M	S	F	M	S	F	M	S	F	M
1	*Absidia* sp.	-	-	-	-	-	-	-	8.70	-	-	5.66	2.13	9.09	5.56	-	-	5.77	-
2	*Alternaria alternata*	-	6.45	-	-	9.68	12.50	5.26	10.87	10.42	5.13	11.32	10.64	11.36	12.96	10.53	6.82	9.62	15.38
3	*Alternaria* sp.	-	9.68	7.69	-	9.68	9.38	7.89	4.35	10.42	-	13.21	-	-	11.11	-	-	13.46	-
4	*Aspergillus flavus*	7.41	9.68	7.69	8.70	6.45	9.38	7.89	8.70	-	2.56	5.66	8.51	11.36	-	5.26	13.64	-	3.85
5	*Aspergillus fumigatus*	14.81	12.90	10.26	8.70	9.68	12.50	10.53	-	-	17.95	5.66	8.51	6.82	9.26	5.26	-	5.77	7.69
6	*Aspergillus nidulans*	7.41	3.23	7.69	-	9.68	-	5.26	4.35	6.25	12.82	5.66	10.64	6.82	-	-	9.09	-	-
7	*Aspergillus niger*	18.52	12.90	12.82	17.39	9.68	6.25	15.79	10.87	8.33	7.69	7.55	8.51	6.82	12.96	14.04	13.64	7.69	5.77
8	*Aspergillus terreus*	-	-	2.56	-	-	-	10.53	-	6.25	-	-	10.64	6.82	5.56	-	9.09	9.62	-
9	*Curvularia lunata*	14.81	9.68	15.38	17.39	12.90	9.38	7.89	8.70	12.50	10.26	7.55	4.26	4.55	5.56	3.51	11.36	3.85	9.62
10	*Curvularia* sp.	11.11	9.68	7.69	13.04	-	9.38	7.89	6.52	-	-	-	-	-	7.41	-	-	-	-
11	*Drechslera* sp.	-	-	-	-	6.45	-	-	8.70	8.33	7.69	5.66	8.51	-	5.56	5.26	-	5.77	11.54
12	*Fusarium graminearum*	-	-	-	-	-	-	-	6.52	6.25	5.13	-	6.38	11.36	5.56	-	4.55	7.69	-
13	*Fusarium oxysporum*	14.81	9.68	15.38	8.70	6.45	15.63	7.89	-	8.33	7.69	-	4.26	9.09	-	12.28	13.64	-	11.54
14	*Fusarium* sp. 1	3.70	9.68	-	13.04	9.68	9.38	-	6.52	6.25	7.69	13.21	8.51	-	-	-	4.55	3.85	11.54
15	*Fusarium* sp. 2	-	-	-	-	-	-	2.63	2.17	-	5.13	3.77	-	-	1.85	10.53	-	13.46	-
16	*Helminthosporium* sp.	-	-	-	-	-	-	-	-	6.25	-	5.66	4.26	-	-	7.02	-	-	9.62
17	*Phoma* sp.	-	-	-	-	-	-	-	10.87	6.25	-	1.89	4.26	11.36	7.41	8.77	-	5.77	5.77
18	*Rhizopus* sp.	7.41	6.45	5.13	13.04	6.45	6.25	10.53	-	-	10.26	-	-	4.55	7.41	7.02	11.36	7.69	7.69
19	*Trichoderma viride*	-	-	-	-	-	-	-	-	-	-	3.77	-	-	1.85	10.53	-	-	-
20	Mycelia sterilia	-	-	-	-	3.23	-	-	2.17	4.17	-	3.77	-	-	-	-	2.27	-	-

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