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Studies on the Survival of the Rice Brown Spot Fungus *Helminthosporium oryzae* Breda de Hann in Soil*

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The periods of survival of *H. oryzae*, the brown spot fungus in sterilized and unsterilized soil was studied. The survival of *H. oryzae* as spore suspension, inoculated leaves and inoculated grains in sterile soil was 115, 130 and 130 days respectively. On the other hand, in unsterile soil the survival of the pathogen added as spore suspension, inoculated leaves and grains was 85, 115, and 115 days respectively. The increase in actinomycetes population could be correlated with the decrease in *H. oryzae* population

The mode of survival and persistence of the plant pathogen added to the soil survive only for shorter time together. The possibilities of soil dwelling saprophytes acting on the added pathogen and reducing the pathogenecity was studied with *Trichoderma* sp by Allen and Haenscler (1935). Stover (1959) found that the population of *Fusarium oxysporum* f. *cubense* remained always higher and thrived in sterilized and flooded soils. He also observed that the population of the same had declined rapidly during the first month and were seldom detectable after six months in unsterile soil.

MATERIAL AND METHODS

Mud pots of 4" diameter filled with clay loam soil were sterilized by autoclaving at 20 psi for 3 hr. Another set of pots was maintained under unsterile condition. Spore suspension of *H. oryzae* (Ca. 10,000/ml) was added to the pots. The soil moisture was adjusted to 50 per cent moisture holding capacity by adding sterile water. The spores were mixed thoroughly and incubated at room temperature (2±1°C). The microbial population was assessed by the dilution plate method using Rose Bengal Agar, Soil extract agar and Kenknights agar for fungi, bacteria and actinomycetes respectively.

In order to study the survival of the pathogen infected plant materials added to the soil, rice leaf bits and grains infected with isolate of H. *oryzae* were buried in pots containing sterile and unsterile soils. The leaf bits and grains were removed periodically and placed on sterile potato dextrose agar medium in petridishes to find out the survival.

RESULTS AND DISCUSSION

The rusults are presented in the Table I. In the uninoculated unsterile

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TABLE I. Survival of *Helminthosporium oryzae* in sterile and unsterile soils

Sampling days	Spore Suspension[1]		Inoculated leaves[2]		Inoculated grains[3]	
	Unsterile	sterile	Unsterile	sterile	Unsterile	sterile
Initial	0.86	0.92	0.96	1.28	1.43	1.56
10	1.07	1.36	1.33	1.14	1.27	1.32
25	0.91	0.94	0.89	0.97	1.08	1.21
40	0.63	0.71	0.77	0.76	0.86	0.97
55	0.44	0.53	0.61	0.64	0.77	0.83
70	0.29	0.29	0.49	0.49	0.56	0.62
85	0.03	0.18	0.27	0.35	0.41	0.53
100	0	0.09	0.13	0.21	0.22	0.31
115	0	0.01	0.06	0.13	0.09	0.21
130	0	0	0	0.06	0	0.08
145	0	0	0	0	0	0

(1) Population in 10^3/g of soil on dry basis
(2) and (3) data represent average of three replications.

TABLE II Changes in the fungal population* due to inoculation of *H. oryzae*

Treatment	Sampling days (P_1 P_{11})										
	Initial	10	25	40	55	70	85	100	115	130	145
T_1 Unsterile Soil	1·21	1.34	1.34	1.26	1.42	1.31	1.22	1.28	1.39	1.38	1.29
T_2 Unsterile Soil+*H oryzae* spore suspension	1.23	1.31	1.21	1.11	1.28	1.32	1.15	1.25	1.34	1.31	1.29
T_3 Unsterile Soil+*H.oryzae* inoculated leaves	1.23	1.22	1.31	1.21	1.26	1.25	1.28	1.33	1.23	1.34	1.29
T_4 Unsterile Soil+*H.oryzae* inoculated grains	1.33	1.21	1.34	1.01	1.40	1.20	1.15	1.28	1.26	1.33	1.29

*Population in 10^3 g of soil an dry basis.

Test of significance	Treatment	Period
	NS	**
SED	0.56	0.132
CD	–	0.27

soil bacterial and fungal populations fluctuated while that of actinomycetes population showed a general decrease with increase in sampling period. The population of *H. oryzae* added as spore suspension to unsterile soil, showed an initial increase, but decreased gradually and after 85 days no sporse survived while it survived for 115 days in sterile soil. In soil mixed with *H. oryzae* inoculated leaf bits and grains, the population of the pathogen decreased gradually and no colony was observed after 115 days and 130 days in unsterile and sterile soil respectively.

TABLE III. Changes in the bacterial population* due to inoculation of *H. oryzae*

Treatment	Sampling days (P_I to P_{11})										
	Initial	10	25	40	55	70	85	100	115	130	146
T_1 Unsterile Soil	269.21	287.01	196.73	282.64	286.67	281.18	247.93	279.60	294.51	296.72	296.21
T_2 Unsterile soil + *H. oryzae* spore suspension	281.02	284.61	291.26	282.30	278.13	281.90	290.61	278.41	279.13	297.13	289.14
T_3 Unsterile soil + *H. oryzae* inoculated leaves	281.43	288.12	273.10	284.25	276.61	174.26	281.40	278.26	279.26	280.52	278.72
T_4 Unsterile Soil + *H. oryzae* inoculated grains	262.92	283.21	284.12	275.45	273.78	276.41	277.14	261.94	259.35	258.41	261.39

* Population in 10^3/g of soil on dry basis.

	Treatment	Period
Test of significance	**	**
SED	0.51	0.14
CD	—	—

TABLE IV. Changes in the actinomycete population* of soil as influenced by the inoculation of *H.oryzae*

Treatment	Sampling days (P_1 P_{12})										
	Initial	10	25	40	55	70	85	100	115	130	145
T_1 Unsterile soil	46.40	38.10	39.60	38.40	37.50	34.50	33.80	37.40	36.20	34.30	33.60
T_2 Unsterile+*H. oryzae* spore suspension	42.26	38.74	42.10	38.52	39.92	40.03	43.30	41.91	41.21	39.08	40.21
T_3 Unsterile+*H. oryzae* inoculated leaves	33.17	35.37	33.84	34.62	35.38	40.21	10.20	39.81	41.38	41.40	40 32
T_4 Unsterile + *H. oryzae* inoculated grains	36.07	42.51	38.21	38.24	36.83	39·83	38.71	46.12	41.70	40.88	41.91

*Population expressed in 10^4 g of soil or dry basis.

Test of significance	Treatment	Period
	xx	xx
SED	2.1573	4.130
CD	2.04	—

Stover (1959) reported that then *Fusarium oxysporum f. cubense* added to the unsterile and sterile soils declined rapidly in the first month and was seldom detected consistently after 6 months in non-sterile soil. Rangaswami and Prasad (1961) found that *Fusarium* spp. and *Xanthomonas cassiae* were suppressed by the soil bacteria and actinomycetes in unsterile soil. Ethiraj (1962) found that *Helminthosporium* spp. added to sterile soil survived for a longer period than the unsterile soil.

In unsterile soil, there is a constant competition for nutrients among the myriad groups of microoganisms and the observed decline in the population may possibly be due to depletion of the certain nutrients in the ecosystem (Papavizas and Ayers, 1965). In the present study, the actinomycetes population increased with a decrease of *H. oryzae* population in all the treatments. The data further showed that the population of bacteria and fungi did not have any statistical significance in respect of the survival of *H. oryzae*. As suggested by Rangaswami and Vidhyasekaran (1963), the presence of the antagonistic actinomycetes in the soil might be responsible for the decline of the population of *H. oryzae*.

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REFERENCES

ALLEN, M. C. and C. M. HAENSCLER. 1935. Antagonistic action of *Trichoderma* and *Rhizoctonia* and other soil fungi. *Phytopathology*, 25: 244-52.

ETHIRAJ. S. 1962. *Studies on the survival of three species of Helminthosporium added to the soil.* Unpub. M.Sc., Thesis. submitted to the Annamalai University. South India.

PAPAVIZAS. G. C. and W. A. AYERS, 1965. Virulence, host range and pectolytic enzymes of single basidospore isolates of *Rhizoctonia bataticola* and *Rhizoctonia solani*. *Phytopathology*, 55: 111-16.

RANGASWAMI. G. and N. N. PRASAD. 1961. Studies on the survival of plant pathogens added to the soil. I. *Fusarium* sp. and *Xanthomonas cassiae*. *Indian Phytopath.* 14: 83-87.

RANGASWAMI, G. and P. VIDHYASEKARAN, 1963. Antibiotic production by *Streptomyces* sp. in corn rhizcsphere. *Phytopathology*, 53: 995-97.

STOVER. R.H. 1959. Growth and survival of root infecting fungi in soil. In: *Plant Pathology problems and progress* 1908-1958 (eds.) C.S. Holton, C. W Fisher, R.W. Fulton, H. Hatt and S.E. McCallan. Univ. Wisconsin, Press. Madison, pp. 339-55.