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EFFECT OF T. M. V. AND CERTAIN CHEMICALS ON THE RHIZOSPHERE MICROFLORA Or TOBACCO*

S. BALAKRISHNAN AND J. SAM RAJ
Division of Plant Pathology, Agricultural College & Research Institute, Vellayani, Kerala State

When a plant becomes diseased, changes are likely to occur in its matabolism. Quantitative and qualitative changes in the root exudates can also occur which may have a direct influence on the microbial population in the rhizosphere. Thus Lakshmikumari (1960) found an increase in the number of microorganisms in the rhizosphere of *Dolichos lablab* plants infected by the Dolichos enation mosaic virus. A similar effect was noticed by Ranganathan (1965) in banana plants infected by the bunchy top virus.

In a like manner, introduction of chemicals, especially those having systemic action, into plants was found to bring about changes in the rhisosphere microflora by workers like Halleck and Cochrane (1950) Venkatram (1960) Sadasivan (1963) and Kandasamy and Rangaswami (1967).

In the present investigations an attempt was made to study the effect of tobacco mosaic virus and also of certain chemicals on the rhizosphere microflora of tobacco plants. The individual effects of the virus and the chemicals on the plant as well as the effect of pretreating the plants with chemicals before inoculation were determined.

Material and Methods

Potted tobacco plants of the *Jaffna* variety were used. The potting mixture was made up of farm yard manure, river sand and garden soil in the ratio 1: 1: 1.

The rhizosphere microflora was determined by the soil dilution and plate counts method (Timonin 1940). Soil extract agar (Taylor and Lochhead 1938), Kenknight's agar and Peptone-dextrose agar with rose bengal and streptomcin (Martin 1950) were the media used for bacteria, actinomycetes and fungi respectively.

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Sixty five days old tobacco plants grown singly in pots were divided into three lots and each lot received a foliar spray of an aqueous solution of 0.83 M urea, 10 ppm 2, 4-D or 0.00112 M terramycin. Half the number of plants under each treatment was inoculated with T. M. V., 24 hours after receiving the spray. The remaining plants served as sprayed control. Unsprayed controls were also kept. The spray material was applied on the foliage with atomizers at 20 ml per plant. The surface of the soil was covered with cotton wool, to prevent the materials from reaching the root system. The cotton wool was removed as soon as the spray got dried up.

Root samples were collected at intervals of 6, 16 and 26 days after spraying, from plants receiving Urea + TMV, 2, 4-D -f TMV, Terramycin + TMV, Urea only, 2, 4-D only, Terramycin only, TMV only and no treatment.

Results and Discussion

The rnicrobial population in the rhizosphere of tobacco plants was found to increase as the plants became older till the 110th day after which there was a decline (Table 1 }. Inoculated plants developed clear symptoms of mosaic within seven days. The increase in the rnicrobial population in the rhizosphere was greater in the infected plants than in the healthy plants. The increase was pronounced in the case of bacteria and actincomycetes (Table 2).

The stimulatory effect on the rnicrobial population following the virus infection may be attributed to the changes brought about in the root exudates. Balagopal *et al* (1969) for instance showed that changes occur in the amino acid content of the root exudates of tobacco when infected by T. M. V.

Urea. Urea was found to exert a slight depressing effect on the rnicrobial population in the rhizosphere of healthy plants. The bacterial population of healthy plants on the date of spraying was 53.24 million. This rose to only 54.81 million after 6 days in the treated plants, while in the untreated plants the corresponding population was 57 75 million. The difference subsequently narrowed down and on the 26th day the population in the treated and untreated plants became almost similar, namely, 91.86 million and 92.34 million respectively.

While the bacterial population in the inoculated plants which were pretreated with urea, on the 6th day after treatment was 67 02 million that

Table I

Total bacterial, actinomycete and fungal counts (10^6 per gm of dry soil) in the rhizosphere of tobacco plants at different stages of growth and in the control soils

		Age in days						
		30	60	90	100	110	120	135
Bacteria	Control soil	4.50	4.54	4.66	4.52	4.62	4.59	4.96
	Rhizosphere	58.04	6.50	72.46	95.58	118.76	122.24	118.65
	R : S Ratio	11.60	1.55	17.27	20.06	25.71	27.24	28.83
Actinomycetes	Control soil	2.87	0.02	2.92	0.40	2.04	2.95	2.00
	Rhizosphere	10.46	14.07	18.92	21.40	26.39	28.25	28.20
	R : S Ratio	4.29	4.22	6.50	6.92	9.25	10.25	9.80
Fungi	Control soil	1.14	1.10	1.14	1.20	1.10	1.14	1.12
	Rhizosphere	0.84	0.26	4.01	4.25	4.70	4.52	4.45
	R : S Ratio	0.70	0.50	3.52	3.70	4.28	4.00	3.85

Table 2

Effect of foliar application of urea, 2,4-D and terramycin on the rhizosphere microflora of Healthy and T. M. V. infected tobacco plants

(Population 10^6 per gram of dry soil)

	Bacterial population			Actinomycete population			Fungal population		
Treatment	6 days	16 days	26 days	6 days	16 days	26 days	6 days	16 days	26 days
Control soil	4.62	4.84	4.87	3.03	3.15	3.21	1.14	1.16	1,23
				HEALTHY PLANTS					
No chemical	57.75	77.02	92.34	12.98	16.03	19.01	3.23	3.57	4.30
Urea	54.81	76.02	91.86	12.14	16.06	18.56	3. 14	3.76	4.13
2,4-D	67.48	88.36	100.75	14.13	17.32	20.21	3. 19	4.15	4.67
Terramycin	51.77	74.13	90.70	11.67	15.88	17.82	2.94	3.48	4.24
				TMV INOCULATED PLANTS					
No chemical	62.81	85.73	100.01	18.34	19.98	22.03	3.32	3.77	4,83
Urea	67.02	90.53	102.08	18.26	21.65	22.31	3.51	3.96	4.99
2,4-D	82.23	98.04	115.78	19.63	22.56	23.17	3.91	4.41	5.19
Terramycin	59.53	78.20	96.43	15.78	16.81	21.50	3.28	3.65	4.68

Before treatment: Bacterial population 53.24 Actinomycete population 11.86 Fungal population 3.10

in the inoculated plants which did not receive urea was only 62.81 million. This difference subsequently narrowed down. Not much difference was noticeable in the case of actinomycetes and fungi (Table 2 }. Thus, in the inoculated plants, urea seemed to exert a stimulatory effect on the microbial population. This stimulatory effect was greater than that brought about by inoculation alone. It is possible that the plant, whose metabolism was already affected by urea, reacted in a more vigorous manner when the virus was introduced into its system.

2,4-D. The bacterial population in the rhizosphere of healthy treated plants was 67.48 million on the 6th day after treatment, while that in the untreated plants was only 57. 75 million. This stimulatory effect was seen on the 16th and 26th days also. An increase in the actinomycetes population was also noticeable in the treated plants (Table 2).

The stimulatory effect was highly pronounced on plants which were treated with 2,4-D before inoculation. The bacterial population in the rhizosphere of these plants on the 6th day after treatment was 82.23 million as against 62.81 million in the inoculated plants which did not receive 2,4-D. This effect was noticeable on the 16th and 26th days also. The actinomycetes population was also slightly higher in plants which received both the treatments as compared to those which received only the inoculation (Table 2). The increase in the microbial population of the rhizosphere in the healthy plants was more or less equal to that brought about as a result of inoculation with T. M.V. The combined effect of 2,4-D and T.M.V. on the microbial population was, however, very highly pronounced which is indicative of serious metabolic changes in the system of the plants which received the treatment, eventhough nothing is known about the combined action of 2,4-D and virus on plants.

Terramycin. An inhibitory effect on the rhizosphere microflora was noticeable in the healthy as well as inoculated plants which received the terramycin spray. The bacterial populations in the rhizosphere of healthy plants which received the treatment on the 6th day was only 51.77 million as against 57.75 million in the untreated plants. Similarly on the same day the bacterial population in the inoculated plants which received terramycin was only 59.53 million as against 62.81 million in the inoculated plants which did

not receive terramycin. A reduction in the actinomycetes population was also noticeable in plants treated with terramycin (Table 2). A similar inhibitory effect was noted by Rema Devi and Sam Raj (1968) in tomato plants which received a foliar spray of streptomycin. This inhibitory effect may be due to the excretion of the antibiotic through the roots or due to changes in the root exudates as a result of altered host metabolism or due to both.

Summary

Studies were made on the effect of T. M. V., urea, 2,4-D and terramycin on the rhizosphere microflora of tobacco plants.

The microbial population in the rhizosphere was higher in tobacco plants inoculated with T. M. V. than in the healthy plants. This effect was manifested within 48 hours after inoculation.

Urea, applied on the foliage, exerted a depressing effect on the microbial population in the rhizosphere of healthy plants while a slight stimulatory effect on the microbial population was evidenced when followed up with T. M. V. inoculation.

Foliar application of 2,4-D exerted a stimulatory effect on the microbial population in the rhizosphere of both healthy and T. M. V. inoculated plants; this effect was highly pronounced in the latter.

An inhibitory effect on the rhizosphere microflora was noticeable in healthy as well as T. M. V. inoculated plants when sprayed with terramycin. It is considered likely that the inhibitory effect was due to the excretion of the antibiotic through the roots or due to changes in the root exudates caused by altered host metabolism or due to both,

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