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INTERRELATIONSHIP OF *MELOIDOGYNE INCOGNITA* AND *RALSTONIA SOLANACEARUM ON JUTE*

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Influence of the presence of root-knot nematode on development of bacterial wilt on jute were tested under screen house conditions. Early and extensive wilt symptoms were noticed when the bacteria was inoculated with more numbers of the nematode. Effect of the nematode on the host as well as their population development were found adversely effected by the presence of the bacteria.

Keywords : Bacterial Wilt; Interaction; Jute; Root-knot.

Introduction

Jute, the cheapest source of natural fibre is infested by several soil born pathogens. There are several reports on the association of root-knot nematode *Meloidogyne incognita* causing considerable damage to this important cash crop[1-3]. On the other hand the crop is also intruded by *Ralstonia solanacearum* causing bacterial with[4,5]. These two disease causing organisms are soil born in nature and they infest plants through the root system. It has been known for long time that root-knot nematode along with bacterium (*Ralstonia solanacearum)* greatly influence the incidence of wilt of several host plants, especially Solanaceous vegetables[6,7]. However, studies on the disease complex involving root-knot nematode and bacterial wilt on jute are but, meager. With this view, the investigation was carried out to understand the interaction of *M. incognita* and *Ralstonia solanacearum* on jute (Variety - Navim, JRO-512) under green house conditons.

Materials and Method

Ralstonia solanacearum was isolated from freshly wilted jute plants on Triphenyl Tetrazolium Chloride[8] and cultured on nutrient agar slants at 29°C. Bacterial - suspension was prepared in distilled water and diluted to three different optical densities in Spectronic 20 spectrophotometer with blue filter (600nm) to obtain pathogenic (0.5 optical density), below pathogenic and pathogenic transmittance level, 60 ml of which were inoculated per plot according to the treatment. Root-knot nematode, *Meloidogyne incognita* was maintained on jute plant and originated from single eggmass. 1 nematode per gm of soil was inoculated as the pathogenic inoculum for the nematode.

15 cm. diiameter earthen pots were filled with autoclave sterilized soil and jute seeds were placed near the center. 15 days after germination the pots were thinned to single seedling per pot and were inoculated with nematode and bacteria simultaneously according to the schedule of treatments. Each treatment was replicated five times. The experiment was monitored regularly and observations on incidence of wilt were recorded from time to time. Plants showing wilting were given 100 percent wilt incidence (PWI) and "0" PWI for plants not showing any wilt symptom. After 60 days of inoculation, the experiment was terminated and observations on different growth parameters were recorded. In case of plants wilted earlier, observations on growth parameters were recorded as soon as the plant was wilted. Extraction of nematodes from soil was done by using Cobb's Sieving and decanting technique followed by population estimation in replicated aliquote. The experiment was conducted for two years following Completely Randomize Block Design of experiment. Each year data were recorded and at the end of two year subjected to statistical analyses.

Results and Discussions

Data on different plant growth parameters

presented in Tab. 1 reveals a general trend of poor growth in all treatments compared to control. Further, the treatments with below pathogenic level of nematode alone and in combinations with different levels of bacterial inoculation and the treatments with different levels of bacteria alone could not reduce the plant growth parameters significantly from the control. The lowest records of these parameters were recorded in the treatment with above pathogenic level of the nematode alone which were found at par with the records in the treatment with pathogenic level of the nematode alone. These findings confirm the findings of Sitaramaiah and Sinha[9] who reported non reduction of plant growth of brinjal by the bacteria alone and Bora and Phukan[3] who reported non significant reduction of plant growth of jute by lower inoculum levels of root-knot nematode and beyond the pathogenic inoculum level the plant growth do not differ significantly from pathogenic level of root-knot nematode inoculation. The results also reveal that the plant growth parameters were lower in treatments with nematode alone compared to their combined treatments with the bacteria indicating an inhibitory effect of the bacteria on the effect of nematode which is in agreement with Swain *et al*[10] who reported the inhibitory effect of the bacterion on the effect of *M. incognita* but contradictory to Sitaramaiah and Sinha[9] on plant height of brinjal when inoculated with the bacteria and *M. javanica.*

There was an early expression of wilt symptoms by the host, noticed in different associations of above pathogenic and pathogenic inoculum levels of these two pathogens. The maximum PWI (100) within 45 days of inoculation was noticed when above pathogenic level of the nematode was inoculated with either pathogenic or above pathogenic level of bacteria. None of the other associations of these two pathgens and the bacteria alone could produce 100 PWI even at the termination of the experiment (60 days after inoculation) The early and increased wilt experession at higher inoculum level of the nematode and bacteria could be attributed to increased puncturing of root by the nematode which facilitate increased establishment and multiplication of the bacteria in the host. Similar findings of higher wilt incidence at higher inoculum level of nematode was also reported by Sitaramaiah and Sinha[9] and Napier[11] on tomato and brinjal respectively, when associated with the bacteria.

The present investigation revealed a progressive increase in number of galls and eggmasses with the increase of inoculum level of the nematode from below pathogenic level to pathogenic level, but the above pathogenic level of the nematode could not increase it significantly from the pathogenic level. This finding confirms the findings of Bora and Phukan[3] who reported increase in number of galls and eggmasses on jute, with increased inoculum level of the nematode to a certain level, beyond which it declined. The results also revealed that the nematode alone produced more galls and eggmasses compared to its association with the bacteria. It may be due to the reason that establishment of the bacteria, induce certain changes in the root system which are not favourable for the nematode. However, the present finding agrees with the findings of Bhagawati *et al*[12] on jute but in disagreement with the findings of Sellam *et al*[13] who reported that presence of the bacteria do not effect the root-galling in tomato plants.

The nematode population at the harvest was found increased differently at different levels of the nematode inoculum and in each of the nematode inoculum within three levels of the bacteria. Higher nematode populations were observed when nematode was inoculated alone and was maximum (19,775.00) in the above pathogenic inoculum level. Further, each level of the nematode alone build up higher final population compared to it's association with the bacteria suggesting some inhibitory effect of the bacteria on the population build

Table 1. Effect of different associations of *Meloidogyne incognita* and *Ralstonia solanacearum* on growth and disease severity of jute plant.

TREATMENT	ON THE HOST			ON WILT DISEASE				ON NEMATOD DISEASE & POPULATION		
	Plant height (cm)	Fresh shoot weight(g)	Fresh root weight(g)	Percent Wilt IIncidence 15DAI	30DAI	45DAI	60DAI	Number of Galls	Number of Egg masses	Final Nematode Population
1. Nematode BP + Bacteria BP	58.80^{a}	16.80^{a}	7.70^{ab}	0 (2.87*)^{c}	0 (2.87*)^{c}	10 (11.30*)^{ca}	20 (19.72*)^{ca}	23.40 (4.81**)^{T}	12.80 (3.56**)^{g}	4912.50 (70.50**)^{l}
2. Nematode BP + Bacteria P	58.60^{a}	16.00^{a}	7.50^{ab}	0 (2.87)^{b}	0 (2.87)^{c}	10 (11.30)^{ca}	30 (28.15)^{ca}	22.80 (4.72)^{T}	11.20 (3.29)^{n}	4578.00 (67.63)^{l}
3. Nematode BP + Bacteria AP	58.20^{a}	16.20^{a}	7.30^{ab}	0 (2.87)^{b}	0 (2.87)^{c}	10 (11.30)^{ca}	30 (28.15)^{ca}	22.90 (4.75)^{T}	6.20 (2.44)^{l}	4252.00 (65.17)^{k}
4. Nematode P + Bacteria BP	45.30^{b}	13.20^{a}	6.80^{b}	0 (2.87)^{b}	20 (19.72)^{bc}	30 (28.15)^{bca}	50 (45.00)^{bc}	47.20 (6.85)^{b}	29.10 (5.38)^{bc}	7056.00 (81.4)^{T}
5. Nematode P + Bacteria P	45.60^{b}	13.40^{b}	6.65^{b}	20 (19.72)^{ab}	40 (36.57)^{ab}	50 (45.00)^{b}	70 (61.85)^{ab}	39.00 (6.19)^{de}	24.60 (4.94)^{der}	6358.00 (79.72)^{g}
6. Nematode P + Bacteria AP	44.90^{b}	13.00^{b}	6.60^{b}	20 (19.72)^{ab}	40 (36.57)^{ab}	50 (45.00)^{b}	70 (61.85)^{ab}	36.10 (5.97)^{e}	22.10 (4.67)^{T}	5535.00 (74.37)^{h}
7. Nematode AP + Bacteria BP	43.40^{b}	13.00^{b}	5.15^{c}	0 (2.87)^{b}	20 (19.72)^{bc}	40 (36.57)^{bc}	50 (45.00)^{bc}	54.12 (6.85)^{bc}	30.85 (5.52)^{b}	8038.00 (89.61)^{c}
8. Nematode AP + Bacteria P	43.15^{b}	12.90^{b}	5.20^{c}	30 (28.15)^{a}	60 (53.43)^{a}	100 (87.13)^{a}	100 (87.13)^{a}	45.30 (6.70)^{cc}	27.30 (5.20)^{ca}	7551.50 (86.86)^{e}
9. Nematode AP + Bacteria AP	43.50^{b}	13.20^{b}	5.30^{c}	30 (28.15)^{a}	60 (53.43)^{a}	100 (87.13)^{a}	100 (87.13)^{a}	41.20 (6.38)^{cae}	23.90 (4.86)^{er}	7007.50 (83.65)^{T}
10. Nematode BP	59.80^{a}	15.80^{a}	7.90^{ab}	0 (2.87)^{b}	0 (2.87)^{c}	0 (2.87)^{a}	0 (2.87)^{a}	37.40 (6.08)^{e}	26.00 (5.08)^{ae}	9772.50 (98.80)^{c}
11. Nematode P	39.10^{c}	13.00^{b}	6.15^{bc}	0 (2.87)^{b}	0 (2.87)^{c}	0 (2.87)^{a}	0 (2.87)^{a}	58.30 (7.52)^{a}	51.60 (7.15)^{a}	16930.00 (130.09)^{b}
12. Nematode AP	36.80^{c}	12.80^{b}	5.00^{c}	0 (2.87)^{b}	0 (2.87)^{c}	0 (2.87)^{a}	0 (2.87)^{a}	60.80 (7.74)^{a}	53.30 (7.28)^{a}	19775.00 (140.59)^{a}
13. Bacteria BP	60.30^{a}	16.10^{a}	7.50^{ab}	0 (2.87)^{b}	0 (2.87)^{c}	0 (2.87)^{a}	0 (2.87)^{a}	0 (0.70)^{g}	0 (0.70)^{l}	-
14. Bacteria P	61.60^{a}	16.00^{a}	7.48^{ab}	0 (2.87)^{b}	0 (2.87)^{c}	10 (11.3)^{ca}	20 (19.72)^{ca}	0 (0.70)^{g}	0 (0.70)^{l}	-
15. Bacteria AP	60-70^{a}	16.20^{a}	7.55^{ab}	0 (2.87)^{b}	0 (2.87)^{c}	20 (19.72)^{ca}	30 (28.15)^{ca}	0 (0.70)^{g}	0 (0.70)^{l}	-
16. Control	62.60^{a}	17.00^{a}	8.10^{a}	0 (2.87)^{b}	0 (2.87)^{c}	0 (2.87)^{a}	0 (2.87)^{a}	0 (0.70)^{g}	0 (0.70)^{l}	-
S.Ed. (+)	2.04	1	0.61					0.27	0.13	0.61
LSD 0.05	4.03	1.97	1.2	17.49	22.09	22.64	25.71	0.54	0.26	1.21

P= Pathogenic level, BP = Below pathogenic level, AP=Above pathogenic level.
DAI = Days after inoculation
* Angular transfromed value
** Square root transformed value
Means within columns are separated by Dunean's Multiple Range Test (p=00.05)
Means followed by the same letter shown in superscript(s) are not significantly different.

up of the nematode. Similar findings of poor population build up of root-knot nematode in presence of the bacteria was earlier reported by Swain *et al*[10] on brinjal and Bhagawati *et al*[12] on jute.

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