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EFFECT OF THE INTERACTION BETWEEN *MELOIDOGYNE INCOGNITA, FUSARIUM OXYSPORUM* AND *RHIZOCTONIA BATATICOLA* ON CHICKPEA

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Root knot nematode in combination with *Fusarium oxysporum* and *Rhizoctonia bataticola* result in more severe disease leading to less produce. In the present study an experiment was conducted using all the three pathogens isolated from local fields in different combinations to find out their role in disease severity. The reduction in plant growth characters and severity of root knot and wilt incidence were more in combination than in either of the pathogen alone. The reduction in shoot-root length and weight were more pronounced when *F. oxysporum* and *R.bataticola* were combined with *M.incognita* and in nematode alone as compared to control and both the fungus alone.

Keywords : Chickpea, *Fusarium oxysporum, Meloidogyne incognita, Rhizoctonia bataticola.*

Introduction

Heavy root knot severity was observed in chickpea fields in Jaipur district causing stunting, yellowing of leaves, poor flowering and fruiting in the plants. Chickpea is also susceptible to variety of diseases in addition to root knot such as Fusarium wilt, black root rot, collar rot and dry root rot. These diseases cause significant economic losses to chickpea growers. Observations revealed the presence of *Fusarium oxysporum* and *Rhizoctonia bataticola* on roots injected with *Meloidogyne* sp. The root knot nematode aggravate the severity of these diseases on chickpea. Uma and Maheshwari *et al*[1], Khan and Hosseini Nejad[2] reported that *M. javanica* along with *Fusarium oxysporum* synergistically reduced plant growth and nodulation. Nematode *M. javanica* breaks the wilt resistance in chickpea variety 'avrodhi[3,4]'. Goel and Gupta[5] reported the additive adverse effect of combined inoculation of *M. javanica* and *Rhizoctonia bataticola.* Nematode presence enhances the wilt incidence due to the additive adverse effect on plant growth was reported by Kumar *et al*[6], Tyagi and Alam[7] and Krishna Rao and Krishnappa[8].

In the present study an experiment was conducted using the three pathogens viz. *Meloidogyne incognita, Fusarium oxysporum* and *Rhizoctonia bataticola* isolated from local fields in different combinations to find out their role in disease severity.

Materials and Methods

The experiment was conducted in pot trials. Surface sterilized chickpea seeds were shown in 15 cm dia pots containing autoclaved soil. Seven treatments were given in an experimental pot trials, viz. control, nematode alone, *Fusarium* alone, *Rhizoctonia* alone, *Fusarium* and nematode inoculated simultaneously; *Rhizoctonia* and nematode inoculated simultaneously; and all the three pathogens, i.e., *Fusarium, Rhizoctonia and* nematode inoculated simultaneously. 1000 freshly hatched juveniles of *M. incognita* were inoculated to 3 week old seedlings. Both the fungus were cultured on P.D.A. and the three week old plants were inoculated with 5% w/w of fungus culture. Observations for different parameters were recorded after 60 days of various treatments.

Results and Discussion

Reduction in shoot and root length in all treatments was observed, but it was more

Table 1. Effect of *Fusarium, Rhizoctonia* and *Meloidogyne* in different combinations on disease development in chickpea.

S.No.	Treatment	Length Root	Length Shoot	Fresh Weight Root	Fresh Weight Shoot	Dry Weight Root	Dry Weight Shoot	No. of Galls Per plant	No. of Eggs per egg mass	Final nematodes population
1.	Control	49.63	47.46	14.83	17.06	1.57	1.97	0	0	0
2.	N alone	27.20	24.46	5.16	5.98	0.67	0.84	203.66	304.66	7594.66
3.	R alone	39.96	37.10	9.26	13.26	1.19	1.62	0	0	0
4.	F alone	42.23	41.86	10.27	15.80	1.40	2.20	0	0	0
5.	R+N	35.76	33.10	6.76	10.4	0.77	1.60	136.33	252.66	4889
6.	F+N	32.30	31.36	6.36	10.06	0.75	1.37	121	257	4819.66
7.	F+R+N	32.46	29.40	6.64	9.23	0.76	1.06	99	240.66	4003.33
	SEM	1.30	0.697	0.55	0.516	1.30	0.1238	0.2	0.222	0.53
	CD at 5%	2.7885	1.49	1.179	1.10682	2.7885	0.265	0.429	0.476	1.36
	at 1%	3.8701	2.07	1.63	1.536	3.8701	0.3685	0.5954	0.66	1.577

pronounced when *F. oxysporum* and *R. bataticola* were combined with *M. incognita* and nematode alone as compared to control and fungus alone. Maximum fresh and dry weight of shoot and root were observed in uninoculated control plants as compared to inoculated ones. Marked decrease in number of root galls per plant with fungal inoculum was observed. It was maximum in nematode alone followed by R + N, F+N and minimum number of galls observed in F + R + N treated plants. The number of eggs per egg mass was also decreased in fungus treated plants and minimum in F + R + N treated plants.Final nematode population at harvest was significantly correlated with fungal inoculum. It was maximum in nematode alone treated plants followed by R + N, F + N and F + R + N respectively. All the data were statistically significant.

Nematodes are known to interact with a number of soil borne fungal pathogens with a resulting synergistic increase in disease severity. The results of the experiment are in accordance with the results of Kumar *et al*[6] who reported that wilt caused by *F. oxysporum* f. sp. *ciceri* is enhanced in presence of *M. incognita* and greatest reduction in plant growth occurs in soil infested with the nematode and fungus. The nematodes break the resistance of chickpea genotypes of *F. oxysporum* f. sp. *ciceri* . A *Fusarium* wilt resistant chickpea genotype ICC 12275 shows 50% wilting when infected with nematode and fungus together[9]. The level and the type of interaction varies with the population of two pathogens.

The results suggested that the nematode and the two fungi cause appreciable damage to the plant when inoculated singly. The greatest damage was observed in the nematode alone followed by *Rhizoctonia* and *Fusarium*. When they are inoculated in combination the F + N combination is more damaging than R + N combination. The diagnostic symptoms like stunting of plant, yellowing of leaves and wilting were more pronounced when *M.incognita* was inoculated with both *Fusarium oxysporum* and *Rhizoctonia bataticola*. This may be due to the injuries caused in the root system of the plant which was caused by the pathogen, hence they adversely affected the translocation in the stem. Nematode causes hypertrophy and stunting of roots whereas *F. oxysporum* and *R.bataticola* produce toxic substances in the plant tissue (translocated throughout the plant) rhizosphere and the soil

causing wilting symptoms[10,11]. The fungal hyphae and their metabolic products caused choaking of water conducting vessels, hence enhancing the wilt syndrome. Number of root galls was maximum in N alone and minimum in F + R + N treated plants. The reduction or increase in root galls in presence of some fungi have also been reported by Dickson & Mitchell[12], Raut[13] and Singh *et al*[14].

It is concluded that while nematodes alone are quite capable of causing severe plant injury and reduction in corp production, they are often involved with other organisms which cause diseases. These combinations frequently result in loss that is more additive such as breaking of resistance or the production of symptoms differing from those usually produced by either organism alone.

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