Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6705

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (3):** 19-24 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Reaction of *Pratylenchus thornei* and *Rhizoctonia bataticola* in Chickpea Genotypes

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Received: 25.05.2018 | Revised: 17.06.2018 | Accepted: 27.06.2018

ABSTRACT

Root Lesion Nematode (RLN; Pratylenchus thornei Sher and Allen) is threatens chickpea production, either alone or in presence of R. bataticola. The effects of inoculation of eight chickpea genotypes with P. thornei alone or with joint inoculation with R. bataticola were investigated in a pot experiment. The populations developed on roots were inoculated @ 1000 P. thornei/genotype with four treatments. Nematode alone, Nematode + DRR fungus, DRR alone and untreated along with RLN were replicated five times. During the course of investigation, the extent of damages developed by RLN and DRR individually as well as their combinations was recorded. The study revealed, above the three times rate of reproduction due to P. thornei was noticed in JG 62 over the ICCV2, suggested that JG 62 is more vulnerable to RLN as well as DRR, while the ICCV 2 showed resistance.

Key words: *RLN, DRR, Fresh root weight, Fresh shoot weight and Plant height.*

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the most important pulse crop and world's second most important food legume next to common bean. Asia accounts 89.20% of the chickpea area and 84.47% of production[4]. The major chickpea producing countries, which contributed to about 90% of the global chickpea production, include India (67.4%), Australia (6.21%), Pakistan (5.73%), Turkey (3.86%), Myanmar (3.74%) and Iran (2.25%). In India, chickpea is grown in an area of 10.22 million hectares with a production of 9.53 million tones and productivity of 967 kgha^{-1}. Madhya Pradesh, Chhattisgarh, Rajasthan, Maharashtra, Uttar Pradesh, Andhra Pradesh and Karnataka together contribute 95.71% of production and 90% of area in the country[1]. Chickpea cultivation is often subjected to significant yield losses due to insects and diseases ranging from 5-10% in temperate and 50-100 % in tropical regions[15]. Currently chickpea is attacked by 172 pathogens viz., 67 fungi, 3 bacteria, 22 viruses and mycoplasma, and 80 nematodes reported from 55 countries[11]. Among the diseases of chickpea, dry root rotting emerging as the most destructive constraint to chickpea productivity and production, as the disease is more prevalent during hot temperature of 30 to 35°C and low soil moisture conditions[12].

Cite this article: Jatav, R. and Tiwari, S.P., Reaction of *Pratylenchus thornei* and *Rhizoctonia bataticola* in Chickpea Genotypes, *Int. J. Pure App. Biosci.* **6(3):** 19-24 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6705

Dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler [Pycnidial stage: *Macrophomina phaseolina* (Tassi) Goid] is a soil and seed borne necrotrophic fungal pathogen that has a global distribution, which can infect more than 284 plant species throughout the world including monocot and dicots[5].

Root-lesion nematode (*Pratyienchus thornei* Sher and Allen) is a migratory, endoparasitic that cause severe yield losses in crops of economic significance and can be considered the second most important plant-parasitic nematodes after root knot nematodes worldwide[8]. Root-lesion nematodes penetrate, feed and migrate inside the root cortex giving rise to necrotic lesions and root cavities. The nematode reproduces by mitotic parthenogenesis[6] laying eggs in the cortex and passing through its life cycle in about 4-6 weeks under favorable conditions. Currently, the genus *Pratylenchus* includes more than 60 species[10] which can be differentiated only by means of minor morphological and morphometric differences. However *P. thornei* is the most common species found destructive pest in the chickpea and other crops. In addition, infection of chickpea by *P. thornei* increases the severity of root necrosis and enhances the further invaded by fungi and bacteria resulting in extensive root rots and complex diseases in a wide range of hosts[9]. The objective of this study was to determine the influence of root infections by *P. thornei* on the reaction of susceptible and resistant chickpea cultivars to *Rhizoctonia bataticola*, and to find the reproduction factor during interaction.

MATERIAL AND METHODS

Germplasm

Eight genotypes *viz*, ICCV 2, JG 62, ICC17163, EC556270, ICCV05530, ICC17124, ICC17123 and ICC17121 of chickpea, received from Principle Scientist, Centre for Excellence in Genomics, ICRISAT, Hyderabad, were assessed to find out pathogenic behaviour of *P. thornei* and *R. bataticola*.

Pathogen inoculums

Nematode extraction, identification and mass multiplication

The soil sample was collected from the BISA (Borlaug Institute of South Asia) farm and nematode extraction was done by Whitehead Tray Extraction method[16]. The identification of *P. thornei* nematodes were under the binocular microscope on the basis of Sher and Allen[13] characteristics.

The multiplication and maintained of pure culture of nematodes were on the chickpea (JG 62) earthen pot culture in controlled conditions[14].

Isolation, identification and Preparation of mass culture of dry root rot pathogen

The diseased sample collected from the field of chickpea and the portion from diseased sample was surface sterilize by the 70 per cent ethanol followed by 2 – 3 times washing with sterile water. These sterile bits were transfer on PDA (Potato Dextrose Agar) medium and kept at room temperature for fungal growth after the 4 – 5 days; the fungus was purified by hyphal tip method and identified as *R. bataticola* under the compound microscope. The mass inoculums of *R. bataticola* were prepared by Soil Gram Straw (SGS)[2].

After ten days, the contents of flask were well mixed with 450 cm^3 of sterile soil and were transferred in sterilized 10 cm earthen pots, irrigated with 100 ml sterilized distilled water and remained covered with clean aluminum trays for a week before sowing of the seeds.

The experiment was laid with four treatments and replicated five times.

INOCULATIONS

Pratylenchus thornei: Pure 1000 N/matured female's of *P. thornei* were surface disinfectant with the sodium hypo chloride (1000 ppm) was inoculated on 8 genotypes raised in earthen pots holding 500 cm^3 autoclaved soil and dibbled. The surface disinfested chickpea genotypes with 1000 ppm mercurial chloride followed by thrice changes of sterilized water in the pots. The nematodes culture was inoculated near root by point inoculation followed.

Rhizoctoia bataticola: *R. batatataicla* are applied into the soil by using the soil gram straw medium[2]. Co-inoculation of *P. thorni* and *R. bataticola*: *Rhizoctonia batatataicola* mixed soils were filled in earthen pots and chickpea seeds were raised. Seven days old raised seedling were inoculated with sterilized *P. thornei* @1000 / pot.

Control

Pots were also maintained without inoculation of *P. thornei* and *R. batatiocola.*

OBSERVATIONS

Observations on plant height, fresh shoot and root weight and nematode population were recorded 40 days after inoculation of individual treatments.

Assessment of Nematode Population

The extraction of nematodes from the 500 cm^3 soil samples was processed after 40 days of inoculation of individual treatments. The samples were assayed according to the whitehead tray extraction Method[16]. 1 g soils were used from fungus and nematode + fungus treatment for isolation of fungus by serial dilution technique.

RESULTS AND DISCUSSION

Plant Height

Most of genotypes evidenced significant plant height growth except JG 62 and ICC 05530 in nematode and fungus alone. Whereas all the genotypes evidenced significant height reduction except the ICCV2, ICC 17124 and ICC 17123 in cohabitation (Nematode + Fungus). ICCV 2, ICC 17124 and ICC 17123 showed improved significant growth of chickpea in all the treatment of experiments.

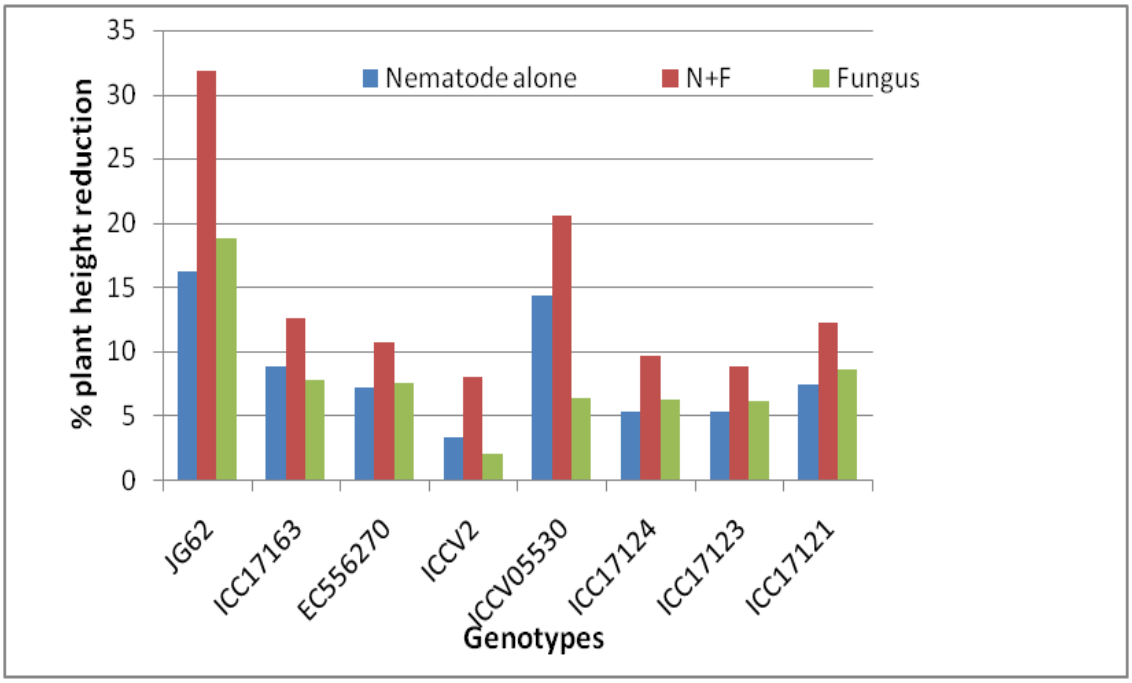

Fig. 1: per cent reduction in plant height

Shoot weight

Fresh shoot weight (Fig. 2) was found non significant reduction of shoot weight except JG 62, ICC 05530 and ICC 17121 in all treatment either in cohabitation or in nematode alone. But genotype JG 62 and ICC 05530 was evidenced showed significant reduction in fresh shoot weight in the treatment either alone nematode or cohabitation with fungus showed the susceptible reactions and in fungus alone it shows the resistant reactions.

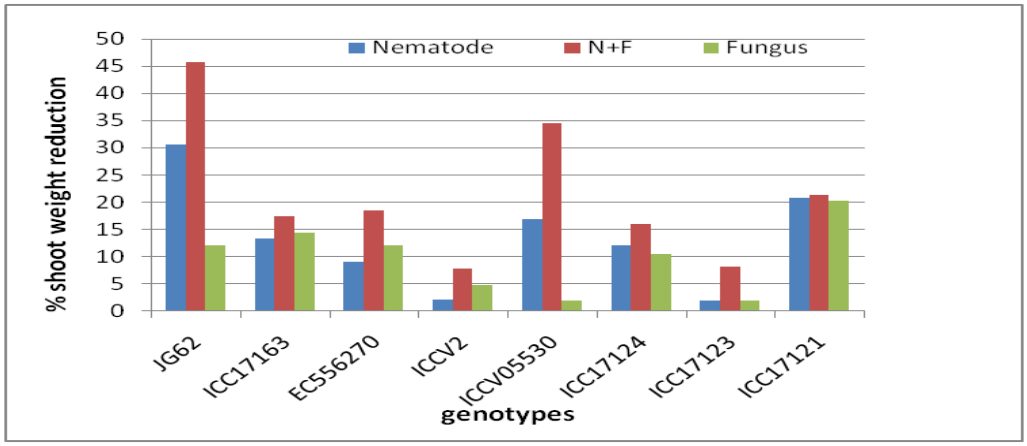

Fig 2: per cent reduction in shoot weight

Root weight

Fresh root weight (Fig. 3) was found significant reduction of shoot weight in the cohabitation except ICCV 2 and ICC 17123 but in nematode and fungus alone all the genotypes showed the improved growth except the JG 62, ICCV 05530 and EC 556270. Whereas genotypes ICCV 05530 showed the significant root growth reduction in Nematode alone or cohabitation with fungus but in fungus alone it showed the resistance reaction and improved root growth.

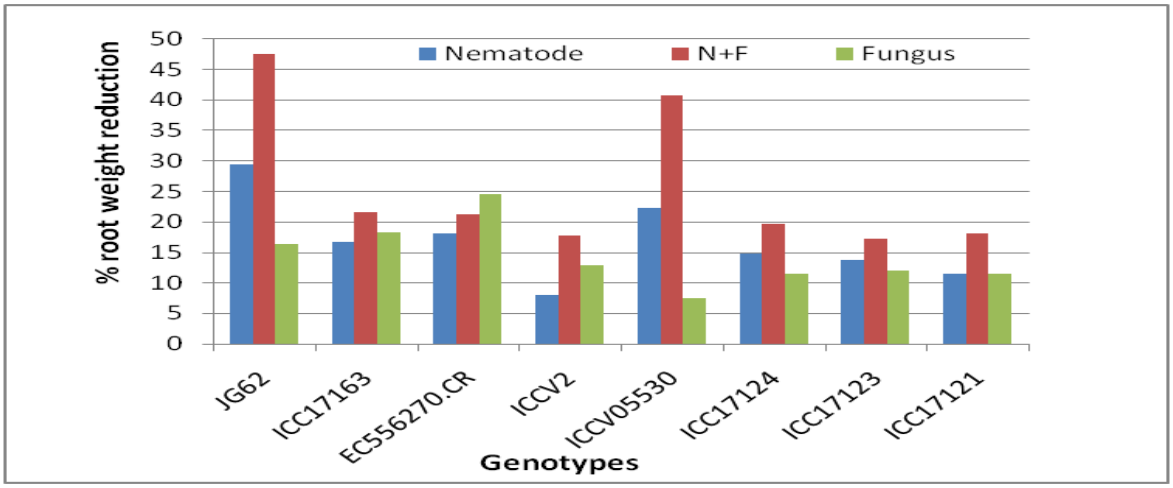

Fig. 3: per cent reduction in root weight

Table 1: Reproduction factor of *P. thornei* in nematode alone and cohabitation with *R. bataticola*

Genotypes	Nematode Population					
	Final Nematode population/ 200 cc soil		Reproduction factor			
	Nematode Alone	Interaction (N+F)	Nematode Alone	Reaction	Interaction (N+F)	Reaction
JG62	3651	5109	3.6	HS	5.10	HS
ICC17163	1382	1812	1.4	MR	1.81	S
EC 556270	1501	1851	1.5	MR	1.85	S
ICCV2	339	509	0.3	R	0.50	R
ICCV05530	3202	4186	3.2	HS	4.19	HS
ICC17124	1457	1927	1.5	MR	1.93	S
ICC17123	1437	1906	1.4	MR	1.90	S
ICC17121	1517	1917	1.5	MR	1.92	S

Reproduction factor "0 to 1; resistant R", "1.1 to 1.5 moderately resistant (MR)", "1.6 to 2 susceptible (S)" and "above the 2 highly susceptible (HS)" Data evidenced from the (table 1) found that only two genotype *viz.* JG 62 and ICCV 05530 were prone to the *P. thornei* in the both the treatment either the nematode alone or with the fungus found maximum reproduction and development of the nematode and were highly susceptible to the nematode.

Remaining genotypes are resistant and moderately resistant to the nematode reproduction and development and resist to the nematode penetration or development in the host and were found the poor host to the nematode reproduction.

In the cohabitations the reproduction rate of nematode were increased as compared with the nematode alone treatment was due to the synergistic reaction between the fungus and nematode which were leads to the sever in the damage and losses in the host plant.

DISCUSSION

Root Lesion Nematode (RLN; *Pratylenchus thornei* Sher and Allen) is a migratory endoparasite and polyphagous pest. Root-lesion nematode usually infects the cortical parenchyma, which cumbers the absorption of water and nutrients, thereby resulting in root damage and reduced plant growth. The root lesion nematode is often found associated with root infecting fungi particularly wilt and, root rot. Nematode-fungal disease complexes, especially those involving *P. thornei*, are common on many crops *viz.*, chickpea and wheat. Attempts have been made in the past to study the pathogenic relationship of *Pratylenchus thornei* and *Rhizoctonia bataticola* in chickpea separately and cohabitation causing reduction in plant height, shoot weight and root weight in chickpea. Root Lesion Nematode and DRR are emerging constrains in the chickpea production, being soil habitat, most difficult to manage.

The investigations are in accordance with the finding of Greco *et al*., Vito *et al*., and Tiwari *et al*.,[14]. Variety JG 62 favored *P. thornei* reproduction whereas ICCV 2 emerged as poor host. Such study is first attempt to established relationship between RLN and DRR at 8 genotypes alone and in combination. Hence it is concluded that the Variety JG 62 is susceptible to both DRR and RLN and show the significant reduction in growth and best host to RLN in individually or combined with the DRR fungus whereas, ICCV 2 is the resistant to RLN and DRR infection over the JG 62.

Acknowledgement

I wish to thank, Dr. M. Thudi, (Senior Scientist) ICRISAT, Hyderabad, who providing seeds and laboratory for my work.

REFERENCES

1. Anon, Ministry of Agriculture, Government of India, *http://agricoop.nic.in* (2013-14).
2. Bhatt, J., Reactioin of chickpea cultivars to *Rhizoctonia bataticola* (Taub.) Butler. *Indian Journal of Pulses Research*. **6:** 118-119 (1993).
3. Di Vito, M., Greco, M. N. and Zeccheo, G., Nematode Problems in the cultivation of chickpea. *Terra Sole* **534:** 112-207 (1987).
4. FAOSTAT, Food and Agriculture Organization of the United Nations, Rome. *http://faostat.fao.org*. (2013).
5. Farr, D. F., Bills, G. F., Chamuris, G. P. and Rossman, A. Y., Fungi on plants and plant products in the United States. 2nd edition. St Paul, Minnesota: *American Phytopathological Society Press* (1995).
6. Fortuner, R., *Pratylenchus thornei*, Commonwealth Institute of Helminthology descriptions of plant-parasitic nematodes. **7(93):** Common Wealth Agricultural Bureaux: *Farnham Royal*, UK (1977).
7. Greco, N., Di Vito, M., Reddy, M. and Saxena, M. C., A preliminary report of survey of plant parasitic nematodes of leguminous crops in Syria. *Nematologia Mediterrania* **12:** 87-103 (1984).

8. Jatala, P. and Bridge, J., Nematode parasites of root and tuber crops. In: Luc, M., Sikora, A., Bridge, J., (eds). Plant parasitic nematodes in subtropical and tropical agriculture. Wallingford (UK). *CAB International*. ISBN 0-85198-630-7. pp 137-180 (1990).
9. LaMondia, J. A., Interaction of *Pratylenchus penetrans* and *Rhizoctonia fragariae* in strawberry black root rot. *Journal of Nematology* **35(1):** 17-22 (2003).
10. Loof, P. A. A., The family Pratylenchidae, pp 363-421 in *manual of agricultural nematology*, Nickle, W. R., ed. Marcel Dekker, Inc., New York (1991).
11. Nene, Y. L., Sheila, V. K. and Sharma, S. B., A world list of chickpea and pigeonpea pathogens. Fifth edition, *International Crops Research Institute for the Semi-Arid Tropics* (ICRISAT), Patancheru, Telangana, India (1996).
12. Pande, S. and Sharma, M., Climate Change: Potential Impact on Chickpea and Pigeonpea Diseases in the Rainfed Semi-Arid Tropics. In: *5th International Food Legumes Research Conference* (IFLRC V) & 7th European Conference on Grain Legumes (AEP VII) 26-30 April 2010 Antalya, *Turkey* (2010).
13. Sher, S. A. and Allen, M. W., *University of California publications in zoology* **57:** 441-470 (1953).
14. Tiwari, S. P., Vadhera, I., Shukla, B. N. and Bhatt, J., Studies on the Pathogenicity and relative reactions of chickpea lines to *Pratylenchus thornei* Sher and Allen, *Indian Journal of Mycology and Plant Pathology* **22(3):** 255-259 (1992).
15. Van Emden, H. F., Ball, S. L. and Rao, M. R., Pest, disease and weed problems in pea, lentil, faba bean and chickpea. In: Summerfield R.J. (eds) World crops: Cool season food legumes. *Current Plant Science and Biotechnology in Agriculture*, **5:** Springer, Dordrecht (1988).
16. Whitehead, A. G. and Hemming, J. R., A comparison of some quantitative methods of extracting small vermiform nematodes from soil. *Annals of Applied Biology* **55:** 25-38 (1965).