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Effect of Organic Amendments on the Level of Chemical Constituents of Red Gram, *Cajanus cajan* Infected with Root-knot Nematode, *Meloidogyne javanica*

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Abstract: The present investigation has been done to study the efficacy of organic amendments on the root knot nematode *Meloidogyne javanica* infecting the red gram, *Cajanus cajan.* From this study the various biochemical constituents, such as, carbohydrate, protein, lipid, NR activity, chlorophyll and phenol were found to be decreasing with increasing inoculum levels of 5, 10 and 15 egg masses except phenol. In the inoculated plants treated with organic amendments, these constituents like carbohydrate, protein, lipid, NR activity and chlorophyll were found to be increasing than the inoculated control plants, except the total phenol content. Since the organic amendment has a remarkable nematicidal property on *M. javanica* there by it can be used in the control of plant root-knot nematodes.

Key words: Organic amendments · Nematicidal property · Biochemical constituents · Root-Knot Nematode

INTRODUCTION

Root-knot nematodes occur throughout the world but are found more frequently and in greater numbers in areas with warm or hot climates and short or mild winters. Root-knot nematodes are also found in greenhouses everywhere when non-sterilized soil is used. They attack more than 2000 species of plants, and reduce world crop production by about 5 percent losses in individual fields, however, may be much higher. Almost all plant pathogenic nematodes live part of their lives in the soil. Many live freely in the soil, feeding superficially on roots and underground stems, but even in the specialized sedentary parasites, the eggs, the preparasitic juvenile stages, and the males are found in the soil for all or part of their lives. Soil temperature, moisture and aeration affect survival and movement of nematodes in the soil. Nematodes occur in greatest abundance in the top 15 or 30 cm of soil [1]. Study on the biocontrol of root-knot nematode *Meloidogyne incognita* infecting the medicinal plant *Withania somnifera* (Aswagantha) using various fungi was carried out [2] and that the fungal agents showed significant control against nematodes and also enhanced the plant growth. They also reported that this type of treatment may also suitable for the medicinal plants such as, betel wine, ginger and tomato [3]. Hence the present investigation was undertaken to ascertain on the root-knot nematode *Meloidogyne javanica* would interfere the biochemical parameters like, carbohydrate, protein, lipid, NR activity, chlorophyll and phenol in the leaves of red gram, *Cajanus cajan* and also to evaluate the nematicidal effect of the organic amendments.

MATERIAL AND METHODS

The nematicidal effect of organic amendments has been studied against the root knot nematode, *Meloidogyne javanica* affecting the red gram, *Cajanus cajan.* It is very heat-tolerant and prefers hot moist conditions. Under Hawaiian conditions, it grows between 18 and 30°C. Also it grows at temperatures above 35°C under adequate soil conditions of moisture and fertility. The egg masses of the root knot nematode, *M. javanica* were separated from the root galls of infected plants of *Acalypha indica* collected from the village of Thambipatti

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near Srivilliputhur. River soil, garden soil and red soil were sieved through 30 mesh sieve separately to remove the coarse particles. These soils were mixed in the proportion of 2:1:1 (River soil, Garden soil and Red soil) to facilitate the penetration of larvae of nematode easily and to give a favourable medium for the growth of the root system. The sterilization was carried out at 20 pounds pressure for 2 h to destroy the various bacterial and other pathogenic organisms and their spores. After this process, the sand soil mixture was aerated overnight and transformed into a container to prevent dust contamination from air. The organic amendments were prepared by using five selected plants like *Adhatoda vasica, Vitex negundo, Leucas aspera, Annona squamosa*, and *Carica papaya*. These plants leaves were collected and shade dried. The dried leaves were powdered using mixer grinder and sieved thoroughly to get nice particles of powder. About 1 kg of sieved powder mixed with 5 liter of cow urine uniformly. These mixtures were taken in a mud pot and tightly covered. Then this set up was burried in the soil at the depth of 1 meter for 14 days continuously. After this, the mixture was added with water and prepared in three concentrations (10%, 20% and 30%). The experimental host plants were inoculated with the different levels (5, 10 and 15 egg messes) of the nematode by pouring into four holes made around the root zone of the plant. Each treatment was replicated three times. One week after inoculation, the prepared mixture of organic amendments was powder for sixty days very nearer to the roots of experimental plant at various percentages. The plant of the *Cajanus cajan* was also observed biochemically by estimating the amounts of total sugar, soluble protein, lipids and total phenol content.

The efficacy of the different percentages of organic amendments (10%, 20% and 30%) on *M. javanica* was analyzed statistically by observing standard deviation and Anova.

RESULT AND DISCUSSION

The biochemical estimation of compounds such as Carbohydrates, Proteins, Lipids and total Phenols were analyzed and the results are presented as follows, Table 1 shows the effect of the root-knot nematode, *M. javanica* and the organic amendments on total carbohydrate content (mg/g) in the leaf of red gram, *Cajanus cajan* were analyzed at 60 days post treatment. The total carbohydrate content (mg/g) was found to be 26.425±0.32 and inoculated control have low carbohydrate content 15.187±0.83 (5 egg mass inoculum) and 9.213±0.472 (15 egg mass inoculum). There is an increasing trend of carbohydrate content in the leaves of treated plants with increasing percentages of 5 egg masses, the carbohydrate content has been found to be 20.523±0.25 (10%), 23.664±1.42 and 25.818 treatments respectively. The trend has also been observed in the plants inoculated with 10 egg masses and 15 egg masses. The carbohydrates are quick energy source compounds obtained from the vegetable plants or crops. Due to the infection of various species of root-knot nematodes, the carbohydrate content has been decreased in banana. In the use of neem seed derivations showed better improvement in carbohydrate content than this inoculum levels [4]. The total protein content was present in the leaves *Cajanus cajan* of control and experimental plants inoculated with *M. javanica* were analyzed as 60 days of treatment and tabulated. When compared with control plants 25.34±0.783 mg/g. the inoculated control plants have low protein content 12.83±0.285 (5 egg mass inoculum), 10.27±0.32 (10 egg mass inoculum) and 7.45±0.96 (15 egg mass inoculum). There is an increasing trend of protein content in the leaves of treated plants with increasing percentages of organic amendments, that is in 5 egg mass inoculated plants has been found to be 17.322±1.410 (10%), 18.36±1.527 (20%) and 19.27±0.148 (30%). The same trend was observed in 10 egg mass and

Table 1: Effect of organic amendments on the level of chemical constituent (Total carbohydrate) of *Cajanus cajan*, after infected with *M. javanica*

Inoculum level of egg masses	Total carbohydrate content (mg/g)				
	Control	Inoculated control	10 %	20 %	30 %
5	26.425±0.32	15.187±0.83	20.523±0.25	23.664±1.42	25.818±0.81
10		13.821±0.12	18.726±0.37	20.865±0.39	23.690±0.28
15		9.213±0.472	14.55±0.21	17.72±0.52	19.465±0.73

±Standard deviation

The statistical analysis an ANOVA that the results are statistically significant at the level of <0.05

Note: Data are the average value of three replications

Table 2: Effect of organic amendments on the level of chemical constituent (Total protein) of *Cajanus cajan*, after infected with *M. javanica*

Inoculum level of egg masses	Total protein content (mg/g)				
	Control	Inoculated control	10 %	20 %	30 %
5	25.34±0.783	12.83±0.235	17.322±1.410	18.36±1.527	19.27±0.148
10		10.27±0.32	13.212±0.5	13.037±1.330	15.56±0.256
15		7.45±0.96	9.527±0.740	11.82±0.62	12.928±0.75

±Standard deviation

The statistical analysis an ANOVA that the results are statistically significant at the level of <0.05

Note: Data are the average value of three replications

Table 3: Effect of organic amendments on the level of chemical constituent (Total lipid) of *Cajanus cajan*, after infected with *M.javanica.*

Inoculum level of egg masses	Total lipid content (mg/g)				
	Control	Inoculated control	10 %	20 %	30 %
5	7.53±0.352	5.087±0.32	4.024±0.30	4.38±0.142	5.27±0.17
10		3.333±0.17	3.50±0.42	3.92±0.35	4.25±0.29
15		2.18±0.38	3.56±0.25	4.12±	4.50±0.38

±Standard deviation

The statistical analysis an ANOVA that the results are statistically significant at the level of <0.05

Note: Data are the average value of three replications

Table 4: Effect of organic amendments on the level of chemical constituent (Total phenol) of *Cajanus cajan*, after infected with *M. javanica.*

Inoculum level of egg masses	Total phenol content (ög/g Fresh.Wt)				
	Control	Inoculated control	10 %	20 %	30 %
5	9.865±0.372	13.08±1.40	12.325±2.03	11.027±1.03	8.532±0.72
10		16.81±0.137	14.67±0.821	13.935±0.50	12.879±1.28
15		18.273±1.62	16.928±0.472	14.53±0.47	12.320±0.27

±Standard deviation

The statistical analysis an ANOVA that the results are statistically significant at the level of <0.05

Note: Data are the average value of three replications

15 egg masses inoculum level. (Table 2). The protein content in the leaves of test plants has been decreased in inoculated plants and increased in ten indigenous plant extract treated plants [5]. Inoculated control plants have low lipid content 5.087±0.32 (5 egg mass inoculum), 3.333±0.17 (10 egg mass inoculum) and 2.18±0.38 (15 egg mass inoculum) when compared with control plants. 7.453±0.352 at found to be increasing with increasing percentages of organic amendments from 4.024±0.30 (10%) to 5.27±0.17 (30%) at 5 egg mass inoculum, 3.50±0.42(10%) to 4.25±0.29 (30%) at 10 egg mass inoculum. The same trend was observed in 15 egg mass inoculum level (Table 3). The lipid content is increased infected untreated plants than the control plants [6]. The low levels of sugar might be due to the possible consumption by the nematode for its sustenance or mobilization pool for synthesis of other metabolites like phenol, protein and lipid etc as suggested [7]. The total phenol content (mg/g) in the leaf of the experimental plants was found to be decreasing with increasing percentages of organic amendments. In the inoculated control plants, the total phenol content (mg/g) was recorded as 13.08±1.40 (5 egg mass inoculum), 16.81±0.137 (10 egg mass inoculum) and 18.273±1.62 (15 egg masses inoculum) after 60 days of treatments. The total phenol content (mg/g) in the leaves of the control plants inoculated with 5 egg mass found to be 12.325±2.03 (10%), 11.027±1.03 (20%) and 8.352± 0.72(30%) treatments of 60 days respectively. The same trend was also recorded in the plants inoculates with 10 and 15 egg masses (Table 4). The total phenol increased with infected plants than the healthy plants [8]. These observations are in confirmation of earlier reports [9-10] had showed that resistant cultivar of tomato and brinjal had more total phenol than susceptible and also that greater increase in phenolic contents after infection of nematode had occurred in resistant.

Since the organic amendments has a remarkable nemeticidal property on *Meloidogyne javanica*, further studies have been recommended to isolate and characterize nemeticidal chemical of organic amendments by sophisticated techniques, there by it can be used in the control of plant root-knot nematodes instead of synthetic pesticides in future.

REFERENCES

1. Agrios, G.N., 1997. Plant Pathology. Academic press, New York, pp: 565-577.
2. Sharma P. and R. Pandey, 2009. Biological Control of root-knot nematode; *Meloidogyne incognita* in the medicinal plant; Withania somnifera and the effect of biocontrol agents on plant growth. Afr. J. Agric. Res. 4(6): 564-567.
3. Sharma, M.K., A.U. Siddiqui and S. Bhargava, 2006. Management of root-knot nematode; *Meloidogyne incognita* in ghili through seed treatment. J. Mycol. Pl. pathol.
4. Musabyimana, T. and R.C. Saxena, 1999. Efficacy of neem seed derivatives against nematodes affecting banana. Phyto parasaitica, 27(1): 43-49.
5. Padhi, N.N. and G. Behera, 2000. Evaluation of nematicidal potential in ten indigenous plant species against *Meloidogyne incognita*. Indian phytopath. 53(1): 28-31.
6. Vaitheeswaran, M. and M. Ibrahim, 2003. Effect of leaf extract of *Leucaenae leucocephala* on *Phaseolus mungo* infected by *Meloidogyne incognita*. Indian J. Nematol., 33(1): 21-23.
7. Kannan, S., 1977. Studies on the hypersensitive reaction in the roots of the bean (*Dolichos lablab*) infected with the root-knot nematode. J. Madurai. Univ., 1: 56-62.
8. Bhargava, S., M.K. Sharma and P.K. Dhasora, 2007. Histopathological and Biochemical changes induced by Root-knot nematode, *Meloidogyne incognita* of resistance and susceptible cultivars of cowpea. J. Mycol. Pl. Pathol., 37(1): 112-116.
9. Ganguli, A.K. and D.R. Dasgupta, 1979. Sequential development of peroxidase (c.c.1.11.7) and IAA oxidase activities in relation to resistant and susceptible responses to tomatos to the root-knot nematode, *Meloidogyne incognita*. Indian J. Nematol., 9(2): 143-151.
10. Hasan, N. and S.K. Saxena, 1979. Effect of inoculating tomato with root-knot nematode, *Meloidogyne incognita* on the phenolic content and polyphenoloxidase activity In: Physiology of host pathogen intraction. A. Mahadevan, ed. Current trends in life sciences New Delhi, India; Today and Tomorrow's Printers and Publisher, 6: 99-203.