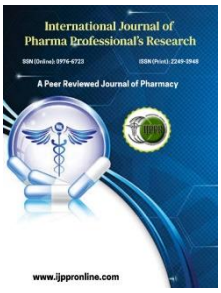
IJPPR (2023), Vol. 14, Issue 4 *Research Article*

INTERNATIONAL JOURNAL OF PHARMA PROFESSIONAL'S RESEARCH



Estimation of Organic Metabolites in Root Knot Nematode-Infested Spinach

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Keywords: Chlorophyll content, total carbohydrates, total free amino acids, root knot nematode (Meloidogyne incognita), Spinach (Spinacea oleracea), peels of kaghzi neemboo (Citrus aurantifolia)

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ABSTRACT: The Nematodes contain an enormous phylum of creatures that incorporates plant and creature parasites as well as some free-living species. Soil is a rich living space for nematodes, with around 26% of portrayed genera occupying soil as bacterivores, fungivores, omnivores, hunters or plant parasites. It is said that any place there is soil there are nematodes. Nematodes might harm plants straightforwardly or by implication. As a rule, the nematode invasion in fields is poly explicit; be that as it may, contingent on the agro-climatic conditions, a couple of animal types overwhelms over the rest. Meloidogyne incognita is all around damaging to practically every one of the plants including vegetables, foods grown from the ground cereal yields. Spinach (*Spinacea oleracea*) is additionally viewed as plagued by something very similar. Biocontrol with strips of Citrus aurantifolia (kaghzi neemboo) demonstrated gainful in controlling the invasion. Different natural metabolites were assessed in root tie nematode invaded spinach. Among natural metabolites chlorophyll, absolute carbs, all out free amino acids were assessed. Root tie nematode invaded spinach was treated with lemon's strips, which demonstrated valuable as far as expanded chlorophyll content. Adjusted complete carb and absolute free amino corrosive substance was found with S/4 of lemon strips treated spinach plants.

Introduction: Soil is a rich natural surroundings for nematodes, with around 26% of depicted genera occupying soil as bacterivores, fungivores, omnivores, hunters or plant parasites.[1] It is said that any place there is soil there are nematodes.

The Nematodes contain an enormous phylum of creatures that incorporates plant and creature parasites as well as some free-living species. Plant parasitic nematodes are commit parasites, acquiring nourishment just from the cytoplasm of living plant cells. These small roundworms by and large 4 mm long and scarcely noticeable to the natural eye) harm food and fiber crops all through the world and cause billions of dollars in misfortunes every year.[2]

The stationary endoparasites of family Heteroderidae cause the most financial harm around the world. Heteroderidae can be isolated into two gatherings: the blister nematodes (genera Heterodera and Globodera) and the root-tie nematodes (family Meloidogyne). The root-tie nematode, Meloidogyne incognita, is worldwide in circulation. It is broad in Asia, South-east Asia and typically happens in hotter regions.

Nematodes are captivating in light of the fact that they go through nearly their whole time on earth cycle implanted inside the underlying foundations of higher plants, sucking supplements from a taking care of site. This kind of presence gives them various advantages, which might assist with expanding the quantity of posterity.[3] The phytonematodes are for the most part answerable for slippery sickness manifestations in various harvests habitually and broadly bringing about gigantic misfortunes. Nematodes might harm plants straightforwardly or by implication as a rule, the nematode invasion in fields is poly explicit, in any case, contingent on the agro-climatic conditions, a couple of animal types rules over the rest.[4,5]

Accordingly, control endeavors have been made for avoidance of nematode passage, concealment of its populace, decrease in its impacts on the yields or blend of these standards.[6] Writing uncovers that root hitch nematodes (Meloidogyne incognita) are generally horrendous to practically every one of the plants including vegetables, leafy foods oat crops. Monetarily significant species in India are *M. javanica*, *M. incognita*, *M. graminicola* and *M. exigua*.[7,8] The essential indications, rankles or tie created on roots are symptomatic of the root hitch nematode (*M. incognita*) contamination. With this thought the current review had been taken to notice and control the root tie invasion on spinach *Spinacea oleracea* (spinach) has a place with Chenopodiaceous family and is broadly developed in India for its nutritious leaves.[9,10]

It is extraordinary among vegetable harvests on account of its incredibly high return in a generally brief timeframe. Other than a significant wellspring of Vitamin K, spinach is a decent wellspring of minerals, Vitamin B complex, ascorbic corrosive and carotene.[11,12] It is being assaulted by different specialists viz. microscopic organisms, growths and so on other than nematodes causing corruption, twisting and fixes on its leaves, which influence its general development followed by creation. Among different nematodes viz. Tylenchorynchus sp. Tylenchus sp., Heterodera sp., Meloidogyne sp., root tie nematode (*M. incognita*) and found to parasitize underlying foundations of spinach showing weighty nerve arrangement and misfortune to this harvest.[13]

In nematology, new control innovation devices are being worked out on the

example of those produced for bug bother control. Research around there is getting and potential endeavors might yield a few helpful other options.[14] These practices incorporate pheromone correspondence, steroid or chemical action, tactile improvements, utilization of avermectins which have powerful anthelminthic and insecticidal exercises and are in widespread use, particularly as specialists influencing parasitic nematodes. Notwithstanding, it is all around understood that incorporated nematode the board is the most ideal choice for keeping the populace levels of the vermin underneath financial edge by consolidated utilization of various control rehearses.[15,16]

An answer for this issue is likewise by the utilization of phytotherapeutic substances, through which nematode the executives are relied upon to be profoundly practicable according to the perspective of cost adequacy, natural wellbeing and financial suitability.[17] Fluid and natural concentrates of many plants have been accounted for to contain nematicidal or nematostatic compounds announced that bloom concentrates of Bauhinia variegata, Ixora parviflora Moringa oleifera, Tagetes eracta, Argemone maxicana and others were profoundly harmful against J2's of M. incognita.[9,10,16,18]

2. Materials and Methods: Seeds of spinach were cultivated in three imitations every one of Normal-Control, Infested Infected-control, and hacked strips of Citrus aurantifolia (lemon) and were corrected in 100 percent, half and 25% w/v of autoclaved soil and named as S, S/2 and S/4 individually. Following 60 days plants were removed and following boundaries were assessed. All out carb content was resolved as 100 mg of plant test was killed with 5 ml of 2.5 N HCl in water shower for 3 hrs and Neutralized further with Na_2CO_3. The volume was made up to 100 ml and centrifuged. 4 ml of Anthrone reagent was added to 1 ml supernatant. The test tests were kept alongside control in water shower for 8 minutes. It was cooled and optical thickness was estimated at 630 nm against glucose as 'clear'. A standard bend was drawn utilizing various convergences of standard glucose (0.2, 0.4, 0.6, 0.8 and 1 ml separately). The outcomes were communicated as how much all-out sugar was present in 100gm of plant test.

The method was followed for the assessment of free amino corrosive: Ca++, Mg++, Na+ ions. 500 mg of plant test was extricated with 10 ml of 80 % ethanol.[6] After centrifugation, 0.1 ml of supernatant was taken and in it, 0.1 ml refined water and 2 ml of ninhydrin arrangement was added. It was kept in a water shower for 15 minutes. Tests were cooled and 2 ml of ethanol was added, purple tone was created. The optical density of the test was estimated at 575 nm against leucine as 'clear'. Absolute free amino corrosive was communicated as percent identical to leucine. Complete chlorophyll was assessed by, 1 gm of finely cut leaves were ground in 20 ml of 80 % ethanol and centrifuged at 5000 rpm for 5 minutes.[4] Supernatant was isolated and buildup was again ground with 80% $CH_3)2CO$ till it become drab and again centrifuged at 5000 rpm. The volume of supernatant was made up to 100 ml with 80 % $CH_3)2CO$. The absorbance of arrangement was perused at 645, 663 and 652 nm against 80 % $CH_3)2CO$ as clear.

3. Results and Discussion:

3.1 Total Chlorophyll Content: The information introduced in Table 1 uncovered that chlorophyll content got adjusted in the typical, pervaded and treated spinach. All-out chlorophyll content in spinach leaves corrected with strips of Citrus aurantifolia showed expansion in chlorophyll content as contrasted and invaded control (I-C). Spinach treated with centralizations of S, S/2, S/4 contained 1.34, 1.29, 0.88 mg chlorophyll/gm tissue when contrasted with 0.79 mg chlorophyll/gm tissue of I-C and 0.94 mg chl/gm in typical control (N-C). Notwithstanding, revision with S and S/2 fixation showed more increment over plagued control and ordinary control spinach. Information introduced in Table 1 uncovered that the alteration of strips adjusts the chlorophyll content of spinach.

Absolute chlorophyll disintegrated in plagued control which have 0.45 mg chl/gm tissue when contrasted with 0.82 chl a/gm of typical control spinach S, S/2 and S/4 have 0.75, 0.82 and 0.84 mg chl/gm tissue S/4 contains more chlorophyll than S and S/2. Chlorophyll b in I-C, N-C spinach is 0.18, 0.45 mg chl b/gm tissue. S/2 and S/4 contain 0.43, 0.44, 0.45 mg chl b/gm tissue. S/4 showed increment over S, S/2. Medicines showed a lot of increment Chl b content over invaded control.

3.2 Total Carbohydrate Content: Expanded substance of absolute starch had been recorded in the infected foundations of spinach when contrasted with ordinary control spinach (Table 2). Swarmed spinach showed 137.5% sugar content over ordinary. Kaghzi neemboo altered spinach content which contains lower sugar than ordinary control. The pace of carb substance was viewed as contrarily corresponding to the pace of concentrates focuses as S/4 as S/4, S/2 and S showed 92.5%, 55% and 37.5% expansion over typical control spinach.[15] It revealed expanded sugar content in the root hitch nematode immunized roots, which might be because of the developments of different metabolites towards the disease site from different pieces of plants. Notwithstanding, a few different workers revealed decline carb content in the infected root when contrasted with the expansion sugar levels to high metabolic action in infected tissues.[19-23]

3.3 Total Free Amino-Acids: Expanded all out free amino corrosive had been found in the invaded control spinach when contrasted with typical control spinach. Invaded control spinach contained 3.70 mg/ml while ordinary spinach had showed as it were 0.38 mg/ml complete amino corrosive substance, S, S/2, S/4, kaghzi neemboo treated spinach contained 0.51, 3.30 and 4.87 mg/ml complete amino corrosive substance. Comparable conditions had been met by a few laborers, saw expanded amino corrosive substance because of improved turnover to assist nematode into effectively exposed type of amino-corrosive.[3,8,14,15] They likewise co-related the expanded degree of dissolvable proteins and amino acids with high protease movement in tainted tissue. The proteases are emitted by the nematode into have tissue for such a proteolytic debasement.[5] likewise noticed comparative changes that expansion level of protein content because of restraint of rootknot pervasion in Okra and brinjal plants.[7] additionally detailed expanded protein fixation at introductory phase of contamination.

Table 1. Estimation of Chlorophyll (mg/gm) of *Spinacea Oleracea* (Spinach)

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S. No.	Amendment	Normal control	% I/D	Infested control	% I/D	S	% I/D	S/2	% I/D	S/4	% I/D
1.	Peels of *Citrus aurantifolia*		--								
2.	Total chlorophyll mg/gm	0.94	-	0.79	-15.95	1.34	+42.53	1.29	+37.23	0.88	-6.81
3.	Chlorophyll a mg/gm	0.38	-	0.31	-18.42	0.57	+50.00	0.56	+47.36	0.35	-7.89
4.	Chlorophyll b mg/gm	0.60	-	0.48	-0.20	0.98	+63.33	0.93	+55.00	0.56	-6.66

Table 2. Quantitative Estimation of Different Metabolites in the Roots of Spinach

S. No.	Concentrations	Organic			
		Total carbohydrate content (mg/ml)	% I/D	Total free amino acid (mg/ml)	% I/D
	Normal-control	0.40	--	0.38	
	***Citrus aurantifolia* treatment**				
1.	S	0.55	+37.5	0.51	+34.21
2.	S/2	0.62	+55.0	3.30	+768.4
3.	S/4	0.77	+92.5	4.87	+1181.5
4.	Infested control	0.95	+137.5	3.70	+873.0

References:

1. Wharton DA, Barrett J, Goodall G, Marshall CJ, Ramløv H, Ice-active proteins from the Antarctic nematode Panagrolaimus davidi, Cryobiology. 2005; 51(2): 198-207.
2. Sasser JN, Freckman DW, A world perspective on nematology: the role of the society, Vistas on Nematology (Eds. JA Veech & DW Dickson), Society of Nematologists, Hyattsville, Maryland, USA. 1987; 7-14.
3. Tytgat T, De Meutter J, Gheysen G, Coomans A, Sedentary endoparasitic nematodes as a model for other plant parasitic nematodes, Nematology. 2000; 2(1): 113-121.
4. Arnon DI, Copper enzymes in isolated chloroplasts. Polyphenoloxidase in Beta vulgaris, Plant physiology. 1949; 24(1): 1.
5. Abbasi MW, Ahmed N, Zaki MJ, Shaukat SS, Effect of Barleria acanthoides Vahl. on root-knot nematode infection and growth of infected okra and brinjal plants, Pakistan Journal of Botany. 2008; 40(5): 2193-8.
6. Spies JR, Colorimetric procedures for amino acids: methods of enzymology, Academic Press, 1957; 464-471.
7. Gautam SK, Poddar AN, Study on protein and sugar content in Meloidogyne incognita infested roots of bitter gourd, International Journal of Current Microbiology and Applied Sciences. 2014; 3(5): 470-8.
8. Tayal MS, Agarwal ML, Biochemical altertations in galls induced by Meloidogyne incognita: Some hydrolysing enzymes and related chemical metabolites, Indian Journal of Nematology. 1982; 12(2): 379-82.
9. Mohanty KC, Swain SC, Pradhan T, Biochemical variations in resistant and susceptible brinjal varieties infected by root knot nematode, Meloidogyne incognita, Indian Journal of Nematology. 1995; 25(2): 142-6.
10. Hameed SF, Note on the effect of some organic additives on the incidence of root-knot nematodes in tomato (Lycopersicon esculentum Mill), Indian Journal of Agricultural Science. 1970; 40: 207-10.
11. Hofmann J, Wieczorek K, Blöchl A, Grundler FM, Sucrose supply to nematode-induced syncytia depends on the apoplasmic and symplasmic pathways, Journal of Experimental Botany. 2007; 58(7): 1591-601.
12. Hofmann J, Szakasits D, Blochl A, Sobczak M, Daxbock-Horvath S, Golinowski W, Bohlmann H, Grundler FM, Starch serves as carbohydrate

storage in nematode-induced syncytia, Plant Physiology. 2008; 146(1): 228-35.

13. Singh IN, Sharma JA, Sharma RA, Biochemical alterations induced by Meloidogyne incognita in brinjal, Indian journal of nematology. 1978; 8: 122-126.
14. Khan AH, Masood A, Saxena SK, Effect of water soluble extracts of oilcakes on incognita, Indian Journal of Nematology. 1980; 10: 105-6.
15. Mohanty KC, Mohanty PK, Pradhan T, Effect of Meloidogyne incognita on root biochemistry and functioning of nodules in green gram, Indian Journal of Nematology. 1997;27(1):1-5.
16. Nandal SN, Bhatti DS, Preliminary screening of some weeds shrubs for their nematicidal activity against Meloidogyne javanica, Indian Journal of Nematology. 1983; 13(1): 123-7.
17. Nayak DK, Mohanty KC, Biochemical changes in brinjal induced by root-knot nematode, Meloidogyne incognita. Indian Journal of Nematology. 2010; 40(1): 43-7.
18. Rakesh P, Alok K, Neetu K, Sunil K, Nematicidal activity in flowers of some medicinal and aromatic plants, Indian Journal of Nematology. 2001; 31(1): 96-8.
19. Saxena R, Singh R, Efficacy of botanicals, efficacy of botanicals against root knot nematode meloidogyne incognita on sponge gourd. Luffa cylindrica, L., International Journal Mendel. 2001; 18(1-2): 43-6.
20. Sharma W, Trivedi PC, Biochemical evaluation of various metabolites as influenced by root-knot nematode in Abelmoschus esculentus, Indian Journal of Nematology. 1996; 26(2): 152-7.
21. Siddiqui ZA, Mir RA, Mahmood I, Effects of Meloidogyne incognita, Fusarium oxysporum f. sp. pisi, Rhizobium sp., and different soil types on growth, chlorophyll, and carotenoid pigments of pea, Israel Journal of Plant Sciences. 1999; 47(4): 251-6.
22. Singh R, Evaluation of some natural plant extracts against root knot nematode, Meloidogyne sp. on cucurbitaceae (Doctoral dissertation, Ph. D. Thesis, MJP Rohilkhand University, Bareilly). 1999.

Gawade BH, Chaturvedi S, Khan Z, Pandey CD, Gangopadhyay KK, Dubey SC, Chalam VC, Evaluation of brinjal germplasm against root-knot nematode, meloidogyne incognita, Indian Phytopathology. 2022; 75(2): 449-56.