Research Journal of Recent Sciences _____ ISSN 2277-2502
Vol. 3**(ISC-2013),** 264-266 **(2014)** *Res. J. Recent. Sci.*

Effect of leaf Extract of Nilakumil, (*gmelina asiatica*) against the Root knot Nematode, (*Meloidogyne incognita*)

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Available online at: www.isca.in, www.isca.me
Received 7th November 2013, revised 3rd January 2014, accepted 19th February 2014

Abstract

Studies on the identification and use of local plant extracts for the control of plant parasitic nematodes, or integrated control methods are the current areas of research in plant nematology. The present study was undertaken to identify the new activities from plant origin for their nematicidal activity to determine the egg hatchability and nematode larval mortality of root knot nematode, Meloidogyne incognita. Many plants are known to have nematicidal properties which may be utilized as organic amendments or biopestcides. Many scientists have carried out the research on plant extracts for the control of root knot nematodes .The extract of Gmelina asiatica plant leaves at different concentrations (5, 10, 15, 20 and 25 ppm) were tested on root-knot nematode, Meloidogyne incognita egg masses. The nematicidal activity of G.asiatica leaves, inhibition of egg hatchability and larval mortality were decreased with increase in all the concentrations of leaf extract. Larval mortality was increased gradually with increased period of exposure time and increasing concentrations of leaf extract. They reported a reduction in egg hatchability and an increase in nematode larval mortality. Hence, the present investigations on nematicidal potential of plant species G.asiatica against the root knot nematodes, M.incognita.

Keywords: *Meloidogyne incognita, Gmelina asiatica,* nematicidal potential, nematicidal activity, Egg hatchability and larval mortality.

Introduction

Agriculture is the backbone of the World economy. In the modern scenario, the World is facing a challenge to provide balanced and healthy food to everyone in the World due to growing population explosion especially in India. The amount of food production is greatly being reduced because of the damage caused by nematodes in the agricultural crops. Plant diseases are the major cause of the downfall of agricultural markets of a country. *Meloidogyne* species are main parasites of fruits and vegetables. These parasites produce immense physiological as well as morphological disorders and diminish harvest around the globe[1-3]. More than 2000 plants species were affected by plant parasitic nematodes.

Root knot nematode, Meloidogyne incognita is most important plant pathogen found in the tropical and sub tropical region. It is affect the plant growth, reduction the yield and have the ability to break the resistance of host plant and make it more susceptible to other pathogens[4-6]. The nematodes damege the root systems and reduce the uptake of water and fertilizers utilization, leading to additional losses for the growth of the plant. Most of the currently used methods for the management are not effective against root knot nematodes as they are soil inhabiting. Cultural practices, such as, crop rotation are commonly used, but such practices are not effective as root knot nematodes have a wide host range and they remain in soil for years.

Synthetic chemical nematicide is one of the most fastest and effective nematode control methods, but they are hazard to both humans and the environment and are relatively unaffordable to the average small scale farmers[7]. Hence, there is the need to develop alternative methods to control that are cheap, eco friendly and not harmful to human beings. The use of botanicals is one of the alternative methods suggested by nematologist for nematode control. Botanicals such as *Azadirachta, Eucalyptus, Chrommelina, Sida acuta* and *Targetis* have been found to be effective in the control of nematodes in cowpea, tomato and egg plant fields[8].These plant based products are not only control plant parasitic nematodes but also improve the soil fertility and crop yield by several years. Hence, the present investigation have been carried out the nematicidal activity of leaf extract of *G.asiatica* against the root knot nematode, *Meloidogyne incognita*.

Material and Methods

The leaves of the plant, *Gmelina asiatica* are collected from Nallatharai village nearby Aruppukottai at Virudhunagar District. The leaves were collected, shade dried and powdered with the help of a mixer grinder. The leaf powder was extracted by using Soxhlet apparatus with 200 mL of acetone as a solvent. The extracted leaf material was then dissolved in acetone (1:10) w/v to prepare stock solution. Different concentrations of plant extracts (5 to 25 ppm) were prepared from the stock solution using distilled water. For obtaining the egg masses and nematode larvae, pure culture of *M.incognita* maintained on tomato plants

in sterilized soil. Effect on egg hatchability was evaluated on five mature uniform size egg masses of *M. incognita* were suspended in the extracts and water (control), replicated three times in cavity blocks. The blocks were kept at room temperature. The total number of larvae hatched was recorded at 24, 48 and 72 hours intervals. Hatched larvae were counted under the inverted compound microscope. For effect of nematode mortality on 30 freshly hatched J2 of *M. incognita* were placed in each dilutions and control, replicated three times in cavity blocks. The blocks were kept at room temperature. Larval mortality of was calculated as a percent of total larvae suspended and LC_{50} and LC_{90} values were determined by using Probit analysis[9].

Results and Discussion

Egg-hatchability: Plant material, plant based phytochemicals are known to possess the effective control of of plant-parasitic nematodes[10] including root-knot nematodes[11, 12]. Naturally occurring nematicidal compounds toward *Meloidogyne incognita* include pyrrolizidine alkaloids[13], trans-anethole[14], p-anisaldehyde, transcinnamaldehyde, 2-furaldehyde and benzaldehyde[15]. The nematicidal effect of leaf extract of *G.asiatica* is shown in table 1. The effect of different concentrations of leaf extract on *M.incognita* egg hatch inhibition in the laboratory. The egg suspension was diluted to 30 eggs at 1ml concentration and 1ml of the egg suspension was transferred to each cavity block. The cavity blocks were covered with glass covers and incubated at room temperature. There were three replicates for each treatment. Hatched eggs were counted after 24, 48, 72 hrs exposure time using an inverted compound microscope. The result indicated that leaf extract was more effective and also higher the dilutions of extracts lower their inhibitions against egg hatchability. This result shows that as dilutions increases the toxicity decreases and hence decreased in percentage of egg hatched. The control recorded 100 % egg hatchability because it contained only distilled water. The inhibitory effect of the extract could also as result of their phytochemical content which has ovicidal property. Abdalla *et al*.,[16] reported that methanol and hexane extracts of the 27 plant leaf extracts were screened for nematicidal property against root knot nematode, *M. incognita* in the laboratory. The second stage juveniles of *M.incognita* were exposed to 500 ppm of each plant extract for 24, 48 and 72 hrs. Five plant extracts exhibited highly promising mortality rates of 95-99% after 72 hrs of exposure ($P<0.05$)[17]. Reported that extracts that contain alkaloids and flavonoids have ovicicidal property against *Meloidogyne* eggs.

Larval mortality: Table 2 shows the effect of the different concentration of the leaf extract of *Gmelina asiatica* on larval mortality over time. The leaf extract is effective in causing larval mortality with 25 ppm concentration being more efficacious. It showed that a high significant difference than the other concentration. The numbers of active and motionless juveniles were counted after 24, 48 and 72 hours exposure using an inverted compound microscope. The juvenile mortality was observed to increase with increase of exposure time. Nematodes that remained motionless when touched with a needle were considered as dead[18]. The result of the study indicated that increasing the concentration of leaf extract increasing the larval mortality was recorded. Control recorded the low mortality because it was only distilled water. Nematicidal property of some phytochemical (saponins, flavonoids and glycocides) content extracted by these plant leaf or oxygenated compounds which have been characterized by their lipophytic properties that enable them dissolve the cytoplasmic membrane of the nematode cells and their functional groups interfering with enzyme protein structures of nematodes[19].

Table-1
Effect of different concentrations of leaf extracts on egg hatchability in the root knot nematode *Meloidogyne incognita*

Exposure Time (Hours)	Egg hatchability at different concentrations (ppm) of Nilakkumil, *Gmelina asiatica*						Total
	Control	5 ppm	10 ppm	15 ppm	20 ppm	25 ppm	
24	18	13	11	10	8	3	63
48	23	19	15	12	6	2	77
72	28	22	18	15	10	2	95

Table-2
Effect of different concentrations of leaf extracts on larval mortality in the root knot nematode *Meloidogyne incognita*

Exposure Time (Hours)	Larval mortality (%) at different concentrations (ppm) of Nilakkumil, *Gmelina asiatica*					
	Control	5 ppm	10 ppm	15 ppm	20 ppm	25 ppm
24	0	14.67	16.34	18.67	20.67	26.67
48	0	19.0	22.34	23.67	26.0	27.34
72	0	15.34	18.34	20.34	23.0	25.67

Table-3
Toxic effect of leaf extracts *Gmelina asiatica* against the root knot nematode *Meloidogyne incognita*

Plant	Hours	LC50	LC 90	Slope ± SE	Chi square (X^2)	Spontaneous response rate
Gmelina asiatica	24	7.79	59.01	0.52 ± 0.46	3.597	0.06 ± 0.04
	48	3.69	30.43	0.55 ± 0.49	0.434	0.10 ± 0.05
	72	6.32	51.90	0.53 ± 0.46	0.846	0.06 ± 0.04

Conclusion

The present investigation indicates that the leaf extract of *G. asiatica* was able to inhibit the egg hatchability and larval mortality of root knot nematode, *Meloidogyne incognita*. It is recommended for the control of nematode population and infection to the host plant. The efficacy of leaf extract is recommended for the small scale former.

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