Acta Parasitologica Globalis 6 (2): 103-106, 2015
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2015.6.2.94260

Nematicidal Activity of Root Extracts of *Aerva lanata* and *Aerva javanica* against the Root-Knot Nematode, *Meloidogyne incognita*

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Abstract: The present study was carried out to evaluate the nematicidal activities of two plant root extracts of *Aerva lanata* and *Aerva javanica* against the root-knot nematode, *Meloidogyne incognita.* The root extracts were prepared using sohxlet apparatus using methanol as a solvent. Various concentrations (5, 10 and 15ppm) of root extracts were prepared. Hatchability decreased and the larval mortality increased with increasing of both concentrations and exposure time. The root extracts of *A. lanata* and *A. javanica* were also highly promising mortality at 15 ppm concentration at 80% after 72 h exposure. *A. lanata* and *A. javanica* root extracts suppressed egg hatchability and increased larval mortality of the root-knot nematode, *M. incognita.*

Key words: Nematicidal Potential · Egg Hatchability · Larval Mortality

INTRODUCTION

Nematodes, the tiny roundworms are among the most abundant creatures on earth [1]. All plant parasitic nematodes are obligate parasites, feeding exclusively on the cytoplasm of living plant cells. The most economically important groups of nematodes are the sedentary endoparasites, which include the genera *Heterodera* and *Globodera* (cyst nematodes) and *Meloidogyne* (root-knot nematodes). One of the major threats to agricultural sustainability is the incidence of microscopic parasitic worms, called nematodes, causing global crop yield loss of $125 billion annually [2].

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 [3-5]. The nematodes damage 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.

Although the application of chemical nematicides have been found as an effective measure for the control of nematodes but due to high toxic residual effect of chemical on the environment and particularly on non-target organisms [6]. Many plants are known to have nematicidal properties which may be utilized as organic amendments or bio-pesticides. Many scientists have carried out the research on plant extracts for the management of root knot nematodes. Botanical extracts are alternative to nematicides in recent times. Some botanicals such as, *Argemone mexicana, Calotropis procera, Solanum xanthocarpum* and *Eichhornia echinulata* are already being exploited in nematode management [7]. Plants are nature's chemical factories which provide the richest sources of organic chemicals on earth [8]. Exploration of nematicidal potential of botanicals (Egg hatchability and larval mortality test) and their application is on increase. Different plant species are being tested to identify the sources of nematicidal substances (Analyzing photochemical using GC -MS) and many of them have shown promising results in the control

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of plant parasitic nematodes [9]. Hence the present study aimed to evaluate the root extracts of *Aerva lanata* and *Aerva javanica* as a good nematicidal activity against the root-knot nematode, *Meloidogyne incognita*.

MATERIALS AND METHODS

The roots of *Aerva lanata* and *Aerva javanica* were collected from Sathirapatti village nearby Sivakasi at Virudhunagar District, Tamil nadu, India. The roots are collected, shadow dried and making powdered by using a mixer grinder. An amount of 25 g of root powder was weighed and tagged with filter paper. Then the extract was taken in Sohxlet apparatus using acetone as solvent and the temperature was maintained at 55°C [10]. The extract was stored in a refrigerator and used whenever needed after redissolving in distilled water. One gram of residue taken and dissolved in 100 ml of distilled water, which is kept as stock solution. To prepare the 5 ppm of test solution, 5 ml of stock solution was taken and dissolved with one litre of distilled water. The same procedure was followed to prepare 10 and 15 ppm concentrations. A small drop of eggs suspended in distilled water was placed in Petri dishes and eggs counted under a stereo microscope. Ten milliliter of the undiluted and each dilution of root extract of each plant were added. Petri dishes containing distilled water served as controls. Each treatment was replicated four times. The Petri dishes were incubated at room temperature. Hatching was observed after 24, 48 and 72 h. For larval treatments, 10 ml of the undiluted and each dilution of root extract of each plant were separately poured into Petri dishes and 1ml of suspensions containing 20 freshly hatched juveniles were added to each Petri dish. All treatments were replicated four times. The Petri dishes were incubated at room temperature. Percent mortality was calculated after 24, 48 and 72 h [11]. Larval mortality was calculated as a percent of total larvae suspended and LC_{50} and LC_{90} values were determined by using Probit analysis [12].

RESULTS AND DISCUSSION

Egg-Hatchability: The nematicidal effect of root extracts of *A. lanata* and *A. javanica* root extracts were selected and tested on the egg hatchability of root-knot nematode, *M. incognita* (Table 1). The effect of different concentrations of root extract on *M. incognita* egg hatching inhibition in the laboratory. The result indicated that root extracts were more effective and the high dilutions of extracts had lower inhibitions against egg hatchability. The control recorded 100 % egg hatchability because it contained only distilled water. Similarly Ganai *et al*. [13] reported that the fresh leaf extracts of *Nicotiana plumbaginifolia*, *Wedelia chinensis*, *Cassia tora* and *Jatropha curcas* and flowers of *W. chinensis*, *Catharanthus roseus* and *Calendula officinalis* for their hatching inhibitory and juvenile mortality. Increased dilution showed a direct effect on hatching but an inverse effect on mortality. The juvenile mortality increased with increase in exposure period. The egg hatchability and larval mortality of root knot nematode *M. incognita* against the leaves of *Mimusops elengi*. Decrease larval hatchability in the high concentration of the leaf extract and the increase in number of larval mortality were observed [14].

Larval Mortality: Table 2 shows the effect of the different concentrations of the root extracts of *Aerva lanata* and *Aerva javanica* on larval mortality over time. The root extract caused larval mortality with 15 ppm concentration being more efficacious. It showed that a high significant difference than the other concentrations. The juvenile mortality increased with increase of exposure time. Nematodes that remained motionless when touched with a needle were considered as dead [15]. Similarly results were observed Archana and Saxena [16] studied the aqueous extract of medicinal plants viz., *Amaranthus spinosus*, *Chenopodium album*, *Catharanthus roseus*, *Solanum nigrum* and *Ocimum sanctum* against second stage juvenile of *M. incognita* by *in vitro* technique.

Table 1: Effect of different concentrations of root extracts of *Aerva lanata* and *Aerva javanica* on egg hatchability in the root knot nematode *Meloidogyne incognita*

	Egg hatchability (%) at different concentrations (ppm) of *Aerva lanata*				Egg hatchability (%) at different concentrations (ppm) of *Aerva javanica*			
Exposure time (h)	Control	5	10	15	Control	5	10	15
24	4	6	4	4	4	3	2	2
48	6	5	4	4	5	6	5	4
72	5	4	4	3	4	4	4	3

Table 2: Effect of different concentrations of root extracts of *Aerva lanata* and *Aerva javanica* on larval mortality in the root knot nematode *Meloidogyne incognita*

	Larval mortality (%) at different concentrations (ppm)							
	Aerva lanata				*Aerva javanica*			
Exposure time (h)	Control	5	10	15	Control	5	10	15
24	0	40	60	70	0	20	50	60
48	0	30	40	50	0	40	50	70
72	0	40	70	80	0	40	60	80

Table 3: Toxic effect of root extracts *Aerva lanata* and *Aerva javanica* against the root knot ematode *Meloidogyne incognita*

Plants	Hours	LC50	LC90	Slope±SE	Chisquare (x^2)
Aerva lanata	24	7.103	43.097	1.63±1.19	0.001
	48	6.298	22.210	2.34±1.24	0.027
	72	15.787	241.809	1.08±1.19	0.014
Aerva javanica	24	10.986	38.997	2.32±1.25	0.092
	48	6.811	26.095	2.19±1.22	0.129
	72	7.973	54.707	1.53±1.18	0.227

Aqueous extract of all plant roots exhibited nematicidal activity. LC_{50} values calculated as 1024 ppm for *C. roseus*, 1867 ppm for *S. nigrum*, 1968 ppm for *A. spinosus*, 3428 ppm for *C. album* and 962 ppm for *O. sanctum*. LC_{50} values showed that out of these extracts *O. sanctum* found to be the most effective.

CONCLUSION

It has been concluded that certain plant extracts are a source of cheap and effective nematicides of root knot nematodes. The root extracts of *Aerva lanata* and *Aerva javanica* were found to be nematicidal properties. The present investigation indicates that the root extracts of *A. lanata* and *A. javanica* was able to inhibit the egg hatchability and larval mortality of root knot nematode, *Meloidogyne incognita*.

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