Effect of *Aerva lanata* in Controlling Root-Knot Nematode *Meloidogyne incognita* of Tomato in Sri Lanka

G.D.T.M. Nanayakkara, P.B. Ratnaweera *and* A.A.K. Karunathilake
Uva Wellassa University, Badulla, Sri Lanka

Introduction

The root knot nematodes (*Meloidogyne spp.*) are a group of endo-parasites which are among the most damaging agricultural pests, attacking a wide range of crops worldwide. In Sri Lanka, tomato (*Lycopersicon esculentum* Mill.) is a commercial and a widely grown vegetable which is often severely prone to attack by root-knot nematode, *Meloidogyne incognita*. Other than in tomato, the *Meloidogyne spp.* cause serious reduction in yield in several economically important plants such as potato, chillies, okra, mung-bean, rice, tea and tobacco (Akhtar, 2000).

Nematode control is mainly based on chemical nematicides, which present potential risk on non-target organisms and the environment. Their high costs, non-availability at the time of need and the hazards they pose, discourage most potential users. In the search for more environmental friendly and acceptable alternatives to chemicals, possibilities are being investigated to exploit nematode-anatagonistic plants for nematode control. Leaf extracts of certain plants are known to have nematicidal or nematostatic properties against several plant parasitic nematodes (Gapasin *et al.*, 2002). The nematicidal activity of the plant extracts can leads for development of plant-based agrochemicals.

Weeds are usually aggressive growers with the presence in large quantities. These plants species may therefore contain active biological compounds to resist various nematode infections. Biological nematicides prepared with weed plant extracts have the advantage of readily availability, low cost and environmental safety over other conventional nematicides. Therefore, the main objective of this study was to evaluate the effect of *Aerva lanata* (Ameranthaceae) weed plant species for nematicidal activity against *Meloidogyne incognita*, root-knot nematode collected from tomato.

Materials and methodology

According to Potenza *et al.* (2006) several families of plants are known to have compounds with insecticidal activity. Therefore, the weed plant species, *A. lanata* from family Ameranthaceae was selected for the study. The plants were collected from home gardens and university premises and were authenticated by the National Herbarium, Peradeniya. Second stage juvenile (J2) larvae of *M. incognita* which were collected from root knots of infected tomato plants and cultured under laboratory conditions were used for the investigation.

The leaves of *A. lanata* were separated and air dried for two weeks until complete removal of water. Then 15 g of dried plant leaves from each species were ground and extracted separately with absolute ethanol, ethyl acetate and dichloromethane solvents using a sonicator for 20 minutes. The extracts were filtered with filter paper (Whatman No. 1) and solvents were completely evaporated using a rotary evaporator at 40 ^{0}C and 150 rpm. The solid residual was weighted and stored at 4 ^{0}C until use. Measured quantities of plant leaves extract were dissolved with distilled water to make five different dilutions (100, 300, 700, 500, 1000 μg/mL). 3 mL of each dilution was poured into sterile petri dishes and ten freshly hatched J2 larvae of *M. incognita* were transferred into each petri dish. Distilled

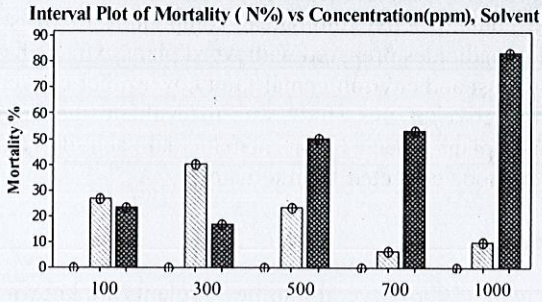
water was used as the control and each treatment was replicated thrice. The petri dishes were kept in the dark at room temperature (25-27 °C) and the number of dead J2 larvae was counted by using a stereo microscope (Labomed, USA) after 24 and 48 hours.

The nematicidal activity of the plant extract was assessed based on the mean mortality percentage of the nematodes. General linear model was used for the data analysis using Minitab 14 software. Means were compared using Tukey comparison test while Probit Analysis was used to estimate the LC_{50} (50 % killed lethal concentration) values. Paired T-test was used to compare nematode mortality after 24 hours and 48 hours of exposure.

Results and discussion

Ethyl acetate extract of *A. lanata* leaves with a concentration of 1000 µg/mL showed the best nematicidal activity which is 83.33 ± 5.77 % after 24 hours (Figure 1a). This extract showed a highly significant difference ($P<0.05$) compared to control, and most of the other concentrations of other solvent extracts. 700 µg/mL and 500 µg /mL concentrations of ethyl acetate extracts also showed high *M. incognita* mortality of 53.33 ± 11.55 % and 50.00 ± 10.00 %, respectively. Hence, there was no significant difference between these two extracts and the best extract. Dichloromethane extracts of *A. lanata* showed no effect on *M. incognita* mortality after 24 hours. According to the probit analysis, the LC_{50} values for ethyl acetate and ethanol extracts of *A. lanata* were 722.16 ± 0.25 µg/mL and 19211.00 ± 0.84 µg/mL, respectively. Thus, ethyl acetate extract showed the highest lethal effect to *M. incognita*. These results demonstrate that ethyl acetate is the most suitable solvent to extract the chemical compounds in the leaves of *A. lanata*.

(a)



(b)

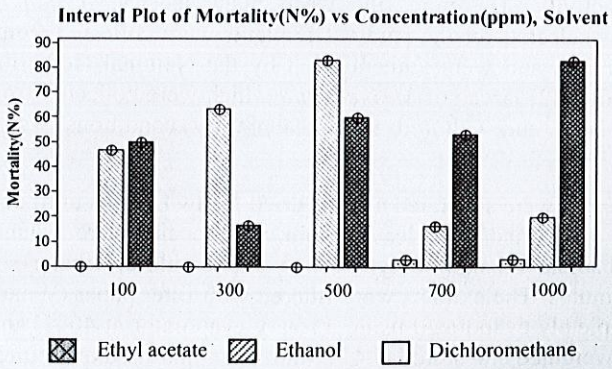


Figure1: Mean % mortality of *M. incognita* at 100, 300, 700, 500, 1000 µg /mL concentrations of dichloromethane, ethanol and ethyl acetate leaf extracts of *A. lanata* after 24 hours (a) and 48 hours (b) of exposure.

Figure 1b demonstrates that the nematode mortality percentage has increased after 48 hours of exposure to *A. lanata* leaf extracts. Nematode mortality showed a significant increase after 48 hours of exposure to 500 µg/mL and 300 µg/mL ethanol extracts (T_{500}=5.2, T_{300}=7.0, $P<0.05$). Though dichloromethane extracts had no effect on *M. incognita* mortality after 24 hours, 700 µg/mL and 1000 µg/mL concentrations of the dichloromethane leaf extract have shown nematode mortality with longer time of exposure.

The nematicidal activity of the *A. lanata* plant extract used in this study may serve as leads for development of plant-based agrochemicals. Thus, it is unknown whether the nematicidal activity was due to a single compound or to a complex of compounds, or other mechanisms and/or interactions. Therefore, future research should be carried out using bioassay guided fractionation methods to isolate the bioactive compounds responsible for the nematicidal activity.

Conclusion

This study showed that the leaf extracts of the weed plant, *A. lanata* posseses good nematicidal activity against *M. incognita* in tomato and the mortality of *M. incognita* increases with longer duration of exposure.

References

Akhtar, M. 2000. Nematicidal potential of the neem tree *Azadirachta indica* (A. Juss), Integrated Pest Management Reviews. 5:57-66.

Gapasin, R. M., S. Miller, and C.V. Ranchez 2002. Nematicidal activity of some plant species PCARRD Highlights, Philippines.118-119.

Potenza, M. R., J. Justi-Junior and J. N. Alves 2006. Evaluation of contact activities of plant extracts against *Sitophilus zeamais motschulsky* (Coleoptera: Curculionidae), Alternative Methods to Chemical Control, PS7-19-6203,811-815.