EFFECTS OF *AZADIRACTA INDICA, HANNOA UNDULATA AND HANNOA KLAINEANA* SEED EXTRACTS ON THE ABILITY OF *MELOIDOGYNE JAVANICA* JUVENILES TO PENETRATE TOMATO ROOTS

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The potential for nematicidal activity in indigenous plant materials or byproducts of the food or oil industries, as possible substitutes for conventional nematicides, has been investigated by many research workers. One of the more common essences suggested is neem (*Azadirachta indica* A. Juss.). There is substantial evidences that neem leaves (Egunjobi & Afolami, 1976 ; Saxena, Chhabra & Jasial, 1977) and neem oil cake (Sitaramaiah & Singh, 1978 ; Vijayalakshmi & Prasad, 1979) contain effective nematicidal substances. The present research was done to compare the effects of seed extracts of neem and two african essences *Hannoa undulata* (Guill. Perr.) Planch. and *Hannoa Klaineana* Planch. on the penetration of *Meloidogyne javanica* juveniles into tomato roots.

Seed extracts were prepared as follows :

— Crude powders of neem, *H. undulata* and *H. klaineana* were prepared by shelling almonds, cutting them into pieces and grinding in 5 cm^3 of distilled water for 5 mm in a Potter tissues grinder (1 500 R/mn) the quantities necessary to prepare suspensions in concentrations of 400, 800, 2 000, 4 000, 20 000 and 40 000 ppm.

— Delipidified powders of the three essences were obtained by extracting lipids of ground almonds with hexane in a Soxhlet apparatus (Polonsky & Bourguignon-Zylber, 1965). Each suspension was prepared in concentrations of 200, 400, 800, 2 000, 4 000 and 20 000 ppm in distilled water.

— Crude quassinoids of *H. klaineana* were obtained crystallised according to Polonsky and Bourguignon-Zylber's (1965) procedure. Solutions in distilled water were prepared in concentrations of 4, 20, 40, 200, 400 and 2 000 ppm.

Juveniles of *M. javanica* used in these experiments were derived from a clone established from a single egg mass and maintained on kenaf (*Hibiscus cannabinus* L.) in the greenhouse. Juveniles were extracted from galled roots using a mist chamber (Seinhorst, 1950) and only individuals collected within a 24 h period were used.

One hundred juveniles in 0.1 ml of distilled water were put in each Syracuse watch glasse (US Bureau of Plant Industry Model inside dimensions 20 mm

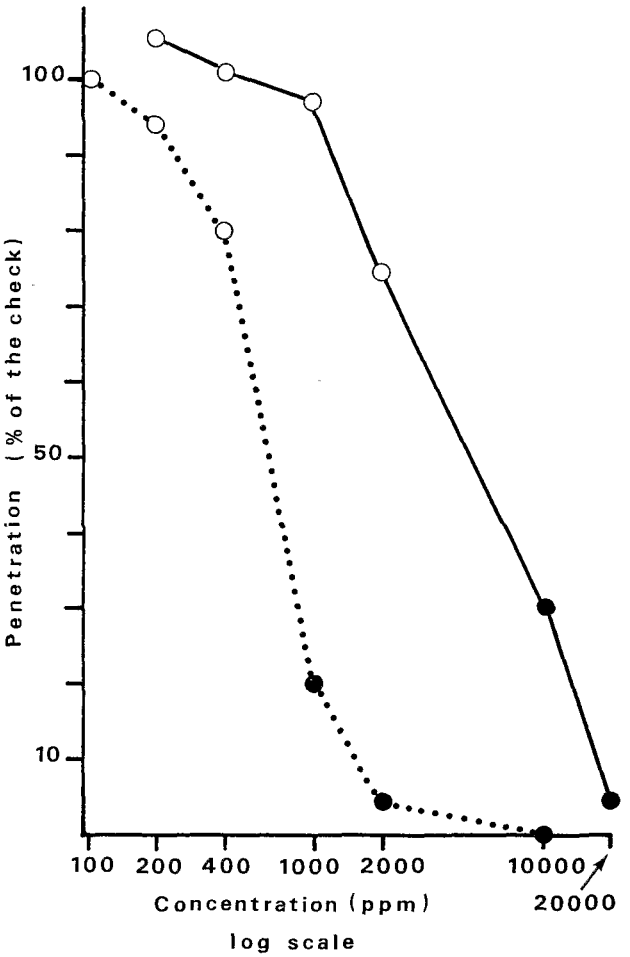

Fig. 1. Effects of Neem *(Azadirachta indica)* seed extracts on the percentage penetration (relative to controls) of tomato roots by *Meloidogyne javanica* juveniles previously exposed for 24 h to crude powder (solid line) and delipidified powder (dotted line). Filled circle indicates a significant difference ($p = 0.05$) after Mann-Whitney test.

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diameter × 8 mm deep). Then 0.1 ml of seed extract was added to the nematodes suspension and 0.1 ml of distilled water was added to the check lots. The concentrations, at which juveniles were exposed, were respectively : crude powders 200, 400, 1 000, 2 000, 10 000 and 20 000 ppm and delipidified powders 100, 200, 400, 1 000, 2 000 and 10 000 ppm and crude quassinoids of *H. klaineana* 2, 10, 20, 100, 200 and 1 000 ppm.

Juveniles were left in the extracts 24 h at 28°. Then the juveniles were inoculated on two-week-old tomato seedlings transplanted in a 18 cm^3 glass pot containing 16 cm^3 of autoclaved (120° for 30 mn) sandy soil. Forty eight hours after inoculation tomato roots were washed free of soil and stained with cold cotton blue lactophenol (de Guiran, 1966) and juveniles in the roots were counted using a dissecting microscope. The experiments were repeated three times with seven replications for each extract and concentration combination.

Figures 1, 2 and 3 summarize results recorded with Neem, *H. undulata* and *H. klaineana* extracts respectively. Inhibition of juvenile penetration increased with the concentration of each extract. Seed extracts of *H. undulata* and *H. klaineana* reduced the penetration more than extracts of Neem. With crude seed extracts of Neem, *H. undulata* and *H. klaineana* 20 000, 10 000 and 2 000 ppm respectively were needed for full inhibition of nematode penetration. Ten times less crude extracts of *H. undulata* and *H. klaineana* (1 000 ppm) than extracts of neem (10 000 ppm) induced a significant reduction in penetration.

The three delipidified seed extracts were two times more effective than the corresponding crude extracts. These seeds contain approximately 50 % lipid and their removal may have concentrated the active ingredient ; there is also substantial evidence that the active compounds are not liposoluble and that they remain in the oil cakes and are soluble in water (Egunjobi & Afolami, 1976). In fact the crude quassinoids of *H. klaineana* extracted from the delipidified powder with boiling water were twenty times more effective than the delipidified powder. A full inhibition of juvenile penetration was obtained at 100 ppm and a significant reduction in the penetration rate was observed at 20 ppm.

These effective pretreatment concentrations of 100 and 20 ppm quassinoids were diluted by at least 10 times in the soil water during the penetration period of the pot experiment. During the penetration phase in soil the effective quassinoid concentrations in the soil water were approximately 10 ppm for a full inhibition of juveniles penetration and 2 ppm for a significant reduction in penetration. These concentrations are close to the effective concentrations of conventional nematicides. Johnson and Lear (1968) observed that concentration of 20 to 25 ppm DBCP/g of soil water was necessary to kill *M. javanica*. A full inhibition of penetration of *Pratylenchus vulnus* into bean roots was obtained under continuous exposure of 10 ppm of carbofuran (Marban-Mendoza & Viglierchio, 1980).

The crude quassinoid extract of *H. klaineana* was a mixture of three polycyclic lactones : chaparrinone, klaineanone and glaucarubolone ; investigations to identify their mode of action are in progress.

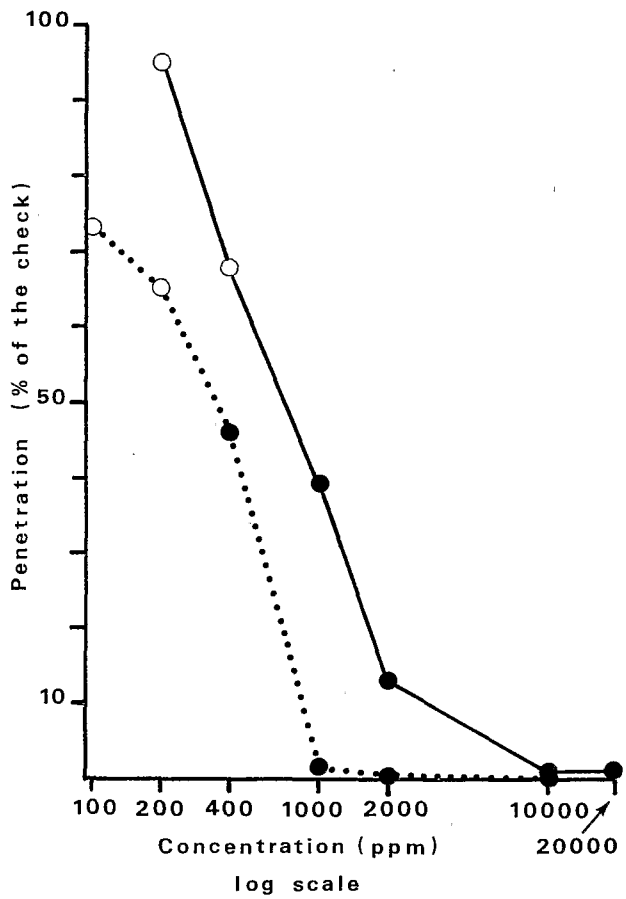

Fig. 2. Effects of *Hannoa undulata* seed extracts on the percentage penetration (relative to controls) of tomato roots by *Meloidogyne javanica* juveniles previously exposed for 24 h to crude powder (solid line) and delipidified powder (dotted line). Filled circle indicates a significant difference ($p = 0.05$) after Mann-Whitney test.

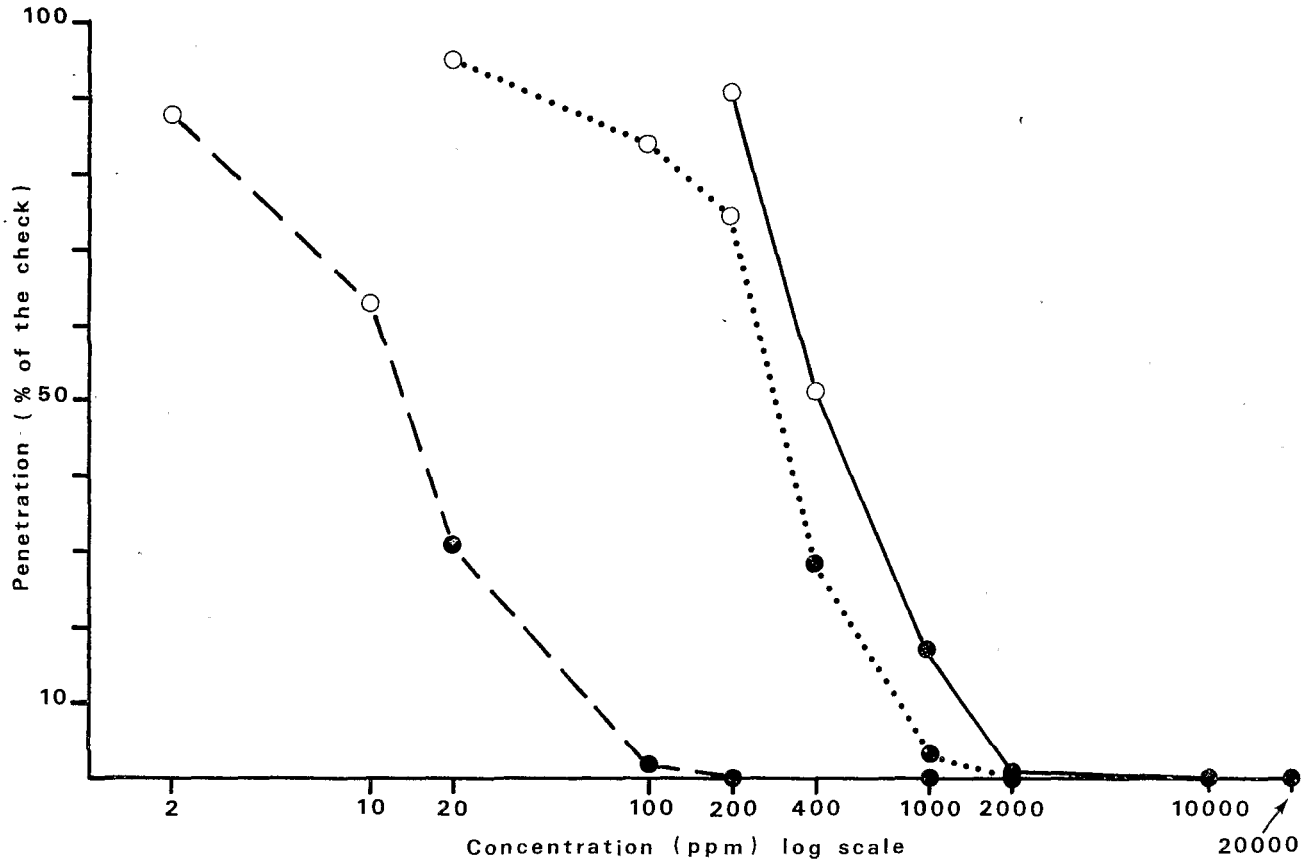

Fig. 3. Effects of *Hannoa klaineana* seed extracts on the percentage penetration (relative to controls) of tomato roots by *Meloidogyne javanica* juveniles previously exposed for 24 h to crude powder (solid line), delipidified powder (dotted line) and crude quassinoids (broken line). Filled circle indicates a significant difference ($p = 0.05$) after Mann-Whitney test.

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