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Effects of some plant extracts on larval hatch of the root-knot nematode, *Meloidogyne incognita*

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Abstract
The inhibitory effect of water extract of seed, leaf and bark of five plants, viz., *Tamarindus indica, Cassia siamea, Isoberlinia doka, Dolnix regia* and *Cassia sieberiana* was evaluated on larval hatch of *Meloidogyne incognita* in the laboratory. All the plant parts inhibited larval hatch of *M. incoginta* Percentage inhibition was higher in the seeds followed by the leaves and bark. Degree of inhibition observed, was directly related to the concentration of the extract. The standard suspensions inhibited hatching by about 97% while dilutions of S/100 inhibited larval hatch by 3%. Nematicidal activity of the plant parts of the five plants showed that *C. siamea* was the most effective followed by *C. sieberiana, I. doka, T. indica* and *D. regia*.

Keywords: *Root-knot nematodes, toxicity, plant extracts, control*

Introduction

Several measures have been employed to manage nematode problems worldwide. Notable among these are chemical nematicides. Although instantaneously effective, they are usually prohibitively expensive and not readily available particularly for the resource-poor farmer in Nigeria. Moreover, they cause a lot of hazards to both man and livestock and inflict injury to the environment. This has prompted research into alternatives that are effective, cheap and compatible with the environment. Notable among these alternatives is the use of plants and plant parts. Several reports abound to show the nematicidal activity of plants, plant parts and extracts of plant parts on plant-parasitic nematodes. For instance, chopped leaves of seven plants were found to significantly suppress population build-up of five species of nematodes (Mohammed & Mashkoor 1989, 1990). Pod husks of cocoa suppressed populations of *Melidogyne* spp. on cowpea when incorporated into the soil (Egunjobi 1985; Egunjobi & Afolami 1976). Nematicidal effects of plants extracts (Padhi et al. 2000, Deprasad et al. 2000; Miller et al. 1973; Egunjobi & Afolami 1976), and essential oils of plants (Rakesh et al. 2000; Deprasad et al. 2000) on phytoparasitic nematodes have also been demonstrated.

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Information on the use of plant material for the control of plant-parasitic nematodes in Nigeria is scanty. This is particularly so for the savanna ecologies where nematode problems are serious and farmers are generally poor. Knowledge of potential plants capable of reducing nematode populations in this ecology will go a very long way in assisting the resource-poor farmers manage the nematode problems particularly in their vegetable gardens. This paper reports on the nematicidal activity of some commonly occurring plants in the savanna ecological zones of Nigeria.

Materials and methods

Fresh leaves and bark of and dry pods of five plants namely, *Isoberlinia doka* Crab and Stapt., *Cassia siamea* Lam., *Cassia sieberiana* De Linn., *Delonix regia* Raf. and *Tarmariuundus indica* Linn., were collected and extract of each was prepared in distilled water. Two kg of each of the plant parts was taken and first crushed into a coarse form using pestle and mortar. Each of the crushed leaves and bark was blended in 200 ml distilled water using an electric Philips Kitchen Blender at 10,000 rpm for 1 min. The macerated paste was suspended in 5.8 litres of sterile distilled water for 24 h. The crushed seeds were treated in the same manner but were first ground to powder using a powerful electric Thomas Willey Laboratory Model 4 crusher. The suspensions were poured in plastic containers, stirred thoroughly and left on the laboratory bench for 24 h. The containers were covered with aluminium foil to prevent evaporation. After 24 h, each solution was filtered through a Whatman No. 1 filter paper. They were left to stand again for 24 h after which the clear suspensions were collected by decanting. These constituted standard solution and labeled 'S'. From the standard concentration, dilutions were prepared with distilled water in the ratio of 1:2, 1:10 and 1:100, (S/2, S/10 and S/100 concentration). Two freshly-collected matured uniform-sized egg-masses of *M. incognita* averaging (500 eggs) were inoculated into 5 cm diameter Petri dishes containing 10 ml of each concentration of the extract. To prevent bacterial growth, three drops of 1.0% streptomycin sulfate were added to each Petri dish (Hassan et al. 1981). A Petri dish with sterile distilled water alone served as control. Each treatment was replicated four times and the experiment repeated twice. The ambient temperature of the laboratory ranged between 30 – 32%. The total number of hatched larvae was recorded after 3, 6, 12, 24, 48 and 96 hours. Data collected were subjected to square root transformation and analysed in a factorial randomized complete block design using GENSTAT 5 (Release 3.2; Rothamsted Experimental Station, Harpenden, UK).

Results and discussion

Results of the study showed that all the plant parts of the trees treated inhibited the larval hatch of *M. incognita*. Extracts of seed of all plant parts almost completely inhibited the larval hatch throughout the period of observation (96 h) at S/2 and S/10 concentrations when compared with the control (see Figure 1).

Percentage inhibition was as high (up to 97%). Only in the *I. doka*-treated Petri dishes were more larvae observed from 24 h of exposure. But these were significantly less than those recorded for the control at corresponding periods. Larval hatch at S/100 concentrations for all the plants was significantly higher than the other concentrations but significantly lower than the control. The inhibitory effect of the leaf extracts gave similar results as in the seeds (see Figure 2).

Leaf extracts of *C. sieberiana* showed a decrease in effectiveness as larval hatch began to pick up at 6 h of exposure even at S/2 concentration. Larval hatch for all the plants began to

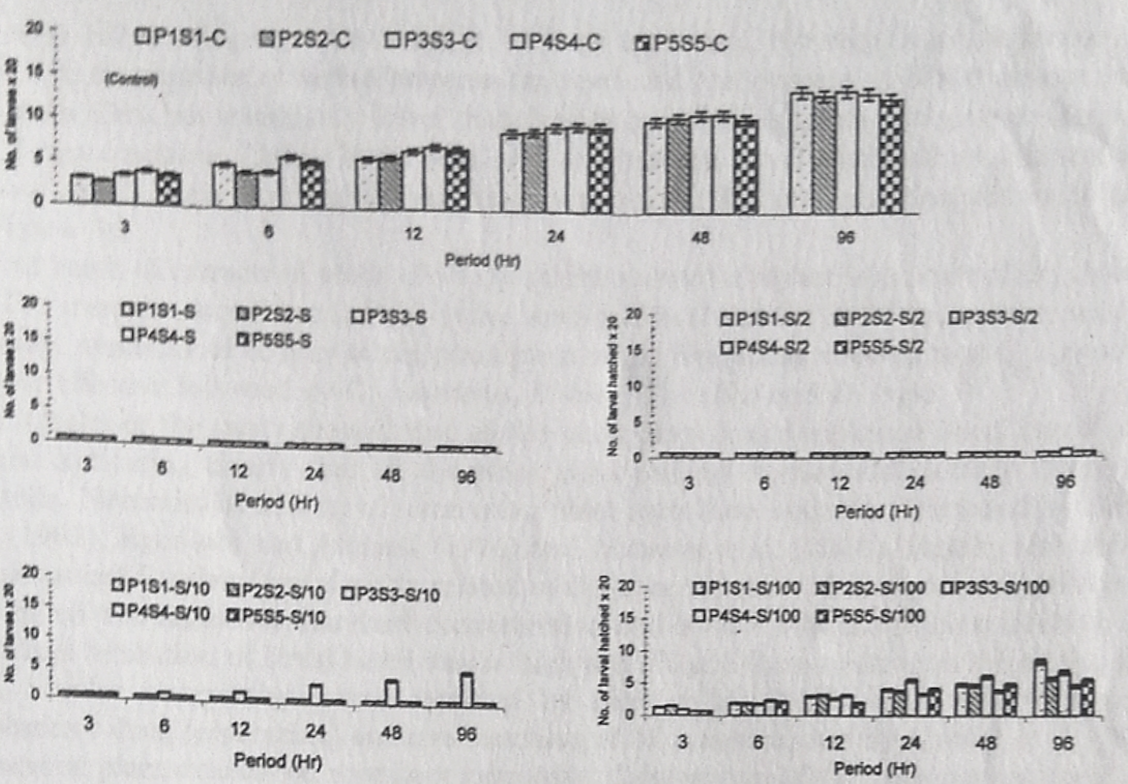

Figure 1. Effect of water-soluble fraction of the seed (S) extracts of *Tamarindus indica* (P1), *Cassia siamea* (P2), *Isoberlinia doka* (P3), *Delonix regia* (P4) and *Cassia sieberiana* (P5) on egg hatch of *Meloidogyne incognita* at different concentrations and time.

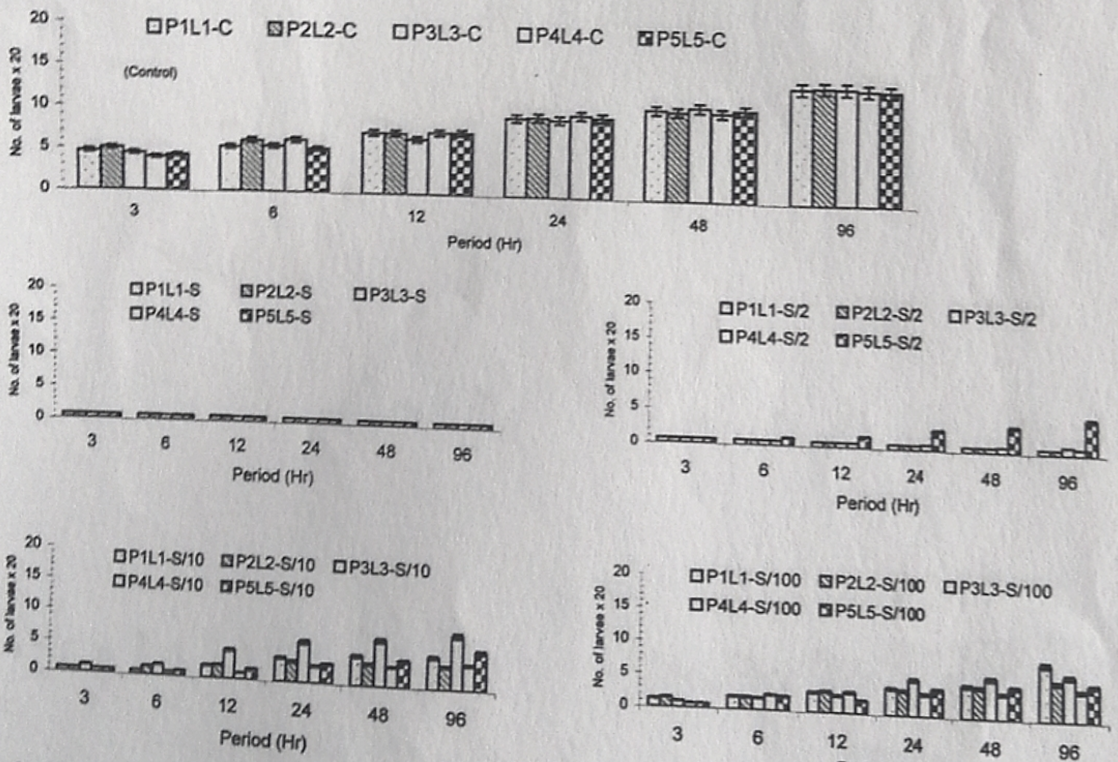

Figure 2. Effect of water-soluble fraction of the leaf (L) extracts of *Tamarindus indica* (P1), *Cassia siamea* (P2), *Isoberlinia doka* (P3), *Delonix regia* (P4) and *Cassia sieberiana* (P5) on egg hatch of *Meloidogyne incognita* at different concentrations and time.

increase at S/100 concentration even at 12 h of exposure. No significant difference was observed in the number of larvae between the seed and leaf extracts at S/100 concentration within each plant but statistically lower than the control. Bark extracts also gave similar result at the S concentration. Unlike in the seed and leaf extracts, larval hatch in bark extracts of *C. sieberiana* and *D. regia* were higher than the others even at S/2 concentration within 24 hours (see Figure 3).

Larval hatch of extracts of seeds of all the plants showed a higher inhibitory effect than the bark. For instance, larval hatch for *I. indica* seed and bark extract at 96 h exposure was 3%. Generally, nematicidal activity of the plant parts of the five plants showed that *C. siamea* was the most effective followed by *C. sieberiana*, *I. doka*, *T. indica* and *D. regia*.

The results of the study showed that all the plant parts tested inhibited larval hatch of *M. incognita* indicating clearly that all the plant parts possess nematicidal activity against the nematode. Nematicidal activity of some other plant parts have been demonstrated by Haseeb et al. (1982), Egunjobi and Afolami (1976) and Mateeva et al. (2000). Results also showed that nematicidal activity was directly related to the concentration of the extract. Inhibition of larval hatch was highest at standard concentration and lowest with the highest dilution. The percentage inhibition of larval hatch was as high as 97% at S/2 concentration for all the plant parts. Similar observations were reported by Israr et al. (1979) with locally prepared anthelmintic drug (piperazine) on larval hatching of *M. incognita*, and by Ahmad et al. (1990) with several plant extracts on root-knot nematode. Comparison of the plant parts showed that seed extracts recorded the highest inhibitory effects followed by the leaves and bark. This is in agreement with the report by Mateeva et al. (2000), Mohammed and Mashkoor (1989, 1990). From this study, it is clear that the seeds, leaves and bark of the five plants tested have nematicidal properties. These plants, especially *C. siamea* and *C. sieberiana* which were the most effective, are commonly available in the Nigerian savanna and can therefore be

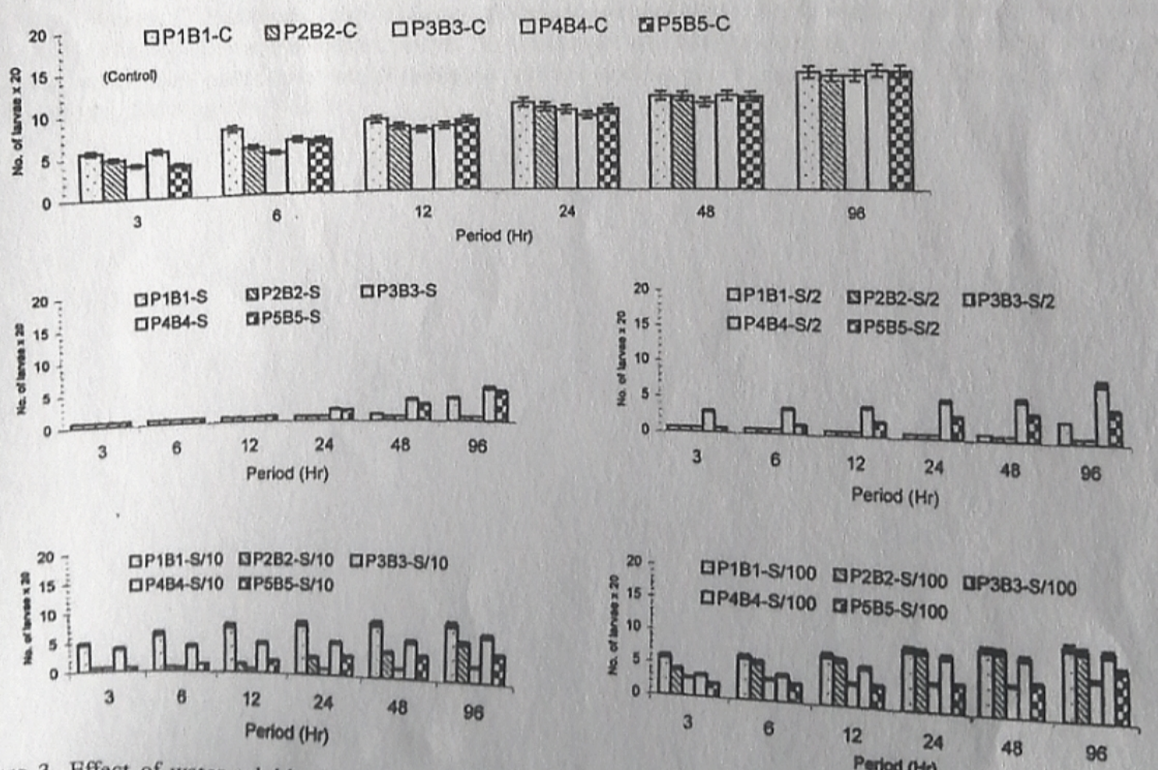

Figure 3. Effect of water-soluble fraction of the bark (B) extracts of *Tamarindus indica* (P1), *Cassia siamea* (P2), *Isoberlinia doka* (P3), *Delonix regia* (P4) and *Cassia sieberiana* (P5) on egg hatch of *Meloidogyne incognita* at different concentrations and time.

effectively utilized particularly by small-scale farmers for the control of root-knot nematodes in vegetable gardens in an integrated manner.

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