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EFFECT OF ANTIHELMINTH DRUGS ON ROOT KNOT NEMATODES

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Abstract

Some allopathic and homoeopathic drugs were evaluated against, *Meloidogyne incognita* root knot nematode. Significant reduction in hatching of eggs was observed with Katrex (99 %) followed by T 26 (94 %) after 96 hrs. All the test drugs showed significant larval mortality and reduced invasion of tomato roots by root knot nematodes.

Introduction

Plant diseases produce serious losses to crop plants and adversely affect the agricultural economy of a country. The various species of *Meloidogyne* induce major morphological and physiological changes within roots, attack nearly every crop sown where not only yields are greatly affected but quality is also reduced (Sasser, 1980). In Pakistan the root knot nematode, *Meloidogyne* species are recognized as important parasites of vegetables and fruit crops. Of a total of 70 *Meloidogyne* species identified so far (Luc *et al.*, 1988), only 4 *viz. M. incognita* (Kofoid & White) Chitwood, *M. javanica* (Treub) Chitwood, *M. arenaria* (Neal) Chitwood and *M. hapla* Chitwood are of major economic importance. About 100 plants have been found infested with root knot nematodes in different cultivated zones of Pakistan (Maqbool, 1988; Zaki, 2000).

Since the discovery and wide scale use of a nematicide (D-D mixture – 1,3-dichloropropane – 1,2-dichloropropene), methyl bromide, a number of products and formulations have been developed for use against several nematode pests and these are available in most regions of the world (Hague & Gowen, 1987). In Pakistan, very little attention has been paid on the use of nematicides for the control of plant parasitic nematodes. Ashrafi *et al.* (1970) determined the nematicidal properties of different aromatic fractions of petroleum. Many studies were carried out on imported nematicides *viz.* Nemagon, Aldicarb, (Temik-10G), Carbofuran (Furadan-3G, Curator-10G) against nematodes attacking banana, citrus, papaya, sugar cane, okra and corn showing considerable reduction in galls (Maqbool & Kishwar, 1981; Maqbool & Hashmi, 1987). Few nematicides *viz.* Tenekil, Fertinemakil and Nimbokil have also been developed in Pakistan by PCSIR and PARC. Antihelminth drugs are generally used for the control of roundworm, hookworm and eelworm, which produce diseases in human beings. Their potential against plant parasitic nematodes is not known. Therefore, experiments were carried out to evaluate their nematicidal potential against the most destructive plant parasitic nematodes, the root knot nematodes.

Materials and Methods

Hatching test: Eggs of *M. javanica* obtained from roots of brinjal plants (*Solanum melongena* L.) were collected by the method of Hussey & Barker (1973). A suspension of eggs in distilled water was prepared. One mL of egg suspension (30–45 eggs/mL) and

1 mL of test chemical (Vermox, Katrex, Kent-20, T-26, BM-43) was transferred in glass cavity block, diam 2.5 cm and kept at room temperature. Each treatment was replicated 3 times. The glass cavity block containing 1 mL egg suspension and 1 mL water served as control. After 24, 48, 72, 96 and 120 hours' exposure, the number of hatched eggs were counted under a low power stereoscopic microscope (x6). The toxicity of chemical suspension was assessed as the mean %age of the hatched eggs.

Mortality test: Eggs/eggs masses of *M. javanica* obtained from the roots of brinjal plants (*Solanum melongena* L.) were placed in distilled water and incubated at room temperature (25±2 °C) for 24 hours. After hatching, the juveniles were collected and a suspension of juveniles in distilled water was prepared. One mL of freshly hatched suspension (30 - 45 juveniles / mL) and 1 mL of test chemical (Vermox, Katrex, Kent-20, T-26, BM-43) was transferred in glass cavity block, 2.5 cm diam. and kept at room temperature. Each treatment was replicated 3 times. The glass cavity block containing 1 mL nematicide suspension and 1 mL distilled water served as control. After 24, 48 and 72 hours' exposure, the number of juveniles killed were counted under a low power stereoscopic microscope (x6). The toxicity of chemical was assessed as the mean percentage (%) of the dead nematodes. The nematodes were considered dead if they did not move when probed with a fine needle (Cayrol *et al.*, 1989).

Nematode penetration/Invasion test: Sandy loam soil was taken in paper pots (8 cm dia.) @ 150 g/pot. Each pot was drenched with test chemicals @ 10 mL/pot. Soil treatment was followed by transplantation of 3-4 week old tomato seedlings @ single seedling/pot raised in sterilized sandy loam soil in greenhouse. After 2–3 days of seedling transplantation fresh hatched juveniles of *M. javanica* @ 200 J_2/pot were inoculated. Each treatment was replicated 3 times. Plant containing sterilized distilled water served as control. Experiment was terminated after 15 days of nematode inoculation. Plants were up-rooted and washed under running tap water. Roots were air dried, weighed, cut into small pieces, wrapped in muslin cloth and dipped for 3 – 5 minutes in boiled 0.25 % acid fuchsin stain. Roots were left in the stain to cool, then washed under tap water to remove excess stain. Roots were put in vials containing destain (1:1, glycerol: water with few drops of lactic acid). Roots were macerated in an electric grinder for 45 seconds, the macerate suspended in 100 mL water and number of J_2, J_3, J_4 and females were counted with the aid of low power microscope (x6). Number of nematodes/g roots was calculated.

Results and Discussion

All the test antihelminth allopathic and homeopathic drugs significantly inhibited hatching of *Meloidogyne* eggs. Larval emergence increased with exposure time. Significant reduction in hatching was observed with allopathic drug Katrex (99 %) followed by homeopathic drug T-26 (94 %) after 120 hours of exposure (Fig. 1). The larval mortality differed with test antihelminth drugs but all showed significant death of nematode larvae, which increased with exposure time. Antihelminth drug Katrex and T-26 were found the most effective in causing death of larvae (100 %) followed by Kent 20, which showed (84 %) mortality as compared to other drugs (Fig. 2). Antihelminth drugs when used as nematicides showed variation in their effects on plant parasitic root knot nematode, *M. javanica*. T-26 was found to be the most significant and reduced (81 %) root invasion by nematodes followed by Katrex, which showed (80 %) inhibition in invasion of tomato roots by nematodes (Fig. 3).

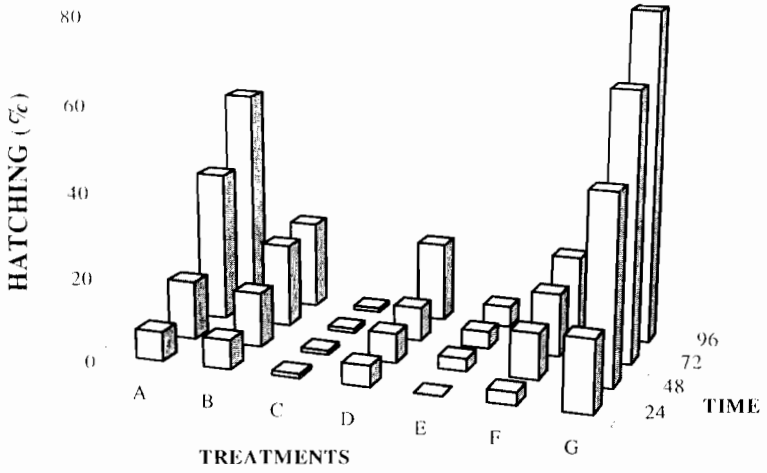

Fig. 1. Effect of of antihelminth drugs on egg hatching (%) of root knot nematode *in vitro*.

A= Vermox (Tabs.), B= Vermox (Susp.), C= Katrex, D= Kent 20, E= T 26, F= BM 43, G= Control
Time= 136.25 (***), Treatment= 303.004 (***), Interaction= Time x Treat.= 16.01 (***)

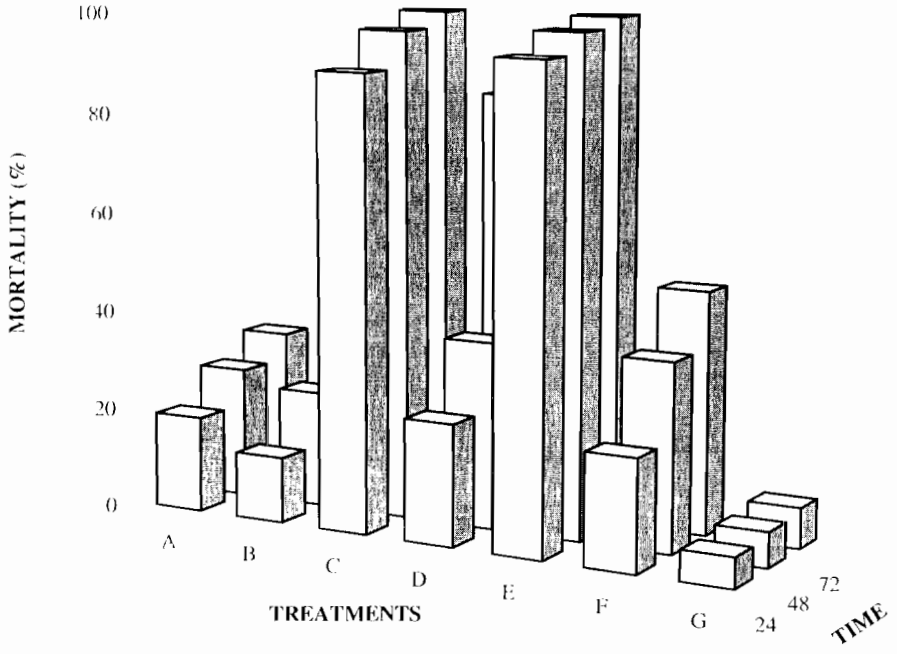

Fig. 2. Effect of antihelminth drugs on larval mortality (%) of root knot nematode *in vitro*.

A=Vermox (Tabs.) , B=Vermox (Susp.), C=Katrex , D=Kent 20, E=T 26, F=BM 43, G=Control
Time = 48 47 (***), Treatment = 532.91 (***), Interaction: Time x Treat. = 3.02 (**)

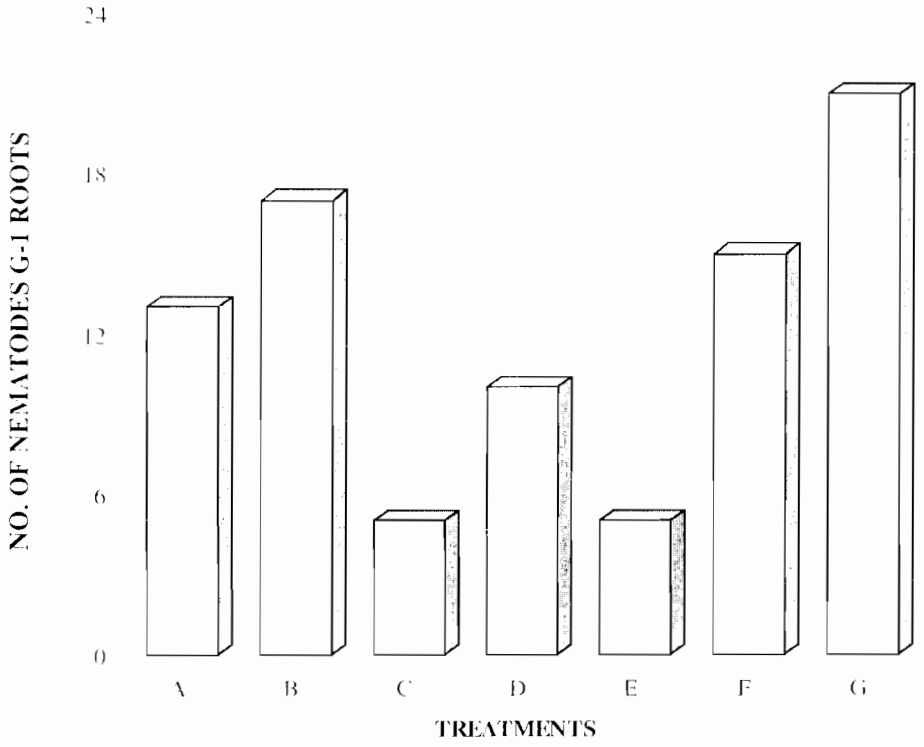

Fig. 3. Effect of antihelminth drugs on root knot nematode penetration in tomato roots.

A= Vermox (Tabs.), B= Vermox (Susp.), C= Katrex, D= Kent 20, E= T 26, F= BM 43, G= Control LSD 0.05 = 41.124

Chemical pesticides used to control pests are more active and immediate in their action (Griffiths, 1981). Hatching tests have been widely used to estimate the efficacy of nematicides against second stage juveniles of plant parasitic nematodes (Fenwick *et al.*, 1953). In the present studies, antihelminth allopathic (Katrex, Vermox) and homoeopathic drugs (Kent-20, T-26, BM-43) showed nematicidal effects of varying degree on emergence of root knot nematode larvae from eggs. Among the antihelminth drugs, significant reduction in hatching was observed with allopathic drug Katrex (99 %) followed by homoeopathic drug T-26 (94 %) after 96 hours of exposure time. In the initial screening, rate of mortality was low at the beginning but an appreciable increase was recorded after 72 hours of exposure. Of the test chemicals, Katrex and T-26 were found more effective causing more than 90 % larval death after 72 hours of exposure. Invasion tests are extremely useful for eliminating ineffective nematicide candidates in screening programmes (Whitehead, 1973). The T-26 was found to be the most effective and reduced 81 % tomato root invasion by nematodes. In the present study, antihelminth drugs were found effective against root knot nematode, *M. javanica* in egg hatching, larval mortality and larval penetration tests.

Reference

Ashrafi, S.H., M. Saeed and M. Ahmed. 1970. Nematicidal properties of different aromatic fractions of petroleum. *Pak. J. Sci. Ind. Res.*, 13: 401-402.

Cayrol, J.C., C. Djian and I. Pijarowski. 1989. Studies on the nematocidal properties of the culture filtrate of the nematophagous fungus *Paecilomyces lilacinus*. *Rev. Nematol.*, 12: 331-336.

Fenwick, D.W., B.G. Peters and R.P. Libbey. 1953. Effect of repeated field infections of D.D. mixture against potato-root eel worm. *Ann. Appl. Biol.*, 40: 208-214.

Griffiths, E. 1981. Heterogenic plant diseases. *Annu. Rev. Phytopathol.*, 19: 69-82.

Hague, N.M.H. and S.R. Gowen. 1987. Chemical control of nematodes. In. *Principles and Practices of Nematode Control in Crops*. (Eds.): R.H. Brown and B.R. Kerry. Acad. Press, p. 131-178.

Hussey, R.S. and K.R. Barker. 1973. A comparison of methods of collecting inocula for *Meloidogyne* spp., including a new technique. *Pl. Dis. Reptr.*, 61: 328-331.

Luc, M., A.R. Maggenti and R. Fortuner. 1988. A reappraisal of Tylenchina (Nnemato). 9. The family Heteroderoidae Filip've and Schuurmans Stekhoven, 1941. *Revue Nematol.*, 11: 159-176.

Maqbool, M.A. 1988. An overview of nematode problem and research in Pakistan. In: *Advances in Plant Nematology. US Pak Int. Workshop on Plant Nematology*, 1986. (Eds.): M.A. Maqbool, A. M. Golden, A. Ghaffar and L.R. Krusberg. N.N.R.C, Karachi Univ., Pakistan, p. 23-46.

Maqbool, M.A. and S. Hashmi. 1987. Effect of granular nematicides on nematicides on nematode population and sugarcane yield. *Rev. Nematol.*, 10: 111-113.

Maqbool, M.A. and S. Kishwar. 1981. Studies on the chemical control of root-knot nematodes. *Proceedings of the 3rd Research Planning Conference on Root-Knot Nematodes (IMP) Region-VI*, Jakarta, Inodonesia, p. 130-141.

Sasser, J.N. 1980. Root-knot nematodes. A global menace to crop production. *Pl. Dis.*, 64: 36-41.

Whitehead, A.G. 1973. Control of cyst nematode (*Heterodera* sp.) by organophosphates, oximecarbamates and soil fumigants. *Ann. Appl. Biol.*, 75: 439-453.

Zaki, M.J. 2000. Biomanagement of root knot nematodes problems of vegetables. Final Research Report DFID, Botany Depart. Karachi Univ., 131 pp.