

NEMATODES ON BANANA and THEIR CONTROL



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NEMATODES ON BANANA and THEIR CONTROL

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FOREWORD

The Technical Bulletin on Nematodes attacking Banana and their control has been prepared as an aid to help agricultural extension workers to identify nematode pests which limit banana productivity in Kerala State. Kerala Agricultural University has gathered considerable evidence on the damage caused to banana plants by parasitic nematodes. The symptoms of nematode damage vary depending on the species of the pest associated with the crop. It is my hope that the contents of the bulletin will help our extension workers to understand the nematode problems in the field so that appropriate control measures can be recommended to the cultivators.

Vellanikkara,
6-2-1988.

Dr. E.G. SILAS
Vice Chancellor
K. A. U.

PREFACE

Banana is cultivated in an area of 53 thousand hectares in Kerala State. However, the production per hectare is only around 6800 kg. Among the several factors responsible for the low productivity, nematodes are reported to play an important role. The root-knot nematode, the burrowing nematode, the lesion nematode and the cyst nematode are found to be relatively more serious in many parts of the State. The external symptoms caused by these parasites are characteristic and well defined. The present booklet is published with the object of imparting information of nematodes and their control measures for the benefit of extension workers. There is an apparent necessity to educate farmers on the various aspects of nematode infection in bananas and measures to be adopted for their control. This publication is intended to provide the technological background necessary for adopting several practices recommended, in a meaningful way.

Vellanikkara,
6-2-1988

M. ARAVINDAKSHAN
Director of Research i/c.
K. A. U.

Introduction

Plant parasitic nematodes are one of the major limiting factor in banana production throughout the world. Extensive damage caused to the root system due to the attack of different kinds of nematodes leads to loss of vigour of individual plants followed by reduction in crop yield. Nematode infestation in banana crop has become a serious problem in Kerala affecting banana production.

Among the plant parasitic nematodes, the most important ones attacking banana are (1) The burrowing nematodes (*Radopholus similis*), (2) The root-lesion nematode (*Pratylenchus coffeae*) and (3) The spiral nematode (*Helicotylenchus multicinctus*), which are considered to cause economic level of damage and yield loss. Recently the cyst nematode (*Heterodera oryzae*) has been observed to infect the crop. This nematode attack also causes considerable amount of crop damage and yield loss. The other nematodes of importance which attack banana are (1) The root-knot nematode (*Meloidogyne incognita*), (2) The reniform nematode (*Rotylenchulus reniformis*) and (3) The lance nematode (*Hoplolaimus* sp).

The nature of attack and the symptom produced under field condition by these nematodes differ considerably, the details of which are presented in the following paragraphs.

1. Major nematode pests

1.1 The burrowing nematode (*Radopholus similis*)

This is a completely migratory endoparasite feeding on the cortical tissues of the fleshy roots and is the most important nematode pest of Banana. All larval stages and the adult females are infective. The nematode completes one generation in 20-25 days. They can attack and penetrate into



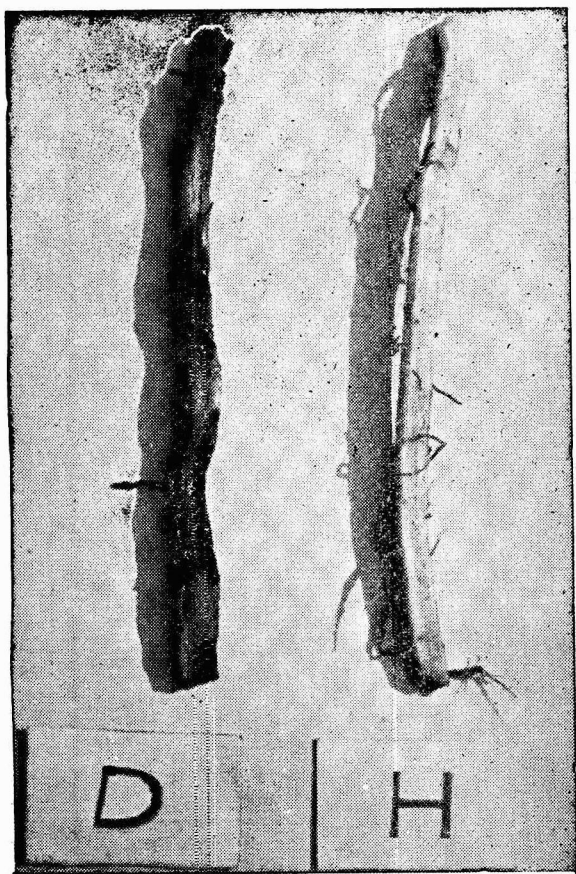
On fleshy root different areas of reddish purple colouration associated with *R. similis* infection

root at any point. Once they enter and invade the root, they feed on the cortical cells and move intra and intercellularly completely destroy and killing the invaded portions. During the course of their invasion into the root and further feeding they produce minute lesions on the roots which later on coalesce and make the root necrotic. The nematodes migrate through the tissue in advance of the necrosis till the root is completely killed and further move out into the soil and reinfest the healthy roots. Thus the nematodes kills large number of roots of the plant which consequently lead to severely decreased root system. Under such condition the plants exhibit poor and stunted growth with less number of leaves. The leaves show chlorosis which begin from the margin of the leaf lamina towards the mid rib and mostly found in the leaves of middle whorl. The size of the leaves are also considerably reduced. The plants which have been severely infested with the nematode either fail to flower or considerably (upto one month) delay in flowering. When such plant, if at all produce bunches the hands will be few with less number of fingers which are thin and underdeveloped. The plants which produce such type of bunches are also fail to stand and topple over especially during wet and windy weather. The plants also exhibit sensitivity to water stress. The nematode prefer lateritic loamy as well as clayey loam soils. Pathogenicity tests conducted under the All India Co-ordinated Fruit Improvement Project at Banana Research Station, Kannara using graded loads of populations of *R. similis* during the period 1975-79 indicated that the plant growth got retarded when the population of nematode exceeded the level of 100 numbers in 10g root. The yield loss in bunch weight in such cases can exceed over 40%.

When the roots of such plants are examined on splitting longitudinally pinkish discolouration in the cortical area can be observed indicating the areas of nematode attack and feeding. The nematode can also migrate through the root into the cortex of rhizome causing necrotic lesions and rotting by which the rhizome may get completely blackened and discoloured.



Tip over under wind action due to destruction of roots in diseased area



Infected roots showing characteristic reddish brown lesions which extend throughout the cortex

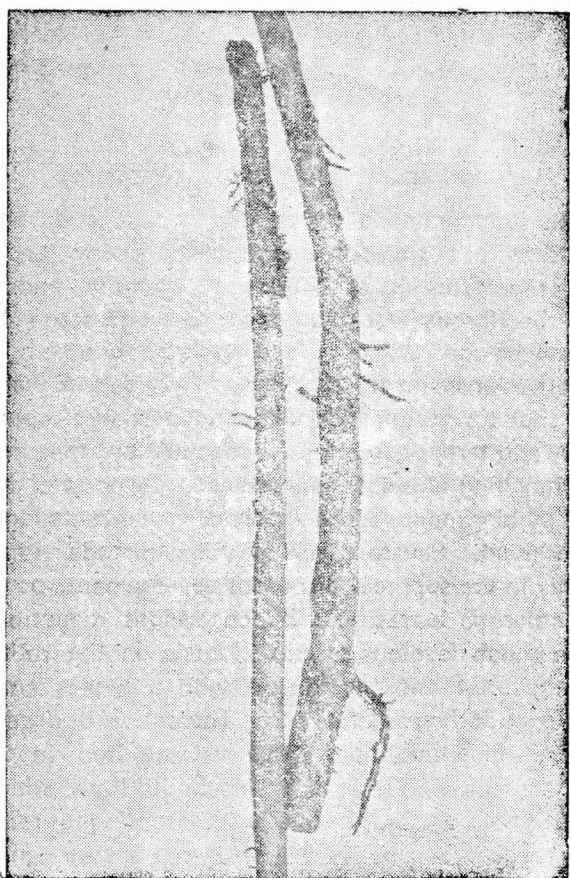


Vertical section of rhizome showing extensive necrosis
in the cortical area

1.2 The root lesion nematode (*Pratylenchus coffeae*)

This nematode causes root lesion similar to those caused by *R. similis*. The initial entry of the nematode into the root produce a reddish elongated fleck which enlarge as the nematode continued to feed. The older part of the lesion turn black and shrink while the margins remain red. The nematodes are found in the red margin area. They feed and destroy the cortical parenchyma cells. They can also infect into the the cortex of rhizome. The nematode attacked plants show poor growth, chlorotic leaves and reduced bunches.

1.3 The spiral nematode (*Helicotylenchus multicinctus*)



Roots showing small brown lesions, the result of infection by *Helicotylenchus* sp

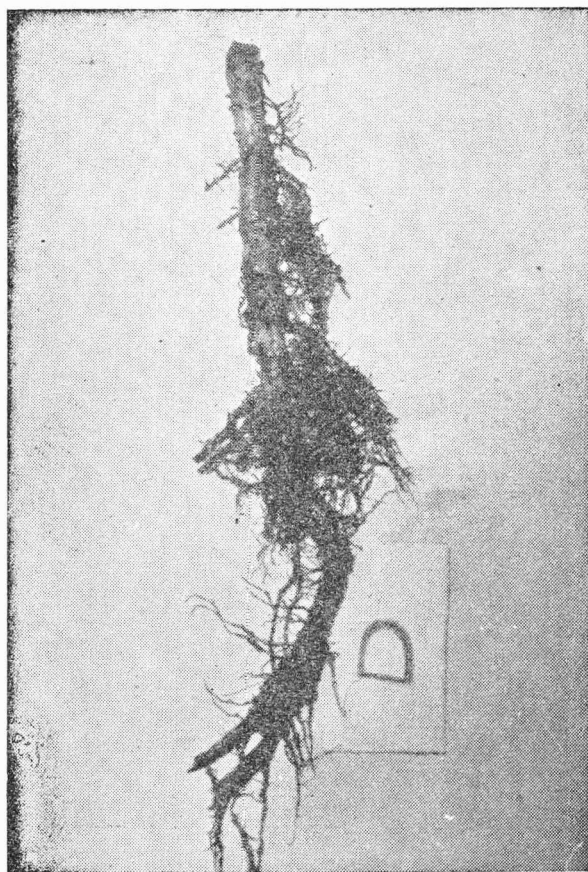
This nematode is widely present in all banana cultivated areas and it is found feeding on the parenchyma and cortical cells as an ecto/endo parasite. The development of all life stages including that of egg can take place inside the root. The life cycle is completed in 26 days. The invasion of nematode produces superficial lesions which resembles pustule like eruptions. Such large number of lesions can be seen on a root and these do not spread as in the case of lesions produced by *R. similis*. The invasion by this nematode on banana plant causes extensive root necrosis, dieback and disfunction of roots leading eventually to debility of the entire plant. The lesions produced by this nematode are colonised by fungi especially of *Fusarium*, *Rhizoctonia* and *Cylindrocarpum* leading to the further rotting of roots. Drying of leaf margins in older leaves and yellowing area the above ground symptoms of injury.

1.4 The cyst nematode (*Heterodera oryzicola*)

The cyst nematode which attacks the rice crop has been observed attacking banana grown in paddy lands as a rotation crop. This is a completely sedentary endoparasite invading the fibrous feeder roots. The second-stage larva is the infective stage which are found in abundant in soil. The infective larvae invade the zone of elongation well away from the root tip of newly developing tertiary roots. The secondary and tertiary roots are affected by the nematode attack. Branching of numerous rootlets at the point of infection followed by blackening and necrosis of feeder roots are commonly observed. Severe attack of this nematode on banana plant leads to the suppression of root development, poor plant growth, chlorotic leaves and bunch weight reduction. The nematode which develops as adult female in the root finally ruptures the root and come out with a eggsac containing 100-150 eggs at the posterior end. The cuticle of dead female hardens to form a tough, protective cyst and drop in the soil. The cyst also contain viable eggs inside its body which later hatch and come out as second stage larva leading the reinfection of the root. In the absence of host crop a cyst can remain viable in the soil for many years.



Infective second-stage larva entering the root



Roots heavily infected by *Heterodera oryzae*

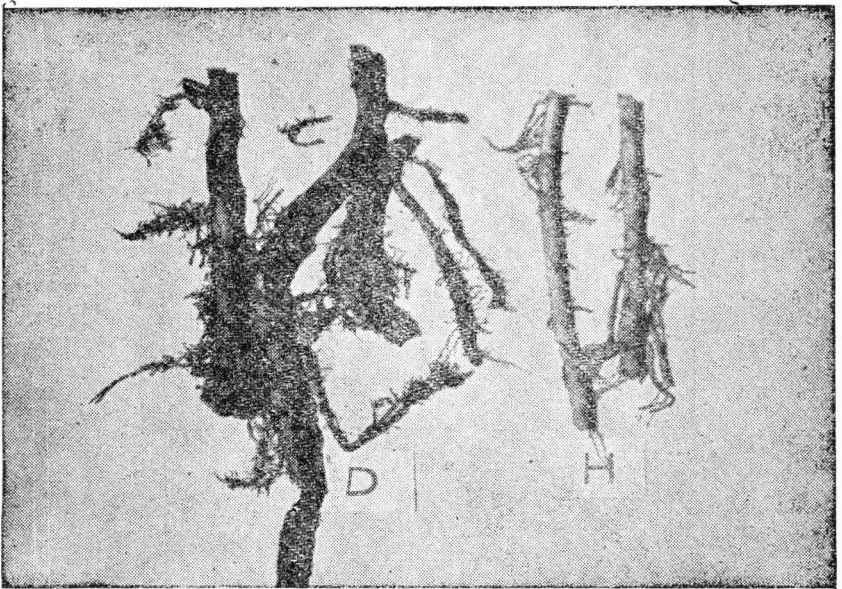


Female cyst nematode with eggsac filled with eggs

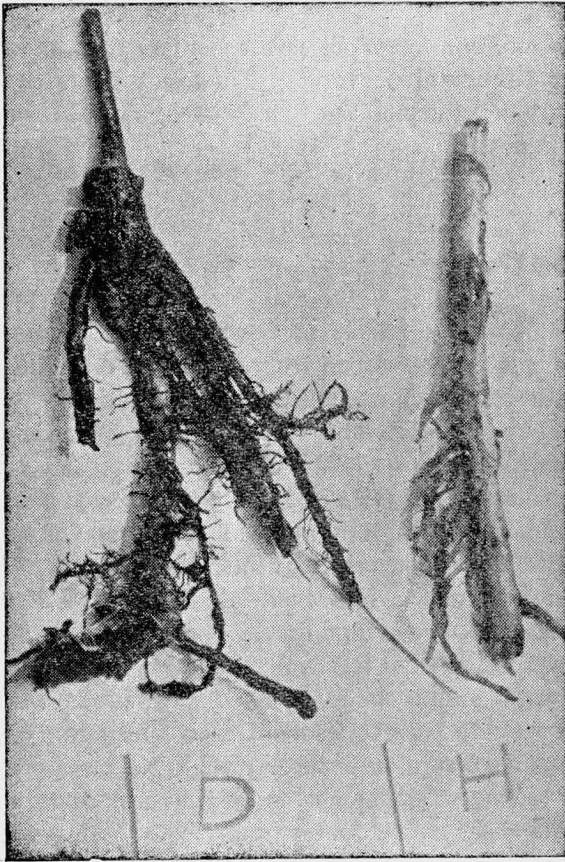
2. Other parasitic nematodes

2.1 The root-knot nematode (*Meloidogyne incognita*)

The root-knot nematode which are present in all agricultural field also found to attack the banana roots. This is a complete sedentary endoparasite feeding on the xylem-phloem tissues (conductive tissues) and which lead to atrophy of the root. They produce small galls on the fibrous roots but the roots are not made to rot. The nematode attack on fleshy roots often lead to splitting and cracking. Sometimes produce large number of side roots with gall and severe nematode infestation result in adverse effect on the growth and productivity of the plant.



Large swellings on banana roots



Roots showing galls and excessive branching (side roots)

2.2 The lance nematode (*Hoplolaimus* sp)

The lance nematode which attack banana incite discrete relatively shallow necrotic lesion on roots which are eventually invaded by secondary soil pathogens (fungi and bacteria).

2.3 The reniform nematode (*Rotylenchulus reniformis*)

The reniform nematode is a sedentary semi-endoparasite attack the fibrous feeder roots. The exact nature of damage and symptom produced by the nematode has not been assessed in detail.

3. Control

3.1 The nematode attack on banana takes either through the suckers collected from nematode infested mother plants or from soil in planting pits where the fields are already infested by the nematodes. Planting nematode free banana suckers is the safest method to avoid nematode damage in early stages of crop growth then to harvest and obtain a well developed bunch. This method also ensures that the nematodes are not carried and deposited in new fields and areas where the land is free of these organisms. Any of the following practices may be followed according to the suitability of local situations, to check the nematode attack. All the nematode parasites mentioned above are of highly polyphagous nature having wide host range for them. So raising of banana as an intercrop in other cropping system, should be done with extreme care, so that these nematodes are not carried to those land where they are not present and attack those crops also. Coconut, arecanut, black pepper, ginger, turmeric, tuber crops, solanaceous and cucurbit vegetables and pulses are some important crops which are favourable hosts for the above mentioned nematodes.

3.2 Planting nematode free suckers

- a) This can be done by paring the suckers, by scrapping with a sharp knife and removing all the necrotic superficial lesions thus exposing only healthy tissues, and planting such suckers.

- b) Dip the pared suckers in 1000 ppm (0.1%) Carbofuran Suspension for 30 minutes or hot water at 55°C for 10 minutes prior to planting.
- c) Do not collect suckers for planting from mother plants which are heavily infested by the nematodes.

3.3 When the land is infested with nematodes

If the land proposed to raise banana crop is known to be infested by the nematode (by soil sampling and carrying out microscopic examination of nematode extracted from the sample) disinfestation of nematode may be done by one of these methods.

- a) Plough the land to a depth of 30 cm and expose the soil to solar radiation for a week.
- b) Sterilise the planting pit by burning trash, dried leaves etc. to enable the heat to penetrate one foot all around the pit and then plant.
- c) Apply Nematicide granules (carbofuran or phorate) @ 2 g a. i. around the suckers at the time of planting and irrigate to moisten the soil.

3.4 When the banana plants are found infested at a later stage after planting

- a) Apply nematicide granules (carbofuran or phorate) @ 2g a. i. per plant all around 50 cm away from the pseudostem and irrigate to moisten the soil. Repeat the chemical application @ 1 g a. i./plant after one or two months of first application after checking the plant growth characters and intensity of nematode attack.

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