

Biological Sciences Section

Pakistan J. Sci. Ind. Res., Vol. 25, No. 4, August 1982

ROOT-KNOT NEMATODES ASSOCIATED WITH BANANA IN PAKISTAN*

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INTRODUCTION

In Pakistan, cultivation of banana started only some 34 years ago. Climate of the province of Sind being favorable, banana spread in this area and within two decades it occupied about 30,000 acres of land, mostly in the non-frost districts. The yield of banana was reasonably good in the beginning, but in the last decade, the growers have been complaining of poor harvest despite fairly good irrigation and fertilization measures. This decline notwithstanding, banana continued to draw the attention of growers and spread further to occupy about 50,000 acres as of 1978 [1].

In the last several years, however, the continued decline in harvest forced growers to start substituting other crops for banana. Since this decline in yield could not be attributed to any of the visible pathogens or other more familiar causes, nematodes were looked upon as the possible agents, and therefore, a survey of banana plantations was undertaken in 1977 - 78. Since collection of the empirical experiences of common farmers was also in view, one of the questions invariably asked of them was if they had seen galls or swellings on the roots of plants in their fields. As such, though not aimed, the survey became one bearing emphasis on root knot nematodes.

Based on an extensive survey of 30 Taluqas (agricultural units), belonging to all the seven banana-growing districts of lower Sind, the present report is a part of a comprehensive report submitted to the Pakistan Council of Scientific and Industrial Research (PCSIR), Ministry of Science and Technology, Government of Pakistan [2]. In this survey, 774 samples of soil and roots were collected from over 100 localities, and about 150 farmers were interviewed to fill up the questionnaire constructed especially for this purpose. These 774 samples represented the odd 50,000 acres land presently occupied by banana in Sind.

*Presented at the Third Research Planning Conference on "Root-knot Nematodes, *Meloidogyne* spp.," Jakarta, Indonesia, July 20 - 24, 1981.

MATERIALS AND METHODS

Usual methods of a nematological survey were followed. Species were identified on the basis of perineal patterns. However, no attempt was made to index the infestation level, as we believe that it is difficult to obtain reliable estimates of this kind with a plant like banana (though easier in comparison to trees).

The presence of galls on the roots of a plant was taken as an indication of the presence of root-knot nematodes. However, in several cases (when galls were not visible), number of nematodes was also taken into consideration; this was when at least 10 of them were recovered in a 100 - ml soil sample, and there was no dispute over their generic identification. So it is possible that in some cases root-knot nematodes might have escaped our observation; the other possibility was, however, remote.

RESULTS AND DISCUSSION

Occurrence. *Helicotylenchus* spp. (*multicinctus*, *indicus*, *dihystera*) constituted the most prominent phytonemic fauna. This was followed by *Meloidogyne* spp. Of the 744 samples which were analyzed in this survey, root-knot nematodes were recovered in 355 (46 %) samples (galls on 308, over 10 larvae in 47 cases). Another 35 samples were suspected to contain root-knot nematodes as each of them yielded less than 10 larvae. It may be mentioned that *Helicotylenchus* spp. were found in more than 50 % of the samples, whereas the notorious parasite of banana - *Radopholus similis* - was found in only 20% of the samples.

As shown in Table 1, the highest occurrence of root-knot nematodes was found in district Hyderabad (51.1 %). This was followed by Nawatshah (50.7 %), Thatta (49.5 %), Sanghar (44.2 %), Tharparkar (40.1 %), Badin (36.9 %) and Karachi (33.3 %). Galls were of small to moderate size, the biggest being about 1.2 cm in diameter.

Distribution of Root-knot Nematodes in Relation with Indus. The river Indus enters the province of Sind to form the boundary between the districts of Sukker and Jacobabad (Fig. 1). Down to the south it forms natural

boundaries for other districts: Larkana-Khairpur, Nawabshah-Dadu, Hyderabad and Thatta. It is only in Thatta that the river passes through the middle of the district and forms her delta before joining the Arabian sea.

Except in Thatta, banana is cultivated only in the eastern plain of the Indus up to 90 miles (Taluqa Diplo: District Tharparkar). However, in Thatta, the major share comes from the western side, from up to 30 miles in this district (Taluqa Mirpursakro) and farther up to 50 miles in Karachi district. As shown in Fig. 1, the Indus passes through only three of the seven banana districts (Nawabshah, Hyderabad, Thatta). It was interesting to note that these three districts gave the highest occurrence rate (%) of root-knot nematodes (Table 1). Further, in these three districts, the highest root-knot nematode-yielding localities were found to lie within a distance of about 20 miles from the Indus, this being both east and west in Thatta and only east in the remaining two districts (Fig. 2). This areas lies between 24° to 27° N and zigzags over 68° E.

The correlation between the distribution of *Meloidogyne* spp. and the course of the Indus could not be

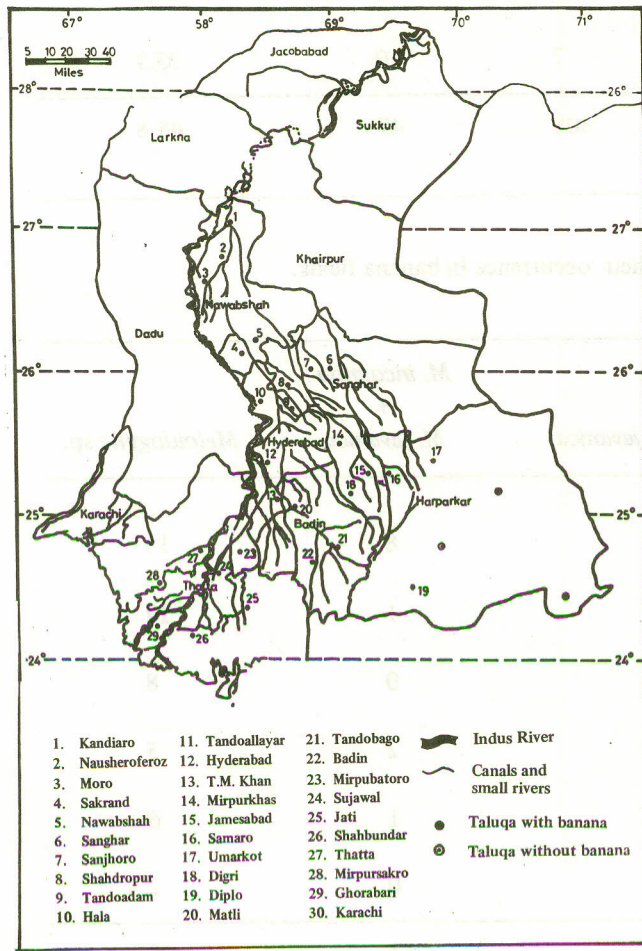


Fig. 1. Districts of province of Sind and areas sampled.



Fig. 2. Show relationship of root-knot nematodes with Indus.

explained. The sandy texture of the soil and plentiful supply of water (due to the network of irrigation canals) could probably be the attributable factors. As mentioned earlier, this survey was only for banana, and therefore, it would be worthwhile to study if this correlation stands with other crops and other districts as well.

Species of *Meloidogyne*. Only two species could be identified. *Meloidogyne incognita* was the most dominant one, and out of 308 root samples that bore galls, this species was found in 172 samples (Table 2). *M. Javanica* was found in 62 samples, whereas these two species occurred simultaneously in only 14 samples. There were as many as 60 samples in which nematodes could not be identified to specific level and have been identified only as *Meloidogyne* sp. (g). These are in addition to 47 samples which were included as RKN samples on the basis of recovery of more than 10 larvae per 100 ml soil and classified as *Meloidogyne* sp. (1).

Table 1. Break-up analysis of samples collected in Sind.

District	Number of Taluqas surveyed	Number of villages surveyed	Number of samples collected	Number of samples yielding RKN		4 vs 5 in terms of percentage
				Galls	Over 10 larvae	
1	2	3	4	5		6
Thatta	7	27	216	82	25	49.5
Hyderabad	4	21	168	79	7	51.1
Tharparkar	6	19	152	55	6	40.1
Badin	3	12	84	27	4	36.9
Sanghar	4	10	70	29	2	44.2
Nawabshah	5	9	63	29	3	50.7
Karachi	1	3	21	7	0	33.3
Total	30	101	774	308	47	45.8

Table 2. Species of *Meloidogyne* and their occurrence in banana fields.

District	Total number of samples	<i>M. incognita</i>	<i>M. javanica</i>	<i>M. incognita</i> + <i>M. javanica</i>	<i>Meloidogyne</i> sp.
Thatta	82	51	12	8	11
Hyderabad	79	42	17	1	19
Badin	27	15	4	0	8
Sanghar	29	14	8	2	5
Nawabshah	29	17	5	1	6
Karachi	7	4	1	0	2
Total	308	172	62	14	60

Information presented here shall be found useful as long as root-knot nematodes are considered as a group and the approach is practical and pragmatic. It would be worthwhile to mention that at present banana is fetching about 50,000,000 dollars annually. It has been estimated that the production of banana can be increased by 50 % (= 25,000,000 dollars) if proper measures of nematode control are taken. This twenty-five million dollar annual loss to banana in Pakistan is attributable to all the species, and separate statistics for different species do not exist. Though, in the case of banana, root-knot nematodes are not considered as virulent as *Radopholus similis* or *Helicotylenchus* spp., yet in view of their widespread occurrence, certainly they are responsible for a sizable proportion of this loss that is worth consideration. Taylor and Sasser [3] envisage a loss of 5 % being caused by root-knot nematodes as an average on a world basis.

Certainly, as they fear, developing countries like Pakistan are on the upper side of this average. In other experiments (not include here) root-knot nematodes were

found responsible for up to 30 % of loss in yield. This work is in progress and shall be presented elsewhere.

Acknowledgement. Cooperation of Director, and Plant Protection Officer, Ministry of Agriculture, Government of Sind is acknowledged.

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