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Prevalence of Rice Root Nematode in the Farmer Rice Fields as Influenced by Edaphic Factors

M.S. Islam, M.U. Ahmad, M.E.H. Sarker and A.H.M.M. Haque
Department of Plant Pathology, Bangladesh Agricultural University,
Mymensingh-2202, Bangladesh

Abstract: An investigation on prevalence of rice root nematode in the farmer rice fields under natural condition was carried out. Farmer fields were located under Jamalpur district, Tangail district and Mymensingh district. Nematodes were isolated by following Bangladesh plate technique (modified Whitehead and Hemming tray method, 1965) and were counted per liter soil at booting, flowering, milking, soft dough, hard dough and harvesting stage. The highest nematode population 1196.7 L^{-1} soil was recorded in Madarganj having soil pH 5.9 sandy loam texture, 0.92% OM and higher N status followed by 524.4 L^{-1} soil in Sutiakhali having soil pH 5.4, loamy texture and 1.06% OM maximum nematode population 965.3 L^{-1}, soil was observed at soft dough stage.

Key words: Rice, root nematode, farmer fields

INTRODUCTION

Rice is the main cereal crop in Bangladesh. It covers about 75.5% of the total cropped area having 26.68 million acres and the only source of cash income for many farmers[1]. The total rice production in Bangladesh is about 23.07 million metric tons[1]. There are many constraints responsible for low yield of rice in Bangladesh. Among the constraints, disease is considered to be the most important one. About 43 diseases recorded, so far, to occur on rice in this country[2]. Plant parasitic nematodes are found to be harmful in rice cultivation. Among the plant parasitic nematodes, the rice root nematode, *Hirschmanniella* spp. are one of the most common nematodes inhabiting rice paddies throughout the world. Eleven species attack rice roots[3-6], although they were earlier considered to be the single species, *Hirschmanniella oryzae*. Vander Vecht and Bergman[7] observed the nematode penetrating into the roots of healthy rice plants, feeding on the parenchymatous tissues and multiply in them, the root cortex becoming discoloured. The loss in vigor and yield are usually more prominent in non-fertilized plots. Fortuner *et al.*[8]. Generally the losses are estimated to range between 28 to 42%[10]. Soils are of different types of viz., heavy clay, clay, clay loam, loamy, sandy loam and sandy etc. These different types of soil and some other edaphic factors like soil texture, soil pH, soil organic matter etc. have great impact on survival, multiplication and density of a number of plant parasitic nematodes. Certain nematodes thrive well in specific types of soil and continue their parasitic activities. This research has been undertaken to assess the quantitative prevalence of rice root nematode in boro rice fields under different edaphic conditions.

MATERIALS AND METHODS

The experiment was carried out in the farmers field of Madarganj (Jamalpur district), Madhupur (Tangail district), Sutiakhali, Nilukkhar char near the river Brahmaputra and also BAU farm (Mymensingh district). The laboratory work was performed in the Nematology Laboratory of the Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh. For each location soil related factors viz., soil texture, soil pH and soil organic matter were assessed in the Laboratory of Soil Science Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh. Soils along with hills of rice Cv. BRRI Dhan 29 were collected from selected location at booting, flowering, milking, soft dough, hard dough and harvesting stages of growth of rice plant. In case growth stage, three samples were collected from three fields of each location and brought to the laboratory in separate polythene bags. Nematodes from soil were isolated Bangladesh plate technique (modified Whitehead and Hemming tray method[11]. Nematodes were counted under steriobinocular microscope. Isolated nematodes were killed by keeping them in a drop of water on the glass slide and moving over the flame of a spirit lamp with to and fro motion. Killed nematodes were preserved in

Corresponding Author: Md. Emdadullah Kaisar, G-9/7R/A, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

TAF fixative solution kept in small vials with proper labeling. Preserved nematodes were identified following the identification keys of C.I.H. sheets[6]. Average of the nematode from three replications of each collected sample of each stage from each location were taken. The data on the number of nematode per litre soil were analysed statistically following the RCBD to find out the level of significance.

RESULTS AND DISCUSSION

Soil analysis shows that Madarganj (Jamalpur district) soil is sandy loam in type having 66.04% sand, 23% silt and 10.96% clay. Madhupur (Tangail district) soil is loamy textured with 49.04% sand, 32% silt and 18.96% clay. Sutiakhali soil is also loamy soil having 41.04% sand, 35% silt and 23.96% clay. Nilukkhar char soil is found loamy textured containing 35.04% sand, 46% silt and 18.96% clay. BAU farm soil is found sandy loam textured containing 53.04% sand, 42% silt and 4.96% clay. Soil pH of the selected locations were assessed before sample collection. In that time following soil pH 5.9, 4.4, 5.4, 5.6 and 5.6 were recorded in Madarganj, Madhupur, Sutiakhali, Nilukkhar char and BAU farm soil, respectively. Organic matter in different soils were recorded to be 0.92, 0.99, 1.06, 1.38 and 1.88% in Madarganj, Madhupr, Sutiakhali, Nilukkhar char and BAU farm soil, respectively (Table 1). Present research revealed that among the five locations. Madarganj soil was found to have significantly the highest population of rice root nematode. Hirschmanniella oryzae in all the growth stages of rice Cv. BRRI Dhan 29. Higher population *Hirschmanniella oryzae* was recorded in the soil of Nilukkhar chair and BAU farm in most of the stage. Soil population of Madhupur and Sutiakhali were appeared to have lower population of the nematode in majority of the growth stage (Table 2). In the overall location wise population, the highest population 1196.7 of the nematode was found in Madarganj soil. Comparatively, the higher and identical population 668.9 of the nematode was observed in each soil of BAU farm and Nilukkhar char. Significantly lower and identical populations 542.2 and 524.4 of the nematode were found in Madhupur and Sutiakhali soils, respectively (Table 3).

In case of growth stagewise population of *Hirschmanniella oryzae*. Significantly the highest population of nematode was observed at soft dough stage followed by milking, flowering, booting and hard dough stages (Table 4). The highest population of rice root nematode, *Hirschmanniella oryzae* was found to be prevalent at the highest level in Madarganj soil compared to the other locations in growth stages of rice. This might be due to convenient edaphic factors like organic matter, nutrient status, textural consistency. Soil pH and monocropping pattern of cultivation. The very low organic matter content 0.92% of Madarganj soil aided in the higher reproduction of the nematode as well as higher build up of the nematode population as similarly observed by Dwivedi[11] and Johnathan *et al.*[12]. On the other hand, higher organic matter content 0.99-1.88% in other locations specially Madhupur soil supplemented with cowdung by the farmer and BAU farm soil supplemented

Table 1: Characteristics of soils from five different locations

Location	pH	%OM	Texture% Sand	Silt	Clay	Textural class
Madarganj	5.9	0.92	66.04	23	10.96	Sandy loam
Madhupur	4.4	0.99	49.04	32	18.96	Loam
Sutiakhali	5.4	1.06	41.04	35	23.96	Loam
Nilukkhar char	5.6	1.38	35.04	46	18.96	Loam
BAU farm	5.6	1.88	53.04	42	4.96	Sandy loam
Critical level for rice	5.5-7.0	2.0	-	-	-	

The edaphic characters of five soils were assessed from the Soil Sciences Division of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh

Table 2: Nematode population of *H. Oryzae* recorded per 5 g root at different growth stages under different locations

Location	Booting	Flowering	Milking	Soft dough	Hard dough	Harvesting
Madarganj	10.66a	1186.6a	1360.0a	1466.7a	1280.0a	820.0a
Madhupur	466.70c	566.6c	720.0c	913.6b	366.7d	220.0d
Sutiakhali	426.70c	566.6c	606.7d	713.3c	466.7c	366.7c
Nilukkhar char	580.00b	676.0b	820.0b	880.0b	580.0b	480.0b
BAU farm	620.00b	673.3b	786.7bc	786.7bc	566.7b	513.3b

Each value is an average of three replications. Values having same letter do not differ significantly at p=0.05 by DMRT

Table 3: Overall locationwise populations of rice root nematode (*Hirschmanniella oryzae*) recorded per litre soil

Location	Nematode population
Madarganj	1196.7a
Madhupur	542.2c
Sutiakhali	524.4c
Nilukkhar char	668.9b
BAU farm	668.9b

Each values is an average of six stages (each stage comprises three replications). Value having same letter do not differ significantly at p0.05 by DMRT

Table 4: Stagewise variation of population of rice root nematode (*Hirschmanniella oryzae*) recorded per litre soil under different locations

Growth stage	Nematode population
Booting	632.0d
Flowering	733.3c
Milking	858.7b
Soft dough	965.3a
Hard dough	652.0d
Harvesting	480.0e

Each value is an average of five locations (each location comprises three replications). Values having same letter(s) do not differ significantly at p=0.05 by DMRT

with green manuring by BAU farm management helped in reducing the population of *H. oryzae*. Similar observations are also made by Johnathan *et al.*[12] and Ismail *et al.* [13] Madarganj soil was found to be treated with higher dose of nitrogenous fertilizer with urea by the farmer compared to the other locations. This might have given a more N status of the soil which ultimately favour the growth and development *Hirschmanniella oryzae* higher significant level compared to the other locations. Ichinohe[--] similarly observed that the application of nitrogenous fertilizer increased nematode population in paddy fields. The peak period of multiplication of the nematode was found at soft dough stage both in soil and root population, whikeit decreased at the harvesting stage in both the cases. Similar observations were also made by Hendro *et al.*[14], Ramakrishnan[15] and Korayern[16] working with *Hirschmanniella oryzae*.

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