



RESEARCH ARTICLE

**OCCURRENCE AND DISTRIBUTION OF ENTOMOPATHOGENIC NEMATODES
IN SOILS OF JORHAT DISTRICT OF ASSAM, INDIA**

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ABSTRACT

A two years random roving survey was conducted for occurrence and crop wise distribution pattern of Entomopathogenic Nematode (EPN) in Jorhat district of Assam under the Department of Nematology, Assam Agricultural University, Jorhat during 2011-2012. A total of 120 soil samples were collected from all 5 blocks of the district Jorhat of which 45 samples were found EPN positive. The percent occurrence of *Steinernema* and *Heterorhabditis* were 19.73% and 19.72% respectively. The maximum frequency of occurrence (35%) was recorded from Baghchung block and minimum (15 %) from both in Dhekorgorah and Titabar blocks. In crop wise distribution pattern, maximum frequency was observed in fruit crops (35%) followed by ornamental crop (25%), plantation crops (20%) and field crops (20%).

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INTRODUCTION

Entomopathogenic nematodes (EPN) from Heterorhabditidae (Poinar, 1976) and Steinernematidae (Travassos, 1927) families are obligate insect parasites, which can infect and kill a broad range of insect hosts (Kaya & Gaugler, 1993). These nematodes are symbiotically associated with entomopathogenic bacteria *Photorhabdus* (Boemare *et al.*, 1993) and *Xenorhabdus* (Thomas & Poinar, 1979). These nematodes are currently marketed world-wide for the biological control of insect pests (Grewal *et al.*, 1998). EPN belongs to the families *viz.*, Heterorhabditidae and Steinernematidae are represented by the genera, *Heterorhabditis* Poinar and, *Steinernema* Travassos and *Neosteinerema* Nguyen & Smart, respectively. The state of Assam is hot and humid rich in wide range of flora and fauna and have large diversity of both beneficial and harmful insect pests. There is no systematic survey for EPNs carried out in Assam till today. The current survey is the first to be conducted in Assam, and focused on Jorhat district of Assam. The goal of this study was to survey entomopathogenic nematodes from the families Heterorhabditidae and Steinernematidae in the Jorhat district of Assam, to find out the distribution pattern of EPN, their ecosystem and habitat.

MATERIALS AND METHODS

Location and Area

The district Jorhat of Assam is located at 26.75°N and 94.22°E and has an average elevation of 116 Meters (381 ft).

Jorhat is surrounded by Sivasagar in the east, Lakhimpur in the north, Golaghat in the west and Wokha district (Nagaland State) in the south. The district comes under semi-arid region with summer temperature 25°–35°C and winter temperature 22°–10°C. In case of vegetation structure of Jorhat is concerned, the district comprises of wide types of agricultural land to forest areas. The district is spreading over 2851 sq. km. with mean annual rainfall is 2029 mm.

Methods of collection

A total of 152 soil samples were collected by random roving survey from all the 5 blocks of Jorhat district in Assam from November 2010 to January 2012 covering all cropped areas and habitats (forest, cultivated, road side virgin, etc) (**Figure 1**).

Relatively cooler, shady and moist sites were chosen for soil sample collection. About 500g of soil was collected from each sampling site at a depth of 10-15cm from the soil surface. The EPNs were isolated from the soil samples by insect baiting technique using late instar larvae of *G. mellonella* (Bedding and Akhurst, 1975), the initial culture of which was obtained from the Department of Entomology, Assam Agricultural University, Jorhat. Five *Galleria* larvae as bait were placed at the bottom of a plastic container (8 cm height and 6 cm diameter) and were loosely topped with 200g of representative soil sample. Every alternate day samples were observed for EPN infection. The larval cadavers, if any, were collected from the soil sample, washed

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with distilled water and placed on White's trap (White, 1927) to observe the emergence of IJs. The collected nematode isolates were identified as EPNs after confirming their pathogenicity against the larvae of *G. mellonella*.

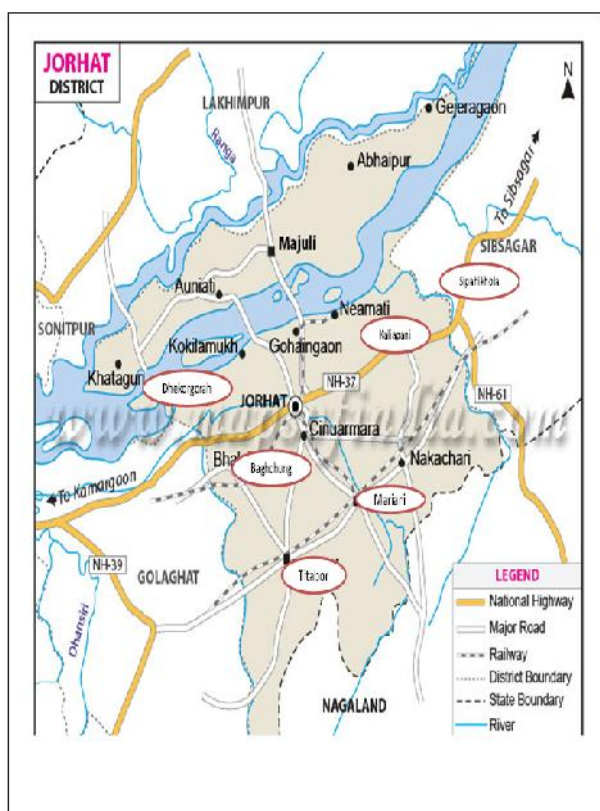


Figure 1 Jorhat district of Assam showing selected Blocks for survey work. (Source: jorhat.nic.in)

Identification

To identify EPN species, the isolated infective juveniles (IJs) were killed by gentle heating at 60°C in water and fixed in TAF (7 ml formalin + 2 ml triethanolamine + 91 ml distilled water). After keeping the nematodes in fixative for 5-7 days, they were transferred to a cavity block with ethanol, glycerine and water in the ratio of 15:1:5 and kept in desiccators for 15 days. Thereafter the IJs were mounted in glycerol on a glass slide. EPN species were identified with the help of published literature (Adam *et al.*, 2006; Adams and Nguyen, 2002; Hominick *et al.*, 1997). Measurements were taken using a Leica IM50 microscope equipped with differential interference contrast optics. Some of the specimens were identified and confirmed by comparing with the specimens in Department of Nematology, Assam Agricultural University, Assam, India and identified specimens were arranged in systematic order.

Statistical Analysis

Microsoft Excel was used for analysis of the morphometric variables of the males and IJs. The collected data was analysed using PASW statistics 18 and the percent frequency of occurrence (F) of entomopathogenic nematode in different blocks as well as crops were calculated using the following formula:

$$\frac{(\text{EPN positive samples})}{(\text{Total number of samples})} \times 100$$

RESULTS

EPN were recovered from 27 out of 120 soil samples collected from five blocks of Jorhat district and the frequency was recorded highest in Baglung block 35%, followed by 30% in Sipahikula block, 25% in Kaliapani block and 15% in Mariani and Titabar block respectively. The frequency of occurrence in the region ranges from 35-15 per cent. Among 27 positive samples, 6 samples (19.73%) contained *Steinernematid* and 21 samples contained *Heterorhabditids*. The highest recovery of EPN from Baglung block of Jorhat district is 35% is an indication of the suitable climate for the survival and multiplications of EPNs that

Table 1 Frequency of occurrence of EPN from five blocks of Jorhat district, Assam, India

| Name of the block | Total no of sample collected | No of sample with EPN | Frequency of occurrence (%) |
|-------------------|------------------------------|-----------------------|-----------------------------|
| Baglung block | 20 | 7 | 35 |
| Dhekorgorah block | 20 | 3 | 15 |
| Kaliapani block | 20 | 5 | 25 |
| Sipahikula block | 20 | 6 | 30 |
| Mariani block | 20 | 3 | 15 |
| Titabar block | 20 | 3 | 15 |

Table 2 Crop wise distribution pattern of EPN in the district of Jorhat, Assam, India

| Crops | <i>Heterorhabditids</i> . | | <i>Steinernematid</i> | | Frequency of EPN Positive (%) |
|------------------|---------------------------|---------------|-----------------------|---------------|-------------------------------|
| | Number/20 sample | Frequency (%) | Number/20 sample | Frequency (%) | |
| Field Crops | 3 | 15 | 1 | 5 | 20 |
| Plantation crops | 4 | 20 | 1 | 5 | 25 |
| Fruit crops | 5 | 25 | 2 | 10 | 35 |
| Ornamental Crops | 4 | 20 | 2 | 20 | 30 |

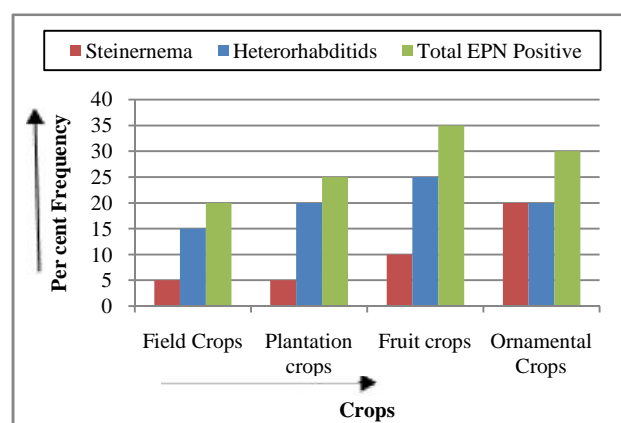


Figure.2 Frequency of occurrence of EPN in different crops in Jorhat district, Assam, India

prevail in the area (Table 1). The highest crop wise distribution of EPN recorded in fruit crops (35%) followed by ornamental crops (30%), plantation crops (25%) and field crops (20%) (Table 2. and Figure 2).

DISCUSSION

Abundance of native EPNs was found in the surveyed area (27 sample out of 120) may be due to prevailing ecosystems where human impact is substantial like perennial orchards. This result is in conformity with Shahina *et al.*, (1998). He reported that abundance of native EPNs is high in ecosystem with substantial

human impact. The large variability in EPN occurrence can also be increased due to insect host aggregation (Marcek and Becvar, 2000). The district has fertile and loam to sandy loam soil and good vegetation cover. These conditions in addition to adequate rain that generally prevail in Assam must have supported the survival and prevalence of host insects and ultimately high occurrence of EPNs especially in fruit crops due to shade and higher moisture under the big canopy of the tree.

CONCLUSION

The surveys have shown that all five blocks of districts are rich in EPN diversity, and occurrence of Steinernematids and Heterorhabditids in fruit crops, plantation crops, ornamental crops and field crops of the district indicates their potential role in the natural control of soil inhabiting insect pests of major crops. The study has also necessitated the need for further study on taxonomic and molecular characterization and host ranges of these EPN species to explore and ascertain their possible potential scope to use as biological control agent.

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