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# Effect of Different Inoculum Levels of *Meloidogyne incognita* on the Germination and Early Development of Vegetable Crops

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Abstract

Cow pea, broad bean and french bean are important vegetable crops widely grown in North East part of India including Manipur. Root- knot nematode (*Meloidgyne incognita*) causes heavy losses in these crops. Experiments were carried out to study the effect of *M. incognita* on germination by inculating in different inoculum level i.e., 0 (control), 10, 100, 1000 and 10,000 second stage juveniles per 200 gm. of soil. With the increase of inoculum levels of *M. incognita*, there was a progressive decrease in the rate of germination and in growth parameters of the crops. Significant reduction in the length of short, root and weight of whole germinated seed were found in 10,000 inoculum level. The number of larvae penetrated into root and soil were significantly increased as the inoculum level increased.

Key Words: *Meloidogyne incognita*

## Introduction

Cow pea (*Vigna sinensis* L.) broad bean (*Vicia faba* L.) and french bean (*Phaseolus vulgaris* L.) are important vegetable crops extensively grown in almost all parts of Manipur and are commonly infected by root-knot nematodes. Application of organic amendment nematicidal plant products and chemicals with nematicidal properties have been practiced by many workers. For effective nematode control and advisory services information about establishment of nematode population and start of infection with respect to plant age are prerequisite. Hence, in the present study inoculation of root-knot nematodes from the very beginning of germination in different inoculum levels is taken place in Cow pea, broad bean and french bean.

## Materials and Methods

Healthy seeds of cow pea (*Vigna sinensis* L.), broad bean (*Vicia faba* L.) and french bean (*Phaseolus vulgaris* L.) had been selected and soaked in filtered water for 24 hours. Small plastic bags of 15 cm diameter were filled with 200 gm. of sterilized sandy loam soil collected from Imphal. Three healthy soaked seeds were sown in each plastic bags and at the same time freshly hatched second stage juveniles of *M. incognita* were inoculated with different inoculum levels of 0 (coutrol ),10, 100, 1000 and 10,000. Each treatment was replicated five times with one plastic bag as one replicate. After 20 days of inoculation the germinated seeds were uprooted then washed in tap water. Observations were made on the length of shoot, root and weight of whole germinated seed (i.e., root + germinated seed), number of larvae in root and soil. The number of nematode larvae in roots were counted by staining the roots with Lecto- phenol acid fuchsin. While nematode population in soil was estimated by processing the soil of each replicate by Cobb's (1918) seiving and decanting method followed by Baermann's funnel technique and counting in Syracuse counting dish.

## Results and Discussion

The data on seedling emergence indicated that there were significant suppression or delay in emergence of vegetable corps viz. cow pea broad bean and french bean by inoculation of Meloidgyne incognita (Table a, b, & c). With increasing inoculum levels there was a progressive decrease in all plant growth characters of the crops studied. The length of shoot, root and weight of the whole germinated seed (i.e. root + Shoot + Seed) were gradually reduced as the inoculum level increased i.e. 10, 100, 1000 and 10,000 second stage juveniles inoculated per plastic bag containing 200 gm. sterilized soil. In Cow pea, at 10 larvae inoculated per plastic bag, the length of shoot was reduced about 6.84% of that of the uninoculated seedling while the root length was reduced by about 4.05%. All inoculum level of 100, 1000 and 10,000 juveniles per 200 gm. soil the reduction of shoot length was 26.71%, 84.33% and 90.51% while in root length the reduction were 32.96%, 73.37% and 93.95% respectively. The weight of whole germinated seed were also reduced by 23.82%, 41-85%, 51.66% and 60.77% at the inoculum levels of 10, 100, 1000 and 10,000 larvae per 200 gm. of soil respectively. The number of larvae penetrated into root and in soil were significantly increased as the inoculum level increased.

Table (a) : Effect of different inoculum levels of Meloidgyne incognita on germination of broad bean (*Vigna Sinesis* L.)

| Inoculum Level | Length of shoot (cm) | % of reduction from control | Length of root (cm) | % of reduction from control | Wt. of whole germinated seed (g) | % of reduction from | No. of larvae in Soil | No. of larvae in root |
|---|---|---|---|---|---|---|---|---|
| 0 (Control) | 4.53 | - | 4.46 | - | 5.71 | - | 0 | 0 |
| $10J_2$ | 4.22 | 6.84 | 4.05 | 9.19 | 4.35 | 23.81 | 2.43 | 3.31 |
| $100J_2$ | 3.32 | 26.71 | 2.99 | 32.96 | 3.32 | 41.85 | 21.02 | 7.41 |
| $1000J_2$ | 0.71 | 84.33 | 0.92 | 73.37 | 2.76 | 51.66 | 63.95 | 12.75 |
| $10000J_2$ | 0.43 | 90.51 | 0.27 | 93.95 | 2.24 | 60.77 | 99.1 | 21.2 |
| C.D. at 5% | 0.068 | - | 0.152 | - | 0.197 | - | 2.014 | 0.49 |
| C.D at 1% | 0.093 | - | 0.21 | - | 0.272 | - | 2.18 | 0.53 |

Table (b): Effect of different inoculum levels of Meloidgyne incognita on germination of broad bean (*Vicia faba* L.)

| Inoculum Level | Length of shoot (cm) | % of reduction from control | Length of root (cm) | % of reduction from control | Wt. of whole germinated seed (g) | % of reduction from | No. of larvae in Soil | No. of larvae in root |
|---|---|---|---|---|---|---|---|---|
| 0 (Control) | 6.42 | - | 3.43 | - | 10.21 | - | 0 | 0 |
| $10J_2$ | 5.56 | 13.39 | 3.144 | 8.34 | 8.35 | 18.22 | 3.34 | 2.58 |
| $100J_2$ | 4.06 | 36.76 | 2.33 | 32.07 | 7.57 | 26.44 | 10.06 | 7.36 |
| $1000J_2$ | 2.39 | 62.77 | 1.5 | 56.27 | 6.26 | 38.69 | 63.9 | 12.36 |
| $10000J_2$ | 1.32 | 79.44 | 1.18 | 65.6 | 4.42 | 56.71 | 112.2 | 19.2 |
| C.D. at 5% | 0.23 | - | 0.124 | - | 0.18 | - | 2.14 | 1.35 |
| C.D at 1% | 0.32 | - | 0.17 | - | 0.25 | - | 2.95 | 3.94 |

Table (c) : Effect of different inoculum levels of *Meloidgyne* incognita on germination of broad bean (*Phaseolus vulgaris* L.)

| Inoculum Level | Length of shoot (cm) | % of reduction from control | Length of root (cm) | % of reduction from control | Wt. of whole germinated seed (g) | % of reduction from | No. of larvae in Soil | No. of larvae in root |
|---|---|---|---|---|---|---|---|---|
| 0 (Control) | 7.1 | - | 3.54 | - | 8.36 | - | 0 | 0 |
| $10J_2$ | 5.32 | 25.07 | 2.56 | 27.68 | 7.37 | 11.84 | 2.7 | 2.3 |
| $100J_2$ | 1.98 | 72.11 | 0.89 | 74.86 | 5.37 | 35.77 | 48.8 | 10.6 |
| $1000J_2$ | 1.0 | 85.92 | 0.51 | 85.59 | 4.19 | 49.88 | 70.6 | 22.8 |
| $10000J_2$ | 0.46 | 93.52 | 0.34 | 70.40 | 2.65 | 68.30 | 148.2 | 25.3 |
| C.D. at 5% | 0.216 | - | 2.12 | - | 0.184 | - | 1.85 | 1.61 |
| C.D at 1% | 0.233 | - | 0.27 | - | 0.254 | - | 2.55 | 2.213 |

In *Vicia faba* the length of shoot, root and weight of whole germinated seed were significantly reduced as the inoculum level increased while the number of larvae penetrated into the root and in the soil were significantly increased with increasing inoculum level. The reduction in shoot length of *Vicia faba* were 13.39%, 36.76%, 62.77% and 79.44% of the uninoculated seedlings at the inoculum level of 10, 100, 1000 and 10,000 juveniles, while the reduction in root length were 8.35%, 32.07%, 56.27% and 65.01% and weight of whole germinated seed were 18.22%, 26.44%, 38.69% and 56.71% respectively.

Significant reduction in shoot length, root length and weight of whole germinated seed were also recorded in case of french bean also, 25.07% reduction in shoot length at the inoculum level of 10 larvae per 200 gm. of soil was observed while higher reduction i.e. 72.11%, 85.92% and 93.52% in shoot length were observed as the inoculum level increased at 100, 1000 and 10,000 juveniles per 200 gm. of soil. The root length was also found reduced by 27.68% at 10 larvae but at higher inoculum levels i.e 100, 1000 and 10,000 juveniles per 200 gm soil, the reduction in root length were recorded as 74.86%, 85.59% and 90.40% of those of the uninoculated respectively. The weight of whole germinated seed were also reduced by 11.84% at 10,35.77% at 100, 49.88% at 1000 and 86.30% at 10,000 larvae inoculum level.

In all the three vegetable crops studied similar results i.e. reduction on shoot length, root length and weight of whole germinated seed were recorded. The rate of germination was significantly delayed or suppressed with the increasing inoculum level which is similar with the findings of Gaur (1973) and Nanjappa (1974). The higher percentage of reduction in the rate of germination in these three vegetable crops could be due to introduction of *Meloidgyne* larvae from the very beginning of germination. Severe infection in the early stage of germination and possibility of more penetration in the younger plants than older ones were similar with the findings of several workers like Dasgupta and Seshadri (1972) reported that *Meloidgyne hapla* was less pathogenic to older lettuce plants. A heavy depression or reduction in the growth were also observed in the present study which could be due to infection or penetration in the primary and secondary roots and root hairs from the very onset of plant growth. The rate of depression in seedling emergence i.e. the rate of germination with the same inoculum level in different vegetable crops showed variations as reported by Gaur and Prasad (1991).

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