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BIO-EFFICACY OF TWO BACTERIAL INSECTICIDE STRAINS OF BACILLUS THURINCIENSIS AS A BIOLOCICAL CONTROL AGENT IN COMPARISON WITH A NEMATICIDE, PHENAMIPHOS, ON CERTAIN PARASITIC NEMATODES.

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ABSTRACT

*A greenhouse experiment was conducted to determine the possibility use of commercial bacterial pathogen insecticide, **Bacillus thuringiensis**, as biocontrol agent against **Meloidogyne javanica** and **Tylenchulus semipenetrans** nematodes.*

*The obtained results indicate that that the two strains of B. **thuringiensis** suppressed the total nematode populations and egg-mass production of **Meloidogyne javaica** and **Tylenchulus semipenetrans**. Also they could remarkably, reduce the precentage of egg hatchability of the two nematode genera. SAN 415 Bacillus strain was highly effective than Diple strain and surpassed it in this respect, but it was approximately similar to the standard nematicide phenamiphos.*

INTRODUCTION

Several research attempts have been done to find safe and effective pesticides to control economic pests. Relatively few pathogens have been exploited as pest control agents. Some of these agents have shown much potential and offer an excellent alternative to chemical pesticides. The bacterial pathogen insecticide, *Bacillus thuringiensis* is one of the most common microbial insecticide in use today.

Bacillus penetrans is an obligate pathogen of some plant parasitic nematodes (Mankau, 1975), and has a life cycle remarkably adapted to parasitism (Mankau and Imbriani, 1975). Its spores which attack *Meloidogyne* spp. attach to the cuticle of second stage juveniles in soil and germinate after the spore-encumbered juveniles enter roots and initiate feeding feeding (Sayre and Wergin, 1977). They added that a germ tube penetrates the cuticle and the pathogen then proliferates through the body of the developing nematode. The diseased females of nematodes, with *B. penetrans*, reproduced little or not at all at maturity (Mankau, 1980 and Mankau and Prasad, 1972). Therefore, *B. penetrans* has the attributes of successful biological control agent against root-knot nematodes (Mankau, 1980 and Sayre, 1980).

The bio-efficacy of the bacterial pathogen-insecticide, *B. thuringiensis* on many insects was studied by several investigators, i.e., Sheta et al. (1979); Hamed and Fawzia (1984); Abou-Baker et al. (1984); abdel-Megeed et al. (1984); Osborne et al. (1985); and Hauflera and Knuz (1985).

Little information was found in the literature on the efficacy of the microbial insecticide, *B. thuringiensis,* on plant parasitic nematodes (Ignoff and Fropkin, 1977). From this point of view, the present work was conducted to determine the efficacy of two strains of the commercial bacterial pathogen insecticides in comparison with a standard chemical nematicide, Phenamiphos as a biological control agent on two parasitic nematode genera.

MATERILAS AND METHODS

A greenhouse experiment was carried out using fomato, *Lycopersicon esculentum* cv. Pritchard and Balady orange, *Citrus sinensis* cv. Balady as host plants for *Meloidogyne javanica* and *Tylenchulus semipenetrans*, respectively. We used 20 cm in diameter clay pots containing 2 Kg sterilized sandy soil. There were eight treatments (each replicated 4 times) as foll ows :

(1) M. javanica alone, alone,
(2) M. javanica + B. thuringiensis (SAN 415),
(3) M. javanica + B. thuringiensis (Dipel),
(4) M. javanica + Phenamiphos,
(5) T. semipenetrans alone,
(6) T. semipenetrans + B. thuringiensis, (SAN 415),
(7) T. semipenetrans + B. thuringiensis (Dipel) and,
(8) T. semipenetrans + Phenamiphos.

The tested commerial bacterial pathogen insecticide, *B. thuringiensis* Berliner, was used as SAN 415 (32000 I.U./mg) at the rate of 5 kg/feddan (0.05 g/1 kg soil) and Dipel (16000 I.U./mg) at the rate of 5 kg/feddan(0.05 g/1 kg soil). The systemic granular nematcidie, phenamiphos, o-ethl-o(3-methyl-4-methylthiophenyl)-isopropylamido-phosphate, (Nemacur 10 G) was applied at the rate of 10 kg/feddan (0.1 g/1 kg soil). Immediately following the addition of nematode inocula (600 2nd stage larvae of each genus/pot), the bacterial insecticide or Nemacur were added to soil as side-treatment. The experiment was maintained 75 days after nematode inoculation in the greenhouse at 28 $\pm$ 5°C. Plants were then removed from soil and the roots were washed and one gram roots of each replicate was stained with acid fuchsin in cold lactephenol for counting nematode pooulation and number of egg masses. The percentages of eggs hatchability was determined by incubating seperate freshly extracted egg-masses from each treatment in Baerman's funnels at 28°C.

RESULTS AND DISCUSSION

Nematode populations in treatments of *M. javanic* of *T. Semipenetrans* combined with *B. thuringiensis* or phenamiphos were significantly lower than those in the treatments of *M. javanica* or *T. semipenetrans* alone (Table 1 $ 2). Similarly the number eggmasses in the treatments of nematode and either bacterial insecticide or Nemacur in tomato and citrus roots were significantly lower than in the treatments of *M. javanica* or *T. semipenetrans* singly. In the two experiments, fewer eggs hatched in treatments of either *Bacillus* or Nemacur than that of the nematode alone.

Nematode population in treatments of SAN 415 or Nemacur did not differ significantly from each other but there were significant differences between SAN 415 or Nemacur and Dipel treatment.

Accordingly, *B. thuringiensis* suppressed nematode population and number of egg-masses of both nematode genera. These results confirm earlier reports of Mankau (1980) and Mankau and Prasad (1972) , in which greenhouse tomatoes had fewer galls on roots wheen grown in soil containing *M. incognita* and *B. penetrans* than in soil without the bacterium. Our results, also, confirm the report of Stirling (1984) who observed that *B. penetrans* significantly reduced populations of *M. javanica*.

Likely, Brown and Smart (1985) findings were in agree with these results. They reported that *B. penetrans* inhibited penetration by *M. incognita* second stage juve nile into tomato roots in laboratory and greenhouse.

To a lesser extent, *B. thuringiensis* also reduced the percentage of hatchability of eggs of *M. javanica T. semipenetrans*. These results are in harmony with those of Benjamin and Smart (1987) who reported that *B. penetrans* reduced the root galling and eggmass production by *M. incognita*. They also reported that *B. penetrans* reduced the percentage hatch of eggs. They added that *B. penetrans*attacks aecond stage juveniles, kill some of them, those that survive and become adult females produce few or no eggs but instead their bodies become filled with spores of *B. penetrans*.

Finally, it could be concluded that the effeciency of commercial bacterial insecticide, *B. thuringiensis* SAN 415 is approximately similar to that of Nemacur, taking in our mind it is safe. So, it can be used safly as a biocontrol agent rather than the chemical pesticide to avoid hazards of environmental pollution.

Table (1) : Effect of two strains of the commercial pathogen insecticide, *Bacillus thuringiensis,* on nematode population, egg-masses count, and egg-hatch of *Meloidogyne javanica* on tomato,

Treatment	Average No. of nematode population per 1 g roots	% Reduction	Egg-masses count/1 g roots	% egghatch
Meloidogyne javanica alone	24	-	15	83
M. javanica + *B. thuringiensis* SAN 415	6	75.0	5	63
M. javanica + *B. thuringiensis* (Dipel)	10	58.33	7	66
M. Javanica + Phenamiphos	5	79.16	4	59
L.S.D. at 5% level	5.11		1.37	

Table (2): Effect of two strains of the commercial pathogen insecticide, *Bacillus thuringiensis*, on nematode population, egg-masses count and egg hatch of *Tylenchulus semipentrans* on orange.

Treatment	Average No. of nematode populat-ion per 1 g roots	% Reduction	egg-masses count/1 g roots	% egghatch
Tylenctulus semipenetrans alone	138	-	38	75
T. semipenetrans + *B. thuringiensis* (SAN 415)	27.6	80	10	59
T. semipenetrans + *B. thuringiensis* (Dipel)	82.7	60	40	66
T. semipenetrans + Phenamiphos	20.37	85	8	54
L.S.D. at 5% level	11.37		4.78	

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