Comparative studies between insect pathogenic nematodes and other 1ethods in controlling some soil insects and fruit tree borers

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1-laboratory studies:The effect Of mixing the nematode strains Steinernerna carpocapsae (All), Heterorhabditids bacteriophora (HP88) and Heterorhabditids bacteriophora (H t) with four nematicides (Nemacur, Rugby, Temik and Vydate) against the 6th instar larvae, prepupae and pupae of both Spodopetra littoralis andAgrotis ipsilon were investigated.The nematicide Rugby alone or combined with S. carpocapsae or H. bacteriophora (HP88) gave 100 %mortality, whereas its combinations with H. bacteriophora (H t) gave 93.3%. These mortality percentages were similar to those resulted by the nematode alone against S. littoralis. The combination of Oxamyl (Vydate) and nematodes gave mortality rates more than the Vydate alone, but mixing Nemacur and 1-IP88 or Ht strains gave mortality rates more than in case of S. carpocapsae (All). Mortalities of the three tested concentrations of Temik, evidently differed when they were combined with nematodes. All concentrations of Rugby, combined with H t, S c and HP88, gave maximum standard of mortality (100%), that were more than either the pesticide or each species of nematodesalone against A. ipsilon.Combinations of nematode strains and nematicides were more lethal against S. littoralis prepupae than nematicides, but their efficiency were less or equal to those of nematodes alone which gave 100 % mortality for each strain. The mixtures of S.carpocapsae or H. bacteriophora (HP88) with the four tested nematicides resulted in an increase in the mortality percentage of A. ipsilon prepupae than did pesticides, alone. On the other hand the nematode strains yielded higher mortalities iercentage of A. ipsilon prepupae (100, 100 and 91.7% for H , Sc and HP88, respectively).Concerning toxicity of the pesticides al with nematode strains against pupae of S. littor that Rugby alone was the most potent mortalities ranged between 83.3 - 97.7%, while i resulted from the other pesticides ranged betw On the other hand the potency of the four t combined with the entomopathogenic nema recording mortality percentages (35.4 - 100, 41. 100 %) when combined with Ht, Sc and HP88, reIn case of A. ipsilon pupae, Rugby (Cad combined with Ht, Sc or HP88, gave the highes which ranged between 70.8-100% that were none or combined lh, it was found esticide giving sect mortalities en 3.3 - 25.5%. sted pesticides odes, increased - 83.3 and 41.7- pectively.'salsas) alone or mortality rates -arly similar tothose of nematodes alone (89.6 for Ht, 100 for Sc and 91.7 for 111'88). With respect to other three tested pesti ides (Nemacur, Temik and Vydate) their combinations with en omopathogenic nematode enchanced their effectiveness more han using them alone. Their mortalities ranged between 8.4-1 .8% (pesticides alone), 29.2-79.2 % (with Ht) 27.1-72.9 % (ith Sc) and 4.2-54.2 % (with HP88).The pesticides varied in their toxicity. t• the infective stages of nematode strains. The effect of nematicides andinsecticides on activity of H. bacteriophora (Ht) resulted in raising mortality rates to a level ranged between 1.8 to 19.4% respectively. On the other hand, nematicides killed only 1.1%, while the insecticides killed 13.8% of the imported strain H. bacteriophora (HP88).Different degrees of dispersal (expressed as % individuals migration (%m) and distances covered by these individual [E (D)] were observed among the tested nematode strains. S. glaseri strain recorded the highest migration rate (89.28%), covering an average distance of 6.88 cm. The other tested strains could be arranged in a descending order as follows: H. bacteriophora (Ht), H. bacteriophora (HP88), S. carpocapsae (All) and S. carpocapsae

(agriotis), recording migration rates of 79.7, 76.48, 29.85 and 21.45%, respectively. The corresponding E (D) values were 12.62,13.07,5.97 and 3.23 cm, for the four strains, respectively, in case of the presence of, Galleria mellonella as a host. In case of presence of S. littoralis, the migration rate of S. glaseri was better than those of the other strains, achieving 91.12% and E(D) was 16.15 cm.Several factors were found to affect dispersal and migration as follows:1-The presence or absence of the host, since the dispersal and migration of the infective stages were better in the presence of the host.2-The nematicides improved migration and average net . distance of all tested nematode strains, except the S.g strain,with which a remarkable inhibition in its i obility, was obviously, observed.3-Feces of S. littoralis increased the migration nd dispersal than the host itself.4-Most nematode strains were attracted to S. h toralis morethan to G. mellonella larvae. II-Field studies :Application method and nematode concentratio s :Field trials were conducted for managing is control some fruit tree borers. The employed techniques and nematode concentrations were very important in application of entomopathogenic nematodes. It could be mentioned that the used two methods (spraying and injection) were effective for the tested insects. Morality of Zeuzera pyrina ranged between 70.7 and 74.5 % for spraying, and 69.4 to 80.03% for the injection techniques. However, the mortality rates of Synanthedon myopaeformis ranged between 45.9-59.3 for spraying technique while for injection, it ranged between 53.8 —76%. It was found that the tested nematode strains were more effective against Z. pyrina than against S. myopaeformis.The cotton plugs and the injection techniques were, statistically equal in their, effect giving S. myopaeformis larval mortalities of 68.4 and 59.6 %, respectively. On t le other hand, • the spray technique induced 30.5 % larval mortality of S. myopaeformis. Regarding Z. pyrina, the cotton plugs and thespray techniques were statistically equal in their effect giving larval mortalities of 86.1 and 87.98 %, successfully. On other hand the injection technique induced 76.95%larval mortality.Comparing the nematodes and the recommended insecticides in controlling S. myopaeformis and Z.pyrina, results showed that the combination between nematodes and insecticides, were the best, giving the greatest values of mortality. Both nematodes and insecticides alone achieved least mortality rates, ranging between 45.9-59.23%.Also, the performance of the entomopathogenic nematodes alone or combined with conventional nematicides had been comparatively, evaluated in an other experiment against S. myopaeformis and Z. pyrina on apple trees, in 1998 seasons. S. myopaeformis mortality rates ranged between 20-68.1%, whereas combination with insecticides achieved mortality rates between 34.3-64.3%. However, the insecticides alone, achieved 30-31.1% against S. myopaeformis. Combination of nematodes and insecticides achieved mortality rates ranged between 36.7-79.3% but insecticides alone achieved 30-31.3% against Z.pyrina.Comparing between entomopathogenic nematodes and B. thuringiensis in controlling Z. pyrina had been studied. Results showed that using nematodes against Z. pyrina, individually resulted in higher percentages of mortality than combination of nematodes and bacterium and /or the bacterium alone except in case of S. carpocapsae + B. thuringiensis in spring It could also be stated that strain S. carpocapsae (all) was more effectiveagainst the borers in autumn than in spring. While the strain of H. bacteriophora was more effective in high temperatures.Result showed that strain S. carpocapsae (all) in November (21°C) tended to give better control than in May (26.1°C) because of the high sensitivity of sich strain to high temperatures whereas the two strains of H. bacteriophora (HP88) and H. bacteriophora (Ht) achieved mortality rates of 67.95 and 74.8%, respectively in November. However, in high temperature of May, Heterorhabditis were the best in Killing Z. pyrina, larvae which achieved mortality rates of 77.4 and 78.1% against 62.3% for S. carpocapsae.Conclusion & RecommendationIt is a matter of fact that, the recent state of the international environment, especially the Egyptian one, reflect a high level of fully destroyed ecosystem, because of the extensive use of toxic pesticides against pests. People were severely injured from pesticide residues, taken with the agricultural source food, on which humans feed, thus we must links our point of view, towards new concept dealing with safe pest population management for preventing man, domestic animals and theenvironment from being severely injured.Internationally, the traditional methods of control, appeared to be neglected and replaced by more safe ones which cause no environmental pollution, no ecosystem destroy, and no injuries to man or his domestic animals. This method doubtedly appear to be the sole one which help in realizing our object, which

is known as ” the biological control ” which may start asintegrated control.Going on with such modern concept, it felt necessary to conduct such research work, dealing with the use of some biological control agents, in which both entomopathogenic nematodes in combination with the famous entomopathogenicbacteria ” Bacillus thuringiensis”.Simultaneously, certain nematicides and insecticides were tested, for exploring their effects on such biological control organisms that were used against some insect pests, which infestsome field crop and fruit trees in Egypt.The following are the obtained resu ts, which are supported with some recommendations:1-Supplying mixture of both entomopathogenic ematodes with some nematicides against some insect st ges (larvae-prepupae—pupae) of some field crop pests whi h are found in soil, resulted in an increase in their manageme tal potentiality of the pest population. Such finding may help ii utilizing suchspecies of nematodes safely within integrated • est population management.2-It was observed that both of the import -d and local entomopathogenic nematode strains, are highly olerant, rather to high concentrations of pesticides which re ched 800ppm for nematicides and about 1600ppm for ins cticide. This finding can throw light on the applicability of s ch biologicalcontrol agent, irrespect of the level of pesticide residues in soil.3-Studying dispersal and migration of the entot iopathogenic nematodes, it was found that it differ accor ling to some factors, especially the presence or absence of the host, the level of pest population, host species and fi ally to both quality and quantity of pesticides residues ac umulated insoil. It was found that such residues have posi ive effect on such research point.4-The use of nematode cotton plugs method proved to be most effective one over all treatments, especially in decreasing populations of the stem borer species of fruit tree. Thus, theyConclusion & Recommendationmust be preferred, when setting up new applicki programmes for controlling such pests.5-Variability in the efficiency of different nematode species, was observed according to the host species, as they were more efficient against Zeuzera pyrina than against Synanthedon myopaeformis. In this respect, it is suggested to conduct more research works dealing with such point for recognizing certain selective biological control agent, to be used in application.6-It was found that the abiotic factors in the environment, especially temperature, had significant effect on the activity and efficiency of such entomopathogenic nematodes. Such results indicate that species belonging to genus Heterorhabditis prefer high temperature degrees, while Steinernema in contrast prefer low temperature degrees. Thus, species of the first genus is suggested to be used only during spring season while species of the second genus are recommended to be applied only during autumn and winterseasons.7-It was found that, mixing of both entomopathogenic nematodes and entomopathogenic bacteria (B. thuringiensis) had negative effect on the efficiency of the nematodes, especially against Z. pyrina. However nematode alone had a level of efficiency exceeded that was obtained from the mixture. Thus, it must be suggested to avoid mixing the aforementioned biological control agents. Entornopathogenic bacteria may suppress activity of the nematode, reflected inConclusion & Recommendation ?04low level olefficiency. II they were blended in a same controlprogramme, each of them must be applied, individually, with enough period intervals.Final necessary wordfrom the previously mentioned results, in addition to what me know and feel about the recent level of ecosystem destroy because of the extensive use of toxic pesticides during the foregoing time, which caused lethal dangerous diseases symptoms which had dispersed among peop e and domestic animals because within tissues agricultural products, that areused as food.Thus we find it necessary to call all humans all over the world to stop, instantaneously, the use of ” chemical control” and replace it with the prolyphic ”biological control” method. That, surely, will be useful for preventing en ironment from being polluted, man and animal from being toxicated, and Finally a state ” natural balance dominance”.Conclusion & Recommendation 105