Available online at www.derpharmachemica.com

ISSN 0975-413X
CODEN (USA): PCHHAX

Der Pharma Chemica, 2016, 8(4):133-136
(http://derpharmachemica.com/archive.html)

Nano Imidacloprid efficacy against the desert locust, *Schistocerca gregaria* under laboratory and semi field conditions

Sabbour M. M. and M. A. Abdel-Raheem

Pests and Plant Protection Department, Agricultural & Biological Research Division, National Research Centre, 33rd ElBohouth St. – Dokki, Giza -Egypt

---

ABSTRACT

Nano- Imidacloprid (IMI) evaluated against the desert locust, Schistocerca gregaria under National Research Centre (NRC) laboratory conditions and semi field conditions in green house in NRC. The LC_{50} of S. gregaria recorded 344, 359, 366, 379 and 340 mg/L for Newly hatched nymphs , nymphs, Last nymphal stage , Adult ♀ and Adult ♂ respectively, under laboratory conditions. While, under semi field conditions the effect of the Nano-Imidacloprid recorded, that the LC_{50} of target pest 333, 343, 344 and 346 mg/L for Newly hatched nymphs , nymphs, Last nymphal stage , Adult ♀ and Adult ♂ respectively.

Key words: Nano, *Schistocerca gregaria*, Imidacloprid**.**

INTRODUCTION

Nanotechnology is new trend opens up a wide array of opportunities in various fields like agriculture and medicine. These include the Pests management through the formulations of the Nano materials which based on the pesticides and the insecticides, which enhancement of the agricultural productivity and using bio-conjugated of the Nanoparticles (encapsulation) for the slow release of nutrients and water, Nanoparticle-mediated. Desert locust, *Schistocerca gregaria* were controlled by bioassay by the using Nano toxin destruxin (from the fungus *Beauveria bassiana)* on the leaves containing early stages larvae Sabbour (2013[a]). The mortality was between 64-85%. Bioassay of destruxin by against desert locust, *S. gregaria* nymphs showed its acceptable effect of destruxin. More than 300 species of locusts and grasshoppers are known to exist in the African continent, but fortunately only a few of them are major pests; most are sedentary, inhabiting a rather confined area throughout their life cycle. The desert locust in Africa exhibits fully gregarious characteristics and is known for its long-range pattern of migration, covering as many as several thousand kilometers within a single generation. This is the main reason why the locust was, not surprisingly, the most feared among agricultural pests in antiquity. It may be assumed that proliferation of the pathogens and parasites was often counterbalanced in ancient times by natural enemies. It is not clear whether this applies also to locusts. Imidacloprid, is a systemic, chloronicotinyl insecticide, which specifically blocks the microtinergic neuronal pathway. It has recently been demonstrated a highly effective and a systemic insecticide (Byrne and Toscano, 2006). Imidacloprid is the first commercially available representative of a new chemical class. The Imidacloprid consider a chloronicotiny or neonicotinoid insecticides. It can be applied for seed, soil or foliar treatment.

This study aimed to evaluate the toxicity of Nano-Imidacloprid (IMI) against the desert locust, *S. gregaria* in Egypt.

MATERIALS AND MEHODS

Insect rearing

Locust was reared under laboratory condition for several generations on semi-artificial diet as mentioned by Sharaby *et al.* (2010).

Preparation of the nano- imidaclorprid

The imidaclorprid Nanoparticles synthesized by the hydrolyzing titanium tetra isopropoxide in a mixture of about 1:1 anhydrous ethanol and water. About 9 ml of titanium tetra isopropoxide is mixed with about 41ml of anhydrous ethanol (A). 1:1 ethanol and water mixture is prepared. The (B) Solution and A solutions added in drop wise to solute ion B and stirred in a vigorously for about 2hrs, At the room temperature hydrolysis and condensation are performed, by using about 1M of sulphuric acid and stirred for about 2 hrs. Then the solution was left for about 12hrs. The gel was transferred into an the autoclave apparatus and tightly closed hard, then the mixture was subjected to hydrothermal treatment at about 353K for 24hrs. After filtration the obtained of the solid residue was washed well thoroughly with distaed water and the ethanol mixture, then they dried at 373K in an oven and calcined at 773K.

Efficacy of the imidaclorprid against the target insect pests

The imidaclorprid were tested at the 6 concentrations: 6 g, 5g ,4g,3g, 2g,1g. They prepared 6 concentrations (prepared according Sameh et al., 2009). The percentages of mortality were calculated according to Abbott's formula (Abbott, 1925), and the LC50 values were calculated throughout the probit analysis according to (Finney, 1971). All the experiments were carried out under the laboratory conditions of 26±2°C and 60-70% RH.

Bioassays

The efficacy of the nano- imidaclorprid were tested at three dose rates, 0.25, 0.50 and 1 g/kg wheat against the 3rd instar larvae of *S. gregaria* **(**Orthoptera**:** Acrididae**)**. For each case, five glass jars as replicates were used. Each one of the replicate was treated individually with the respective nano-imidaclorprid quantity and then they was shaken manually for about one minute to achieve equal distribution of the imidaclorprid. Subsequently, fifteen nymphal individuals of 3rd instar of the tested insects were introduced into each glass jar and covered with muslin for sufficient ventilation. Ten replicates glass jars containing untreated wheat served as control. Mortality was assessed after about seven days of the first exposure in the treated and untreated jars. Mortality was corrected according to Abbott (1925). All tests were conducted at 27 ± 2 °C and 65 ± 5% relative humidity (RH). All the experiments were repeated three times.

RESULTS AND DISCUSSION

Table (1) show the effect of the Nano-IMI against *S. gregaria* under laboratory conditions , which detect that the LC_{50} of *S. gregaria* 344, 359, 366, 379 and 340 mg/l for Newly hatched nymphs , nymphs, Last nymphal stage , Adult ♀ and Adult ♂ respectively.

Under semi field conditions the effect of the Nano- Imidacloprid fond in table 2, which show that the LC_{50} of *S. gregaria* 333, 343, 344 and 346 mg/l for Newly hatched nymphs , nymphs, Last nymphal stage , Adult ♀ and Adult ♂ respectively (Table2).

Table 3, show that under semi field conditions , the numbers of the individuals infestations were significantly decreased . The infestations number of *S. gregaria* decrease to 0.1±1.1, 2.0±2.1, 5.7±8.8 and 10.1±3.9 individuals after 20, 50, 90 and 120 days of Nano-IMI first applications as compared to 22.2±9.4, 39±3.8, 39±3.8 and 97±8.8 individuals after the corresponding periods in the control (Table3).

Figure 1 show the infestations of the locust stages of *S. gregaria* significantly increased after the Nano-IMI treatments under semi field conditions.

The same obtained matched with Sabbour 2014[a] & [b]) who find that, LC_{50}s of the locust *S. gregaria* after treated with the Nano-destruxin which is recode, 99 X 10^4,106 X 10^4 and 114 X 10^4 spores/ml . Under semi field condition, the LC_{50}s of newly hatched nymphs, last nymphal stage and adult stages, 210 X 10^4, 227 X 10^4 and 224 X 10^4 spores/ml .also Sabbour 2013[a]&[b], montioned that Bioassay of destruxin by against desert locust, *S. gregaria* nymphs.

Sabbour, 2014[a] reported that, under laboratory conditions, the LC_{50}s, were significantly decreased when the adult female of grasshopper *Hetiracris littoralis* treated with nano-destruxin and reached to 153X10^4 spores/ml. Also,

Under semi-field conditions, the percentage of infestations of *H. littoralis* significantly decreased to 1.0±0.3, 3±0.1, 5±3.0 and 10±2.9 individuals after treated with nano-destruxin in 20, 50, 90 and 120 days, respectively as compared to 15.2±2.9, 39±3.5, 66±9.6 and 98±6.6 individuals in the control. Sabbour 2014[b] found LC_{50}s of the locust *S. gregaria* after treatment with destruxin, 210 X 10^4, 221 X 10^4, 250 X 10^4 spores/ml, of newly hatched nymphs, last nymphal stage and adult stage, respectively The effect of Nano-destruxin against *S. gregaria* under semi-field conditions show that after 20 days, the infestations number were significantly decreased to 2.2±1.2, as compared to 2.4±5.3, and 12.2±2.2 individuals after treated with destruxin and in the control. Sabbour, 2013 [a&b] reported that. Desert locust, *Schistocerca gregaria* bioassayed by using the leaves containing early stages larvae and the data were recorded after 1, 2, 3 and 4 days after treatment. Results showed that range of mortality was between 84-65% based on the end point data. The minimum of three days to achieve 60% mortality was proved by probit analysis of time-mortality responses. They found that, the range of mortality was between 88-65% based on the end point data. The minimum of three days to achieve 50% mortality was proved by probit analysis of time-mortality responses. The same results obtained by Sabbour and Singer, 2015, Sabbour, 2015[a& b], and Sahab, *et al.*, 2015 found the insecticidal activity the Nano-chitosan (CS-g-PAA) showed highest effect against the three insect of soybean. As the means number of eggs deposited /female were significantly decreased. Under laboratory and semi field condition, *Aphis gossypii* were significantly decreased to 20.9±9.1 and 28.9±9.2 eggs/female respectively as compared to 97.3±4.9 and 90.3±4.9 eggs/female in the control, respectively. The same trends were also observed against *Callosobruchus maculatus* .Sabbour, 2015 [a,b, c&d] found that the Nano insecticides of Imidacloprid and fungi strains cases a higher mortality for insect infestations. Our results agree with Sabbour and Abdel- Raheem, 2015 [a&b], Sabbour and Singer, 2015 [a&b] and Sabbour and Shadia, 2015 who find that the Nano pesticide decrease the infestation percentage of different pests.

Table 1.Effect of Nano-IMI against *S. gregaria* under laboratory conditions

Stages	LC_{50}	V	S	95% confidence limits
Newly hatched nymphs	141	0.01	1.1	78-167
Last nymphal stage	159	0.01	1.0	100-178
Adult ♀	166	0.01	1.0	111-189
Adult ♂	199	1.01	0.2	99-280
	190	1.2	0.1	101-261

Table 1. LC_{50} of *S. gregaria* **recorded under laboratory conditions after IMI treatments,** *S. gregaria*141, 159, 166, 199 and 190 **mg/L for** Newly hatched, nymphs, Last nymphal stage, Adult ♀ and Adult ♂ **respectively.**

The LC_{50} for the corresponding stages under semi field conditions, 130, 149, 148, and 145 **mg/L (Table 2).**

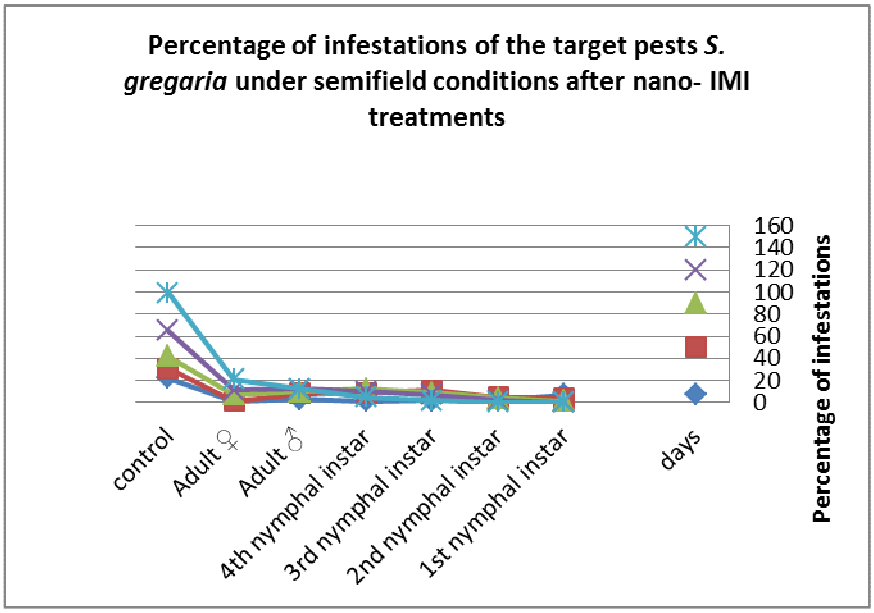
Table 2.Effect of Nano IMI against *S. gregaria* **under semi-field conditions.**

Stages	LC_{50}	V	S	95% confidence limits
Newly hatched nymphs	130	0.01	1.3	100-159
Last nymphal stage	149	0.01	0.1	110-189
Adult ♀	148	0.01	1.1	100-179
Adult ♂	145	1.00	0.1	99-159

Table (3): Effect of Nano IMI against *S. gregaria* **under semi field conditions**

treatments	Days after treatment	No .of infestations of the target pests (Means ± S.E.)
control	20	20.2±1.4
	50	37±1.8
	90	50±8.6
	120	99±8.8

Fig. 1. Percentage of infestations of the target pests *S. gregaria* under semi field conditions after IMI treatments



Acknowledgments
This research was supported by Agric. Department, National Research Centre, Giza, Egypt. Project No (10120601).

REFERENCES

[1] Abbott, W.W. **1925**. *J. Econ. Entomology* 18: 265-267.
[2] Byrne, F.J. and N.C. Toscano. **2006**. *Crop Prot*. 25 (2006) 831–834.
[3] Finney, D.J. 1971. Probit Analysis, Cambridge: Cambridge University Press.
[4] Sabbour M.M. **2013**[a]. *J. Egypt. Acad. Environ. Develop*. 14(1): 35-41.
[5] Sabbour M.M. **2013**[b]. *J.Egypt. Acad. Environ. Develop*. 14(1): 29-34.
[6] Sabbour, M.M. **2014**[a]. *J. Egypt. Acad. Environ. Develop*. 15(2): 9-17.
[7] Sabbour, M.M.**2014**[b]. *J. Egypt. Acad. Environ. Develop*. 15(2): 1-7.
[8] Sabbour M. M. **2015**[a]. *Journal of Nanoscience and Nanoengineering.* Vol. 1, No. 3, 2015, pp. 142-147.
[9] Sabbour M. M. **2015**[b]. *American Journal of Biology and Life Sciences*. 3 (5):155-160.
[10] Sabbour, M.M. (**2015**[c]). *Open Science Journal of Bioscience and Bioengineering*49-45 :(5)2 90.
[11] Sabbour, M.M. **2015**[d]. *Advances in Biochemistry & Biotechnology.* 1-13.
[12] Sabbour M.M and S.M. Singer. **2015**[a]. *International Journal of Scientific & Engineering Research*, Volume 6, Issue 8, August-2015.
[13] Sabbour M.M and S.M. Singer. **2015**[b]. Efficacy of Nano *Isaria fumosorosea* and *Metarhizium flavoviride* against Corn Pests under Laboratory and Field Conditions in Egypt. *International Journal of Science and Research* (IJSR).
[14] Sabbour, Magda and Mohamed Abdel-Raheem.**2015**[a]. *American Journal of Innovative Research and Applied Sciences*.2015; 1(7):251-256.
[15] http://www.american- jiras.com/SabourManuscriptRef.1-AJIRAS300715.pdf
[16] Sabbour, Magda and Mohamed Abdel-Raheem. **2015**[b]. *The American Journal of Innovative Research and Applied Sciences*.2015; 1(6):197202.
[17] http://www.americanjiras.com/Magdamanuscript_Ref.ajiras_ 1-220615_EGYPT.pdf
[18] Sabbour, M.M. and Shadia El-Sayed Abd-El-Aziz. **2015**. *Bull. Env.Pharmacol. Life Sci.*, Vol 4 [7] June 2015: 54-59. Sahab, A. F.; Waly, A.I., Sabbour, M. M. and Lubna S. Nawar. **2015**. Synthesis, antifungal and insecticidal potential of Chitosan (CS)-g-poly (acrylic acid) (PAA) nanoparticles against some seed borne fungi and insects of soybean. Vol.8, No.2, pp 589-598.
[19] Sameh, A. Moustafa; Ahmed, E. Abd El-Mageed; Mostafa, M. El-Metwally and Nabil, M. Ghanim. **2009**. *Acad. J. biolog. Sci*., 2 (2): 171- 178.
[20] Sharaby, A., Montaser, S.A.,Mahmoud,Y.A., and Ibrahim, S.A. **2010**. *Journal of Agriculture and Food Tecgnology*, 1 (1):1-7.