EVALUATION OF SPINOSAD RESIDUES AS AN ALTERNATIVE SAFETY ENVIRONMENTAL AGENT TO CHLROPYRIFOS IN PLANTS AND SOIL DURING CONTROL *SCHISTOCERCA GREGARIA* AND *LOCUSTA MIGRATORIA* IN THE FIELD

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Abstract: Traditional pesticides cause dangerous effects on the non-target organisms when use them to control the target insect pests speciality, when insecticides are used on crops. So, their usage should be reduced and used alternatives elements to insecticides like entomopathogenic agents and Naturalyte insecticides like Spinosad. In this study we try to enter new pesticide spinosad to control *Schistocerca gregaria* and *Locusta migratoria* in the field. Spinosad showed a good result that the mortality percentages reached 89.33 and 88.67% in two seasons on the *L. migratoria* and 86.67 and 88.53% on desert locust. On the other hand mortality percentages to Chloropyrifos were 95.33 and 96% on desert locust and 96.67 and 98% of *L. migratoria*. When evaluated the insecticides residues on *Suaeda monoica* to seven days after treatment were 10.44 and 7.05 mg/kg of chlropyrifos treatment in two seasons but spinosad residues were 0.03 and ND mg/kg but the insecticides residues on *zea mays* were 17.82 and 22.43 mg/kg to chlropyrifos and were ND on seven days in the first season and on the third day in the second season to spinosad. In the soil Chlropyrifos residues as a result to control desert locust were 2.10 and 2.15 in two seasons but as a result to control *L. migratoria* were 0.16 and 0.024 mg/kg in two seasons. Spinosad residues were ND in two seasons as a result to control desert and *L. migratoria*.

Keywords: Insecticides residue, Spinosad, *Schistocerca gregaria, Locusta migratoria,* Chlropyrifos, Environmental Safety

1. Introduction

One of the destructive insects is the desert locust, *Schistocerca gregaria* (Forskal), which assume the most paramount economic insects occasioning severe injury to plants which food to human and animal (**Wopke *et al.*, 2005; Sabbour, 2016)**. Desert locust probably infest Egypt from out the country while in the suitable environment conditions can breeds and move to crops in the cities the migratory locust *Locusta migratoria* L., also is extremely distributed in the world **(Uvarov, 1977; Soliman, 2019).** They feeds on grass and often causes dangerous harm to agricultural crops **(Pener and Simpson, 2009)**. Currently; locusts controlled by insecticides mainly pyrethroides and organophosporous while The common usage such synthetic insecticides consider dangerous due to their persistence then their residues and a lot of effects on both of environmental components and mammals (**Lecoq, 2001; Ghoneim *et al.*, 2015; Soliman, 2019).**

Application of insecticides may cause disaster effects on the non-target organisms in an agro-ecosystem (S**arfraz and Keddie, 2005; Suhail *et al.*, 2007)**. The use of insecticides on crops is one of the main factors affecting the agro- ecosystem. They are considered as a major source of environmental pollution. So their usage should be reduced and used alternatives to insecticides **(El-Sheikh, 2012)**.

Naturalyte insecticides, which include microorganisms or their metabolisms, are more selective than traditional chemical insecticides, where their side effects are low on non-target organisms **(Besard *et al.*, 2011).** Therefore, progress in manufacture of new chemical pesticides must increase where, they are safe to natural enemies and reduce their population **(Sarfraz and Keddie, 2005; Suhail *et al.*, 2007)**. Spinosad and *Bacillus thuringiensis* var. *kurstaki* from these new chemical pesticides are used in control many economic insects **(El-Sheikh, 2012)**. These insecticides are used widespread in integrated pest management (IPM) program environmentally safe **(Sarfraz and Keddie, 2005; Suhail *et al.*, 2007; Besard, 2011).** Spinosad is one of the naturalyte insecticides has been known as bio-insecticide **(Copping and Menn, 2000)**. It is metabolites produced by *Saccharopolyspora spinosa* Mertz and Yao (Actinomycetales: Pseudonocardiaceae), the soil actinomycetes, under fermentation conditions it is a strong insecticidal activity **((Mertz and Yao, 1990; Salgado, 1997; Sabry and Abdel-Azizhe, 2013).** This work aims to use alternatives insecticides as safe insecticides than traditional insecticides pyrethroids and organophosporous for the desert locust and migratory locust control in the field especially in reclaimed and planed crops area to reduce human environmental pollution.

2. Materials and Methods

3.1. Test insects.

Third , Fourth, Fifth, nymphal instars and maturing insects of *Locustae migratoria and Schistocerca gregaria* were used under the field conditions.

3.2. Study locations.

Two seasons (2018 -2019) during the winter and summer were carried out ecological survey operations in locusts areas infesting and breeding in AL- Craf Wady (N 22o 29" 01/ E 036o 04 " 38) 40 km north of Abo-ramad. the Red Sea Coast and Shark El-Owinat region of east Egypt to evaluate the density of desert locust and migratory locust , this area is importance as an environmentally sensitive area. The soil texture was sandy soil. Many important herbaceous plants growth in AL-Craf Wady that are mainly used as a primary pastures for camels and sheeps, such as *Panicum turgidum* bushes ,*Calotropi procera* bushes, *Suaeda monoica* bushes (Al-adlib).

Many important crops planted in Shark El-Owinat region that enter the human and animal food, such as *Medicago sativa*, *Sorghum bicolor* and *zea mays* which used in the this study after forty five days of planted

3.3. Pesticides

3.3.1.Spinosad

Trade Name:, Spinosad 24 % SC (Suspension Concentrate), at the rate of 65 ml/100L. of water, Dow Agroscience Co.

3.3.2.Chlorpyrifos

Trade Name: Locoban 45% ULV at the rate of 1Liter/hectare solitaire for agricultural and industrial chemical co.

3.4. Test plants

Zea mays (Cyperales: Poaceae) is one of the most important staple food crops. Also commonly used in the world after wheat and rice. Like other cereal crops, maize is also extremely vulnerable to attack of insect pests **(Devananda *et al*., 2018)**.

Suaeda monoica (Caryophyllaes: Chenopodiacae) is very abundant in the southern section of Red Sea coast. **(Zahran *et al*., 2016)**. *S. monoica* is distributed throughout the Egyptian red sea coast and east desert. Locally it is called as Adlib that have been used to feed animals such as camel, in grazing some species of goat.

3.5. The experimental design

Four experimental blocks (A, B, C and D) were measured in the field to each insecticide. Each block was divided into five plots (50×21m = 1050m^2 = ¼ feddan). 210m^2 buffer zones (21×10 m) were maintained between plots and between blocks the plots in every block were as replicates. Every block was treated with recommended, half and quarter concentration of each insecticide and the forth block (D) was left as a control.

Each treatment plot was represented with one cage (0.5 x 0.5 m) the insects were collected randomly from each treatment directly after pesticide application by using sweep net and placed in the cages; the cages were maintained in the area of treatment under field conditions. The insects were fed daily on treatment plants from treatment plot. Mortality counts were recorded daily until 72 hrs. post treatment. Mortality data were summarized as estimates of the Median Lethal Concentration (MLC). Two blocks (A) were used as treated area with recommended concentrations of two pesticides to evaluate the residues to each insecticide and the Fourth block (D) was kept as a control.

3.6. Methods of pesticides application.

Chlorpyrifos (45% ULV) were applied using a handheld sprayer (rotary spinning disc, Micro-Ulva®), the red nozzle was used with a flow rate (FR) 0.065 L/min and spraying height was 0.5 m. forward speed was 3.9 km./h., track spacing 10 m according to wind velocity

Spinosad as 24% SC (Tracer®), were applied using a backpack sprayer (air pressure Taral port 512 S knapsack mist blower, Motorlu Shirt company filled volume application rate (var) 128 L/ha. The nozzle number 3 was used with a flow rate (FR) 2.5 L/min and spraying height was 0.5 m forward speed was 3.9 km/h, track spacing 3 m according to wind velocity.

3.7. Sampling and sample storage

3.7.1. sample of plant

About 1 kg fresh weight of the shoot system of plants (*S. monoica* and *Z. mays*) which sampled randomly from each plot at 1 h. after application, 1, 3, 5 and 7 days after the application. Samples were cut by nickel sharp scissors and mixed, eventually, the total weight of the sample were 5 kg , kept in airtight polyethylene bags and stored in deep freeze (-20 ºC) until extraction and analysis.

3.7.2. Sample of soil

About 1 kg weight of the surface layer of sandy soil from the same place as the plants (1 cm to 15 cm) which sampled randomly from each plot at 1 h after application, 1, 3, 5 and 7 days after the application samples were tacked by nickel shovel and mixed, ultimately, the total weight of sample was 5 kg kept in airtight polyethylene bags and stored in deep freeze (-20 ºC) until extraction and analysis.

3.8. Analysis of spinosad and chlorpyrifos residue

Samples have been extracted and analyzed by central agricultural pesticides laboratory which prepared, extracted, cleaned up and analyzed By the Quick, Easy, Cheap, Effective, Rugged and Safe 'QuEChERS' technique using Sample weight/volume analyzed: 10 g by Using high performance liquid chromatography (HPLC) Analysis method: EN15662:2009-02, apply ISO/IEC 17025:2005 which is Specifiec method for the analysis of pesticide residues on plant and soil (German Institute for Standardization) (Deutsches Institute für Normung) (Aproval from DAKKS).

3.9. Statistical analysis

The percentage of nymphal mortality was corrected according to Abbotts formula **(Abbott, 1925)**

Lc_{25}, Lc_{50}, Lc_{90} values and slope of regression lines were calculated by using (Lpd line) software for calculating and drawing toxicity lines according to **Finney (1971)**.

3.Results

3.1. Mortality percentages for desert locust and migratory locust after treated with two insecticides chloropyrifos and spinosad

Usage insecticides chloropyrifos and spinosad at three concentrations recommended, a half recommended and quarter recommended concentration to control desert and migratory locusts was carried out in Abo-ramad and Shark El-Owinat regions by handheld sprayer (rotary spinning disc, Micro-Ulva®) and backpack sprayer (air pressure Taral Port 512S Knapsack mist blower, in winter and summer for two seasons to estimates of the median lethal concentration (LC_{50}), all data were represented in **table (1**). Insecticide chloropyrifos at recommended concentration occurred mortality to desert locust after 72 hrs. The first season caused 95.33% mortality, while the second season induced 96% mortality, however, the mortality percentages on *L. migratoria* were 96.67 and 98%, respectively. LC_{50} value was 5.4069 and 8.0718 ml. in season one on desert and *L. migratoria*, but was 6.9671 and 5.9471 ml. in season two. Insecticide spinosad in recommended concentration reduce the population of desert locust, 86.67 in season one and 88.53% in second season also LC_{50} was 0.952 and 1.147 ml. also appeared decrease in *L. migratoria* population 89.33 and 88.67 % in two seasons respectively. LC50 was 0.7356 and 1.093 ml.

Table 1. The mortality percentages of *L. migratoria* and *S. gregaria* after treated with insecticides under the field conditions.

insect	insecticide	Season	concentration ml/ 1050m^2	mortality%	LC50 ml.	lower limit	upper limit	Slope	X^2
S. gregaria	Chlropyrifos	first	100	95.33	5.41	0.19	12.51	1.24+/-0.39	0.52 tabulated 3.8
			50	86.67					
			25	80.67					
		Second	100	96	6.97	0.71	14.26	1.26+/-0.35	0.88
			50	83.33					
			25	77.33					
	Spinosad	first	9	86.67	0.95	0.11	1.74	1.12+/-0.34	0.06
			4.5	76.67					
			2.25	66.67					
		Second	9	88.53	1.14	0.27	1.88	1.27+/-0.34	0.70
			4.5	74.67					
			2.25	66					
L. migratoria	Chlropyrifos	first	100	96.67	8.07	1.32	14.69	1.60+/-0.43	0.52
			50	88					
			25	79.33					
		Second	100	98	5.97	0.36	12.72	1.46 +/-0.44	2.95
			50	87.33					
			25	84					
	Spinosad	first	9	89.33	0.74	0.05	1.49	1.11+/-0.35	0.24
			4.5	79.33					
			2.25	71.33					
		Second	9	88.67	1.09	0.23	1.83	1.25+/-0.34	0.62
			4.5	75.33					
			2.25	66.67					

3.2. The insecticides residues of chlropyrifos and spinosad on plants and soil at two seasons under the field conditions

The insecticides residues of chlropyrifos and spinosad were evaluated after 1hr. (initial deposit), 1day, 3days, 5days and 7days of application during two seasons (2018-2019). These residues analysis in two plants, *S. monoica* and *Z. mays* and in the soil in two locations, Abo-ramad and Shark El-Owinat respectively. The results were summarized in fig (3, 4) there is not residues of Spinosad in the soil after 5days of application during two seasons in Abo-ramad and Shark El-Owinat, but chloropyrifos residues were 2.1 and 2.15 mg/kg in Abo-ramad during two seasons and were 0.16 and 0.024 mg/kg in Shark El-Owinat after 7 days of application. Results in fig (1, 2) appeared values of residues in *S. monoica* at two seasons were 10.44 and 7.05 mg/kg for chloropyrifos and 0.03 mg/kg and None for spinosad after 7days of application, but result in fig 5, 6) showed that in Z. mays were 17.82 and 22.43mg/kg for chloropyrifos and there is not any residues of Spinosad in Z. mays after 3days in the first season and 7days in the second season.

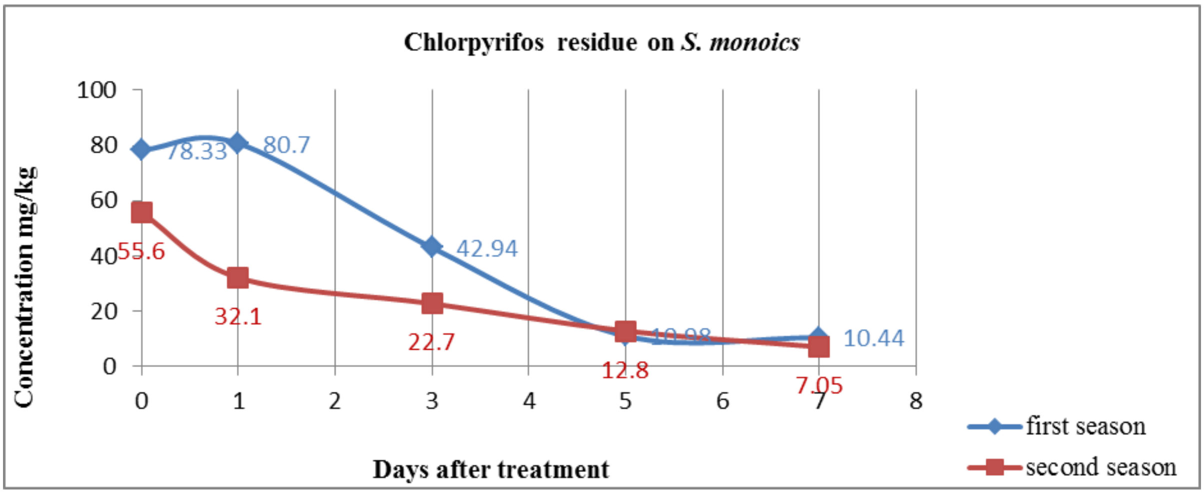

Fig. 1. Chlropyrifos residues in *S. monoica* during two seasons for a period of 7 days after application.

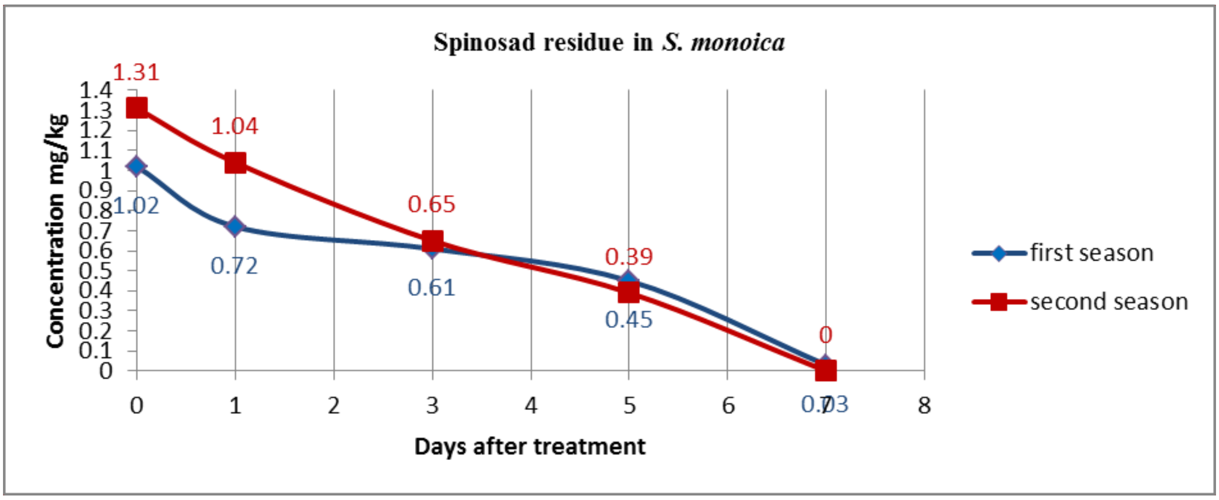

Fig. 2. Spinosad residues in *S. monoica* during two seasons for a period of 7 days after application.

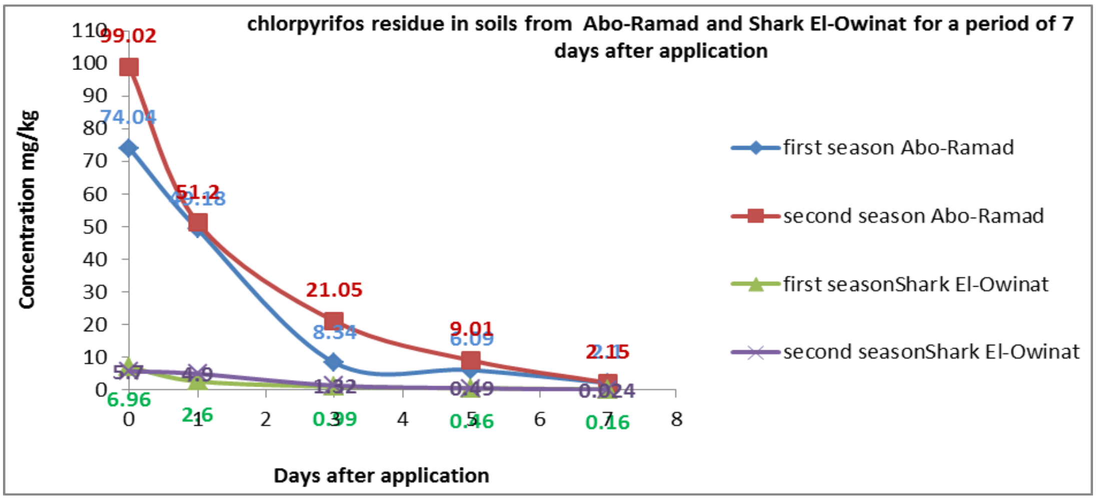

Fig. 3 Chlropyrifos residues in soils during two seasons from two regions (Abo-Ramad and Shark El-Owinat) for a period of 7 days after application.

Desert and migratory locusts are considered the most important species spread in Egypt from the Acrididae family, order: Orthoptera, along with some types of grasshoppers, as they cause a lot of economic damage to Egyptian agriculture. Where the desert locust has become continuously present in Egypt in some areas that have become one of the breeding areas for desert locust such as the Red Sea coast in some regions such as Shalateen, Abo-Ramad and Halayeb and some valleys in the far southeast of the eastern desert such as Al-daeeb, AL- Craf Wady which runs between Egypt and Sudan, passing through the Egyptian-Sudanese borders.

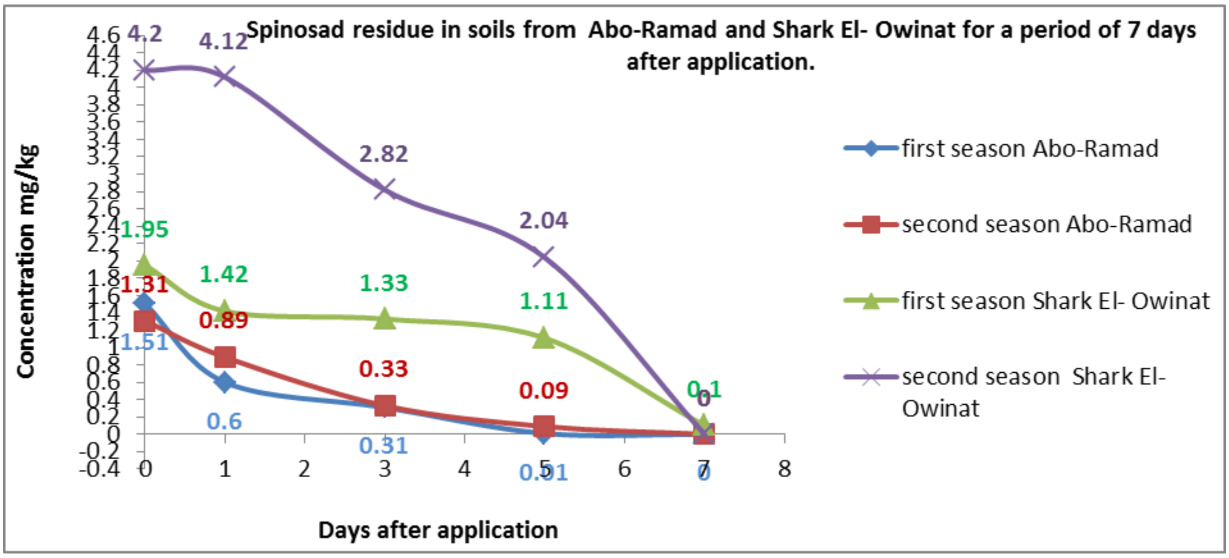

Fig. 4. Spinosad residues in soils during two seasons from two regions (Abo-Ramad and Shark El-Owinat) for a period of 7 days after application

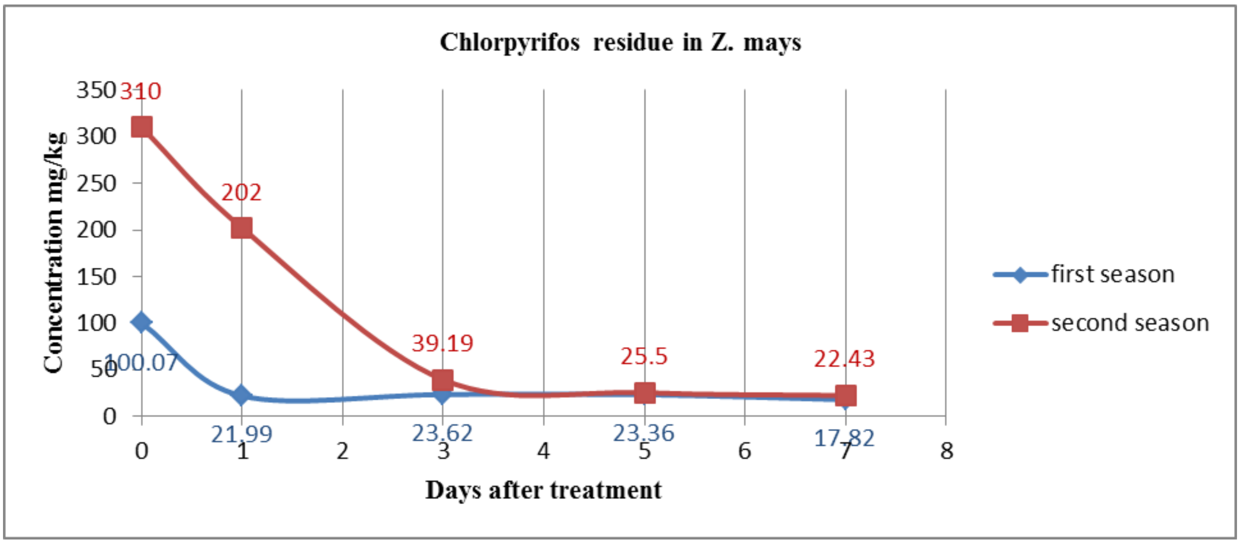

Fig. 5 Chlropyrifos residues in *Z. mays* during two seasons for a period of 7 days after application

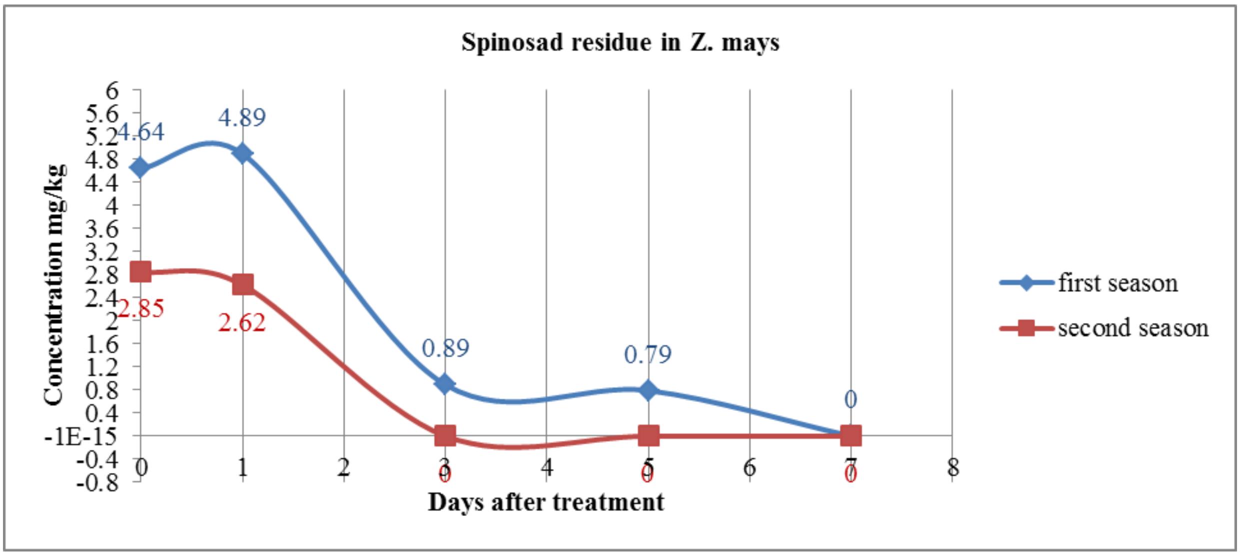

Fig. 6. Spinosad residues in *Z. mays* during two seasons for a period of 7 days after application

4. Discussions

Currently, Al-daeeb Valley 70 km north of Abo-Ramad has become a desert locust breeding area, extending to a length of 120 km between Egypt and Sudan. Annual rains fall on the valley from September to March leading to the presence of green plants, as well as ground moisture and loose sandy soil that enables locusts to breed, lay eggs and exit nymphs and successive generations. Significantly increasing the numbers and shifting from the solitary phase to the gregarious phase, whereby during the summer the individuals decrease the insect's numbers and exist in the form of individual insects that spread throughout the eastern and with the improvement of the appropriate conditions for laying eggs and reproduction increases preparation and turns to the gregarious phase, which may cause significant economic problems.

On the other hand, migratory locusts are found in the far southwest of the western desert, especially with the presence of agricultural reclamation areas that have been spread since several years ago and widely spread in the regions of Toshka and Shark El-Owinat. Solitarious phase usually does not cause any economic damage. *L. migratoria* feeds on grass and causes dangerous damage to cultivated crops **(Pener, 1991; Pener and Simpson, 2009)**. Cultivated crops are heavily affected by migratory locust in Toshka and Shark El-Owinat. These are reclaimed area were cultivated by many crops like wheat, potato, *Z. mays*, sorghum and some medicinal and aromatic plants. *L. migratoria* occurred great damage to the planted area. The suitable ground for migratory locust breeding, especially in the summer, and cultivating some types of crops preferred for migratory locusts in nutrition, such as the grass family, sorghum and Zea mays, which are grown for the purpose of using silage or to obtain a crop. All of this and with the availability of loose sandy soil suitable for laying eggs and reproducing, the appropriate environment existed for the breeding of migratory locusts, so it became available and increased from year to year.

However, last outbreak occurred at a small scale this is found on reclaimed land **(Yamagishi and Tanaka, 2009).** Migratory locust is a major pest in a lot of tropical areas, especially in Madagascar and sub-Saharan Africa. This locust is hardly discovered During long recession seasons, but bands of hopper and swarms can cause great damage during plagues periods **(Davey and Johnston, 1956)**. The Niger River is one of the main location of *L. migratoria* in Mali, also Sudan on the Blue Nile and in the Lake Chad basin, So local plagues often occur and sometimes are very serious and for crop protection large areas must be sprayed **(Lecoq, 1991)**. *S. gregaria* and *L. migratoria* have the most disaster agricultural insects worldwide. Phase polyphenism in both species affected on density, which includes some changes in morphological and behavioural aspects **(Pener, 1991).**

In the past few years, the use of pesticides recommended by the Food and Agriculture Organization (FAO) to control locusts, such as organic phosphorous and pyrethroids, has been in the form of water-soluble emulsions or Ultra-Low Volume such as chlropyrifos, delta, and cyber. In two years ago, the Egyptian agricultural pesticide GNU has recommended a locust pesticide in the form of ULV from the active ingredient chlropyrifos. Insecticide spray directly onto nymphs bands or settled adult swarms, was considered the sole strategy, widespread spraying has been controversial for human, environmental safety and economic reasons **(Showler, 1995a; Everts and Ba, 1997).**

Environmental concerns caused bans on organochlorins in agricultural field **(Wiktelius and Edwards, 1997)**. It has become better for us to search for alternatives to pesticides currently used in locust control. These alternatives are less effective on environmental components than environmental health and safety. In our study, the main goal was to research the possibility of introducing more than a new safe pesticide.

From that side, spinosad has strong insecticidal efficacy **(Thompson *et al*., 1997).** And appeared little toxic to mammalian and non-target organisms **(Bret *et al*., 1997; Sparks *et al*., 1998).** Also, spinosad was classified as a bio-pesticides **(Copping and Menn, 2000**). It has acted as contact and ingestion chemical pesticide **(Sparks *et al*., 1998; Elbarky *et al*., 2008)** demonstrated that radiant in a recommended dose was safe to predators inhabiting cotton field.

Spinosad is one of the pesticides that is characterized by a low toxicity to the environment. The study in which locusts exist whether it is field crops or for grazing, it is worth mentioning some studies that are consistent with our study of the safety of spinosad on the environment and non-target living organisms, the residual presence of pesticides in the environment and the occurrence of dissolution of the pesticide in the last time period. Furthermore, it has no toxicity to birds during toxicity tests. Spinosad has also been appearing practically nontoxic to natural enemies **(Bret *et al*., 1997)**. Also, when spinosad applied on aphids coccinelids and chrysopids larvae fed it showed no predator mortality **(Schoonover and Larson, 1995).**

Insecticide applications are a dangerous to health, environmental components and exports, if insecticides are not applied or found under maximum residue limits (MRL) this will lead to produce healthy crops and will be safe on environmental components, human non-target organisms. A lot of insecticides are known as neurotoxic, such as carbamates and organophosphates which inhibit acetylcholinesterase action. **(Mansour, 2004; Koprucu *et al*., 2006).** Therefore, it was chosen to have this study on it by studying its ability to reduce the population of locust in the field, as well as the presence of the least residue of the pesticide in both soil and plants.The insecticide treatments were Spinosad and chloropyrifos applied at the maize and *S. monoica* field to identify the level of insecticide residues after field application in *Z. mays*, *Suaeda monoica* and the soil. For insecticides extraction and clean up from all treatments 'QuEChERS' technique was used, while HPLC equipment was used to determine pesticide residues. Residue levels of insecticides decreased with prolonged time after treatment (**Strada *et al*., 2012)**.

Two plants: *Z. mays* and *S. monoica* were sprayed with a recommended concentration of 128 L/ha. of spinosad and collected after 0(1hr.), 1, 3, 5, and 7 days. The residues were analysed using high performance liquid chromatography (HPLC). Spinosad degradation in *S. monoica*, *Z. mays* and the soil showed that there is no residues after five days from application to two seasons in all treatment. The residue values of chlropyrifos in soil were reported to be 2.10–310 mg/kg in a *S. monoica* field and 0.024–6.96 mg/kg in *Z. mays* field after seven days. The degradation of spinosad and chlropyrifos is affected by soil conditions, insecticide formulation, location of treatment, climate conditions and treatment method (**Hwang *et al*., 2018)**.

Chlropyrifos excels in its ability to reduce the population on spinosad, but in exchange for the environmental safety achieved by spinosad, especially for non-target organisms, humans and exports, this superiority can be overlooked, especially since spinosad also achieves high rates, reducing population exceeding 88%, and this may lead us in the near future to the use of spinosad will be a good alternative, environmentally safe and with low residual proportions, to traditional insecticides, especially ultra-low volume of pesticides used in locust control in Egypt in breeding areas, both the desert locust in the regions (Abu Ramad, Halayeb and Shalatin) in the south-eastern desert and the African migratory locust in regions (Shark El-Owinat and Toshka) in the western desert, and given the seriousness of this form of the preparation, especially on cultivated crops in reclaimed areas in Egypt and which prepared specifically to bridge the food gap or for export or even on grazing plants in eastern desert such as Acacia and Al-adlib, it is a good idea to find a safer alternative environment in the soil and crops and therefore domestic animals and humans. In view of the insecticide residues were used, whether spinosad or chlropyrifos, the lower concentration of the pesticides present in the soil was Spinosad residues. Likewise, the period of degradation of the pesticide in the soil and the plants was faster in spinosad, as it did not exceed the fifth day in all treatments. As for chlropyrifos, it exceeded the seventh day. On the same side, chlropyrifos residues were less in the soil in the Shark El-Owinat region than in the Abu Ramad, due to the nature of the irrigation method, which is used in the pivot in Shark El-Owinat, but irrigation in Abu Ramad by rain, in winter only, as well as degrees of heat which ranges in Abu Ramad, between 25 to 28 °C during March, while in the Shark El-Owinat, between 40 to 44 °C during August, as well as the soil structure, which is very sandy in Shark El-Owinat, either in Abu Ramad sandy close to Red Sea beach. I think that it can be recommended from this study to control locusts in the uncultivated desert with chlorperifus, where it stays longer in the soil with high effectiveness and use of spinosad in desert lands planted with crops where effectiveness is more in controlling locusts with a low survival period and that is compatible with the environmental safety of mammals.

Conclusion

From the above we conclude that the reduction rates in the population of pesticides are close, and if it is somewhat less in the case of environmentally safe spinosad, it is expected in the next few years that spinosad will be replaced instead of organic phosphorus pesticides or pyrethroids, or at least to be resolved next to them in locust control programs other than desert or migratory locust due to its environmental safety and the crops were used of local consumption or export.

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تقدير متبقيات مركب سبينوساد كبديل آمن بيئيا لمركب الكلوروبيروفوس فى النباتات والتربة اثناء مكافحة الجراد الصحراوي والجراد الأفريقي المهاجر فى الحقل

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الكلمات الإستدلالية: متبقيات المبيدات الحشرية ، السبينوساد ، الجراد الصحراوي ، الجراد الأفريقي المهاجر ، الكلوروبيروفوس, الامان البيئي.

الملخص العربى

تحدث المبيدات تأثيرات ضارة للكائنات الحية الغير مستهدفة عندما استخدمهم فى مكافحة الآفات خاصة على المحاصيل لذلك يجب ان يقل استخدامهما وتستخدم عناصر بديلة للمبيدات الحشرية مثل الممرضات الحشرية وكذلك مركب السبينوساد. نحاول فى تلك الدراسة ادخال السبينوساد كمبيد جديد لمكافحة الجراد الصحراوي والجراد الأفريقي المهاجر فى الحقل. اظهر مركب السبينوساد نتائج جيدة حيث وصلت نسب الموت للجراد الأفريقي لمهاجر ٨٩.٣٣% و٨٨,٦٧% وللجرد الصحراوى٨٦,٦٧ و ٨٨,٥٣% على مدار موسمين على الجانب الاخر كانت نسب الموت لمركب الكلوروبيروفوس ٩٥,٣٣ و ٩٦% للجراد الصحراوي و ٩٦,٦٧ و ٩٨% للجراد الأفريقي. وصلت متبقيات الكلوروبيروفوس ١٠,٤٤ و ٧,٠٥ مليجرام/كجم على نبات العدليب خلال الموسمين بينما وصلت ٠,٠٣ و ٠مليجرام/كجم من مركب السبينوساد بعد ٧ أيام من الرش وصلت متبقيات الكلوروبيروفوس علي نبات الذرة خلال الموسمين ١٧,٨٢ و٢٢,٤٣ مليجرام/كجم بينما ولم توجد فى اليوم السابع لمركب السبينوساد فى الموسم الاول ولم توجد بداية من اليوم الثالث فى الموسم الثاني . فى التربة كانت متبقيات الكلوروبيروفوس بعد مكافحة الجرد الصحراوي ٢,١ و ٢,١٥مليجرام/كجم وسجلت ٠,١٦ و٠,٠٢٤ بعد مكافحة الجراد الأفريقي المهاجر ولم يوجد أي متبقيات من السبينوساد فى التربة سواء بعد مكافحة الجراد الصحراوي او الجراد الأفريقي المهاجر.