OPEN ACCESS
Freely Available Online

OpenAccessPub

JOURNAL OF AGRONOMY RESEARCH
ISSN NO: 2639-3166

Research Article
DOI: 10.14302/issn.2639-3166.jar-20-3246

Management of Fruit Flies Using Environmentally Safer Pesticide (Spinosad) in Shendi, Sudan

Hythum A. Elsanosy[1], Amani M. KhairAbbas[2], Faiza M. A. Magid[3], Abubaker H. M. Adam[4,*]

[1]Ministry of Agriculture, Department of plant Protection, Shendi University

[2]Department of Zoology, Faculty of Science and Technology, Shendi University

[3]Department of Pests and Plant Health, College of Agriculture, University of Bahri, Khartoum North, Sudan

[4]Department of Crop Science, College of Agriculture, University of Bahri, Khartoum North-Sudan

Abstract

The fruit flies of family*Tephritidae* are considered as serious pests of Mango in Sudan. They cause substantial damage to Mango in all Mango production areas. The application of various pesticides appeared to be ineffective. Therefore, this study was carried out to investigate the efficacy of Spinosad as new promising control measure to the fruit flies. This study was carried out at Shendi area, River Nile State during the period from April 2012 to August 2014, where Pheromone and food bait traps were used for detection and monitoring the fruit flies species in the study area. Spinosad (0.24g\L) was applied as a partial spraying pesticide. Results indicated that; the application of Spinosad highly decreased the fruit flies numbers. The average number of fruit flies collected in April was (947.22 and 1001.67) for the treated and untreated orchards respectively. The numbers of fruit flies in the treated orchards had decreased gradually during May, June, July and August, 904.7, 760.22, 609.6 and 452.7, respectively, but in untreated orchards for the same months had increased to 1003.67, 1103.67, 1336.67and 1468.67 respectively. However, the infestation level in mango fruits in the treated orchards was found to be 2% compared with 64% for untreated one.

Corresponding author: Abubaker H. M. Adam, Department of Crop Science, College of Agriculture, University of Bahri, Khartoum North-Sudan. Email: abubakerharoun@gmail.com

Citation: Hythum A. Elsanosy, Amani M. KhairAbbas, Faiza M. A. Magid, Abubaker H. M. Adam (2020) Management of Fruit Flies Using Environmentally Safer Pesticide (Spinosad) in Shendi, Sudan. Journal of Agronomy and Research - 3(1):27-31. https://doi.org/10.14302/issn.2639-3166.jar-20-3246

Keywords: Orchards, Monitoring, Pests, Mango, Infestation

Received: Mar 02, 2020 **Accepted:** May 13, 2020 **Published:** May 25, 2020

Editor: Prem Narain, Professor and Independent Researcher 29278 Glen Oaks Blvd. W. Farmington Hills, MI 48334-2932 USA.

Introduction

Today, more than 4,000 species of fruit flies are known around the world. Two hundred, among them are considered as pests[1]. Among the fruit flies which found in Sudan are the *Ceratitis capitata* and *Ceratitis cosyra*. They are considered as devastating pests to Mango fruits all over the country, especially in Shendi, Senga and Sennar, the popular Mango growing areas. Nevertheless, new species of the genus Bactrocera was reported from Blue Nile areas known as Bactrocera invadens[2].

In 2007, the fruit flies problem became so severe to the extent that they were upgraded and added to the list of the notorious National pest of Sudan. However, up to now, there is no specific recommendation to combat these pests, while their number is progressively increasing in both species and population to cover all production areas.

In Sudan, fruits and vegetables are produced in tradition way. Although, most farmers are educated, but they are still behind. They lack technical knowhow. This poor farm husbandry[3] is aggravated by the misuse of chemicals which reflected by negative impact on socio-economic and environment[4,5].

Spinosad (spinosyn A and spinosyn D) is a class of insecticides. The discovery and characterization of soil actinomycete (*Sccharopolysporaspinosa*) represented novel opportunity to develop portfolio of progressive insect management tools[6] (Figure 1). The active ingredient of spinosad is derived from a naturally excursing soil dwelling bacterium, a rare actinomycete reportedly collected from soil in abandoned rum distillery on a Caribbean island in 1982 by vacationing scientist [7].

Spinosad has been classified as an environmentally friend and toxicologically risk-reduce insecticide[8]. It kills the fruit flies species by causing rapid excitation of the insect nervous system leading to involuntary muscle contraction, prostration with tremors and paralysis .These effects are consistent with the activation nicotinic acetylcholine receptors by mecha-nism that is clearly noval and unique among known insect control products. It also has an effect on GABA receptors function that may contribute further to its insect activity reported by two researchers[9].

Materials and Methods

Field study was conducted during the period from April, 2012 to August, 2014 at Shendi area which is located in the River Nile State, where the average annual rainfall ranges from 14 to 60 mm, occurring during the period from July to September. The climate of the experimental site is semi-arid, relatively cool and dry in winter, with maximum and minimum temperatures ranging from 34 to 36°C and 14 to 16°C respectively, and hot in summer with maximum and minimum temperature ranging from 40 to 46°C and 20 to 22°C respectively. The relative humidity (RH) Ranges from 50 to 75% in the rainy season and far below 50% in winter.

The plot design was one hectare with a buffer area of 100 meters between plots. Four Orchards were randomly selected (three were sprayed with Spinosad compound and one was not treated as Control). A dose

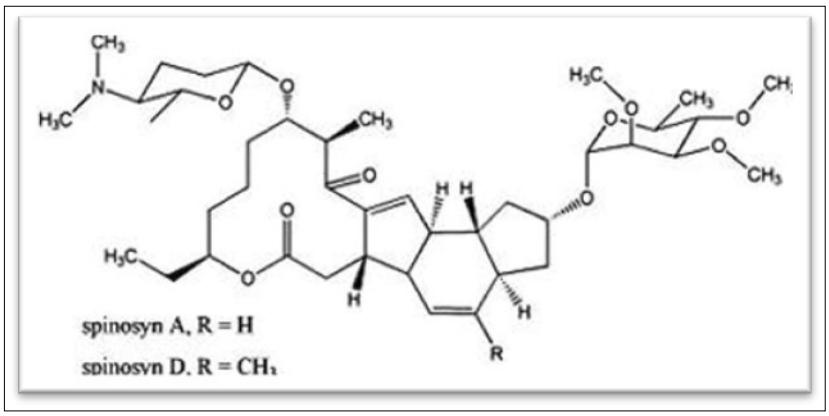

Figure 1. Chemical Structure of Spinosad

of 1.25 L was diluted in 8.75 L of water giving a spray volume 10 L, which applied as scattered droplets. The lower half of the trees trunk was sprayed on the south eastern side of the trees rows, this area known to be less exposed to the sunlight in after noon and it provide a roosting place for the adult fruit flies.

The first spray was applied at early fruiting stage in April and repeated every 10 days using a knapsack sprayer. To monitor the fruit flies population and to assess the pesticide efficacy, the Methyl eugenol traps and food bait traps were placed before and during the execution of the experiment. For testing the efficacy of Spinosad in percentage of infestation, 100 healthy undamaged fruits from 10 trees in the center of the treated plot with GF-120 (Spinosad) were marked and tagged. The same was done for the control plot. All 100 recorded fruits were collected at harvesting stage, and then the number of damaged fruits was counted to calculate percentage of infestation. Any missing or dropped tagged fruit were recorded. The percentage of fruits damaged was counted at harvesting time from the treated orchards and compared with that of untreated one.

Results and Discussion

Considering Table (1), the population of *B. dorsalis* was lower in March (654.3±57.90), but; gradually increased up to (1175.5±131.8) and (1258.5±105.8) in July and August respectively. However; *C.capitata* appeared in few numbers during July (230.3±32.6) and November (206.3±8.7), while the mango fruit fly C. cosyra was found throughout the year, but the lowest number was in March (165.5±7.5) and the highest was noticed during August (233.8±45.9).

The results of data analysis (Table 2) reflected that Spinosad is efficient in controlling fruit flies species. The result displayed that the average numbers of collected insects were (947.22 and 1001.67) for the treated and untreated orchards respectively. But, the numbers were gradually decreased during the months of May, June, July and August in the treated orchards (904.7, 760.22, 609.6 and 452.7) respectively, while the average numbers for untreated orchards showed a rapid increase (1003.67, 1103.67, 1336.67 and 1468.67) for the same months (Figure 2).

However, the statistical analysis showed that the decrease of the insects' numbers per month is not significant between April and May, but highly significant all through the treatment period (Table 2).

According to the results in Fig. 3, a percentage of great reduction in mango fruit infestation was detected in the treated orchards (25), compared to 64% in the untreated orchard. This result agreed with the findings by a researcher who evaluated the efficacy of Spinosad (GF120) applied as a bait in Egypt for controlling *Dacus ciliatus* and *Bactrocera zonata* (Saunders)[10]. They reported that Spinosad is very effective and viable

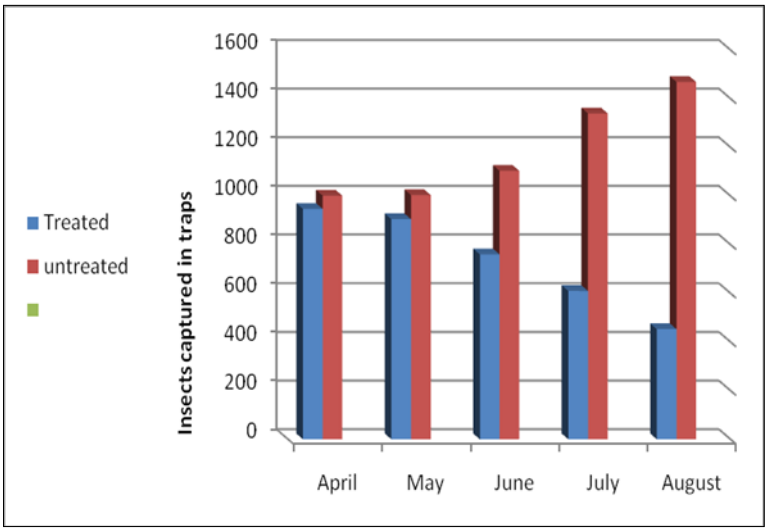

Figure 2. Spinosad efficiency against fruit flies in Shendi area (2014).

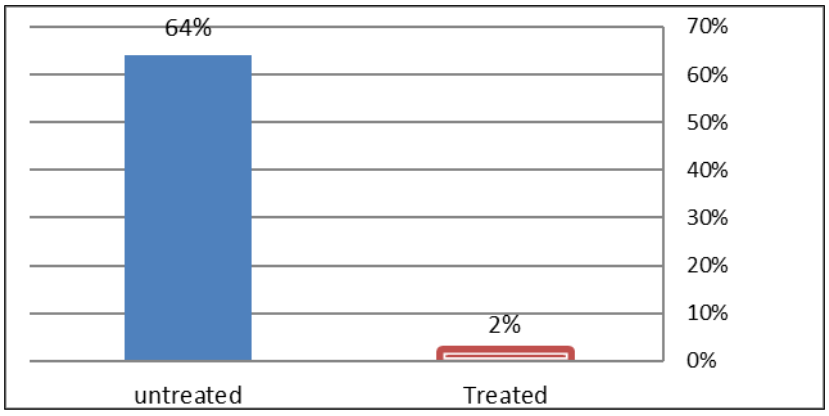

Figure 3. Effect of Spinosad on fruit flies infestation % in mango fruits in Shendi (2014).

Table 1. Monitoring and seasonal abundance of fruit flies at Shendi- Sudan (2014)

Month	No. of C. cosyra	No. of C. capitata	No. of B.dorsalis
April	227.8±18.1	193.5±19.3	847.5.±134.6
May	228.3±21.9	193.5.±24.3	865.3±109.2
June	230.5±28.7	199.5.±31.5	1047.5±121.9
July	280±40.3	230.3±32.6	1175.5±131.8
August	233.8±45.9	257.5±35.7	1258.5±105.8
September	188.5±26.4	183.3±5.4	1005.3±117.9
October	191.8±107.4	201.3±13.9	873.3±56.2
November	183.5±9.5	206.3±18.7	864.5±43.9
December	177.5±10.7	183.3±6.9	810.8±55.7
January	177..8±9.3	147.5±5.5	763.5±56.2
February	172.5±9.5	134±6..7	724±29.8
March	165.5±7.5	131.3±11.6	654.3±57.9

Table 2. Effect of Spinosad on fruit flies trapped from April to August at Shendi Area-Sudan (2014)

Month	Treated Orchards	Untreated Orchards	Reduction%	*P* value
April	947.2±	1001.7±	5.38	0.2
May	904.7±	1003.7±	9.68	0
June	760.2±	1103.7±	31.12	0
July	609±40.3	1339.7	54.49	0
August	452.7±	1468.7	69.17	0

alternative to Malathion and could be a valuable tool within IPM programs for the control of fruit fly in Egypt.

Furthermore, the results was also supported by Stark, et al.; (2004)[9] who reported the use of Spinosad in field crops, horticulture, forestry, and public health against a wide range of insects including Thrips, Mediterranean fruit fly, Olive fruit fly, Codling moth, Caterpillars, Leaf miners, Colorado beetle and Potato worm.

Conclusion and Recommendations

This study concludes that Spinosad is an effective pesticide on fruit flies. It decreases the fruit flies number and the infestation level during the production time. Moreover, it is relatively safe pesticide, and can be included as one of the fruit flies management programs. This could help growers to improve their fruit production to cope with the international markets. Further study is recommended to evacuate the efficacy of Spinosad on other insects.

References

1. White, I. M. Elson-Harris .M. M (1993): Fruit Flies of Economic Significance: Their Identification and Bionomics. *Environmental Entomology*, Volume 22, Issue 6, 1 December 1993, Page 1408, https:// doi.org/10.1093/ee/22.6.1408
2. Drew, R.A.I., Tsuruta, K. and White, I.M (2005): A new species of pest fruit fly (*Diptera: Tephritidae: Dacinae*) from Sri Lanka and Africa. African Entomology. 13(1): 149-154.
3. Michael, F. (2007). Organic fruit fly control .green harvest. com.au.
4. Ali, E.E.; Abbas, A.M.; Ahmed, H.M.; Abdelrhmann, A. A.; Abdelmajid, F.M. (2008). Fruit Fly Review in Sudan From1960-2008. National project for control of fruit flies in Sudan. Workshop 26-27\8\2008.
5. Alyokhin A.V.; Christian, M.; Russell, H. and Duan, J.J. (2001). Selection of pupation habitat by oriental fruit fly larvae in the laboratory, J. of Insect Behavior, Springer Netherlands.
6. Sparks, T. C.; G. D Thompson,. H. A. Kirst,. M. B. Hertlein, J. S. Mynderse, J. R Turner,.T. V. Worden, (1998). Fermentation-Derived Insect Control Agents The Spinosyns. In: *Methods in* Biotechnology, Biopesticides: Use and Delivery. (eds. F. R. Hall and J. J. Menn). 5: 171-188. Humana Press. Totowa, N
7. Cleveland, C.B., Mayes, M.A., and Cryer, S.A., (2001): An ecological risk assessment for spinosad use on cotton. Pest Mgt. Sci. 58:70–84.
8. Copping,L.G.andJ.J.Menn.(2000):Biopesticides: Are view of their action, applications and efficacy. Pest. Manag. Sci. 56:651-676.
9. Stark, J.D., Vargas, R., and Miller, N., (200 4b): Toxicity of spinosad in protein bait to three economically important tephritid fruit fly species (Diptera: Tephritidae) and their parasitoids (Hymenoptera: Braconidae). J. Econ. Entomol. 97, 911–915.
10. Abbas, A.M.; Ahmed, H.M.; Ali, E.E.;;Abdelmajid, F.M. (2008). Fruit Fly Review in Sudan From 1960-2008. National project for control of fruit flies in Sudan. Workshop 26-27\8\2008