Novelty Journals

ISSN 2394-7349

International Journal of Novel Research in Engineering and Science
Vol. 6, Issue 2, pp: (55-60), Month: September 2019 - February 2020, Available at: www.noveltyjournals.com

Appraisal of some botanical oils against various stages of leaf miner *Stomphastis thraustica* (Meyrick) (Family: Gracillariidae) on Jatropha plant

[1]Sawsan S. Moawad, [2]Ibrahim M. A. Ebadah, [3]Hanaa E. Sadek, [4]Youssef A. Mahmoud

Department of Pests and Plant Protection, National Research Centre, Cairo, Egypt

Corresponding author's e-mail: youssefmahamoud@yahoo.com

Abstract: **The leaf miner of jatropha plant, *Stomphestis thuristica* is a destructive pest attack the green parts of the plant and caused reduction in its product. All scientific organizations worldwide recommended to decrease or far away as possible from using chemical pesticide to maintain all living organisms that need to live without pollution and in balanced conditions at the ecosystem. The aim of the study is to estimate of three plant oils (namely, (Moringa, *Moringa oleifera* L., Bitter almond, *Prunus amygdalus* var *amara* and Cinnamon, *Cinnamomum zeylanicum* Blume) to overcome jatropha leaf miner. Data cleared that high concentration of all tested oils caused a reduction in eggs hatches reached to > 85%. The higher concentrations of moringa (10 %) and cinnamon oils (7.5%) caused significant mortality to 1st and 5th larval instars and pupal stage. Lethal concentration of moringa oil caused mortality to 50% of 1st, 5th larval and pupal stage were ranged between (5.1 -7.8%) follow by cinnamon oils were (2.9-12.2), respectively.**

Keywords: **botanical oils, jatropha plant, leaf miner, mortality, egg hatchability, immature stage.**

I. INTRODUCTION

Jatropha curcas L., (Family Euphorbiaceae) considered one of the most important and promising plants in developing countries. This plant is cultivated in dry tropical conditions for producing biodiesel which used at various industrial processes [1] [2] [3]. Beside reminder parts of crops can be used as cattle foods after removing toxic content [4]. The plant can be used to prevent soil erosion, to reclaim land, grown as a live fence, especially to exclude farm animals and also planted as a commercial crop [5].

Jatropha plant is infested by many insect pests which caused reduced its production. *Stomphastis thraustica* is one of the most harmful pests on Jatropha plant. This pest causes great losses in major parts of Jatropha plant especially the foliage which consequently negatively affects the yields of produced seeds, the main target for biodiesel production [6] [7] [8] [9].

Many attempts were conducted for using insecticides to control the insect pests which attack Jatropha plant [10]. While now, different organizations around the world were appealed to prevent or decrease usage insecticide for its hazard to environmental balanced and human health. In the past few decades, various studies have investigated the insecticidal activity of plant oils and their potential uses as bioinsecticides against important insect pests [11] [12] [13] [14] [15] [16]**.** Plant insecticides affect in several ways: as repellents by driving the insects away due to smell or taste, as antifeedants which cause insects on the plants to reduce their food intake and hence starve them to death; as oviposition deterrents, by preventing insects from laying egg; or as inhibitors by interfering with the life cycle of the insects. Bio- insecticides have

many merits as their short life spans once applied and are not poisonous to humans and livestock. Secondly, botanicals do not harm the natural enemies of the pests, such as the ladybird beetle or parasitoids [14]. They are cheap, easy to prepare and in most cases readily available and have more than one active ingredient which works synergistically making it difficult for pests to develop resistance. The scope of the present study was valuable some botanical oils toward different stages of jatropha leaf miner.

II. MATERIALS AND METHODS

Rearing of *Stomphastis thraustica*

Jatropha leaves infested with *Stomphastis thraustica* were collected from the field in cloth bags and transferred to the laboratory for examination. The infested leaves introduced into covered glass cage measured 50x25x50 cm till adult emergence. After then, the mature adults (males and females) were gathered by aspirator and released into other cage provided with Jatropha pots to acts as an oviposition site. The culture was established and maintained under 22 ± 2°C, 55 ±3% RH [17].

Testing the volatile oils

Three plant volatile oils; The experiments were proceeded to evaluate efficacy of three plant oils (Moringa, *Moringa oleifera* L., Bitter almond, *Prunus amygdalus var amara* and Cinnamon ceylon *Cinnamomum zeylanicum* B.) obtained from Luna company, Egypt and Aldrich company Germany. Formulation of 50% Suspension oil was prepared by dissolving 50 ml of tested oils in 30 ml distilled water + 8 ml Arabic gum (50% concentration) + 2 ml tween (20% concentration) with adding two drops from glycerin. After that, from stock oil solution serial concentrations (10, 7.5 and 5%) were prepared for moringa and bitter almond, and (7.5, 5 and 2.5 %) for Cinnamon[18] .

On eggs stage: After adult stage deposited eggs (24hr old) on jatropha leaves they were counted and then placed infested leaves on wet cotton and keep inside Petri dishes. Prepared oils concentrations were sprayed on infested leaves (eggs) and placed on incubator (25 ± 2ºc and 70±5 RH %). Percentage of eggs hatching and reduction in hatchability was determinate.

On larval stages: the experiments were carried out on 1st and 5th larval instars. The infested leaves with eggs were left until hatched (≥ 5 days) after that treatment with tested oils will be started against 1st instar larvae. While 5th instar was obtained after miner reach to blotch shape (after 12 days from starting 1st instar mine) [17]. Generally, infested leaves were sprayed by tested oils and left for 5 minutes in air to dry. After that, each treatment was put on wet cotton inside Petri dishes**.** Each test was replicated ten times to calculate larval mortality. Mortality % in treatments was corrected by Abbott's formula [18].

On pupal stages: the experiments were started after larvae exist from mine to start pupation inside spin silk on jatropha leaves. The leaves contained the pupa were sprayed as mentioned before. Each test was replicated ten times to calculate pupal mortality.

Statistical analysis

The mean number of live larvae and pupae per leaf was tested for percent mortality .The data were subjected to analysis of variance (ANOVA) and the means were compared by LSD test (Least significant deference test) at 0.05 levels ,using SAS computer program [19].and LC_{50} values calculated with Probit analysis method of Finney, using LDP line software [20].

III. RESULTS

On egg stage: The result in Table 1 showed that all tested oils concentrations caused a reduction in egg hatch at different levels. The high concentration (10%) of cinnamon oil caused highest reduction in eggs hatch followed by Moringa and Bitter almond oils 91.3% to 86.8%, respectively. The remaining concentrations (7.5 and 5% conc.) of Moringa oils caused 85.3 and 77.3% reduction in egg hatch while other tested oils caused a reduction less than 60%. Examination of unhatched eggs under stereomicroscope cleared that there is no any sign of embryonic development (i.e. no change in egg color) and that mean the tested oils had toxic effect.

Novelty Journals

ISSN 2394-7349

International Journal of Novel Research in Engineering and Science
Vol. 6, Issue 2, pp: (55-60), Month: September 2019 - February 2020, Available at: www.noveltyjournals.com

On larval stages: the data at Tables 2 and 3 illustrated that the highest mortality percentage to 1st and 5th larval instars caused by treatment cinnamon oils (at 7.5% conc.) reached to ≥ 94.4%; followed by Moringa oils (10% conc) which reached to 91.1% mortality 1st instars and 82.2% to 5th larval instar. The lethal concentration of tested oils that caused 50% mortality to 1st larval instars ranged between 4.4 and 6.8% for Cinnamon, Moringa and bitter almond oils, respectively. While LC_{50} to 5th larval instars ranged between 2.9 and 7.1 for Cinnamon, bitter almond and oils Moringa, respectively.

Table 1: Effect of some plant oil on eggs hatchability of *Stomphastis sp* infested Jatropha plants.

Treatment	Conc.	% Egg hatchability	Reduction in hatchability
Moringa oleifera L.	10 %	10.4 ± 1.9	89.4
	7.5 %	14.4 ± 1.1	85.3
	5%	22.2 ± 2.2	77.3
Prunus amygdalus var amara	10 %	12.96 ± 1.9	86.7
	7.5 %	43.3 ± 5.8	55.7
	5%	73.3± 3.8	25
Cinnamomum zeylanicum B.	7.5%	8.5 ± 3.6	91.3
	5%	40.0 ± 3.9	59.1
	2.5%	78.9± 2.9	19.3
Control+ additives		97.77± 1.1	0.0
L.S.D 0.05 = 8.092 L.S.D 0.01=11.90			

Reduction % = control - treatment / control X100

Table 2: Effect of some plant oil on 1st larval instar of *Stomphastis sp* infested Jatropha plants.

Treatment	Conc.	% mortality	LC_{50}	LC_{90}	slope
Moringa oleifera L.	10 %	91.1 ± 2.2	5.1	9.2	4.9 ± 0.7
	7.5 %	83.3 ± 1.93			
	5%	47.7 ± 9.09			
Prunus amygdalus var amara	10 %	77.7 ± 2.93	6.8	10.9	6.3 ± 0.7
	7.5 %	75.56 ± 4.82			
	5%	14.43± 2.94			
Cinnamomum zeylanicum B.	7.5%	97.76 ± 2.23	4.4	8.60	4.3 ± 0.5
	5%	36.6 ± 3.83			
	2.5%	22.23± 2.93			
Cont.+ additives	--	2 ±2.00			
L.S.D 0.05 = 12.06 L.S.D 0.01 =17.67					

Table 3: Effect of some plant oil on 5th larval instar of *Stomphastis sp* infested Jatropha plants

Treatment	Conc.	% mortality	LC_{50}	LC_{90}	slope
Moringa oleifera L.	10 %	82.2 ± 2.93	7.1	11.6	6.1± 0.7
	7.5 %	53.3 ± 3.83			
	5%	17.8 ± 4.85			
Prunus amygdalus var amara	10 %	82.2 ± 4.85	4.9	16.2	2.5 ± 0.6
	7.5 %	60 ± 3.86			
	5%	54.43± 2.94			
Cinnamomum zeylanicum B.	7.5%	94.43 ± 2.94	2.9	7.3	3.2 ± 0.4
	5%	70.03 ± 3.33			
	2.5%	44.43± 8.02			
Cont.+ additives		4.3 ±2.96			
L.S.D 0.05= 10.57 L.S.D 0.01=15.49					

On pupal stage: The result in table 4 showed that the best oil caused pupal mortality more than 68% was Moringa oils (at 10% conc.); follow by bitter almond oils was 64%. LC_{50} to pupal stage ranged between 7.8 to 12 % for Moringa, bitter almond and cinnamon oils, respectively.

Table 4: Effect of some plant oil on emergence of pupa of *Stomphastis* sp infested Jatropha plants.

Treatment	Conc.	% mortality	LC_{50}	LC_{90}	slope
Moringa oleifera L.	10 %	68.87 ± 5.9	7.8	15.2	4.4± 0.6
	7.5 %	46.66 ± 3.8			
	5%	20 ± 6.92			
Prunus amygdalus var amara	10 %	64.43 ± 5.9	8.6	14.2	5.9± 0.7
	7.5 %	36.67 ± 3.8			
	5%	7.53± 2.9			
Cinnamomum zeylanicum B.	7.5%	34.43 ± 4.8	12.03	84.6	1.5± 0.4
	5%	33.33 ± 3.8			
	2.5%	13.2± 5.9			
Cont.+additives		2 ±1.00			
L.S.D 0.05 = 11.70 L.S.D 0.01 =17.14					

IV. DISCUSSION

The present results confirmed that the tested oils (with special formula) caused a highly reduction in egg hatch, larval and pupal mortality. Higher concentration of Moringa oil followed by cinnamon oil had an ability to depress the infestation of jatroph leafminer. These data agreed with that of [17] who recorded that Moringa oil had an ability to reduced egg hatch and increased in larval mortality and subsequent depression the number of new emerged progeny of cotton leaf worm *Spodoptera littoralis* (boisd). Application of cinnamon oil on tomato leafminer *Tuta absoluta* had an ability to induce 100% of larval mortality within four hours of exposure [21].

Many researchers evaluated efficacy of other botanical oils toward other leafminer insects who recorded that treatment of tomato leaflets with clove oils caused reduction in infestation and mortality of leafminer *Liriomyza trifoll*. Also, clove oil, eugenol and isoeugenol caused highly reduction percentage of penetration and accumulative mortality of larvae and caused ovipositional deterrence reaction toward the adult stage of leafminer *T. absoluta* under laboratory conditions [13] [22].

Chemical composition of botanical oils is lipophilic, which can enter into the insect and cause biochemical dysfunction and mortality [23]. The toxicity of botanical oils does not only depend on the chemical compounds that act as toxins but also on many other factors playing an important role in their toxicity. It has been reported that common plant oils with insecticidal activities can be inhaled, ingested or skin absorbed by insects [13] [24].

V. CONCLUSION

From the obtained results can be concluded that Moringa and Cinnamon oils had ability to reducing the infestation of jatropha leafminer through the decreasing in egg hatchability or the increasing larvae or pupa death. That had been given prospect using the botanical oils as alternative materials and included them at integrated pest management.

REFERENCES

[1] Wani, S.P., Osman, M., D'silva, E. & Sreedevi, T.K. (2006). Improved livelihoods and environmental protection through biodiesel plantations in Asia. Asian Biotechnol. Develop. Rev. 8: 11-29.

[2] Achten, W.M.J, Mathijs, E, Verchot, L., Singh, V.P, Aerts, R. & Muys, B. (2007). Jatropha biodiesel fueling sustainability?. Biofuels, Bioproducts and Biorefining 1(4), 283-291.

[3] Kumar, A. & Sharma, S. (2008). An evaluation of multipurpose oil seed crop for industrial uses (*Jatropha curcas* L.): a review. Ind. Crop. Prod.28, 1, 1-10.

[4] Becker, K & Makkar, H.P.S. (1998). Toxic effects of Phorbol esters in carp (*Cyprinus carpio* L.). Vet Human Toxicol, 40: 82–86.

[5] Heller, J. (1996). Physic Nut. *Jatropha curcas* L. Promoting the Conservation and use of Underutilized and Neglected Crops. International Plant Genetic Resources Institute.

[6] Narayana, D.S.A., Shankarappa, K.S., Govindappa, M.R., Prameela, H.A., Rao, M.R.G. & Rangaswamy, K.T. (2006). Natural occurrence of Jatropha mosaic virus disease in India. Curr Sci, 91: 584-586.

[7] Gao, S.Q., Jaqu, Q.U., Chua, N.H. & Ye, J. (2010). A new strain of Indian cassava mosaic virus causes a mosaic disease in the biodiesel crop Jatropha curcas. Arch. Virol. 155:607-612.

[8] Rao, B.T., Lakshmi, B.B. & Rao, L.M. (2001). Medico-Ethnology and conservation of medicinal plants of Paderu forest division- Visakhapatnam. Ecol. Env. Cons. 7: 117-131.

[9] Rodrigues, S.R., Oliveira, H.N., dos Santos, W.T. & Abot, A.R. (2011). Biological aspects and damage of Pachycoris torridus on physic nut plants. Bragantia 70: 356-360.

[10] Cassimo, A.C., João, E.C.B., Coelho, J.P. & Santos, L. (2011). Evaluation of insecticide doses for the control of Jatropha leaf beetle and Jatropha leaf miner in Mozambique. African Crop Science Conference Proceedings, 10: 187-190.

[11] Anshul, N., Kalra, A. & Singh, D. (2014). Biological effect of sweet wormwood, *Artemisia annua* methanol extracts and essential oil against Helicoverpa armigera Hub. (Lepidoptera: Noctuidae). J. Entomol. Zool. Stud., 2(6): 304-307.

[12] Sharaby, H. A., Rahman, S. & Moawad, S. (2009). Biological effects of some natural and chemical compounds on the potato tuber moth, *Phthorimaea operculella* Zell. (Lepidoptera:Gelechiidae). Saudi J Biol Sci. 2009 Jul; 16(1):1-9.

[13] Sharaby, H. A., Rahman, S., Abdel-Aziz & Moawad, S. (2014). Natural plant oils and terpenes as protectors for the potato tubers against *Phthorimaea operculella* (Zeller) infestation by different application methods. Egypt. Journal of Pest Control, 24: 265-274.

[14] Moawad, S. S., Ebadah, I. M. A. & Mahmoud,Y. A. (2013). Biological and histological studies on the efficacy of some botanical and commercial oils on *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae). Egyptian journal of biological pest control, 23(2), 2013, 301-308.

[15] Moawad, S.S., Elbehery, H. & Ebadah, I.M. (2015). Effect of the volatile oils on some biological aspects of *Galleria mellonella* L. and its' parasitoid species, *Bracon hebetor* Say. Egyptian journal of biological pest control, 25(3):603-607.

[16] Moawad, S. S. & Al Gamdi, F. N. (2018). Efficacy of some botanical volatile oils on protection dry date palm from *Oryzaephilus surinamensis* L. infestation. J.Entomol., 15 (3): 106-113.

[17] Ebadah, I.M.A., Moawad, S.S., Sadek, H.E. & Mahmoud,Y.A. (2017). Morphological Depiction and Life Table of Newly Recorded Jatropha Leaf Miner *Stomphastis sp*. Stages in Egypt. J. Entomol., 14: 122-127.

[18] Moawad, S.S. & Sadek, H.E. (2018). Evaluation of two eco friendly botanical oils on cotton leaf worm, *Spodoptera littoralis* (Boisd) (Lepidoptera / Noctuidae). Annals of Agricultural Sciences, 63(2) in press.

[19] SAS (2009). Statistical analysis system software. Ver. 9.1. SAS Institute Inc., Carry. NC

[20] Finney, D. J. (1971). ***Probit Analysis***, Third Edition, London: Cambridge University Press.

[21] Adil, B., Tarik, A., Abderrahim, K. & Khadija, O. (2015). Evaluation of the insecticidal effect of the essential oil of *Cinnamomum zeylanicum* Against *Tuta absoluta* (Meyrick). International Journal of Innovative Research in Science, Engineering and Technology, 4 (9): 2319-8753.

[22] Ebadah, I. M., Shalaby, Sh. E.M. & Moawad, S. S. (2016). Impact of Certain Natural Plant Oils and Chemical Insecticides against Tomato Insect Pests. J.Entomol., 13(3): 84-90.

[23] Damalas, C.A. & Eleftherohorinos, I.G. (2011). Pesticide exposure, safety issues and risk assessment indicators. Int. J. Environ. Res. Public Health, 8: 1402-1419.

[24] Dawidar, A. & Hussien, K. (2010). Essential Oils, Composition, Photooxidation, Bioactivity. Osiris Bookstore, Cairo, Egypt, pp: 1-28.

[25] Abbott, W. S. 1925.Amethod for computing the effectiveness of an insecticide. Journal of Economic Entomology, 18: 265-267.