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Efficacy of Some Synthetic Insecticides and Botanical oils against Fall Armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae), on Maize in Egypt.

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ABSTRACT

Field experiments were carried out at Qaliubiya Governorate, Egypt during the 2021 maize season to evaluate the efficacy of different chemical insecticides and botanical oils for the management of fall armyworm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) on Maize. Seven chemical insecticides and seven botanical oils and control were replicated three times.

Botanical oils and chemical insecticide fluids are directed to the whorl of plants by modifying the hollow cone nozzle. All materials used caused a significantly higher reduction in the fall armyworm population than the untreated check.

The results clarified that, among tested insecticides, grand mean of reduction percentages showed that Top-green 37% SC insecticide proved the pest showed (91.23%) reduction followed by Octoclod 9.75% SC (89.93%), while Tefluvap 15% SC caused the lowest effect (64.4%). The remaining tested compounds (Neomyl 90% SP, Lamdathrin 5% EC, Dimeuron 10% EC and Match 5% EC) took intermediate effect showed (79.05%, 72.12%, 70.59% and 70.11%) on the fall armyworm larvae, respectively. There were, also high significant differences between tested insecticides at 24 h. and three days after treatment where (P values ≤ 0.05) while, at ten days there were slight significant differences between all chemical insecticides tested (P values ≥ 0.05).On the other hand, among the botanical oils tested, a grand mean of reduction percentages showed that the Neem oil caused the highest percentage of reduction (76.24%) followed by Jojoba oil (72.03%), while Garlic oil caused the lowest effect (50.78%). The remaining tested botanical oils (Bitter melon, Thyme, Parsley and Lemon oil) took intermediate effect showed 64.53%, 63.99%, 62.78% and 61.75% on the fall armyworm larvae, respectively.

INTRODUCTION

The fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), native to the Americas, is found in several countries including Mexico, Brazil, Argentina, and the USA (Prowell *et al.*, 2004; Clark *et al.*, 2007). Full armyworm causes severe economic losses in a variety of crops such as maize, soybean, cotton (Pogue 2002; Nagoshi *et al.*, 2007; Bueno *et al.*,2010) rice, other grasses, and feeds on a number of weeds (Nabity *et al*., 2011).

Severe incidences of fall armyworm were reported from African countries such as Nigeria, Bénin, and Togo in 2016 (Goergen *et al.*, 2016). The incursion of fall armyworm as an invasive pest into Asia was reported for the first time from India on maize during May 2018 (Sharanabasappa *et al.*, 2018a). Since then, it has spread to different states of India on maize (Mahadevaswamy *et al.*2018; Sharanabasappa *et al.*, 2018b). The spread of this pest to other Asian countries, including Thailand, Srilanka, Bangladesh, Myanmar, Vietnam, Laos, and China (Guo *et al.*, 2018; Wu *et al.*, 2019; NATESC 2019a, b; CABI 2019) has occurred quickly.

Fall armyworm is a highly polyphagous insect pest that attacks more than 80 plant species, including maize, sorghum, millet, sugarcane, and vegetable crops Baskran *et al.*,2012; nevertheless, maize is the main crop affected by FAW in Africa. FAW larvae cause damage to the plant by consuming foliage. Young larvae mainly feed on epidermal leaf tissue and also make holes in leaves, which is the typical damage symptom of FAW. Feeding young plants through the whorl causes a dead heart. In older plants, the larger larvae in the whorls can feed on maize cob or kernels, reducing yield and quality (Akhtat *et al.*, 2008; FAO 2018).

Insecticides are used widely as a tool in fall armyworm management both in the Americas Tomquelski & Martins 2007; Hardke *et al.*, 2011; Gutierrez-Moreno *et al.*, 2019) and in Africa (Prasanna *et al.*, 2018; Sisay *et al.*, 2019). Therefore, it is necessary to determine the field efficacy of insecticides on fall armyworms to integrate with Integrated Pest Management practices.

Since the occurrence of FAW in African countries, synthetic insecticides have been widely used as an emergency response to slow the spread of the pest and minimize damage to maize fields. Although synthetic insecticides play an important role in FAW management, given confirmed reports of the development of insecticide resistance in FAW populations Elumalai *et al.*, 2010 as well as other adverse effects due to the role dependence on synthetic insecticide, it is imperative to use an integrated pest management strategy for FAW.

Currently, there is no registered synthetic insecticide for FAW control in African countries, except applications allowed through an emergency label, suggesting an urgent need for synthetic insecticide screening.

Botanical extracts have long been proposed as attractive alternatives to synthetic insecticides for pest management. Botanical extracts are eco-friendly, economical, usually target-specific, and biodegradable. The greatest strength of botanical extracts is their specificity, as most are essentially nontoxic and non-pathogenic to animals and humans (EPPO 2018; Goergen *et al.*, 2016). Various plant species have shown insecticidal properties against FAW, for example, extracts of neem, *Azadirachta indica* Nbair. Res. 2018, *Argemone ochroleuca* Sweet (Papaveraceae) Lee *et al.*, 1997, jabuticabeira, *Myrciaria cauliflora* [Mart.] O. Berg (Myrtaceae) Liu *et al.*, 2000. Botanicals are cheap, readily available, and affordable, which are important qualities of pest control products for smallholder farmers in Africa Goergen *et al.*, 2016.

The objectives of this study carried out to evaluate some synthetic insecticides and botanical oils against fall armyworms under field conditions.

MATERIALS AND METHODS

Two field experiments were carried out at Moshtohor village –Qalyubia Governorate, Egypt during the 2021 season to evaluate the efficacy of seven synthetic insecticides and seven botanical oils against fall armyworm *Spodoptera frugiperda*, in Maize. The experiments were conducted in a Completely Randomized Design (CRD). The chemical insecticides were Lamdathrin 5% EC, Octoclod 9.75% SC, Match 5% EC, Top-green 37% SC, Dimeuron 10% EC, Tefluvap 15% SC and Neomyl 90% SP while, botanical

oils were Parsley, Garlic, Lemon, Neem, Jojoba, Bitter melon and Thyme oil. In both experiments, the area was about 800 m2 planted with maize variety (Hytic 2031) on October 5th, 2021. The whole area was divided into 48 plots (each 15 m2). Each plot is considered of two rows each of 5m long. Three plots were adopted for each treatment and the other three were left without any treatment as a check. All usual agricultural practices were followed except any other insecticides treatment. Foliage application was performed in the open field, the insecticide fluids were directed to the plant whorl by modifying the hollow cone nozzle.

Samples were randomly chosen and directly inspected as ten plants for each replicate, the plants were dissected in the field and alive fall armyworms were counted before application and after 1,3,7 and ten days after treatment.

Reduction percentages in the larvae were corrected by the equation of Henderson and Tilton (1955).

$$\% \text{ Reduction} = \left\{ 1 - \frac{\text{Treatment after x control before}}{\text{Treatment before x control after}} \right\} \text{X100}$$

Statistical Analysis:

Data collected were analyzed using SAS 9.2 software and the least significant difference (L.S.D) was used for treatment mean comparison.

The insecticides used were as follows (Tables 1&2):

Table 1: List of synthetic insecticides and their active ingredients (a.i.), and rates used.

Trade Name	Active Ingredient	Insecticide / feddan
Lamdathrin 5% EC	Lambda - Cyhalothrin	375 ml
Octoclod 9.75 % SC	5.25 Novaluron +4.5 Inoodxacarb	350 ml
Match 5% EC	Lufenuron	160 ml
Top- green 37%SC	Clothiandin 12.3% + difluorobenzoyl) urea 24.7%	200 ml
Dimeuron 10%EC	1-(3,5-dich0ro-4- (1,1,2,2-tetrafluoroethoxy) phenyl)-3-(2,6-difluorobenzoyl) urea	200 ml
Tefluvap 15%SC	Teflubenzuron	50 ml /100 L.
Neomyl 90%SP	Methomyl	300 Gm

Table 2: List of botanical materials and rates of applications:

Botanical oils	Rate / 20 L.
Parsley oil	20 ml
Garlic oil	20 ml
Lemon oil	20 ml
Neem oil	20 ml
Jojoba oil	15 ml
Bitter melon oil	20 ml
Thyme oil	20 ml

RESULTSAND DISCUSSION

Efficacy of the Synthetic Insecticides Against Full Armyworm *S. frugiperda* Larvae Under Field Conditions:

Data in Table (3) show reduction percentages of fall armyworm larvae caused by synthetic insecticides after different periods from treatments.

The data revealed that all the tested synthetic insecticides reduced the fall armyworm larvae compared to the control at 1, 3, 7 and 10 days after treatment.

Regarding the initial effect (one day after treatment), Octoclod 9.75% SC was the highest effective compound resulting in (87.62%) reduction followed by Top- green 37% SC (85.03%), then Lamdathrin 5% EC (77.49%), Neomyl 90%SP (73.09%), Dimeuron 10% EC (42.02%) and Match 5% EC (35.72%). On the contrary Tefluvap 15% SC had the lowest effect 5.73% on fall armyworm larvae.

Three days after treatment, the highest reduction percentages were recorded on fall armyworm was (96.97%) caused by Octoclod 9.75% SC treatment. Neomyl 90% SP, Top-green 37% SC, Lamdathrin 5% EC, Match 5% EC and Tefluvap 15% SC ranked the second category with (91.4, 90.95, 88.56, 81.37 and 75.85% reduction, respectively. On the other hand, the lowest percentages of reduction were caused by Dimeuron 10% EC treatment as (71.65%).

Regarding the effect seven days after treatment, there was an increase in reduction percentages, Match 5% EC was the highest impact on fall armyworm larvae (96.88%), while, Top-green 37% SC, Neomyl 90% SP, Dimeuron 10% EC, Octoclod 9.75 % SC and Tefluvap 15% SC gave intermediate effectiveness. On the other hand, Lamdathrin 5% EC showed the lowest percentages of reduction (73.04%) for fall armyworm larvae.

Table 3: Efficacy of different insecticides against fall armyworm on maize under field condition.

Insecticides	% Reduction in the number of fall armyworm larvae on thirty plants after				
	24 h.	3 days	7 days	10 days	Grand Mean % Reduction
Top-green 37% SC	85.03 a	90.95 ab	94.87	94.07 a	91.23
Octoclod 9.75% SC	87.62 a	96.97 a	85.4	89.74 a	89.93
Neomyl 90% SP	73.09 ab	91.4 ab	89.58	62.14 ab	79.05
Lamdathrin 5% EC	77.49 ab	88.56 ab	73.04	49.37 b	72.12
Dimeuron 10% EC	42.02 abc	71.65 c	89.27	79.42 ab	70.59
Match 5% EC	35.72 cb	81.37 abc	96.88	66.48 ab	70.11
Tefluvap 15% SC	5.73 c	75.85 bc	84.81	91.2 a	64.40
Mean	58.10	85.25	87.38	76.06	76.78
P	0.0175	0.0496	0.6391	0.0821	0.483
L. S. D at 5%	47.6	16.39	28.05	33.57	31.33

*Values with the same letter in a column are not significantly different at 5% level of probability (One way ANOVA)

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Ten days after treatment, the highest percentages of reduction of fall armyworm larvae were 94.07% caused by Top- green 37% SC treatment while the lowest effect was 49.37% caused by Lamdathrin 5% EC. The remaining compounds took intermediate position showing 91.2, 89.74, 79.42, 66.84 and 62.14% reduction for fall armyworm larvae caused by Tefluvap 15% SC, Octoclod 9.75% SC, Dimeuron 10% EC, Match 5% EC and Neomyl 90% SP, respectively.

In general, among chemical insecticides tested grand mean of reduction percentages showed that Top-green 37% SC insecticide proved the pest showed (91.23%) reduction

followed by Octoclod 9.75% SC (89.93%), while Tefluvap 15% SC caused the lowest effect (64.4%). The remaining tested compounds (Neomyl 90% SP, Lamdathrin 5% EC, Dimeuron 10% EC and Match 5% EC) took intermediate effect showed 79.05%, 72.12%, 70.59% and 70.11% on the fall armyworm larvae.

There were, also high significant differences between chemical insecticides tested at 24 h. and three days after treatment where (P values < 0.05) while, at ten days there were slight significant differences between all tested chemical insecticides tested (P values > 0.05) (Table 3).

Efficacy of the Botanical Oils Against Full Armyworm *S. frugiperda* Larvae Under Field Conditions:

The results in Table (4) demonstrated the reduction percentages caused after the application of different botanical oils against fall armyworm larvae. All the evaluated materials were significantly better than the control. After 24 hrs. of application, Parsley oil caused the highest reduction in fall armyworm larvae counts (76.04%), followed by Neem (74.64%), Bitter melon (74.4%), Garlic (64.62%) Lemon (62.1%) and Jojoba oil (58.16%) while the lowest effect was for Thyme oil showed (56.98%). Regarding the effect three days after treatment, there was an increase in the percentage of reduction, the highest reduction percent was recorded for Parsley oil showed (80.86%) followed by Jojoba oil (78.82%), Neem (77.2%), Lemon (67.61%), Bitter melon (67.47%) and Thyme oil (57.31%), while the lowest reduction percent was recorded for Garlic oil (48.38%).

Table 4: Efficacy of different botanical oils against fall armyworm on maize under field conditions.

Botanical oils	% Reduction in the number of fall armyworm larvae on thirty plants after				
	24 h.	3 day	7 days	10 days	Grand Mean % reduction
Neem oil	74.64	77.20	71.85	81.25	76.24 a
Jojoba oil	58.16	78.82	57.39	93.75	72.03 ab
Bitter melon oil	74.40	67.47	79.99	36.25	64.53 ab
Thyme oil	56.98	57.31	65.46	76.19	63.99 ab
Parsley oil	76.04	80.86	53.80	40.41	62.78 ab
Lemon oil	62.10	67.61	53.91	63.37	61.75 ab
Garlic oil	64.62	48.38	63.95	26.15	50.78 c
Mean	66.71	68.24	63.48	59.62	64.58
P	0.454	0.559	0.659	0.3658	0.336
at 5%L.S.D	24.66	39.72	35.43	71.36	21.58

*Values with the same letter in a column are not significantly different at 5% level of probability (One way ANOVA).

After 7 days, the highest reduction percent was recorded for Bitter melon oil (79.99%) followed by Neem oil (71.85%), Thyme oil (65.46%), Garlic oil (63.95%), Jojoba oil (57.39%) and Lemon oil (53.91%), The lowest value of (53.8%) was shown by Parsley oil. After ten days, Jojoba oil caused the highest reduction in fall armyworm larvae counts (93.75%) followed by Neem oil (81.25%), Thyme oil (76.19%), Lemon oil (63.37%), Parsley oil (40.41%) and Bitter melon oil (36.25%), while the lowest reduction percent was recorded for Garlic oil (26.15%).

In general, the tested botanical oils may be classified according to their effectiveness against fall armyworm larvae into 3 groups as follows:

Group (1): Highly effective include two botanical oils, Neem and Jojoba oils where average reduction percentages were (76.24% and 72.03%), respectively. These results agree

with those obtained by (Samuel *et al.* 2021) who stated that the results suggest that both extracts of Neem have great potential as a natural insecticide for the management of fall armyworm.

Group (2): Lowest effectiveness includes Garlic oil where the average reduction percentage was (50.78%) on fall armyworm larvae.

Group (3): Moderate effective include the remaining tested oils where average reduction percentages ranged from (64.53 to 61.75%).

Also, there were no significant differences between all tested essential oils at all days after treatment where (P values> 0.05) Table (4).

Conclusion

From the present study, it was observed that application of the synthetic insecticides, Top-green 37% SC, Octoclod 9.75% SC, Neomyl 90% SP, Lamdathrin 5% EC, Dimeuron 10% EC, Match 5% EC and Tefluvap 15% SC were effective and significantly increased percentage of reduction in full armyworm larval and reduced damage compared to the untreated control and few live larvae were recorded from plants treated with Top-green 37% SC, Octoclod 9.75% SC, Neomyl 90% SP. Among the botanical oils, Neem, Jojoba, Bitter melon, Thyme, Parsley, Lemon and Garlic oil had the highest efficacy causing the highest reduction to full armyworm larvae. This study provides valuable information about the efficacy of insecticides with relatively novel modes of action and provides good protection to manage fall armyworm and used as a last resort in fall armyworm management. An Integrated Pest Management approach is needed for effective management of fall armyworm; other factors of mortality that include natural enemies, use of botanical compounds, pheromones to detect adults, plant deterrent compounds, and cultural practices should be integrated into a comprehensive Integrated Pest Management system for management of fall armyworm.

REFERENCES

Akhtar, Y.; Yeoung, Y.R.; Isman, M.B. (2008): Comparative Bioactivity of Selected Extracts from Meliaceae and Some Commercial Botanical Insecticides against two Noctuidae Caterpillars, *Trichoplusia ni* and *Pseudaletia unipuncta*." *Phytochemistry Reviews;* 7(1):77-88.

Baskaran, J.; Arshid, G.; Krishnappa, K.; Elumalai, K. (2012): Larvicidal activity of selected plant essential oils against tobacco cutworm *Spodoptera litura* (Fab) (Lepidoptera: Noctuidae). *International Journal of Current Advanced Research;* 1(1):13-17.

Briefing note on FAO (2018): actions on fall armyworm in Africa. http://www.fao.org/3/a-bt415e.pdf. 16th February 2018.

Bueno, R.; Carneiro, T.R.; Bueno, A.F.; Pratissoli, D.; Fernandes, O.A.; Vieira, S.S. :(2010) Parasitism capacity of *Telenomus remus* Nixon (Hymenoptera: Scelionidae) on *Spodoptera frugiperda* (Smith) (Lepidoptera: Noctuidae) eggs. *Brazilian Archives of Biology and Technology*,53: 133–139.

CABI. 2019. Invasive Species Compendium: *Spodoptera frugiperda* (fall armyworm). https://www.cabi.org/ISC/datasheet/29810 (last accessed 28 Dec 2019).

Clark, P.L.; Molina, O.J.; Martinelli, S.; Skoda, S.R.; Isenhour, D.J.; Lee, J.; Krumn, J.T.; Foster, J.E. (2007): Population variation of *Spodoptera frugiperda* (J. E. Smith) in the Western Hemisphere. *Journal of Insect Science*, 7: 1–10.

Elumalai, K.; Krishnappa, K.; Anandan, A.; Govindarajan, M.; Mathivanan, T. (2010): Larvicidal and ovicidal activity of seven essential oils against lepidopteran pest *S. litura* (Lepidoptera: Noctuidae). *International Journal of Recent Scientific Research.;* 1:008-014.

EPPO Global Database (2018): *Spodoptera frugiperda* (LAPHFR). https://gd.eppo.int/ taxon/ LAPHFR. 08th December, 2018.

Goergen, G.; Kumar, P.L.; Sankung, S.B.; Togola, A.; Tamo, M. (2016): First report of outbreaks of the fall armyworm *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera, Noctuidae), a new alien invasive pest in the west and central Africa.*PLoS One,* 11: e0165632. doi: 10.137/journal.pone.0165632.

Guo, J.F.; Zhao, J.Z.; He, K.L.; Zhang, F.; Wang, Z.Y. (2018): Potential invasion of the crop devastating insect pest fall armyworm *Spodoptera frugiperda* to China. *Plant Protection*, 44: 1–10.

Gutiérrez-Moreno, R.; Mota-Sanchez, D.; Blanco, C.A.; Whalon, M.; Terán-Santofimio, H.; Rodriguez-Maciel, J.C.; DiFonzo, C. (2019): Field-evolved resistance of the fall armyworm (Lepidoptera: Noctuidae) to synthetic insecticides in Puerto Rico and Mexico. *Journal of Economic Entomology*, 112: 792–802.

Hardke, J.T.; Temple, J.H.; Leonard, B.R.; Jackson; R.E. (2011): Laboratory toxicity and field efficacy of selected insecticides against fall armyworm (Lepidoptera: Noctuidae). *Florida Entomologist*, 94: 272–278.

Hendrson, C. F. and E.W. Tilton. 1955. Tests with acaricide against the brown wheat mite. *Journal Economic Entomology;* 48:157-161.

Lee, S.; Tsao, R.; Peterson, C.; Coats, J.R. (1997): Insecticidal activity of monoterpenoids to western corn rootworm (Coleoptera: Chrysomelidae), two-spotted spider mite (Acari: Tetranychidae) and Housefly (Diptera: Muscidae). *Journal Economic Entomology;* 90:883-892.

Liu, S.Q.; Shi, J.J.; Cao, H.; Jia, F.B.; Liu, X.Q.; Shi, G.L. (2000): Survey of the pesticide component in Plant. In Entomology in China in 21st Century, Proceedings of Conference of Chinese Entomological Society ed. Dianmo, Li Beijing, China: *Science & Technique Press.;* 1098-1104.

Mahadeva Swamy, H.M.; Asokan, R.; Kalleshwaraswamy, C.M.; Sharanabasappa, Prasad, Y.G.; Maruthi, M.S.; Shashank, P.R.; Naorem, I.D.; Surakasula, A.; Adarsha, S.; Srinivas, A.; Rao, S.; Vidyasekhar Shali Raju, M.; Shyam Sunder Reddy, G.; Nagesh, S.N. (2018): Prevalence of R strain and molecular diversity of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) in India. *Indian Journal of Entomology*, 80: 544–553.

Nabity, P.D.; Zangerl, A.R.; Berenbaum, M.R.; Delucia, E.H. (2011): Bioenergy crops *Miscanthus giganteus* and *Panicum virgatum* reduce growth and survivorship of *Spodoptera frugiperda* (Lepidoptera: Noctuidae). *Journal of Economic Entomology*,104: 459–464.

Nagoshi R.N., Adamczyk J.J., Meagher J., Gore R.L., Jackson R. (2007). Using stable isotope analysis to examine fall armyworm (Lepidoptera: Noctuidae) host strains in a cotton habitat. *Journal of Economic Entomology*, 100: 1569–1576.

Nagoshi, R.N.; Dhanani, I.; Asokan, R.; Mahadevaswamy, H.M.; Kalleshwaraswamy, C.M.; Sharanabasappa Meagher, R.L. (2019): Genetic characterization of fall armyworm infesting South Africa and India indicate recent introduction from a common source population. *PLoS One,* 14: e0217755. doi.org/10.1371/journal.pone.0217755.

NATESC – National Agricultural Technology Extension Service Center (2019a). Major pest *Spodoptera frugiperda* have invaded in Yunnan, and all areas should immediately strengthen investigation and monitoring. *Plant Pathogen and Pest Information,* 1-18.

NATESC – National Agricultural Technology Extension Service Center (2019b). Recent reports of fall armyworm in China and neighboring countries. *Plant Pathogen and Pest Information,* 4-4.

Pogue, G.M. (2002): A world revision of the genus *Spodoptera* Guenée (Lepidoptera: Noctuidae). *Memoirs of the American Entomological Society*, 43: 1–202.

Prasanna, B.M.; Huesing, J.E.; Eddy, R.; Peschke, V.M. (2018): Fall Armyworm in Africa:A Guide for Integrated Pest Management, 1st edition. CIMMYT, Edo Mexico, Mexico.

Prowell, D.P.; McMichael, M.; Silvain, J.F. (2004): Multilocus genetic analysis of host use, introgression and speciation in host strains of fall armyworm (Lepidoptera: Noctuidae). *Annals of Entomological Society of America*, 97: 1034–1044.

Samual, K.T.; Francis, A.; Jhon, A. and Enoch, A. 2021. Potential of neem extracts as natural insecticide against fall armyworm (*Spodoptera frugiperda* (J. E. Smith) Lepidoptera; Noctuidae), *Case Studies in Chemical and Environmental Engineering*, 4: 100130.

Sharanabasappa Kalleshwaraswamy, C.M.; Asokan, R.; Mahadeva Swamy, H.M.; Maruthi, M.S.; Pavithra, H.B.; Hegde, K.; Navi, S.; Prabhu, S.T.; Goergen, G. (2018a): First report of the fall armyworm, *Spodoptera frugiperda* (J E Smith) (Lepidoptera, Noctuidae), an alien invasive pest on maize in India. *Pest Management in Horticultural Ecosystems*,24: 23–29.

Sharanabasappa, Kalleshwaraswamy, Maruthi M.S., Pavithra H.B. 2018b. Biology of invasive fall armyworm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) on maize. *Indian Journal of Entomology*, 80: 540–543.

Sisay B., Tefera T., Wakgari M., Ayalew G., Mendesi E. 2019. The efficacy of selected synthetic insecticides and botanicals against fall armyworm, *Spodoptera frugiperda*, in maize. *Insects*, 10: 45. doi: 10.3390/insects10020045.

Tomquelski, G.V.; Martins, G.L.M. (2007): Efficiency of insecticides on *Spodoptera frugiperda* (J. E. Smith, 1797) (Lepidoptera: Noctuidae) on crop maize in the region of Chapadões. *Revista Brasileira Milho e Sorgo* 6: 26–39.

Wu, Q.L.; Jiang, Y.Y.; Wu, K.M. (2019): Analysis of migration routes of fall armyworm, *Spodoptera frugiperda* (J. E. Smith) from Myanmar to China. *Plant Protection*, 45: 1–9.

ARABIC SUMMARY

فاعلية بعض المبيدات الحشرية الكيميائية والزيوت النباتية ضد دودة الحشد الخريفية، *Spodoptera frugiperda* (Lepidoptera: Noctuidae) ، على الذرة في مصر

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اجريت بعض التجارب بمحافظة القليوبية لتقييم بعض المواد ذات الاصـــل النباتى وبعض المبيدات الكيميائية ضددودة الحشد الخريفية *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) على الذرة.
تم تطبيق سبع مبيدات حشرية كيماوية وسبع زيوت نباتية علاوة على الكنترول وقد تم تكرارها ثلاث مرات لكل معامله.
وقد تم اثناء المعاملات توجيه سوائل الزيوت النباتية والمبيدات الحشرية الكيميائية الي قلوب النباتات عن طريق تعديل فوهةالاداهالمستخدمه في المعامله الي شكل مخروطي مجوف.

ولقد اظهرت النتائج ان جميع المواد المستخدمة تسببت في انخفاض كبير في أعداد دودة الحشد الخريفية مقارنة بالكنترول.
وكذلك اوضحت النتائج ان من بين المبيدات التي تم اختبارها، أظهر مبيد Top-green 37% SC كفائه عاليه في خفض تعداد الافه بنسبة عاليه بلغت (91.23٪) يليه مبيد Octoclod 9.75) بنسبة بلغت (89.93٪ SC) ، بينما ظهر مبيدTefluvap 15٪ SC أقل تأثير بنسبة خفض بلغت (64.4٪)).
كما أظهرت المبيدات المختبرة المتبقية (Neomyl 90 % SP ، Lamdathrin 5%EC ، Dimeuron 10%ECو(Match 5%ECتأثير متوسط بلغ 79.05٪ ، 72.12٪ ، 70.59٪ و 70.11٪ على يرقات دودة الحشد الخريفية, علي التوالي.
. كما اظهرت النتائج ان هناك أيضا فروق معنويه بين المبيدات الحشرية المختبرة بعد 24 ساعة. وكلك بعد ثلاثة أيام بعد المعامله حيث كانت قيم ($P < 0.05$) بينما كانت هناك فروق معنوية بسيطه بين جميع المبيدات الحشرية الكيميائية المختبرة بعد عشرة أيام من المعامله حيث كانت قيم ($P > 0.05$)
كذلك اظهرت النتائج ان من بين الزيوت النباتية التي تم اختبارها، أظهر زيت النيم تاثيرا كبيرا في خفض تعداد يرقات دودة الحشد الخريفيه بلغت (76.24٪) يليه زيت الجوجوبا (72.03٪)، بينماظهر زيت الثوماقل تأثيرا بنسبة خفض بلغت (50.78٪).). أما بقية الزيوت النباتية وهي (زيت الحنظل وزيت الزعتر وزيت البقدونس وزيت الليمون) اظهرت تأثيرا وسطيا حيث أظهرت نسب خفض في بلغت (64.53 ٪ و63.99٪ و62.78٪ و61.75٪) ليرقات دودة الحشد الخريفية على التوالي.