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Bioactivity of Essential Oils Against Cotton Aphid, *Aphis Gossypii* Glover (Hemiptera: Aphididae) and Their Selectivity to Eleven-Spotted Lady Beetle *Coccinella Undecimpunctata* (Coleoptera: Coccinellida)

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Abstract

The cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) is a major insect pest of vegetables such as okra. While synthetic insecticides are vastly used to control aphis, extravagant application has led to resistance of insects and poses side effects on the predators. Consequently, essential oils (EOs) are the most effective, promising alternatives to synthetic insecticides. Field and lab experiments were therefore performed to study the impacts of some essential oils on aphids and their natural enemies. The essential oils (EOs) were ginger (*Zingiber officinale*), rosemary, (*Salvia rosmarinus*), basil, (*Ocimum basilicum*), clove (*Syzygium aromaticum*) and *Simmondsia chinensis* against *Aphis gossypii* and adult of the eleven-spotted lady beetle, *Coccinella undecimpunctata*. All essential oils were tested at concentrations of 1%, 3%, 5% in the field and 0.5%, 1.5%, 2.5% in the laboratory. The results revealed that rosemary oil is considered the most potent oil among all tested oils against *A. gossypii*. Whereas clove oil is considered the least effective among the oils tested under the laboratory and field against *A. gossypii*. While ginger oil was the least toxic oil against *C. undecimpunctata*. These essential oils gave promising sources in controlling aphids and selectivity on *C. undecimpunctata*. through the results of this study, natural oils can be used to control aphids.

Keywords: *Aphis gossypii*, Natural oils, *Coccinella undecimpunctata*, natural enemies, insecticides

Introduction

Okra is an economic and valuable vegetable crop worldwide for its high nutrients of protein, vitamin C, and calcium Peng et al., 2019. It grows in subtropical and tropical parts of the world for human consumption and commercial purposes in the Africa, Asia, Brazil, Southern United States, Turkey, and Northern Australia. In Egypt, Okra grows throughout the year in four seasons; early summer season in January and February in Upper Egypt, often under plastic tunnels, the late summer season in March, April, and May in some regions, and the autumn season in July and August for seedlings production be sown in winter in September. The cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) is a main pest of Malvaceae, Brassica and Cucurbitaceae plants **(Yan 2022)**. Adults and nymphs of *A. gossypii* feed on the lower surfaces of leaves and the developing apices of plants by sucking plant nutrients. The feeding leads to the appearance of symptoms on the vegetative parts such as yellowing, wilting, distortions and curling of leaves which directly affect the process of photosynthesis **(Zhang et al. 2014)** and early death of the plant. On the other hand, the eleven-spot ladybird beetle *C. undecimpunctata* L. is a broad predator for several insect pests likewise: aphids, thrips, spider mites, and other pests, and is considered a significant bio-control operator for greenhouse crops (**Liu *et al*. 2019)**.

Nowadays, the intensive use of traditional chemicals of insecticides causes many environmental hazards and problems of pest resistance. Therefore, finding low-cost insecticides that are eco-friendly, efficient, and non-chemical pesticide alternatives is critical (**Vivekanandhan *et al*. 2018)**. In organic farms, pesticides are not allowed, However, botanical pesticides are acceptable alternatives in controlling insect pests due to their safe residues in the environment and little mammalian toxicity **(Digilio *et al*. 2008).** The essential oils (EOs) such as those compounds extracted from plants act as repellents, feeding deterrents, and growth regulators for insect pests without pollution and dissolving quickly in the environment **(Vivekanandhan *et al*. 2018 and Plata-Rueda *et al.* 2018).** In many agro-ecosystems**,** the EOs such as clove (*Syzygium aromaticum* L.), lavender (*Lavandula spica* L.), oregano (*Origanum vulgare* L.), fennel (*Foeniculum vulgare* Mill.), and juniper (*Juniperus communis* L.), showed high mortality against *A. gossypii* **(Atanasova *et al*. 2018)**. Additionally, under laboratory conditions, several EOs such (*Pimpinella anisum* L., *Juniperus oxycedrus* L., *Rosmarinus officinalis* L., *Juniperus excelsa* M. Bieb., *Laurus nobilis* L. and *Juglans regia* L., and *Foeniculum vulgare* Miller, presented aphidicidial activities against Cabbage aphid, *Brevicoryne brassicae* (**Işık *et al*., 2009)**.

Recently, in the field of pest management, various EOs indicated high potential for insect control particularly in the greenhouses **(Tomova et al., 2005).** In this study, the insecticidal impacts of some selected natural EOs extracted from ginger, rosemary, basil, clove, and jojoba were tested in the field at three concentrations 1, 3, 5% against *A. gossypii* and in laboratory at 0.5, 1.5, 2.5% towards the adults of the natural enemy Eleven-spotted Lady Beetle**,** *Coccinella septempunctata* (Coleoptera: Coccinelidae).

Materials and Methods

Design of experimental

The research was carried out on a farm located in Elfath, Assiut Governorate at the beginning of May 2022, and August 2023 in a simple conducted block design with five treatments and four replicas. The seeds of Okra crops were cultivated in June, 2022 in plots each 4 x 3 m, keeping 90 cm distance among rows and 40 cm among plants.

Essential oils (EOs)

The EOs were extracted in the Agriculture Research Center in Cairo, Egypt. The tested oils were ginger (*Zingiber officinale*), rosemary (*Salvia rosmarinus*), basil

(*Ocimum basilicum*), clove (*Syzygium aromaticum*), and jojoba (*Simmondsia chinensis)*.

2.3 Susceptibility of *A. gossypii* towards (EOs) under field conditions

The Eos were sprayed using a 10-liter sprayer under recommended agricultural practices. The population of *A. gossypii* was recorded from twenty randomly selected plants/ replica. To determine the reduction rates in the population from nymphs and adults, the population of nymphs and adults were recorded after and before 1, 3, 5 and 8 days of spray application for each EOs treatment depending on the formula of **Henderson and Tilton, (1955):** Reduction % = 1 – (n in Co before treatment × n in T after treatment / n in Co after treatment × n in T before treatment) ×100 Where: **n** = pest population, **T** = treated, **Co** = control

Susceptibility of *A. gossypii* towards (EOs) under laboratory conditions

Nymphs and Adults were targeted by applying three concentrations (1, 1.5, 2.5%) in three replicas for each treatment. For each concentration of the EOs, 50 healthy Aphids were dipped for 10 seconds in each concentration. Fifty individuals of nymphs and adults of aphids for each replica were treated in plastic units (10 cm in diameter and 10 cm high) to estimate the mortality, as well as fifty nymphs and adults were dipped only in distilled water as a control observation of aphid's mortality was made every 1, 3, 6 and 24 hrs. The mortality value was detected depending on the following formula: Mortality (%) = (Number of infected (dead) / Total number of insects) ×100

Susceptibility of the *C. undecimpunctata* to essential oils under laboratory conditions

Adults of the *C. undecimpunctata* were used for application. Three concentrations (1, 1.5, 2.5), and three replicas were used for each concentration of the essential oils (EOs). Ten healthy insects were dipped for 10 seconds in concentration, then moved to plastic units (10 cm in diameter and 10 cm high) to estimate the mortality. Control adults were dipped only in distilled water. Observation of insect mortality was made every 1, 3, 6 and 24 hrs. The mortality value was computed according to the following formula: Mortality (%) = (Number of infected (dead) / Total number of insects) ×100

Statistical Analysis

All statistical analyses were done Using SPSS (Version 16.0). Data were presented as Mean ± S.E.M (Standard Error of Mean)

Results

Susceptibility of the *A. gossypii* to essential oils under field conditions

Data in (**Table. 1**) showed the reduction percentages of five essential oils (EOs) which were used (Ginger (*Zingiber officinale*), rosemary, (*Salvia rosmarinus*), basil, (*Ocimum basilicum*), Clove (*Syzygium aromaticum*) and *Simmondsia chinensis*) against *A. gossypii*.

Data in **(Table. 1)** showed that the reduction percentages of rosemary oil at concentrations 1%, 3%, and 5% after one day of spraying were 99.25A±0.01, 99.49A±0.01, 99.95A±0.01, respectively. However, after 3 days of spraying these numbers were 99.04A±0.0, 99.24A±0.0, 99.96A±0.0 respectively. Furthermore, the reduction percentages for rosemary oil at concentrations 1%, 3%, and 5 % were 98.7A±0.0, 99.09A±0.0 , 99.96A±0.0 and 98.52A±0.0 , 98.88A±0.0 , 99.96A±0.0 after 5 and 8 days respectively. On the other hand, Results showed that the reduction percentages of clove oil at concentrations 1%, 3%, 5 % after one day of treatment were 49.88C±0.1, 35.98D±0.2, 81.28B±0.3, respectively. While, after 3 days of spraying these numbers were 43.66D±0.1, 38.3D±0.2, 76.8C±0.3 respectively. Furthermore, the reduction percentages of rosemary oil at concentrations of 1%, 3%, and 5 % were 38.11D±0.12, 31.43D±0.14, 75.6C±0.16 and 24.07F±0.17, 25.61F±0.22, 37.39E±0.21 after 5 and 8 days respectively.

Susceptibility of the *A. gossypii* to essential oils under laboratory conditions

Results showed that the Mortality after 1 h exposure, to ginger oil, rosemary oil, basil oil, clove oil and jojoba oil at concentrations of 0.5%, 1.5% and 2.5 were 60.00, 70.00, 50.33, 80.00, 90.00, 100.00, 60.00, 60.33, 70.33, 10.33, 20.67, 30.67, 30.33, 50.00 and 60.00%, respectively. However, after 3 h of spraying these numbers were: 73.33, 80.00, 70.00, 100.00, 100.00, 100.00, 70.67, 60.67, 80.33, 20.00, 30.67, 40.33, 40.33, 50.33 and 60.33%, respectively. In addition, the mortality of aphids after 6 h post-treatment was 80.33, 90.00, 80.33, 100.00, 100.00, 100.00, 90.00, 90.00, 90.00, 30.00, 40.33, 50.00, 40.00, 40.00, 40.00, 40.67, 60.00 and 60.33%, respectively. Whereas the mortality of aphids was: 100, 100, 100, 100, 100, 100, 100, 100, 100, 30.67, 50.33, 60.00, 50.00, and 70.00 %, respectively after 24h. In general rosemary oil, basil oil, and ginger oil were considered the most effective against the adult stages of the *A. gossypii* followed by jojoba oil and clove oil **(Table 2)**.

Susceptibility of *C. undecimpunctata* to essential oils in the lab

Results in **(Table 3)** found that the mortality of rosemary oil against *C. undecimpunctata* was significantly more effective against both of at concentrations 1%, 3%, and 5% after 1, 3, 6, and 24 hours followed by jojoba oil and basil oil, but the effect of ginger oil and clove oil were fairly weak against *C. undecimpunctata.*

Table 1: The effects of essential oils against the cotton aphid, *A. gossypii* under field conditions

Oils	Conc.	Reduction percentages after			
		1 day	3 days	5 days	8 days
Ginger	1	99.95A±0.01	96.39A±0.01	92.67B±0.01	90.42B±0.02
	3	98.44A±0.02	96.84A±0.01	93.55B±0.03	92.45B±0.03
	5	98.77A±0.03	97.32A±0.01	94.41B±0.02	92.98B±0.02
Rosemary	1	99.25A±0.01	99.04A±0.0	98.7A±0.0	98.52A±0.0
	3	99.49A±0.01	99.24A±0.0	99.09A±0.0	98.88A±0.0
	5	99.95A±0.01	99.96A±0.0	99.96A±0.0	99.96A±0.0
Basil	1	97.45A±0.01	89.2B±0.02	77.73C±0.2	65.08D±0.12
	3	95.71A±0.02	91.44B±0.03	91.17B±0.02	78.66C±0.15
	5	96.49A±0.03	91.84B±0.01	91.32B±0.03	88.08B±0.09
Clove	1	49.88C±0.1	43.66D±0.1	38.11D±0.12	24.07F±0.17
	3	35.98D±0.2	38.3D±0.2	31.43D±0.14	25.61F±0.22
	5	81.28B±0.3	76.8C±0.3	75.6C±0.16	37.39E±0.21
Jojoba	1	96.19A±0.01	87.94B±0.2	78.8C±0.11	75.02±0.31
	3	96.91A±0.01	94.91A±0.02	86.93B±0.09	85.78BC±0.08
	5	97.37A±0.01	94.98A±0.03	91.4B±0.02	90.28B±0.03
Control	-	00.00	00.00	00.00	00.00

Table 2: Mortality of the cotton aphid, *A. gossypii* after contact treatment with five essential oils under laboratory conditions

Oils	Conc.	Mortality%			
		after 1 h	after 3 h	after 6 h	after 24 h
Ginger	0.5	60.00EF±1.0	73.33BC±0.5	80.33B±0.6	100.00A±0.0
	1.5	70.00CD±0.0	80.00BC±0.0	90.00B±0.0	100.00A±0.0
	2.5	50.33FG±0.6	70.00C±1.0	80.33B±0.5	100.00A±0.0
Rosemary	0.5	80.00B±0.0	100.00A±0.0	100.00A±0.0	100.00A±0.0
	1.5	90.00B±0.0	100.00A±0.0	100.00A±0.0	100.00A±0.0
	2.5	100.00A±0.0	100.00A±0.0	100.00A±0.0	100.00A±0.0
Basil	0.5	60.00EF±1.0	70.67BC±0.6	90.00B±0.0	100.00A±0.0
	1.5	60.33DE±0.6	60.67CD±0.6	90.00B±0.0	100.00A±0.0
	2.5	70.33BC±0.6	80.33B±0.5	90.00B±.0.0	100.00A±0.0
Clove	0.5	10.33J±0.5	20.00G±1	30.00E±1.0	30.67E±0.6
	1.5	20.67I±0.6	30.67F±0.6	40.33D±0.6	50.33D±0.6
	2.5	30.67H±0.5	40.33E±1.15	50.00D±1.0	60.00C±1.0
Jojoba	0.5	30.33HI±0.6	40.33E±0.6	40.67D±0.6	50.00D±0.0
	1.5	50.00G±0.0	50.33D±0.5	60.00C±0.0	60.00C±0.0
	2.5	60.00EF±0.0	60.33CD±0.6	60.33C±0.6	70.00B±0.0
Control	-	00.00	00.00	00.00	00.00

Table 3: The effects of essential oils against the eleven -spotted Lady Beetle, *C. undecimpunctata* under laboratory conditions

Oils	Conc.	Mortality %			
		after 1 h	after 3 h	after 6 h	after 24 h
Ginger	0.5	0.00C±0.0	0.00D±0.00	0.00D±0.00	0.00D±0.00
	1.5	10.00B±0.01	10.00C±0.00	10.00C±0.00	10.00C±0.00
	2.5	16.66B±0.01	23.33B±0.01	23.33B±0.01	23.33B±00
Rosemary	0.5	96.66A±0.02	96.66A±0.02	96.66A±0.02	100.00A±0.01
	1.5	96.66A±0.02	96.66A±0.02	96.66A±0.01	100.00A±0.02
	2.5	96.66A±0.01	96.66A±0.02	96.66A±0.02	100.00A±0.01
Basil	0.5	0.00C±0.0	0.00D±0.00	0.00D±0.00	0.00D±0.00
	1.5	93.33A±0.01	93.33A±0.01	93.33A±0.01	100.00A±0.01
	2.5	96.66A±0.01	96.66A±0.02	96.66A±0.02	100.00A±0.00
Clove	0.5	0.00C±0.0	0.00D±0.0	0.00D±0.00	0.00D±0.00
	1.5	0.00C±0.0	0.00D±0.0	10.00C±0.00	10.00C±0.00
	2.5	0.00C±0.0	0.00D±0.0	10.00C±0.00	10.00C±0.00
Jojoba	0.5	0.00C±0.0	0.00D±0.0	10.00C±0.00	10.00C±0.00
	1.5	93.33A±0.01	93.33A±0.01	96.66A±0.01	100.00A±0.01
	2.5	96.66A±0.02	96.66A±0.02	96.66A±0.02	100.00A±0.02
Control	0	00.00	0.00	0.00	0.00

Discussion

In this present study, **Isman *et al*. 2008** found that rosemary, tea tree, black pepper and eucalyptus are repellent, ovicidal and antifeedant and have pesticides characteristics against several pests and mites. In addition, Natural oils can have very impact on pesticide tolerant pests (**Farajzadeh *et al*. 2014)**. Furthermore, **(Digilio et al. 2008)** showed that rosemary oil acts as a repellent for *M. persicae* and has a major penetration ability among the cuticle of *M. persicae* than to be suck in the gut and intestines. (**Gamila *et al*. 2018)** tested the effectiveness of some essential oils against *A. gossypii* under greenhouse conditions on cucumber. The results revealed that Azadirachta oil is considered the most potent oil among all tested oils. While, Jojoba oil is considered the least effective among the oils tested against *A. gossypii* under greenhouse conditions._(**Bream *et al*. 2001 and Osman 2003)** found that jojoba oil can act as a toxicant, growth, antifeedant, oviposition, and development inhibitor. (**Batish *et al*. 2008)** indicated that the rosemary natural oil was marketed as an insecticide for its effectiveness against many mites and insect pests. (**Pereira *et al*. 2004)**, tested the impact of neem oil on fecundity, survival, development and against cotton aphid. Mortality rates through the nymphal development adults with the two highest concentrations of the neem extract were 60% and 100%, respectively. (**Nabil and Sherif 2014)**, tested the effect of aqueous plant extracts such as Azadirachta and geranium against *A. gossypii* in the laboratory and greenhouse. Results showed that, geranium and Azadirachta give the highest mortality of cotton aphid**,** *A. gossypii* in greenhouse and laboratory. Tested the effectiveness of *S. intermedia* natural oil for natural enemy *C. septempunctata* and *A. nerii* and found that, the natural oil for *S. intermedia* was more active on *Aphis nerii* than the seven-spot ladybird *Coccinella septempunctata*, It indicates that the Biopredator was more tolerant than the aphid insect for S. intermedia natural oil, as it plays a major role in protecting natural predators. **(Titouhi et al. 2017 and De Souza et al. 2020).** Similar results were recorded for controlling some insect pests and aphids using natural essential oils with protection from natural enemies. Therefore, it is significant to select effective insecticides with decreased side impacts on Biopredator at operative concentrations to the insect pests, which has been obtained in the current research.

Conclusion

The present study concludes that the essential oils (EOs) which were used ginger (*Zingiber officinale*), rosemary, (*Salvia rosmarinus*), basil, (*Ocimum basilicum*), Clove (*Syzygium aromaticum*) and *Simmondsia chinensis* against adult of *A. gossypii* and *C. septempunctata*, can be used individually to manage insect populations in an environmentally friendly manner. The results revealed that rosemary oil is considered the most potent oil among all oils tested. Whereas clove oil is considered the least effective among the oils tested under laboratory and field. While the ginger and clove oils were the least toxic oils against *C. undecimpunctata*. These essential oils were promising sources in controlling the cotton aphid, *A. gossypii* and selectivity on its natural enemies. Through the results of this study, natural oils can be used to control aphids.

References

Amro, M. A., Abd El-Rahim, G. H., & Abd El-Raheem, A. A. (2013). Effect of intercropping systems on the incidence of some sap-sucking and fruit pests infesting okra and roselle plantations. *Assiut University Bulletin for Environmental Researches, 16*(2), 139-150.

Atanasova, D., Ganchev, D., & Nevov, N. (2018). Efficacy of some plant essential oils against cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) under laboratory conditions. *MAYFEB Journal of Agricultural Science, 1*, 10-16.

Barkman, B. (2013). *Repellent, irritant and toxic effects of essential oil constituents on Bemisia tabaci (Gennadius)* [Master's thesis, University of Amsterdam].

Batish, D. R., Singh, H. P., Kohli, R. K., & Kaur, S. (2008). Eucalyptus essential oil as a natural pesticide. *Forest Ecology and Management, 256*, 2166–2174.

Bream, A. S., Ghoneim, K. S., Tanani, M. A., & Nassar, M. I. (2001). The disruptive effects of Azadirachtin and Jojoba on development and morphogenesis of the red palm weevil, *Rhynchophorus ferrugineus* (Curculionidae: Coleoptera). *Mededlingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen, Universiteit Gent, Belgium, 66*(2), 491-502.

Cheng, Y., Zhi, J., Li, F., Jin, J., & Zhou, Y. (2018). An artificial diet for continuous maintenance of *Coccinella septempunctata* adults (Coleoptera: Coccinellidae). *Biocontrol Science and Technology, 28*, 242–252.

Chinniah, C., & Ali, K. A. (2000). Relative efficacy of insecticides/acaricides against sucking insects of okra. *Pest Management and Economic Zoology, 8*, 111-116.

De Souza, M. T., de Souza, M. T., Bernardi, D., Krinski, D., de Melo, D. J., Oliveira, D. C., ... & Zawadneak, M. A. C. (2020). Chemical composition of essential oils of selected species of *Piper* and their insecticidal activity against *Drosophila suzukii* and *Trichopria anastrephae*. *Environmental Science and Pollution Research, 27*, 13056–13065.

Digilio, M. C., Mancini, E., Voto, E., & Feo, V. (2008). Insecticide activity of Mediterranean essential oils. *Journal of Plant Interactions, 3*(1), 17-23.

Farajzadeh, M. A., Khoshmaram, L., & Nabil, A. A. A. (2014). Determination of pyrethroid pesticides residues in vegetable oils using liquid–liquid extraction and dispersive liquid–liquid microextraction followed by gas chromatography–flame ionization detection. *Journal of Food Composition and Analysis, 34*, 128–135.

Gamila, A. M. H. (2018). Evaluation efficiency of some plant extracts on insect *Aphis gossypii* Glover which infesting cucumber plants under greenhouses conditions. *Journal of Plant Protection and Pathology, 9*(10), 659–662.

Gupta, G., & Kumar, N. R. (2017). Growth and development of ladybird beetle *Coccinella septempunctata* L. (Coleoptera: Coccinellidae), on plant and animal based protein diets. *Journal of Asia-Pacific Entomology, 20*, 959–963.

Henderson, C., & Tilton, E. (1955). Test with acaricides against the brown wheat mite. *Journal of Economic Entomology, 48*, 157-161.

Işik, M., & Görür, G. (2009). Aphidicidial activity of seven essential oils against the cabbage aphid, *Brevicoryne brassicae* L. (Hemiptera: Aphididae). *Munis Entomology and Zoology, 4*(2), 424-431.

Isman, M. B. (2000). Plant essential oils for pest and disease management. *Crop Protection, 19*, 603-608.

Isman, M. B. (2005). Botanical insecticides, deterrents and repellents in modern agriculture and an increasing regulated world. *Annual Review of Entomology, 51*, 45-66.

Isman, M. B., Wilson, J. A., & Bradbury, R. (2008). Insecticidal activities of commercial rosemary oils (*Rosmarinus officinalis*) against larvae of *Pseudaletia unipuncta* and *Trichoplusia ni* in relation to their chemical compositions. *Pharmaceutical Biology, 46*, 82–87.

Kumar, D. S., Tony, D. E., Kumar, A. P., Kumar, K. A., Rao, D. B. S., & Nadendla, R. (2013). A review on: *Abelmoschus esculentus* (okra). *International Research Journal of Pharmaceutical and Applied Sciences, 3*(4), 129–132.

Li, R., Cheng, S. H., Liang, P., Chen, Z., Zhang, Y., Liang, P., ... & Gao, X. W. (2022). Status of the resistance of *Aphis gossypii* Glover, 1877 (Hemiptera: Aphididae) to afidopyropen originating from microbial secondary metabolites in China. *Toxins, 14*(11), 750.

Liu, T., Wang, Y., Zhang, L., Xu, Y., Zhang, Z., & Mu, W. (2019). Sublethal effects of four

insecticides on the seven-spotted lady beetle (Coleoptera: Coccinellidae). *Journal of Economic Entomology, 112*, 2177–2185.

Nabil, M., & Sherif, B. A. (2014). Controlling *Tuta absoluta* (Lepidoptera: Gelechiidae) and *Aphis gossypii* (Hemiptera: Aphididae) by aqueous plant extracts. *Life Science Journal, 11*(3), 245-256.

Osman, S. M. (2003). Effect of different plant oils on the black cutworm *Agrotis ipsilon* (Hufn) (Lep. Noctuidae). *Egyptian Journal of Applied Sciences, 18*(11), 316-322.

Peng, C., Lin, H., Lin, C., Wang, C., & Huang, C. (2019). *Abelmoschus esculentus* subfractions improved nephropathy with regulating dipeptidyl peptidase-4 and type 1 glucagon-like peptide receptor in type 2 diabetic rats. *Journal of Food and Drug Analysis, 27*, 135–144.

Pereira, C., Adalci, L., & Torres, A. (2004). Effect of neem extract on the cotton aphid. *Pesquisa Agropecuária Brasileira, 39*(11), 1071-1076.

Plata-Rueda, A., Campos, J. M., da Silva Rolim, G., Martínez, L. C., Dos Santos, M. H., Fernandes, F. L., ... & Zanuncio, J. C. (2018). Terpenoid constituents of cinnamon and clove essential oils cause toxic effects and behavior repellency response on granary weevil, *Sitophilus granarius*. *Ecotoxicology and Environmental Safety, 156*, 263-270.

Rahman, K., Waseem, K., Kashif, M., Jilani, M. S., Kiran, M., Ghazan, F., & Mamoon-Ur-Rashid, M. (2012). Performance of different okra (*Abelmoschus esculentus* L.) cultivars under the agro-climatic conditions of Dera Ismail Khan. *Pakistan Journal of Science, 64*(4), 316–319.

Sampson, B. J., Tabanca, N., Kirimer, N., Demirci, B., Baser, K. H. C., Khan, I. A., ... & Wedge, D. E. (2005). Insecticidal activity of 23 essential oils and their major compounds against adult *Lipaphis pseudobrassicae* (Davis) (Aphididae: Homoptera). *Pest Management Science, 61*, 1122-1128.

Sattler, C., Kächele, H., & Erch, G. V. (2007). Assessing the intensity of pesticide use in agriculture. *Agriculture, Ecosystems & Environment, 119*, 99–304.

Titouhi, F., Amri, M., Messaoud, C., Haouel, S., Youssfi, S., Cherif, A., ... & Jemâa, J. (2017). Protective effects of three *Artemisia* essential oils against *Callosobruchus maculatus* and *Bruchus rufimanus* (Coleoptera: Chrysomelidae) and the extended side-effects on their natural enemies. *Journal of Stored Products Research, 72*, 11–20.

Tomova, B. S., Waterhouse, J. S., & Doberski, J. (2005). The effect of fractionated *Tagetes* oil volatiles on aphid reproduction. *Entomologia Experimentalis et Applicata, 115*, 153-159.

Vivekanandhan, P., Venkatesan, R., Ramkumar, S., Karthi, S., & Senthil-Nathan, S. (2018). Comparative analysis of major mosquito vectors response to seed-derived essential oil and seed pod-derived extract from *Acacia nilotica*. *International Journal of Environmental Research and Public Health, 15*(2), 388.

Zanuncio, J. C., Mourão, S. A., Martínez, L. C., Wilcken, C. F., Ramalho, F. S., Plata-Rueda, A., ... & Serrão, J. E. (2016). Toxic effects of the neem oil (*Azadirachta indica*) formulation on the stink bug predator, *Podisus nigrispinus* (Heteroptera: Pentatomidae). *Scientific Reports, 6*, Article 33401. https://doi.org/10.1038/srep33401

Zhang, S., Lv, L., Wang, C., Luo, J., Li, C., & Cui, J. (2014). Study on cotton aphid-borne viruses via high-throughput sequencing. *Cotton Science, 26*, 539–545.

النشاط الحيوي للزيوت الطبيعية ضد حشرة من القطن: *Aphis gossypii* Glover (Hemiptera: Aphididae) وانتقائيتها للخنفساء ذات الإحدى عشرة نقطة *Coccinella undecimpunctata* (Coleoptera: Coccinellida)

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الملخص العربى

حشرة من القطن، *A. gossypii* Glover (Hemiptera: Aphididae) هى آفة حشرية رئيسية على الخضروات مثل البامية, في حين يتم استخدام المبيدات الحشرية الاصطناعية على نطاق واسع للسيطرة على حشرة المن، فقد أدى الاستخدام المفرط إلى مقاومة الحشرات وكذلك آثارًا جانبية على المفترسات, وبالتالي، تعد الزيوت العطرية (EOs) من أكثر البدائل الواعدة والفعالة للمبيدات الحشرية الاصطناعية .ولذلك تم إجراء تجارب حقلية ومعملية لدراسة تأثير بعض الزيوت العطرية على حشرة المن وأعدائها الطبيعية .كانت الزيوت العطرية (EOs) المستخدمة هي الزنجبيل (*Zingiber officinale*) وإكليل الجبل (*Salvia rosmarinus*) والريحان (*Ocimum basilicum*) والقرنفل (*Syzygiumomaticum*) و *Simmondsia chinensis* ضد حشرة من القطن و الخنفساء ذات الإحدى عشرة نقطة, تم اختبار جميع الزيوت العطرية بتركيزات 1%، 3%، 5% في الحقل و0.5%، 1.5%، 2.5% في المعمل. أظهرت النتائج أن زيت إكليل الجبل يعتبر من أقوى الزيوت بين جميع الزيوت التي تم اختبارها ضد *A. gossypii* في حين أن زيت القرنفل يعتبر الأقل فعالية بين الزيوت المختبرة تحت الظروف المعملية والحقلية ضد *A. gossypii* بينما كان زيت الزنجبيل هو أقل الزيوت سمية ضد *C. undecimpunctata* أعطت هذه الزيوت العطرية مصادر واعدة في مكافحة حشرة من القطن والانتقائية على *C. undecimpunctata* وبناء على النتائج التي توصلنا إليها يمكن استخدام الزيوت الطبيعية كمبيد حشري تجاري ضد *A. gossypii*

الكلمات الدالة: حشرة المن، الزيوت الطبيعية، *Coccinella undecimpunctata*، الأعداء الطبيعية، المبيدات الحشرية.