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Evaluation Efficiency of some Plant Extracts on Insect *Aphis gossypii* Glover which Infesting Cucumber Plants under Greenhouses Conditions

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ABSTRACT

This study was carried out to evaluate the efficiency of some plant extracts against *Aphis gossypii* Glover under greenhouses conditions on Cucumber var. *Cucumis sativus* L. during seasons 2015, 2016. The result obtained In season 2015, with regard to the mean number of aphids at 1, 3, 5, 7, 10 and 15 days post treatment, the extracts could be arranged in the following discending order: Neemazal, Azadirachta, Eucalyptus, Nerium, Helianthus, Glycine, Citronella and Jojoba extracts. The general effect of corresponding reduction percentages were 94.66, 93.65, 91.80, 90.60, 88.53, 87.85, 86.87 and 84.36, respectively. Also, data showed that, in season 2016, with regard to the mean number of aphids at 1, 3, 5, 7, 10 and 15 days post treatment, the compounds could be arranged in the following discending order: Neemazal, Azadirachta, Eucalyptus, Nerium, Helianthus, Glycine, Citronella and Jojoba extracts. The general effect of corresponding reduction percentages were 95.16, 94.23, 92.96, 91.63, 89.83, 88.61, 86.13 and 85.83, respectively. From the above-mentioned data, Neemazal proved itself to be the most effective extract and Jojoba oil was the least one. All extracts recorded significant differences between them and control. No phytotoxicity was observed for any of the tested extracts on leaves or on fruits.

INTRODUCTION

Cucumber considers one of the most important vegetables crops in Egypt and all over the world which cultivated in the open field and under greenhouses conditions. Also, its cultivated area increased gradually during the last years, especially in the new reclaimed areas for purposes local consumption and exportation to the foreign markets (Hanafy, A. R. 2004).

Cucumber crop infested with large scale of different insects such as *Aphis gossypii* Glover (Homoptera : Aphididae) which consider one of the most damaging insects infesting vegetables crops either in the open field or under greenhouses conditions, (Adriaan, J. *et al*. 1994) who reported that the aphid *A. gossypii* seen as highly population on Cucumber crop either in the open field or under glasshouses conditions. Also, *A. gossypii* beside its effects on leaves and fruits transmit Cucumber mosaic virus (CMV), Deborah, J. *et al.* (2004) who reported that *A. gossypii* transmit Cucumber mosaic virus (CMV) which causes a serious disease of narrow-leafed lupin. And also aphids cause sporadic yield losses due to direct feeding damage. And Pereira, C. *et al* (2004) reported that the aphid *A. gossypii* a harmful pest on most vegetables crops, and causes direct damage, reducing plant vigor, and indirect damage by honeydew secretion and transmission of several viruses.

Plant extracts are materials obtained it from different parts of the plants. It has effect anti microbes, diseases and insects. It cans biodegradable and have very low toxicity. Also, the chances of the appearance of resistance in the insects are very week. And it's especially suited with Integrated Pest Management (I.P.M). This study aimed to evaluated efficiency some plant extracts in control *A. gossypii* which infesting Cucumber plants under greenhouses conditions.

This study was carried out to evaluate the efficiency of some plant extracts against *Aphis gossypii* Glover under greenhouses conditions on Cucumber var. *Cucumis sativus* L. (Summer planting) during (March- April), in Perkash region (Giza Governorate) during seasons 2015, 2016. The examined extracts were Neemazal, Azadirachta, Eucalyptus, Nerium, Helianthus, Glycine, Citronella and Jojoba.

MATERIALS AND METHODS

Experimental design

The greenhouse The greenhouses were covered with double layer of polyethylene, the area isolated in the field and divided into nine equal parts. Eight parts for eight extracts and the nine part for control. And this study was carried out on Cucumber (Summer planting) which cultivated during (March- April) whereas population of aphid at its peak in this period. With same all the agricultural operations all over the greenhouse.

Sample size was a number of alive aphids found on one plant. All treatments were applied first on March 15, when aphids had begun to colonize the plants (Hamlen, 1977). Counts of aphid were recorded at first immediately before treatment and at 1, 3, 5, 7, 10 and 15 days after treatment.

An ordinary hand sprayer of 20 liters capacity with a bent down Nozzle was used. Normal agricultural practices for greenhouse Cucumber (fertilization, irrigation, light intensity pinching, photoperiod and temperature) were carried out regularly (Raymond, 2003).

Monitoring studies of the Cotton aphid *A. gossypii* on the Cucumber plants, *Cucumis sativus* L. white wonder were conducted in a private plastic greenhouse 7.5 X 20.6 m at Giza Governorate. Two-efficacy tests were carried out in 2015 and 2016 seasons.

The plant extracts which examined and their rates of application per feddan:

1-Neem extract (Neemazal):

Neemazal-W (a powder of a botanical insecticide containing 10% azadirachtin), Neemazal extract (powder 10%), using per 300 cm at 100 liter water, El-Lakwah, F. and El-Kashlan, H. (1999).

2- Azadirachta:

***Azadirachta indica* fam.:** Meliaceae contains Azadirachin A+B, Margostic acid, Azaridine, Margosine, Margospierne, using per 300 cm at 100 liter water (Duke, 1985)

3- Eucalyptus extract:

Leaves contains 1.5-3.5% volatile oils and essential compound in these oils is Ceniol, it present 54-95%. And amount of volatile oils depending on the age of the leaves. Also, Eucalyptus rich in Flavonoids and Triterpenes, using per 300 cm at 100 liter water (Duke, 1985).

4- *Nerium oleander* extract:

Leafs contain phenols, glycosides, flafenoids, trepans, tenants and ratings, using per 300 cm at 100 liter water (Duke, 1985).

5- Helianthus oil:

Contains Lenolec acid (58-67%), Dicaffeoyl putrescine and coumaroyl spermioline, using per 300 cm at 100 liter water (Rheenen, *et al* 1989).

6-Glycine:

Glycine max L. contains oil (19-22%), protein (20%), Flavonoids (Genectine, Diadzene). And also seeds contain Lycetine, Vitamins (B, E) and Carotiens, using per 300 cm at 100 Liter water (Thulin, 1983).

7-Citronella oil:

As a concentrated form of antioxidants and phytochemicals taken from the plant leaves and stem, contain citronellal, geraniol, gerany acetate and limonene. This oil essential repellent insects, using per300 cm at 100 Liter water (Duke, 1985).

8- Jojoba oil:

The jojoba oil-wax is extracted from the seeds of the jojoba (*Simmondsia chinensis*), a perennial shrub that grows in semi desert areas in some parts of the world. The main uses of jojoba oil-wax are in the cosmetics and pharmaceutical industry, but new uses could be related control some insects, using per300 cm at 100 Liter water, Laureano, C. *et al* (2006).

Statistical analysis:

The data was subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 and 0.01 levels (Stell & Torrie, 1980). The reduction in population density of aphids due to insecticidal treatment was calculated according to equation of Henderson and Tilton (1955).

RESULTS AND DISCUSSION

In 2015 season:

Data presented in Table (1), showed that, the effectiveness of experimented extracts on population density and reduction percentages of the cotton aphid, *A. gossypii* infesting cucumber under greenhouses conditions. Spray of Neemazal, Azadirachta, Eucalyptus, Nerium, Helianthus, Glycine, Citronella and Jojoba extracts (in 2015) effectively reduced populations density of *A. gossypii* after one day post-treatment to 11.8, 10.6, 12.4, 15.7, 16.3, 15.3, 15.5 and 18.5 respectively, whereas reduction percentages were 84.4, 85.4, 84.4, 80.7, 79.3,80.9,79.5 and 77.5%, respectively. The population density of aphid after 3 days post-treatment were 7.3, 7.1, 8.3, 11.0, 15.5, 13.8, 13.3 and 16.5 respectively, whereas reduction percentages were 90.4, 90.2, 89.5, 86.5, 80.3, 82.8, 82.4 and 79.9%, respectively. The population of aphid after 5 days post-treatment was 3.5, 5.9, 7.9, 9.5, 10.4, 10.5, 11.8 and 14.6 respectively, whereas reduction percentages were 95.4, 91.8, 90.1, 88.3, 86.9, 86.9, 83.4 and 82.2%, respectively. The population density of aphid after 7 days post-treatment was 1.7, 3.9, 6.3, 6.2, 5.5, 8.4, 9.5 and 12.6 respectively, whereas reduction percentages were 97.8, 94.6, 92.1, 92.4, 93.0, 89.5, 87.4 and 84.7%, respectively. The population density of aphid after 10 days post-treatment was 0.0, 0.2, 4.2, 3.5, 4.0, 7.5, 4.8 and 10.5 respectively, whereas reduction percentages were 100, 99.9, 94.7, 95.7, 94.9, 90.7, 93.6 and 87.2%, respectively. The population density of aphid after 15 days post-treatment was 0.0, 0.0, 0.0, 0.0, 2.5, 3.0, 3.8 and 4.4 respectively, whereas reduction percentages were 100, 100, 100, 100, 96.8, 96.3, 94.9 and 94.6%, respectively.

Table 1. Average numbers of aphids/plant and reduction percentages of the cotton aphid, *Aphis gossypii* infesting Cucumber as influenced by the tested plant extracts in 2015 season.

Extract	Rate of application	No. of aphids /plant (pre-treatment)	Post-treatment periods (in days)						General effect%
			1	3	5	7	10	15	
Neemazal	300 cm	75.8	(11.8) 84.4	(7.3) 90.4	(3.5) 95.4	(1.7) 97.8	(0.0) 100	(0.0) 100	94.66
Azadirachta	300 cm	72.5	(10.6) 85.4	(7.1) 90.2	(5.9) 91.8	(3.9) 94.6	(0.2) 99.9	(0.0) 100	93.65
Eucalyptus	300 cm	79.3	(12.4) 84.4	(8.3) 89.5	(7.9) 90.1	(6.3) 92.1	(4.2) 94.7	(0.0) 100	91.80
Nerium	300 cm	81.4	(15.7) 80.7	(11.0) 86.5	(9.5) 88.3	(6.2) 92.4	(3.5) 95.7	(0.0) 100	90.60
Helianthus oil	300 cm	78.7	(16.3) 79.3	(15.5) 80.3	(10.4) 86.9	(5.5) 93.0	(4.0) 94.9	(2.5) 96.8	88.53
Glycine oil	300 cm	80.3	(15.3) 80.9	(13.8) 82.8	(10.5) 86.9	(8.4) 89.5	(7.5) 90.7	(3.0) 96.3	87.85
Citronella oil	300 cm	75.5	(15.5) 79.5	(13.3) 82.4	(11.8) 83.4	(9.5) 87.4	(4.8) 93.6	(3.8) 94.9	86.87
Jojoba oil	300 cm	82.2	(18.5) 77.5	(16.5) 79.9	(14.6) 82.2	(12.6) 84.7	(10.5) 87.2	(4.4) 94.6	84.36
Control	-	75.4	85.0	87.9	96.4	103.2	120.4	134.8	-

$LSD_{0.05}$ Extracts : 6.73 $LSD_{0.05}$ Days : 5.63
$LSD_{0.01}$ Extracts : 9.23 $LSD_{0.01}$ Days : 8.26

No. between brackets = Average number of Insect remaining after treatment
No. below = Mortality%

With regard to the mean number of aphids at 1, 3, 5, 7, 10 and 15 days post treatment, the compounds could be arranged in the following descending order: Neemazal, Azadirachta, Eucalyptus, Nerium, Helianthus, Glycine, Citronella and Jojoba extracts. The general effect of corresponding reduction percentages were 94.66, 93.65, 91.80, 90.60, 88.53, 87.85, 86.87 and 84.36, respectively. From the above-mentioned data, Neemazal proved itself to be the most effective extract and Jojoba oil was the least one. Statically analysis showed significant difference

between general effects percentages of extracts which examined. Whereas for extracts LSD (0.05) value was 6.73 and LSD (0.01) value was 9.23, and for days LSD (0.05) value was 5.63 and LSD (0.01) value was 8.26. All compounds recorded significant differences between them and control. No phytotoxicity was observed for any of the tested compounds on leaves or on fruits.

In 2016 season:

Data obtained in Table (2) showed that, the effectiveness of experimented extracts on population density and reduction percentages of the cotton aphid, *A. gossypii* infesting Cucumber, var. *Cucumis sativus* L. under greenhouses conditions. Spray of Neemazal, Azadirachta, Eucalyptus, Nerium, Helianthus, Glycine, Citronella and Jojoba extracts (in 2016) effectively reduced populations of *A. gossypii* after one day post-treatment to 10.8, 10.6, 12.4, 13.7, 15.3, 13.3, 17.5 and 16.5 respectively, whereas reduction percentages were 86.6, 86.6, 85.1, 83.2, 81.0, 84.2, 78.8 and 79.4%, respectively. The population density of aphid after 3 days post-treatment was 6.3, 7.1, 8.3, 10.0, 12.5, 11.8, 15.3 and 14.5 respectively, whereas reduction percentages were 92.2, 91.1, 90.0, 87.7, 84.5, 86.0, 81.5 and 81.9%, respectively. The population density of aphid after 5 days post-treatment was 4.5, 5.9, 6.9, 7.5, 9.4, 10.5, 12.8 and 13.6 respectively, whereas reduction percentages were 94.4, 92.6, 91.7, 90.8, 88.4, 87.5, 84.5 and 83.0%, respectively. The population density of aphid after 7 days post-treatment was 1.7, 3.9, 5.3, 6.2, 5.5, 9.4, 10.5and 10.6 respectively, whereas reduction percentages were 97.8, 95.1, 93.6, 92.4, 93.2, 88.8, 87.3 and 86.8%, respectively. The population density of aphid after 10 days post-treatment was 0.0, 0.0, 2.2, 3.5, 4.0, 7.5, 6.8 and 8.5 respectively, whereas reduction percentages were 100, 100, 97.4, 95.7, 95.0, 91.1, 91.8 and 89.4%, respectively. The population density of aphid after 15 days post-treatment was 0.0, 0.0, 0.0, 0.0, 2.5, 5.0, 5.8 and 4.4 respectively, whereas reduction percentages were 100, 100, 100, 100, 96.9, 94.1, 92.9 and 94.5%, respectively.

Table 2. Average numbers of aphids/plant and reduction percentages of the cotton aphid, *Aphis gossypii* infesting Cucumber as influenced by the tested plant extracts in 2016 season.

Extract	Rate of application	No. of aphids /plant (pre-treatment)	Post-treatment periods (in days)						General effect%
			1	3	5	7	10	15	
Neemazal	300 cm	80.8	(10.8) 86.6	(6.3) 92.2	(4.5) 94.4	(1.7) 97.8	(0.0) 100	(0.0) 100	95.16
Azadirachta	300 cm	79.5	(10.6) 86.6	(7.1) 91.1	(5.9) 92.6	(3.9) 95.1	(0.0) 100	(0.0) 100	94.23
Eucalyptus	300 cm	83.3	(12.4) 85.1	(8.3) 90.0	(6.9) 91.7	(5.3) 93.6	(2.2) 97.4	(0.0) 100	92.96
Nerium	300 cm	81.4	(13.7) 83.2	(10.0) 87.7	(7.5) 90.8	(6.2) 92.4	(3.5) 95.7	(0.0) 100	91.63
Helianthus oil	300 cm	80.7	(15.3) 81.0	(12.5) 84.5	(9.4) 88.4	(5.5) 93.2	(4.0) 95.0	(2.5) 96.9	89.83
Glycine oil	300 cm	84.3	(13.3) 84.2	(11.8) 86.0	(10.5) 87.5	(9.4) 88.8	(7.5) 91.1	(5.0) 94.1	88.61
Citronella oil	300 cm	82.5	(17.5) 78.8	(15.3) 81.5	(12.8) 84.5	(10.5) 87.3	(6.8) 91.8	(5.8) 92.9	86.13
Jojoba oil	300 cm	80.2	(16.5) 79.4	(14.5) 81.9	(13.6) 83.0	(10.6) 86.8	(8.5) 89.4	(4.4) 94.5	85.83
Control	-	85.4	95.0	97.9	115.4	127.2	130.4	137.5	-

$LSD_{0.05}$ Extracts : 5.68 $LSD_{0.05}$ Days : 6.53
$LSD_{0.01}$ Extracts : 8.43 $LSD_{0.01}$ Days : 9.26

No. between brackets = Average number of Insect remaining after treatment
No. below = Mortality%

With regard to the mean number of aphids at 1, 3, 5, 7, 10 and 15 days post treatment, the compounds could be arranged in the following descending order: Neemazal, Azadirachta, Eucalyptus, Nerium, Helianthus, Glycine, Citronella and Jojoba extracts. The general effect of corresponding reduction percentages were 95.16, 94.23, 92.96, 91.63, 89.83, 88.61, 86.13 and 85.83, respectively.

From the above-mentioned data, Neemazal proved itself to be the most effective extract and Jojoba oil was the least one. Statically analysis showed significant difference between general effects percentages of extracts which examined. Whereas for extracts LSD (0.05) value was 5.68 and LSD (0.01) value was 8.43, and for days LSD (0.05) value was 6.53 and LSD (0.01) value was 9.26. All compounds recorded significant differences between them and control. No phytotoxicity was observed for any of the tested compounds on leaves or on fruits.

These results agreement with those obtained by Laisvune, D. and Rasa, K. who studied the effect of Neemazal on the *Aphis fabae* Scop. in Spinach at 2008 and found the efficiency of Neemazal was 74.36, 81.41 and 84.65% mortality percentage after 5, 7 and 14 days, respectively. Pereira, C. *et al*. (2004) studied effect of neem extract on the cotton aphid *A. gossypii* and the effects of extracts of neem (Neemazal) seed powder on the development, survival and fecundity of *A. gossypii* were evaluated. Mortality rate during the nymphal development for aphids on cotton leaf with the two highest concentrations of the neem extract were 60% and 100%, respectively. Nabil, M. *et al*. (2014) studied controlling *Tuta absoluta* (Lepidoptera: Gelechiidae) and *Aphis gossypii* (Hemiptera: Aphididae) by aqueous plant extracts include chinaberry (Azadirachta) in greenhouse and laboratory, and found that chinaberry (Azadirachta) and geranium showed the highest mortality percentages of *A. gossypii* in laboratory and greenhouse after 2, 4, 6 and 8 days after treatment. Fazal, S. *et al*. (2015) studied the effect of different plant extracts with a chemical insecticide

for management of the Aphid, *A. gossypii* in sunflower, and the result on this study revealed that extracts derived from the leaves of Azadirachta was the most successful treatment in term of population reduction of remaining treatments 2% of *Azadirachta indica*. Tunc, S. (1998) found that the vapours of essential oils extracted from eucalyptus, *Eucalyptus camaldulensis* toxic to two greenhouse pests, carmine spider mite *Tetranychus cinnabarinus* (Boised) and cotton aphid *A. gossypii*, and causes 99% mortality after 2-3 days after treatment. Begona. *et al*. (2006) found that mineral oils such as Glycine caused the heighest mortality of aphids (over 80%) for the control of *Myzus persicae*. Charles *et al*. (2006) studied the effect of essential oil from Citronella on Aphids, *Hyadaphis foeniculi* and found that when use concentrations 1, 3, 5 and 7% of Citronella oil causes mortality percentages 81, 98, 98 and 93% respectively.

REFERENCES

Adriaan, J.; Wouter, T. and Peter, W. (1994). Host races of *Aphis gossypii* (Homoptera : Aphididae) on Cucumber and Chrysanthemum. Environmental Entomology 23(5): 1235-1240

Begona, M.; Lanire, V. and Silvia, M. (2006). Use of combined with low doses of insecticide for the control of *Myzus persicae*, Pest Management Science 62(4), 372-378

Charles, S.; Paulo, A.; Maria, J. and Alexander, J. (2006). Effect of essential oil from Citronella and Alfazema on Fennel Aphid *Hyadaphis foeniculi* (Hemiptera: Aphididae) and its predator *Cycloneda sanguine* (Coleoptera: Coccinelidae). American Journal of Enveronmental Sciences 3(1): 9-10

Deborah, J.; Art, J. and Roger (2004). A. Forecasting Aphid outbreaks and epidemics of Cucumber mosaic virus in lupin crops in a Mediterranean-type environment. Virus Research 100 (1): 67-82

Duke, J. A. 1985. Handbook of Medicinal Herbs, Florida, USAv (1-225)

El-Lakwah, F. and El-Kashlan, H. (1999). Efficiency of Neemazal (powder 10%) against some stored product insects. Alexandria Journal of Agricultural Research 44(2), 271-283

Fazal, S.; Main, I.; Sajjad, A. and Maid, Z.(2015). Comparing the effect of different plant extracts with a chemical insecticide for management of the Aphid, *Aphis gossypii* in sunflower, Pak. J. Weed Sci. Res., 21(3): 359-368

Hamlen, R. A. (1977): Insecticides and insect growth regulators control of green peach aphid, banded greenhouse, thrips and a foliar mealybug on aphelandra. Proc. Fla. State. Hort. Soc., 90: 321-323

Hanafy, A. R. (2004). Studies on the most important Cucumber pests in the open field and suitable control programs. Ph.D. thesis, Fac. of Agric. Moshtohor, Benha Branch- Zagazig Univ., Egypt

Henderson, C.F. and Tilton, E.W. (1955): Test with acaricides against the brown wheat mite., J. Econ Entomol., 48 : 157-161

Laisvune, D. and Rasa, K. (2008). The effect of biopesticides bionature R2000 and Neemazal on the *Aphis fabae* Scop. in Spinash, Zemdirbyste Agriculture vol.95, No.3, p. 401-405

Laureano, C.; Ramon, A. and Jesus, C. (2006). Biodiesel from jojoba oil-wax transesterification with methanol and properties as a fuel, Biomass and Bioenergy 30 (1): 76-81

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

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

Raymond, J. K. (2003): Chrysanthemum, commercial greenhouse production. Auburn Univ.

Rheenen, H. A.; Pere, W. M. and Magoya, J. K.(1989). Protection of stored bean seeds against the bean bruchid. FAO Plant Protection Bulletin 31(3): 345-357

Steel, R. G. and Torrie, J. H. (1980): Principles and procedures of stastistics. MC Graw Hill Book Co. Inc., New York

Thulin, M.(1983). Leguminosae of Ethiopia. Opera Botanica No,68.

Tunc, S. (1998). Sensitivity of two greenhouse pests to vapours of essential oils. Entomologia experimentalis et Applicata 86 (2), 183-187

تقييم فاعلية بعض المستخلصات النباتية فى مكافحة حشرة *Aphis gossypii* Glover على نباتات الخيار تحت ظروف الصوب البلاستيكية

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أجريت هذه التجارب بغرض تقييم فاعلية بعض المستخلصات النباتية فى مكافحة حشرة *Aphis gossypii* Glover على نباتات الخيار صنف *Cucumis sativus* L تحت ظروف الصوب البلاستيكية . كما أجريت هذه التجارب خلال موسمي ٢٠١٥ و ٢٠١٦ فى منطقة برقاش (محافظة الجيزة) ، حيث تم تقييم فاعلية ثمانية (٨) انواع من المستخلصات النباتية وهم: مستخلص النيم (نيمازال) Neemazal ، ومستخلص الأزدرخت (الزنزلخت) *Azadirachta indica* ، ومستخلص الكافور *Eucalyptus sp.* , ومستخلص الدفلة *Nerium oleander* , وزيت عباد الشمس *Helianthus sp.* , وزيت فول الصويا *Glycine sp.* , وزيت السيترونيلا *Citronella sp.* ، و زيت الجوجوبا *Jojoba sp.* . وتوصلت النتائج الى أن جميع المستخلصات و الزيوت النباتية المستخدمة تختلف معنويا عن المقارنة (control) وكانت أكثر المستخلصات النباتية فاعلية هو مستخلص النيم (نيمازال) يليه مستخلص الأزدرخت (الزنزلخت) ثم مستخلص الكافور ثم مستخلص الدفلة ثم زيت عباد الشمس ثم زيت فول الصويا ثم زيت السيترونيلا و أخيرا زيت الجوجوبا وذلك خلال عامى الدراسة ٢٠١٥ و ٢٠١٦ . حيث كانت النسبة المئوية للتأثير العام لهذه المستخلصات خلال عام ٢٠١٥ (٩٤.٦٦ , ٩٣.٦٥ , ٩١.٨٠ , ٩٠.٦٠ , ٨٨.٥٣ , ٨٧.٨٥ , ٨٦.٨٧ , ٨٤.٣٦ %) لكلا من مستخلص النيم (نيمازال) , ومستخلص الأزدرخت (الزنزلخت) , ومستخلص الكافور , ومستخلص الدفلة , وزيت عباد الشمس , وزيت فول الصويا , وزيت السيترونيلا , وزيت الجوجوبا على الترتيب . على نفس المنوال كانت النسبة المئوية للتأثير العام لهذه المستخلصات خلال عام ٢٠١٦ (٩٥.١٦ , ٩٤.٢٣ , ٩٢.٩٦ , ٩١.٦٣ , ٨٩.٨٣ , ٨٨.٦١ , ٨٦.١٣ , ٨٥.٨٣ %) لكلا من مستخلص النيم (نيمازال) , ومستخلص الأزدرخت (الزنزلخت) , ومستخلص الكافور , ومستخلص الدفلة , وزيت عباد الشمس , وزيت فول الصويا , وزيت السيترونيلا , وزيت الجوجوبا على الترتيب .