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COMPARATIVE STUDIES ON THE TOXICITY AND BIOCHEMICAL EFFICACY OF NATURAL PLANT OILS AGAINST *Aphis craccivora* KOCH (HEMIPTERA)

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ABSTRACT

Environmental friendly organic natural botanical extracts (essential oils) of Lupine, *Lupinus termis* Forsk (Fabacea), Marjoram, *Majorana hortansis* L. (Lamiaceae), Anise, *Pimpinella anisum* (Umbelliferae), Orange oil. *Citrus vulgaris* (Rutaceae) and Olive oil, *Olea europaea* L (Oleaceae) were tested to evaluate their toxic effect on both laboratory and field strains of *Aphis craccivora*, Koch. The results showed that the field strain was more resistant to all compounds than that of the laboratory strain. On the other hand, the biochemical activity of the detoxification enzymes; MFO, alkaline Phosphatase, β and α-esterase was also investigated and showed fluctuated results according to the source of strain and compound used.

INTRODUCTION

Essential oils of botanical origin and their major components, often their various monoterpenoids have attracted attention in recent years as potential pest control agents. Due to their insecticidal, repellent and/or antifeedant properties (Amos *et al.*, 1974; Grundy and Still, 1985; Shaaya *et al.,* 1997; Lee *et al*., 2003; Ketoh *et al.,* 2005, Rozman *et al.,* 2007; Cosimi, *et al.,* 2009 and Shehawy, 2010). Also, some natural plant compounds used in the control of insect pests are known to influence the enzymatic profiles (Nathan, *et al.,* 2005). Cytochrome P450 monooxygenases (CYPs) and esterases (ESTs) are two major detoxifying enzymes in most organisms. At least one of them is involved in detoxification of insecticides in insects (Bull, 1981). In insects, the diverse functions of P450 enzymes range from synthesis and degradation of ecdysteroids and juvenile hormones to the xenobiotics metabolism (Feyereisen, 2005). Alkaline phosphatase (ALP) is a brush border membrane marker enzyme and is especially active in tissues with active membrane transport, such as intestinal epithelial cells, Malpighian tubules (Etebari and Matindoost, 2004b) and hemolymph (Etebari *et al.,* 2007).

The present investigation aims to investigate the five essential oils with possible insecticidal activity for their toxic efficacy against the laboratory and field strain of cowpea aphid, *Aphis craccivora* Koch and to study the relationship between the efficacy of the tested compounds and some biochemical aspects; *i.e*. Mixed Function Oxidase, Alkaline Phosphatase and non specific esterases activities on aphid species under this study.

MATERIALS AND METHODS

All experiments were carried out at department of Sucking and Piercing insects, plant protection research institute, Agricultural research center (ARC), Giza, Egypt.

Insect bioassay methods

In order to evaluate the toxicity of plant oils as natural products against laboratory strain of *A. craccivora* and field strain that collected from Faba bean plant in Monufia, Governorate. Leaf-dip technique was applied under laboratory conditions as described below.

a. leaf dip technique:

The method described by Harlow and Lampert, (1990), was adopted by the 7 different concentration; 375, 750, 1500, 3000, 4500, 6000 and 7500 ppm, to evaluate the efficiency of the different plant oils used against *A. craccivora* and used to draw the dosage mortality regression line (Ldp line). Ten replicates with 10 apterous adults for each concentration, plant leaf was dipped in water dilution of toxicant for 10 second, the plant leaf was gently agitated for 10 seconds in the toxicant solution then dried in the dry air. While in the control, the leaves dipped in water according to the same technique. The treated plant leaf was put in Petri dish under laboratory conditions. Mortality counts were taken after 24 hours of treatment. Aphids responding to touch with brush were considered alive.

b. Data analysis:

Mortality data were corrected according to Abbott`s formula (1925), potted on log dosage paper and regression line were fitted according to Finney (1971), Sun (1950), described the toxicity index as a mean for comparing the relative susceptibility of the tested insecticides. He proposed the following equation in calculating the toxicity index values:

$$\textbf{Sun's toxicity index} = \frac{\textbf{LC}_{50}\textbf{ of standard material}}{\textbf{LC}_{50}\textbf{ of tested material}} \times 100$$

Detoxification enzyme assays:

Effect of essential oils on the activities of four detoxification enzymes [mixed function oxidase (MFO), alpha esterases (α-esterases), beta esterases (β-esterases), and alkaline phosphatase (ALP)] were measured.

A. craccivora were treated topically with LC_{50} of test essential oils for 24hrs. Then, preserved in refrigerator until analysis, after that, the specimen homogenized in distilled water using a Teflon homogenizer surrounded with a jacket of crushed ice for 3 minutes. Homogenates were centrifuged at 8000 r. p. m. for 15 minutes at 5C°, and the supernatants were used directly to determine the activity mixed function oxidase MFO, alkaline phosphates, beta esterase and alpha esterase. P-nitroanisole o-demthylation was assayed to determine MFO activity according to the method of Hansen and Hodgson (1971) with slight modification. α-esterases and β-esterases were determined according to Van Asperen (I962) using α-naphthyl acetate or β-naphthyl acetate as substrates. ALP was determined according to the method described by Powel and Smith (1954) using disodium phenyl phosphate as substrate.

RESULTS AND DISCUSSION

1. Toxicological assay by leaf dip-technique:

Mortality percentages of laboratory *A. craccivora* strain after 24 hours of exposure to essential oils increased with the increasing oil concentration. *L. termis* extract was able to induce 92% mortality within 24 hours of exposure (Figure 1) followed by *O. europaea* (78%), *P. anisum* (62 %), *M. hortansis* oil (61.0%), *C. vulgaris* induced the lowest mortality percent 48%) at 7500 ppm. On the other hand, mortality percentages of field *A. craccivora* strain after 24 hours of exposure to essential oils also increased with the increasing oil concentration. *L. termis* oil was able to induce 80% mortality within 24 hours of exposure (Figure 2) followed by *O. europaea* extract (76%), *P. anisum* (52 %), *M. hortansis* (50.0%), *C. vulgaris* induced the lowest mortality percent 42%) at 7500 ppm in laboratory strain. The results are in agreement with those obtained by Khalequzzaman and Nahar (2008), they decided that Azadirachtin as a natural plant origin insecticide proved to be the most toxic having LC50 as 0.41 µg cm-2 for *A.craccivora*, 0.34 µg cm-2 for *A. gossypii* and 0.44 µg cm-2 for both *M. persicae* and *L. erysimi.*

Effect of botanical insecticides on laboratory and field strains of *A. craccivora* on the bases of LC_{50}, toxicity index and potency level values.

The data obtained in Table (1) showed that the LC_{50} values of different concentrations of plant extracts; *L. termis, O. europaea, P. anisum, M. hortansis* and *C. vulgaris* were 2180.911, 3263.641, 5893.508, 6776.757 and 11530.0874 respectively, in laboratory strain Table (1). Whereas, it was 4247.082, 4767.84, 7787.493, 8299.527 and 11648.06, respectively in the field strain Table (2).

On the bases of toxicity index at LC_{50} level results indicated that *L. termis* extract was distinctly potent100%, while ethanolic *C. vulgaris* was the least effective one and recorded 18.915% as toxic as *L. termis* in case of testing these phytochemical oils against laboratory strain of *A. craccivora* (Table 1). Also, the toxicity index LC_{50} level indicated that *L. termis* extract was distinctly potent100%, while ethanolic *C. vulgaris* was the least effective one and record 36.46% as toxic as *L. termis* in case of testing these phytochemical oils against field strain of *A. craccivora* (Table 2).

Regarding, the relative potency levels at LC_{50} values expressed as number of folds as shown in Table (1), it was obvious that *L. termis*, *O. europaea*, *P. anisum*, *C. vulgaris* and *M. hortansis* at LC_{50} level were 5.29, 3.53, 1.95and 1.70times more effective than *C. vulgaris*, respectively in the laboratory strain (Table . 1), while in the field strain it was 2.74, 2.44, 1.5 and 1.09 70times more effective than *C. vulgaris*, respectively (Table . 2). the present results are in agreement with those of Shehawy (2007) who decided that, the most toxic extracts according to LC_{50} value against *Aphis craccivora* were ethanolic extracts of *L. termis* (LC_{50} 2071.61 ppm), *Z. officinale* (LC_{50} 2828.868 ppm), *P. nigrum* (LC_{50} 3550.541 ppm), *T. foenum graecum* (LC_{50} 3876.341 ppm) and *A. maritima* (LC_{50} 4968.637 ppm).

Comparison on basis of the slope of toxicity lines

In the laboratory strain of *A. craccivora* it was found that, *L. termis* had the steepest toxicity line, followed by *O. europaea*, *P. anisum*, followed by *C. vulgaris*, while *M. hortansis* had the flattest lines. And it was clear similarity between *Lupinus termis* oil and *Olea europaea* regard their mode of action and rate of effectiveness in spite of remarkable differences in the potency of these compounds. On the other hand, *P. anisum* and *C. vulgaris* represents another type of mode of action and rate of effectiveness. Also, *M. hortansis* represents another type of mode of action and rate of effectiveness against laboratory strain of *A. craccivora* (Fig. 1). While, in the field strain of *A. craccivora* it was found that clear similarity among *L. termis*, *O. europaea* and *M. hortansis* regarding their mode of action and rate of effectiveness in spite of remarkable differences in the potency of these compounds against *A. craccivora*. On the other hand, *C. vulgaris* and *P. anisum* represents another type of mode of action and rate of effectiveness against field strain of *A. craccivora* (Fig. 2). The obtained results are in harmony with those obtained by Abbassy *et al.* (2009) who studied that the essential oil extracted from leaves of *M. hortensis* Moench (Lamiaceae) against *Aphis fabae* L. (Hemiptera: Aphididae).

Table (1): LC_{50} values of *Lupinus termis, Olea europaea, Pimpinella anisum, Majorana hortansis* and *Citrus vulgaris* against Laboratory strain of cowpea aphid, *Aphis craccivora* Koch.

Compound	LC_{50}	Upper limit	Lower limit	Slope	Potency Level	Toxicity Index
Lupinus termis	2180.911	2900.47	1608.518	1.737	5.29	100
Olea europaea	3263.641	3772.835	2844.589	1.734	3.53	66.824
Pimpinella anisum	5893.508	7360.75	4933.401	1.549	1.95	37.005
Majorana hortansis	6776.757	9142.139	5412.603	1.281	1.70	32.182
Citrus vulgaris	11530.09	17005.45	8885.269	1.614	1.0	18.915

Table (2): LC_{50} values of Lupinus termis, Olea europaea, Pimpinella anisum, Majorana hortansis and Citrus vulgaris against field strain of cowpea aphid, Aphis craccivora Koch.

Compound	LC_{50}	Upper limit	Lower limit	Slope	Potency Level	Toxicity Index
Lupinus termis	4247.082	5826.78	3301.987	1.938	2.74	100
Olea europaea	4767.84	6686.016	3718.196	1.94	2.44	89.08
Pimpinella anisum	7787.493	9990.949	6461.881	1.755	1.5	54.54
Majorana hortansis	8299.527	10716.2	6880.346	1.847	1.09	51.17
Citrus vulgaris	11648.06	17237.96	9146.757	2.021	1.0	36.46

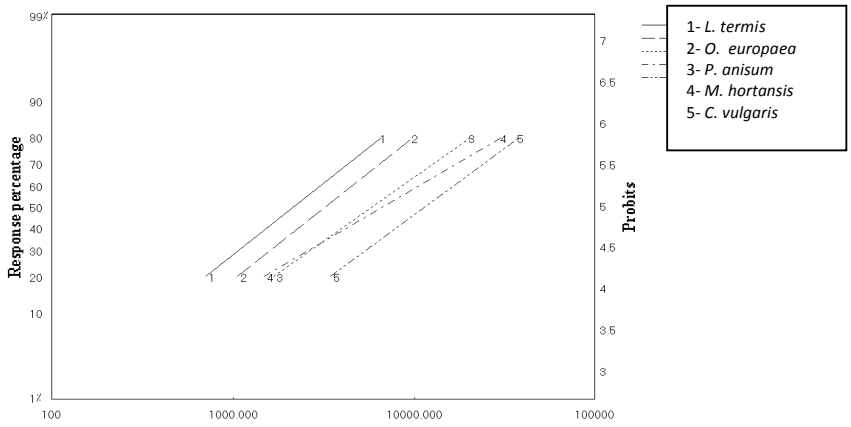

Fig. (1): semi-log of LC_{50} curve slope for *Lupinus termis, Olea europaea, Pimpinella anisum, Majorana hortansis* and *Citrus vulgaris* against Laboratory strain of cowpea aphid, *Aphis craccivora* Koch.

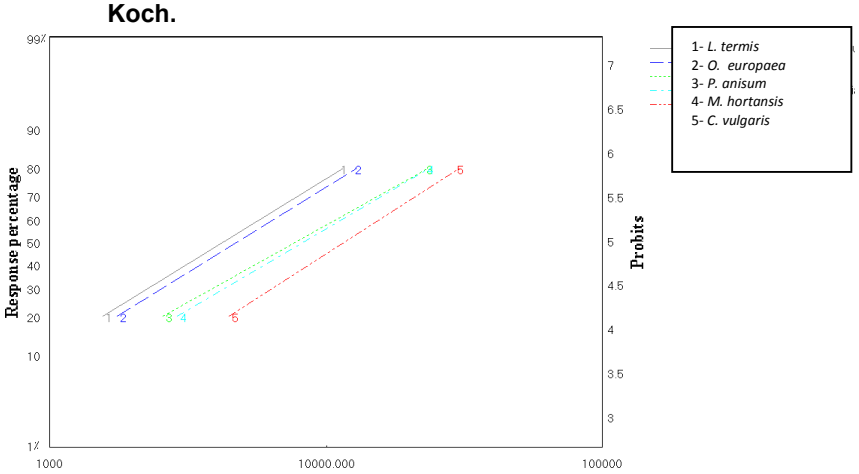

Fig. (2): semi-log of LC_{50} curve slope for *Lupinus termis, Olea europaea, Pimpinella anisum, Majorana hortansis* and *Citrus vulgaris* against field strain of cowpea aphid, *Aphis craccivora* Koch.

2. Enzymatic activity in the laboratory and field strains of *Aphis craccivora*

The activities of the tested hydrolyzing enzymes i.e., Mixed function oxidase, alpha and beta-esterases and alkaline phosphatase were estimated in both field colonies of *A. craccivora* and Laboratory strain.

The obtained results of detoxification enzymes showed that, the different insecticidal effects of essential oils corresponding to different botanical families and mode of action on laboratory and field strain of *A.craccivora*

The activity of mixed function oxidase.

The biochemical assays of mixed function oxidase (MFO) activity in *A. craccivora* are shown in Table (3). In case of laboratory strain which treated with LC_{50} of *C. vulgaris*, *M. hortansis*, *P. anisum*, *L. termis* and *O. europaea*, the biochemical activity of MFO were 276.66, 267.33, 253.33, 477.0 and 510.0 n mole substrate hydrolyzed min/mg protein, respectively Table (3). The results showed that the activities of MFO in laboratory strain were elevated by all botanical insecticides except *P. anisum* reduced the activity of MFO.

On the other hand, the biochemical activity of MFO of field strain collected from Monufia and treated with LC_{50} of botanicals mentioned before were 626.66, 916.33 704.33, 819.66, 795.66 and 782.66 n mole substrate hydrolyzed min/mg protein, respectively, (Table . 4). The results showed that the activities of MFO in field strain were elevated by all botanical insecticides.

One group linked herbivore feeding on plant material protected by chemical defenses with P-450 detoxification in larval tobacco hornworms. The induction in P-450 after initial nicotine ingestion allowed the larval tobacco hornworms to increase feeding on the toxic plant tissues (Snyder and Glendinning, 1996). Herbivores generate enzymes that counter and reduce the effectiveness of numerous toxic secondary metabolic products produced by plants. One such enzyme group, mixed function oxidases (MFOs), detoxify harmful plant compounds by catalyzing oxidative reactions (Feyereisen, 1999)

Enzymatic activity of alpha and beta-esterases:

The biochemical assay of alpha-esterase activity on *A. craccivora* are shown in Table (3&4), In case of laboratory strain which treated with LC_{50} of *C. vulgaris*, *M. hortansis*, *P. anisum*, *L. termis* and *O. europaea*, the biochemical activity of alpha-esterase were 24.0, 11.53, 12.07, 13.17 and 19.0 mg α naphthyl acetate released/min/mg protein, respectively. While, the biochemical activity of Alpha-esterase were 20.1, 22.00, 19.33, 27.66, 22.66 and 22.53 mg α naphthyl acetate released/min/mg protein, respectively, in case of field strain of *A. craccivora*. Generally, the reduction in the activities of α-esterase was showed in *C. vulgaris*, *M. hortansis*, *P. anisum* and *O. europaea* whereas it increased by *L. termis* in laboratory strain of *A. craccivora,* while it was reduced in all treatments in field strain.

On the other hand, The biochemical assay of beta-esterase activity on *A. craccivora* are shown in Table (3&4), In case of laboratory strain which treated with LC_{50} of *C. vulgaris*, *M. hortansis*, *P. anisum*, *L. termis* and *O. europaea*, the biochemical activity of β-esterases were 53.3, 11.73, 22.0, 18.0 and 17.83 mg β naphthyl acetate released/min/mg protein, respectively, While, in case of field strain of *A. craccivora*; the biochemical activity of Beta-esterase were 62.33, 82.33, 55.0, 73.33, 47.66 and 38.17 mg β naphthyl acetate released/min/mg protein, respectively. Generally it was found that the

activities of β-esterase laboratory strain was elevated by all botanical insecticides whereas in field strain it was reduced by all botanical oils except C. volgaris elevated β-esterases. Terriere, (1984) stated that such increase in enzyme activities has been shown to protect insects from insecticide poisoning as part of defense mechanism. Saleem *et al.,* (1998) reported that the increased activities of esterase enzymes of *T. castaneum* adults after Cypermethrin treatment may be due to decreased body weight defend against insecticide stress conditions and or increase the energy production. Esterase's takes part in different biological processes such as regulation of hormone, digestion, reproduction, insecticide resistance etc. (Lima-catelani *et. al.* 2004). When organisms were treated with the insecticides, continuous nerve impulse transmission due to inhibition of acetylcholine esterase may in turn result sudden death of the organisms, probably due to low production of esterase or lack of gene that produce these isozymes (Tsakas and Krimbas 1970)

Variation in the enzyme activity may be used as an alternative biomarker of environmentally induced stress, but, from the present study, it was difficult to represent any straight forward conclusion regarding the susceptibility levels of insecticides against esterases and need further investigation as other pesticide inhibiting enzymes as like glutathion tranferase, monoxigenase may contribute to become resistant (Abdur Rashid 2012).

Alkaline Phosphatase activity:

The biochemical assay of alkaline phosphatase activity in laboratory strain of *A. craccivora* treated with LC_{50} of *C. vulgaris*, *M. hortansis*, *P. anisum*, *L. termis* and *O. europaea*, were 2.43, 2.03, 2.35, 2.73 and 3.23 $\mu \times 10^3$/mg protein respectively, while, the Alkaline Phosphatase activity of field strain were 1.55, 1.77, 1.67, 1.67, 1.68 and 1.51 $\mu \times 10^3$/mg protein respectively.

Generally, increase in the activities of ALP was showed by *C. vulgaris*, *M. hortansis*, *P. anisum*, *O. europaea* and *L. termis* in laboratory strain of *A. craccivora,* while in field strain it was reduced *C. vulgaris*, *M. hortansis*, *P. anisum* treatments in contrast it increased in *O. europaea* and *L. termis* treatment. Miao, (2002) and Zera and Zhao, (2004) stated that different stress, disease and toxic chemicals causes considerable decrease in the activity of ALP. The newly emerged adults had significantly stimulated ALP activity by all extracts (Ghoneim *et. al.* 2014).

Table (3):Biochemical assays of detoxification enzymes activities in laboratory strain of *Aphis craccivora* exposed to different Phytochemicals by leaf-dip technique.

Compound	M FO (*n mole substrate oxidized/min/ mg protein*)	α-esterase (*ug α - naphthyl acetate released /min/mg protein)*	β-esterase (*ug β - naphthyl acetate released /min/mg protein)*	Alkaline Phosphatase *U×10^3/mg protein*
Citrus vulgaris	626.66±35.5	20.1±2.0	62.33±3.5	1.55±0.09
Majorana hortansis	916.33±51.2	22.0±1.5	82.33±8.2	1.77±0.07
Pimpinella anisum	704.33±41.6	19.33±1.8	55.0±2.6	1.67±0.07
Lupinus termis	819.66±30.7	27.66±1.2	73.33±3.3	1.67±0.06
Olea europaea	795.66±48.4	22.66±1.4	47.66±3.7	1.68±0.12
Control	782.66±33.2	22.53±1.5	38.17±2.9	1.51±0.10

Table (4):Biochemical assays of detoxification enzymes activities in field strain of *Aphis craccivora* exposed to different Phytochemicals by leaf-dip technique.

Compound	M FO (*n mole substrate oxidized/min/ mg protein*)	α-esterase (*ug α - naphthyl acetate released /min/mg protein)*	β-esterase (*ug β - naphthyl acetate released /min/mg protein)*	Alkaline Phosphatase *U×10^3/mg protein*
Citrus vulgaris	276.66±18.5	24.0±2.5	53.3±3.3	2.43±0.08
Majorana hortansis	267.33±17.1	11.53±1.0	11.73±0.8	2.03±0.08
Pimpinella anisum	253.33±19.6	12.07±1.5	22.0±1.2	2.35±0.10
Lupinus termis	477.0±20.8	13.17±1.4	18.0±1.5	2.73±0.08
Olea europaea	510.0±28.1	19.0±2.0	17.83±0.7	3.23±0.08
Control	٧٨٩.٠±41.6	٢٤.٦٦±0.9	٣٨.٦٦±2.3	٢.٤٧±0.12

REFERENCES

Abbassy, M. A.; A. M. Samir and Y. A. R. Rasha (2009): Insecticidal and synergistic effects of *Majorana hortensis* essential oil and some of its major constituents. Environmental science, 2 (1): 30-35.

Abbott, W.S. (1925). A method of computing the effectiveness of an insecticide. J. Econ. Entomol. 18: 265–267.

Abdur Rashid, Md.; Bhuiyan Al Sazzad, Rowshan Ara Begum and Reza Md. Shahjahan (2012): Mortality effect of BT extracts and esterase variability in three stored grain insects: *Callosobruchus chinensis, Sitophilus granarius* and *Tribolium castaneum*, International Journal of Agriculture and Food Science 2012, 2(4) : 158-163.

Amos, T.G.; P. Wiliams; P. B. Du Guesclin and M. Schwarz (1974): Compounds related to juvenile hormone: activity of selected terpenoids on *T.castaneum* and *T. confusum*. J. Econ. Entomol. 67: 474–476.

Bull, D. L. (1981): Factors that influence tobacco budworm, *Heliothis virescens*, resistance to organophosphorous insecticides. Bull. Entomol. Soc. Amer 27: 193-197.

Cosimi, S.; E. Rossi; P. L. Cioni and A. Canale (2009): Bioactivity and qualitative analysis of some essential oils from Mediterranean plants against storedproduct pests: Evaluation of repellency against *Sitophilus zeamais* Motschulsky, *Cryptolestes ferrugineu*s (Stephens) and *Tenebrio molitor* (L.) J. Stored. Prod. Res xxx: 1–8.

Etebari, K. and L. Matindoost (2004b): Effects of hypervitaminosis of vitamin B3 on silkworm biology, J. Biosci. 29: 417–422.

Etebari, K.; A. R. Bizhannia; R. Sorati and L. Matindoost (2007): Biochemical changes in haemolymph of silkworm larvae due to pyriproxyfen residue. Pestic. Biochem. Physiol. 88: 14–19

Feyereisen, R. (1999): Insect P450 enzymes. *Annual Review of Entomology* 44: 507– 533.

Feyereisen, R. (2005): Insect cytochrome P450. In Gilbert, L.I.; Iatrou, K. and Gill, S. (Eds.), Comperhensive Insect Physiology, Biochemistry, Pharm. Mol. Biol. Elsevier, Amsterdam, 1-77.

Finney, D.J. (1971): Statistical Method in Biological Assay 2 nd Edition. Griffin, London.

Gacar, F. and V.Tasksn (2009): Partial base sequence analysis of MdaE7 gene and ali-esterase enzyme activities in field collected populations of housefly (*Musca domestica* L.) from Mediterranean and Aegean Regions of Turkey. Pestic. Biochem. Physiol., 94: 86–92.

Ghoneim,K; M. Amer , A. Al-Daly; A. Mohammad , F. Khadrawy and M.A. Mahmoud (2014): Disturbed acid and alkaline phosphatase activities in desert locust *Schistocerca gregaria* (Forskal) (Orthoptera: Acrididae) by extracts from the khella plant *Ammi visnaga* L. (Apiaceae). International Journal of Advanced Research (2014), Volume 2, Issue 5, 584-596.

Grundy, D. L. and C. C. Still (1985): Inhibition of acetylcholinesterases by pulegone1,2-epoxide. Pesticide Biochemistry and Physiology, 23: 383–388.

Hansen, I. G. and E. Hodgson (1971): Biochemical characteristics of insect microsomes. N- and o-demethylation. Biochem. Pharm., 20:1569-1578.

Harlow C. D. and E. P. Lampert (1990): Resistance mechanism in two color forms of the Tobacco Aphid (Homoptera:Aphididae). J. Econ. Entomol., 83: 2130-2135.

Hou, G. L. and J. L. Huang (2002): Diversity and evolution of CYP6 family in insects. Entomol. Knowl., 39: 4246-251.

Kapin, M.A. and S. Ahmad (1980): Esterases in larval tissues of gypsy moth *Lymantria disper* (L): Optimum assay conditions, quantification and characterization. Insect Biochem. 10: 331-337.

Ketoh, G. K.; H. K. Koumaglo and I. A. Glitho (2005): Inhibition of *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) development with essential oil extracted from *Cymbopogon schoenanthus* L. Spreng. (Poaceae), and the wasp *Dinarmus basalis* (Rondani) (Hymenoptera: Pteromalidae). J. Stored. Prod. Res., 41: 363–371.

Khalequzzaman M. and J. Nahar (2008): Relative toxicity of some insecticides and azadirachtin against four crop infesting aphid species. Univ. j. zool. Rajshahi Univ., 27: 31-34.

Lee, S.; C. J. Peterson and I. R. Coats (2003): Fumigation toxicity of monoterpenoids to several stored product insects. J. Stored. Prod. Res., 39: 77-85.

Lima-catelani, A. R. A.; C.R. Ceron, H.E.M. Buicudo (2004): Genetic expression during development, revealed by esterase patterns in *Aedes aegypti* (Diptera: Culicidae). Biochem. Genet. 42: 69-84.

Miao, Y. (2002): Studies on the activity of the alkaline phosphatase in the midgut of infected silkworm, *Bombyx mori* L. J. Appl. Entomol., 126: 38–142.

Nathan, S. S. (2006): Effects of *Melia azedarach* on nutritional physiology and enzyme activities of the rice leaffolder *Cnaphalocrocis medinalis* (Guenée) (Lepidoptera: Pyralidae), Pestic. Biochem. Physiol., 84: 98–108.

Nathan, S. S.; K. Kalaivan and P. G. Chung (2005): The effects of azadirachtin and nucleopolyhedrovirus on midgut enzymatic profile of *Spodoptera litura* Fab. (Lepidoptera: Noctuidae) Pestic. Biochem. Phys., 83 (1): 46-57.

Powell, M.E.A. and M. J. H. Smith (1954): The determination of serum acid and alkaline Phosphatase activity with 4-aminoantipyrine. J. Clim. Pathol., 7:245- 248.

Rozman, V.; I. Kalinovica, and Z. Korunic (2007): Toxicity of naturally occurring compounds of Lamiaceae and Lauraceae to three stored-product insects. J. Stored Prod. Res., 43: 349–355.

Saleem, M. A.; A. R. Shakoori and D. Mantle (1998): Macromolecular and enzymatic abnormaliries induced by a synthetic pyrthroid, Ripcord (Cypermthrin), in adult beetles of stord grain pest, *castaneum* (Herbst) (Coleoptera- Tenebrionidae). Arch. Ins. Biochem. Physiol., 39:144-145.

Shaaya, E.; M. Kostjukovski; J. Eilberg and C. Sukprakarn (1997): Plant oils as fumigants and contact insecticides for the control of stored-product insects. J. Stored Prod. Res., 33: 7–15.

Shehawy, A. A. (2007): Effect of some plant extracts on some Aphids. M.Sc. Thesis, Fac. Sci., Cairo. Univ.

Shehawy, A. A. (2010): susceptibility of some aphid sp. to certain insecticides and natural products Ph. D. Thesis, Fac. Sci., Al-Azhar. Univ.

Snyder, M. J. and J. I. Glendenning (1996): Causal connection between detoxification enzyme activity and consumption of a toxic plant compound. Journal of Comparative Physiology A 179: 255 – 261.

Sun, Y. P. (1950): Toxicity index –an improved method of comparing the relative toxicity of insecticides. J. Econ. Entomol., 43: 45-53.

Terrier, L. C. (1984): Induction of detoxification enzymes in insects Annu. Rev. Entomol., 29:71-88.

Tsakas, S. and C. B. Krimbas (1970): The genetics of *Dacus oleae*.IV. Relation between adult esterase genotypes and survival to organophosphate insecticides. Evol. 24 (1970) 807- 815.

Van Asperen, K. (l962): A study of house flies esterase by means of sensitive colourimetric method. J. Insect Physiol., 8:401-416.

Zera, A. J. and Z. Zhao (2004): Effect of a juvenile hormone analogue on lipid metabolism in a wing-polymorphic cricket: implications for the endocrine biochemical bases of life-history trade-offs, Physiol. Biochem. Zool., 77:255–266.

دراسات مقارنة علي السمية والنظم البيوكيميائية للزيوت النباتيه ضد حشرة مّن اللوبيا

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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة- مصر

تمت الدراسة لمقارنة سمية خمس أنواع من الزيوت النباتيه تشمل زيت الترمس و االبردقوش و الينسون و الزيتون و البرتقال علي كل من السلاله المعمليه و السلاله الحقليه لحشرة من اللوبيا أظهرت النتائج ان كل المركبات لها تاثير سام و تختلف السمية باختلاف التركيز ونوع النبات كما أشارت النتائج الى ان السلاله الحقليه اكثر مقاومة لهذه المركبات عن السلاله المعمليه. علي الصعيد الاخر أظهرت النتائج ايضا ان هناك اختلاف لنشاط بعض الانزيمات المسئوله عن تحطيم المركبات السامة التى تشمل انزيمات (الاكسده) و كذلك انزيم فوسفاتيز القاعدى والفا و بيتا استيريزس وترجع هذه الاختلافات للمركب الذي تعرضت له الحشره وكذلك السلاله سواء كانت سلالة الحشرة معمليه او حقليه.