HNSJ Humanitarian & Natural Sciences Journal
ISSN: (e) 2709-0833
www.hnjournal.net
مجلة العلوم الإنسانية والطبيعية
مجلة علمية محكمة

RESEARCH ARTICLE

LARVICIDAL EFFECT OF SOME LOCAL PLANTS ON THE HOUSEFLY (*MUSCA DOMESTICA* L.; DIPTERA, MUSCIDAE)

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Accepted at 12/01/2021 **Published at 01/02/2021**

Abstract

The housefly *Musca domestica* (Diptera: Muscidae) is one of the most common of insects; it can transmit diseases through contaminating food. This study was implemented to assess the toxicity of Sunt (*Acacia nilotica*), alaweer *(Ipomoea helderbranditti)* and neem (*Azadirachta indica*) leaves to housefly larvae. The plants were collected from main campus of Gezira University, and prepared for water, ethanol or hexane extraction. Housefly larvae were collected from equine feces and were reared till the next generation larvae. Each 50 larvae were kept on larval feed (made of 17 g wheat bran, 2 g milk powder, 1.0 g sugar, 0.5 g yeast, and 20 ml of water) which treated by adding each extract singly at four concentrations (2.5, 1.0, 0.5 and 0.25%) in special containers. Mortality of the larvae was recorded after (1, 2, 3, 4, 5, 6, and 7 days). The results showed that, the neem ethanol extract and sunt aqueous extract were more toxic (mean mortality about 94%) than the neem leaves aqueous extract (mean mortality of was 46.5%), while the rest of leaves extracts produced mean mortalities ranged between 73 and 79. All tested plants have clear toxic effect against larvae in respect to the concentrations and types of extracts. The study recommends using these plant extracts in housefly control programs, and to detect the phytochemicals components that affected the housefly larvae from the tested plant products.

Key Words: Toxicity, *Musca domestica*, alaweer, Sunt, neem, plant extracts.

عنوان البحث

التأثير القاتل لليرقات لبعض النباتات المحلية على الذبابة المنزلية (رتبة: ثنائية الأجنحة)

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تاريخ القبول: 2020/01/12م تاريخ النشر: 2021/02/01م

المستخلص

تعتبر الذبابة المنزلية (ثنائية الأجنحة: عائلة موسيدي) من أكثر الحشرات الشائعة, وتستطيع نقل الأمراض عن طريق تلويث الأغذية. أجريت هذه الدراسة لقياس الأثر السمي لأوراق السنط والعوير والنيم على يرقات الذبابة المنزلية. جمعت الأوراق من المجمع الرئيسي لجامعة الجزيرة وجهزت ليتم إستخلاصها بواسطة الماء والإيثانول والهكسان. جمعت يرقات الذباب المنزلي من روث الحصين وتمت تربيتها للحصول على الجيل الثاني من اليرقات. تم حفظ 50 يرقة في غذاء لليرقات (مكون من 17 جم ردة قمح, 2 جرام لبن, 1 جم سكر, 0.5 جم خميرة و 20 مليلتر ماء) وعولجت بإضافة كل مستخلص علي حده وبأربعة تراكيز (0.25, 0.5, 1, 2.5 %) في أوعية خاصة. سجلت معدلات الوفيات خلال (1, 2, 3, 4, 5, 6, 7 يوم). أظهرت النتائج أن أوراق النيم المستخلصة بالإيثانول وأوراق السنط المستخلصة بالماء هي الأعلي سمية (متوسط معدل الوفيات كان حوالي 94%) عن المستخلص المائي لأوراق النيم (متوسط معدل الوفيات كان 46.5%)، بينما أحدثت بقية مستخلصات الأوراق متوسط الوفيات يتراوح بين 73% و 79%. كل النباتات التي تمت تجربتها لها أثر سمي واضح على اليرقات بالتوافق مع التراكيز وأنواع المستخلصات. أوصت الدراسة بإستخدام مستخلصات هذه النباتات في برامج مكافحة للذبابة المنزلية، كما يجب التقصي عن المكونات النباتية الكيميائية الفعالة التي أثرت علي يرقات الذبابة المنزلية من هذه المنتجات النباتية التي تم إختبارها.

الكلمات المفتاحية: سمية، الذبابة المنزلية، السنط، العوير، النيم، المستخلصات النباتية.

1. Introduction

The order Diptera presents an array of insects which more than any other group poses the greatest challenge to human and veterinary health as vectors of diseases. One such insect, which shares a close ecological niche with man is the housefly, *Musca domestica* Linnaeus (Diptera: Muscidae). A part from disease transmission, *M. domestica* spoils man's food and usually constitutes a nuisance, particularly the adult stage. Houseflies, occur throughout the tropics and are also found in warm temperatures and some cooler areas. It is recognized as a serious public health pest to human beings and livestock by transmitting many infectious diseases. It acts as important mechanical carrier of pathogenic bacteria, such as *Shigella* sp, *Vibrio cholerae*, *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella* spp. Nevertheless, the common housefly has been extensively utilized as a test organism to screen candidate insecticides, chemosterilants and insect growth regulators by scientists in public or private research institutions [(1)].

The diseases that flies can transmit include enteric infections, eye infections, poliomyelitis and certain skin infections. Thus, houseflies are widely recognized as potential reservoirs and vectors of food borne pathogens [(2)]. Houseflies have been suspected to be reservoirs and vectors for pathogens. The harmful effects of the housefly on the human beings and some animals are indicated by the carrying of the diseases-causing agents and the difficulties of controlling the adults. Insecticide treatments include residual surface sprays, space or area sprays, wet sprays, baits, feed additives and pest strips [(3)].

The successful use of plant products in the control of certain insect species depends on contained substances that inhibit the developmental process of those insects. In larvicidal tests *in vitro* against the housefly, in which early-stage larvae were submerged for 1 min in acetone and essential oil extracts at concentrations of 100–300 ppm (0.01–0.03%), the most effective essential oil, peppermint (*Mentha piperita*), was found to have an LC_{50} of 104 ppm [(4)].

The neem tree (*Azadirachta indica*) belongs to the family; Meliaceae (Mahogany family). The neem or margosa tree also is called Indian lilac [(5)]. According to Meinwal *et al.* [(6)], neem leaves extract had produced pronounced morphological changes in the coffee bug, *Antestiopsis* sp. upon topical application. The effect of de-oiled neem kernel powder extract, mixed with wheat grains at 0.06, 0.125, 0.5, 1.0 and 2.0 %, on the development of *Trogoderma granarium* was studied [(7)].

Acacia nilotica (family: Leguminosae, subfamily: Mimosoideae) grows to 15-18 m in height and 2-3 m in diameter [(8)]. *A. nilotica* could be a potential source of antimicrobial agents [(9)]. *A. nilotica* demonstrates highest activity against three bacterial (*E. coli*, *Staph. aureus* and *Salmonella typhi*) and fungal (*Candida albicans* and *Aspergillus niger*) strain [(10)].

In Sudan, the Genus *Ipomoea* involving of three considerable species: alaweer (*I. helderbranditti*), Al tabar (*I. kordofana*), and Al bambai (*I. tuburosum*). *I. carnea* exhibited comparable effectiveness insecticidal action against Aphids and leafhopper [(11)] compared to the ordinary used insecticides. *I.*

helderbranditti plant and its constituents and their derivatives are used as an insecticide [12]. Kulat *et al.* [13], carried out field trial in India to test plant extracts for the control of Aphids on sunflower. The leaves extract of *I. carnea* were equally effective as the insecticides. [14] found that, the aqueous extract of *I. helderbranditti* leaves was lethal for *Anopheles arabiensis* and *Culex quinquefasciatus* larvae.

The aim of this study was to test the toxicity of sunt (*A. nilotica*), alaweer (*I. helderbranditti*) and neem (*A. indica*) leaves extracts (aqueous, ethanol and hexane extracts at four different concentrations) against housefly *M. domestica* larvae.

2. Materials and Methods

2.1. Samples of houseflies and plants:

The housefly larval stages (1st , 2nd, 3rd and 4th) were collected from EL Andalus, west of Wad Madani city, Gezira State. These larvae were kept in special containers in the Basic Science Laboratory, University of Gezira under room temperature (25±3°C). The collected larvae were taken from their source with some breading wastes. Larvae were fed on horse feces till they became adults in an ordinary cage. Two cages (one for control and the other for treatments) were prepared for rearing of house flies. Each cage was 35x35x35 cm and has one designed opening through which feed and larvae were passed. All housefly stages used for this study were collected from the resulted first generation which was emerged and reared in the Laboratory.

In this investigation, sunt (*A. nilotica*), alaweer (*I. helderbranditti*) and neem (*A. indica*) leaves were collected from the main campus of the University of Gezira, at early morning and the collected samples were immediately cleaned, dried in shade under room temperature away from the direct sunlight. After being dried, the plant samples were kept in plastic containers for the further tests.

2.2. Preparation of leaves extracts:

The dried leave samples were ground to fine powder by using an electrical blender. 50 g of each powder was soaked into 500 ml of distilled water, ethanol or hexane in 500 ml conical flasks for 24 hours. Each solution was filtrated by using a filter paper. The resulted extract of each product were evaporated to dryness under vacuum using a rotary evaporator with a water bath adjusted to 80°C. The dry extract (DE) residues were then weighed for estimating their yield percentages and kept until used.

2.3. Bioassay:

Following the instructions of WHO [15], the toxicity of neem (*A. indica*), sunt (*A. nilotica*), and alaweer (*I. helderbranditti*) leaves on housefly larvae were tested. DE's were mixed (at the concentrations of 2.5, 1.0, 0.5 and 0.25%) with larval feed (that composed of 17 g wheat bran, 2 g milk powder, 1 g sugar, 0.5 g yeast and 20 ml water). 50 larvae were placed in special containers, and fed on the prepared mixture (treated feed), while others were taken as control (fed on DE's-free feed) until pupation stage (non-feeding stage). The mortality was recorded after 1, 2, 3, 4, 5, 6 and 7 days,

both in treated or control groups.

2.4. Statistical analysis

The data were analyzed using Microsoft Office, Excel 2007. Simple descriptive statistics, regression analysis and ANOVA were used to describe the observed variation in mortality between the control and the treated samples.

3. Results and Discussions

3.1. Toxicity of neem leaves DE's on housefly larvae

The results of the toxicity of neem (*A. indica*) leaves extracts (aqueous, ethanol and hexane) mixed with the prepared feed (at the concentrations of 0.25, 0.5, 1.0 and 2.5%) against housefly larvae (first, second and third instars), for a selected test period (of 1, 2, 3, 4, 5, 6 and 7 days) were shown in Table (1).

Concerning the aqueous extract, in the control the mortality at the first day was 0%, and varied between 2% and 6% at the 2nd to 5th day. The mortality was just 6% at the end of the sixth day. In lower concentration (0.25%), mortalities increased to 56% at the 2nd day, 76% at the 3rd day and 80% at 4th, 5th, 6thand 7th days. At the concentration of 0.5%, the mortalities varied from 6% at the first day to 38% at the end of the test. The concentration of 1.0% resulted in 14% mortality at the first day to 48% at the last day of the study. In the higher concentration (2.5%), the mortality increased from 14% at the beginning of the test period to 20% at the end of the test period.

In comparison, highest larval mortality (80%) at the end of the test period was observed in the concentration of 0.25%. It was clear that, the increase in concentration from 0.25, 0.5, 1.0 and 2.5% resulted in a corresponding increase in percentage mortality from 6% to 14%, but after the first day the trend was greatly lost between concentrations and mortalities, and this may be due to relative reactions between the active ingredients and the component of the mixtures.

Concerning the ethanol extract, the mortality was 6% in the control. It was also clear that, no clear trend was detected with concentrations and mortalities (the lower concentrations did not always result in the lower mortalities). The ethanol dry extract (DE) that mixed with the feed, resulted in 84% to 100% mortality in housefly larvae after seven days.

Concerning the hexane extract, it was also clear that, relative trend was detected with concentrations and mortalities (specially at 3rd to the 7th days). The hexane dry extract (DE) resulted in 30% to 96% mortality in housefly larvae after seven days.

In a similar work, Kehail [(14)] found that, the aqueous extract of neem leaves was very potent to kill both *Anopheles* and *Culex* larval stage in their aquatic habitat. Hanai [(16)] reported that, the aqueous neem leaves extract has lethal effect on *M. domestica* larvae. Breama [(17)] reported that neem seed powder extract proved to be effective against adult and larval stages of housefly and also the study showed that the larvae were also capable of taking the active ingredients from the treated surfaces and die within 24 hours.

Table (1) Percentage mortality of housefly larvae fed on neem leaves aqueous, ethanol and hexane dry extracts (DEs)

Day	Control	Concentrations of aqueous DE on feed mixture				Regression Analysis			
		0.25	0.5	1.0	2.5	R^2	Equation	SE-X	SE-Y
1	0	6	6	14	14	0.62	Y = 6.16 + 3.61 X	1.99	2.75
2	2	56	26	34	14	0.62	Y = 47.19 - 13.82 X	7.65	10.52
3	2	76	34	40	14	0.65	Y = 63.6 - 20.7 X	10.65	14.65
4	6	80	38	42	14	0.70	Y = 67.52 - 22.6 X	10.54	14.50
5	6	80	38	48	14	0.70	Y = 69.15 - 22.7 X	10.49	14.42
6	6	80	38	48	20	0.63	Y = 67.6 - 19.90 X	10.66	14.66
7	6	80	38	48	20	0,63	Y = 67.6 - 19.90 X	10.66	14.66
		Concentrations of ethanol DE on feed mixture							
Day	**Control**	**0.25**	**0.5**	**1.0**	**2.5**	**R^2**	**Equation**	**SE-X**	**SE-Y**
1	0	34	10	4	0	0.53	Y = 23.68 – 11.0X	7.32	10.08
2	2	56	46	46	2	0.96	Y = 62.39 - 23.4X	3.50	4.82
3	2	86	82	98	48	0.67	Y = 97.02 - 17.4X	8.17	11.85
4	6	90	100	98	68	0.73	Y = 102.2 - 12.4X	5.39	7.39
5	6	90	100	98	76	0.63	Y = 100.15 - 8.2X	4.17	6.35
6	6	90	100	98	84	0.43	Y = 98.14 - 4.84X	3.90	5.36
7	6	96	100	98	84	0.18	Y= 101.34 - 6.44X	2.17	2.98
		Concentrations of hexane DE on feed mixture							
Day	**Control**	**0.25**	**0.5**	**1.0**	**2.5**	**R^2**	**Equation**	**SE-X**	**SE-Y**
1	0	6	2	6	46	0.91	Y = -5.83 + 19.2X	4.44	6.11
2	2	18	14	6	66	0.77	Y = 0.89 + 23.63X	9.12	12.54
3	2	22	58	82	92	0.66	Y = 36.78 + 25.1X	12.68	17.44
4	6	24	80	88	92	0.42	Y = 49.29 + 20.4X	16.94	23.29
5	6	24	80	88	92	0.42	Y = 49.29 + 20.4X	16.94	23.29
6	6	26	80	92	92	0.40	Y = 51.45 + 19.8X	17.10	23.52
7	6	30	80	92	96	0.47	Y = 52.57 + 20.6X	15.59	21.44

3.2. Effect of alaweer leaves DE's on housefly larvae

The results of the toxicity of alaweer (*I. helderbanditti*) leaves extracts (aqueous, ethanol and hexane) mixed with the prepared feed were shown in Table (2).

In the lower concentration (0.25%), mortalities increased to 14% at the first day and did not exceed 16% until the 7th days. At the concentration of 0.5%, the mortalities increased from 44% at the first day to 100% at the end of the test. The concentration of 1.0% resulted in 50% mortality at the first day which increased to reach 100% at the last day of the study. In the higher concentration (2.5%), the mortality was 100% from the beginning of the test period to the end of the test period.

Concerning the ethanol extract, it was also clear that, no clear trend was noticed with concentrations and mortalities (the lower concentrations did not always result in the lower mortalities). The ethanol

dry extracts (DE's) that were mixed with the feed, resulted in 8% to 44% at the first day up to 14% to 100% mortalities in housefly larvae after seven days.

Concerning the hexane extract, it was also clear that, no trend was noticed with concentrations and mortalities. The hexane dry extracts (DE's) that were mixed with the feed, resulted in 20 to 54% at the first day up to 54% to 98% mortalities in housefly larvae after seven days.

The aqueous *I. helderbanditti* leaves extract have lethal effect on *M. domestica* larvae [16]; and also on mosquito (*A. arabiensis* and *C. quinquefasciatus*) larvae [14].

Table (2) Percentage mortality of housefly larvae fed on alaweer leaves aqueous, ethanol and hexane dry extracts (DEs)

Day	Control	Concentrations of aqueous DE on feed mixture				Regression Analysis			
		0.25	0.5	1.0	2.5	R^2	Equation	SE-X	SE-Y
1	0	14	44	50	100	0.94	Y = 15.56 + 34.30X	6.17	8.48
2	2	16	64	68	100	0.65	Y = 30.44 + 29.70X	12.23	16.82
3	2	16	70	74	100	0.66	Y= 34.75 + 28.47X	14.39	19.79
4	6	16	82	88	100	0.48	Y = 43.91 + 25.97X	19.09	26.24
5	6	16	98	90	100	0.33	Y = 51.59 + 22.97X	23.09	31.74
6	6	16	100	96	100	0.30	Y = 54.11 + 22.48X	24.29	33.40
7	6	16	100	100	100	0.29	Y = 55.2 + 22.4X	24.85	34.17
		Concentrations of ethanol DE on feed mixture							
Day	Control	0.25	0.5	1.0	2.5	R^2	Equation	SE-X	SE-Y
1	0	24	8	44	10	0.06	Y = 25.18 - 4.06X	11.29	15.52
2	2	84	38	60	10	0.69	Y = 75.55 - 25.93X	12.39	17.04
3	2	84	54	60	14	0.88	Y = 18.68 - 26.99X	7.15	9.83
4	6	84	72	64	14	0.99	Y = 90.8 - 30.4X	2.11	2.90
5	6	88	100	78	14	0.94	Y = 109.23 - 36.2X	6.66	9.15
6	6	88	100	88	14	0.90	Y = 111.94 - 37.1X	8.68	11.93
7	6	88	100	90	14	0.89	Y = 112.49 - 37.2X	9.19	12.63
		Concentrations of hexane DE on feed mixture							
Day	Control	0.25	0.5	1.0	2.5	R^2	Equation	SE-X	SE-Y
1	0	30	20	54	22	0.02	Y = 34.07 - 2.42X	10.19	14.87
2	2	36	28	76	58	0.26	Y = 37.77 + 11.0X	13.11	18.03
3	2	46	34	78	68	0.36	Y = 43.18 + 11.94X	11.29	15.52
4	6	60	44	78	74	0.36	Y = 54.23+ 9.19X	8.64	11.89
5	6	70	52	78	90	0.63	Y = 59.12 + 12.59X	6.77	9.31
6	6	70	54	80	94	0.71	Y = 59.55 + 14.07X	6.37	8.76
7	6	70	54	82	98	0.74	Y = 59.09 + 15.92X	6.63	9.12

3.3. Effect of sunt leaves DE's on housefly larvae

The results of the toxicity of sunt (*A. nilotica*) leaves extracts (aqueous, ethanol and hexane) mixed with the prepared feed were shown in Table (3).

Concerning the aqueous extract, the lower concentration (0.25%) resulted in mortality of 34% at the first day, and the mortalities then increased till reached 90% at the 7th day. At the concentration of 0.5%, the mortalities increased from 10% at the first day to 100% at the 4th day. The concentration of 1.0% resulted in only 4% mortality (just two larvae) at the first day to 98% at the 7th day. In the higher concentration (2.5%), unpredicted, no mortality 0% at the beginning of the test period but it then increased till it reached 88% at the end of the test period.

Concerning the ethanol extract, it was also clear that, no trend was observed with concentrations and mortalities at the first and 2nd days. The ethanol dry extract mixed with the feed, resulted in 2% to 46% mortality in the first days and it reached 30% to 96% in housefly larvae after seven days. Concerning the hexane DE, it was also clear that, no trend was noticed with concentrations and mortalities. The hexane DE mixed with the feed, resulted in mortalities of 24% to 80% at the first day and it reached 64% to 100% in housefly larvae after seven days.

Zaitoun *et al*. [18], showed acute (212.1 ppm) and chronic (144.2 ppm) effects of *A. nilotica* acetone extract against *Culex pipienis*, which induced 93.33% larval mortality plus reduction of egg hatchability and suppression of adult emergence.

The mortalities of housefly larvae which fed on neem, alaweer and sunt leaves at four concentrations (0.25, 0.50, 1.0 and 2.5) of aqueous, ethanol and hexane dried extracts at the 7th day were presented in Table (4.4). It was noticed that, neem leaves ethanol extracts at its four concentration, at the 7th day killed 378 larvae of housefly (mean 94.5%), while sunt aqueous leaves extract killed 376 larvae among their four concentrations (mean 94%), followed by alaweer aqueous extract (mean 79%), hexane extracts of alaweer and sunt leaves (mean 76% for each), neem hexane and sunt ethanol (mean of 74.5), alaweer ethanol extract (mean 73%), and at last rank the neem aqueous extract (mean of 46.5%).

Table (3) Percentage mortality of housefly larvae fed on sunt leaves aqueous, ethanol and hexane dry extracts (DEs)

Day	Control	Concentrations of aqueous DE on feed mixture				Regression Analysis			
		0.25	0.5	1.0	2.5	R^2	Equation	SE-X	SE-Y
1	0	34	10	4	0	0.53	Y = 23.68 - 10.99X	7.33	10.08
2	2	56	46	46	2	0.96	Y = 62.39 - 23.42X	3.51	4.82
3	2	86	82	98	48	0.67	Y = 97.2 - 17.43X	8.17	11.85
4	6	90	100	98	68	0.73	Y = 102.16 - 12.39X	5.38	7.39
5	6	90	100	98	76	0.63	Y = 100.15 - 8.61X	4.62	6.32
6	6	90	100	98	84	0.43	Y = 98.36 - 4.84X	3.90	5.36
7	6	90	100	98	88	0.25	Y = 97.14 - 2.95X	3.56	4.90
		Concentrations of ethanol DE on feed mixture							
Day	Control	0.25	0.5	1.0	2.5	R^2	Equation	SE-X	SE-Y
1	0	6	2	6	46	0.91	Y = -5.83 + 19.61X	4.44	6.10
2	2	18	14	6	66	0.77	Y = 0.89 + 23.63X	9.12	12.53
3	2	22	58	82	92	0.66	Y = 36.78 + 25.15X	12.68	17.44
4	6	24	80	88	92	0.42	Y = 49.29 + 20.43X	16.94	23.29
5	6	24	80	88	92	0.42	Y = 49.29 + 20.43X	16.94	23.29
6	6	26	80	92	92	0.40	Y = 15.45 + 19.81X	17.10	23.52
7	6	30	80	92	96	0.47	Y = 52.57 + 20.63X	15.59	21.44
		Concentrations of hexane DE on feed mixture							
Day	Control	0.25	0.5	1.0	2.5	R^2	Equation	SE-X	SE-Y
1	0	30	24	26	80	0.87	Y = 13.67 + 24.78X	6.79	9.33
2	2	66	36	44	80	0.40	Y = 43.12 + 12.59X	10.99	15.11
3	2	68	56	60	82	0.62	Y = 56.95 + 8.98X	4.94	6.80
4	6	68	64	68	84	0.89	Y = 62.19 + 8.29X	2.09	2.88
5	6	68	64	68	92	0.90	Y = 60.18 + 12.06X	2.83	3.89
6	6	68	64	70	100	0.93	Y = 58.72 + 15.79X	3.11	4.27
7	6	72	64	70	100	0.86	Y = 60.85 + 14.73X	4.25	5.84

Table (4.4) Mortalities (%) of housefly larvae fed on neem, alaweer and sunt leaves (aqueous, ethanol or hexane) extracts (de) at the 7th day

Treat	Concentrations of DE on feed mixture					
	0.25	0.5	1.0	2.5	*Sum*	*Average*
neem aqueous E	80	38	48	20	**186**	**46.5**
neem ethanol E	96	100	98	84	**378**	**94.5**
neem hexane E	30	80	92	96	**298**	**74.5**
alaweer aqueous E	16	100	100	100	**316**	**79**
alaweer ethanol E	88	100	90	14	**292**	**73**
alaweer hexane E	70	54	82	98	**304**	**76**
sunt aqueous E	90	100	98	88	**376**	**94**
sunt ethanol E	30	80	92	96	**298**	**74.5**
sunt hexane E	72	64	70	100	**306**	**76.5**

ANOVA

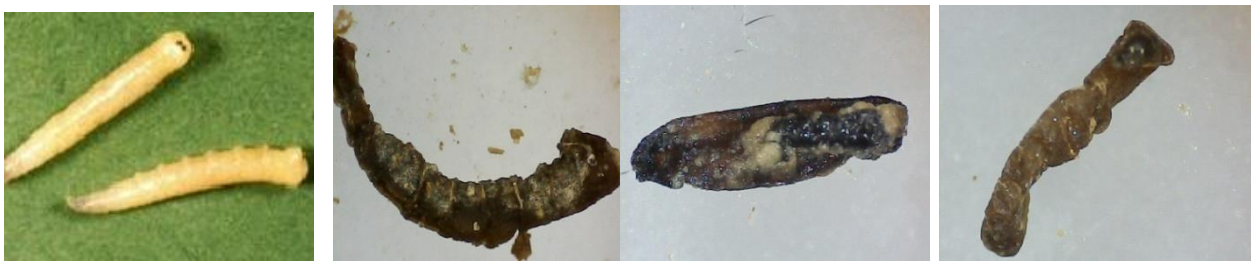
Source	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	6228	8	778.5	1.09	0.406	2.35
Columns	2336.33	3	778.78	1.09	0.374	3.01
Error	17206.67	24	716.94			
Total	25771	35				

Although there were clear mathematical differences (reflected by the obtained data), but Anova analysis revealed no significant difference between concentrations (f= 1.09; f-crit= 3.01) and also between different plant preparations (f= 1.09; f-crit= 2.35) on mortality of housefly larvae.

3.4. Morphological abnormalities

In the present study, the application of all concentrations of sunt *(A. nilotica),* alaweer *(I. helderbanditti) and* neem *(A. indica)* leaves extract against *M. domestica* induced different morphological abnormalities. Considerable number of larvae, pupae and adults showed obvious malformations after the treatment of larvae with plant crude extracts. Malformations include complete darkened larvae, curved larvae, irregular-shaped larvae, swelling larvae, larvae with patches of cuticle melanization, larval-pupal intermediate forms, compressed and shrinkage pupae, dry and darkened pupae, C-shaped pupa, C-shaped larvae, peanut shaped pupa, and small sized pupae. Many adults could not emerge completely and remained concealed in the puparia. Other adults with defective wings, and deformed abdomen were also observed (Plates1-3).

In similar study done by Hamid *et al*., [19], some damage effects (morphological changes) were monitored on the dead larvae of *Anopheles arabiensis* and *Culex quinquefasciatus* that subjected to the extracts of some plant parts, and it includes change in the larval color (to brighter color), disconnected heads and siphon lost.



A B C D

Plate 1: Normal and abnormal larvae of *M. domestica* treated by sunt *(A. nilotica),* alaweer *(I. helderbanditti) and* neem *(A. indica)* leave extracts

A: Normal larvae (control); B: larvae treated with neem hexane extract; C: larvae treated with sunt aqueous extract; D: larvae treated with alaweer ethanol extract.

B C D

Plate 2: Normal and abnormal pupa of *M .domestica* treated by sunt (*A. nilotica*), alaweer (*I. helderbanditti*) and neem (*A. indica*) leave extracts
A: Normal pupa (control); B: pupa treated with of neem hexane extract; C: pupa treated with sunt aqueous extract; D: pupa treated with alaweer hexane extract.

A B C D

Plate 3: Normal and abnormal adult of *M. domestica* treated by sunt *(A. nilotica),* alaweer *(I. helderbanditti) and* neem *(A. indica)* leave extracts
A: Normal adult (control); B: adult treated with neem aqueous extract; C: adult treated with sunt ethanol extract; D: adult treated with alaweer hexane extract.

4. Conclusions and Recommendations

The neem ethanol extract was more toxic (mean mortality was 94.5%) than the aqueous extract (mean mortality of was 46.5%), while alaweer and sunt leaves were similar in their toxicity against larvae**.** ANOVA showed no significant differences between concentrations or plant extracts against housefly larvae.

This study recommended to use these plant (neem, alaweer and sunt leaves) extracts in housefly control programs and the active ingredients of these plant products should be determined in future.

Acknowledgements:

We would like to extend the grateful thanks to *Allah*, for helping in this study. We also thank the staff of Basic Sciences Laboratory, University of Gezira, Sudan, for their technical assistance and laboratory facilities to carry out above research work.

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