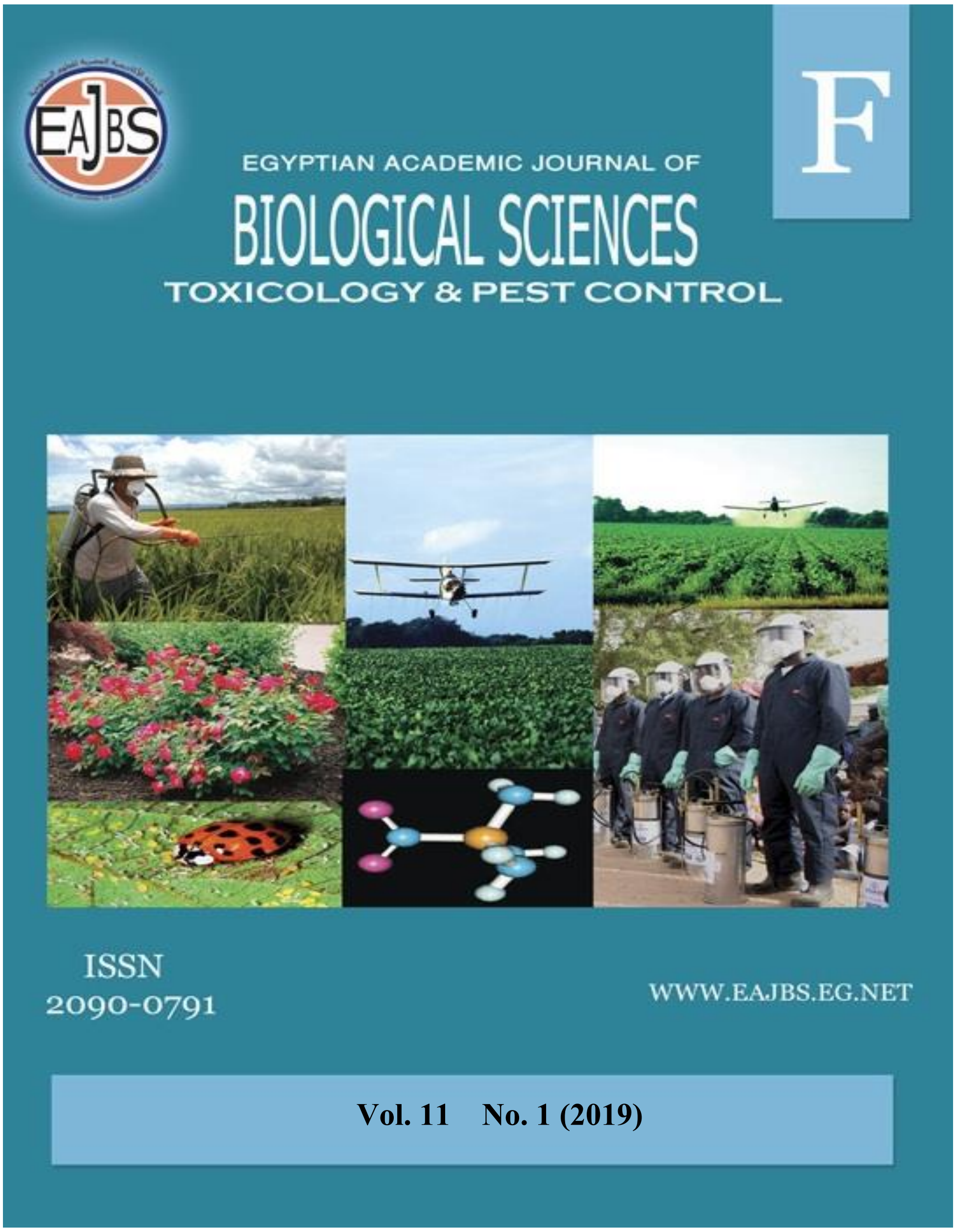

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Biological Activity of *Prunus Domestica* (Rosaceae) and *Rhamnus Cathartica* (Rhamnaceae) leaves extracts against the Mosquito Vector, *Culex Pipiens* L. (Diptera: Culicidae)

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ABSTRACT

The activity of methanol, chloroform and petroleum ether extracts of *Prunus domestica* and *Rhamnus cathartica* leaves against third-instar larvae of the filarial vector, *Culex pipiens* (Diptera: Culicidae) and resulted pupae were evaluated. In addition, the repellent activity of tested extracts against *C. pipiens* starved females was determined. Results showed that all tested extracts possess larvicidal activity against *C. pipiens* third larval instar; however, the petroleum ether extract from leaves of *P. domestica* and *R. cathartica* was more effective (LC_{50} 33.3 and 63.4ppm) than chloroform (LC_{50} 70.8 and 192.1ppm) and methanolic extracts (LC_{50} 132.7 and 273.5ppm), respectively. Also, both larval and pupal periods were prolonged by all tested extracts as compared with control groups. On the other hand, all tested extracts exhibited a variable degree of repellency against *C. pipiens* starved females depending on dose and solvent used in extraction. The highest repellency (97.3 and 90.2%) was recorded by petroleum ether extract of *P. domestica* at the highest doses (3.33 and 5.0mg/cm^2), while petroleum ether extract of *R. cathartica* recorded 89.8 and 80.0% repellency at the same doses, respectively. These results proved that methanol, chloroform and petroleum ether extracts of *P. domestica* and *R. cathartica* leaves act as *C. pipiens* control agents, even in the crude form, providing an opportunity to reach ,mosquito control agents from cheap, available plants which are safe to non-target organisms, as well as environment.

INTRODUCTION

Culex species are known to transmit human pathogens worldwide. *Culex pipiens* L. primarily considered the vector of lymphatic filariasis, *Wuchereria bancrofti* to more than 100 million people of which about 43 million are seriously disabled (Sayed *et al*, 2018). Also, The USA and Canada consider *C. pipiens* as an important vector of West Nile Virus. Overall, the burden caused by *C. pipiens* exceeds those of other diseases transmitted by different mosquito species (Goddard *et al*, 2002). Thus, control of *C. pipiens* is an important strategy for preventing the prevalence of diseases transmission and epidemic outbreaks (Elango *et al*, 2009).

For many decades, *C. pipiens* control was dependent in the application of chemical insecticides, but the continuous application of these compounds caused many problems to human and environment combined with the prevalence of insect resistance

(Ranson *et al,* 2001). Therefore, new materials of natural origin with a new mode of action are needed to avoid the hazards of chemical insecticides. Recently, plant extracts have been evaluated as potential controlling agents against different mosquito species (Abutaha *et al,* 2018). Toxicity of plant extracts against different mosquito species attributed to the presence of bioactive compounds such steroids, alkaloids, phenols, saponins, terpenoids and tannins that act as mosquito development inhibitors or repellents (Shaalan *et al,* 2005; Al-Mekhlafi *et al,* 2013; Castillo-Sánchez *et al,* 2010). Although several phytocompounds have been used as mosquito controlling agent, there is a wide scope for the detection of other active plant materials (Abutaha *et al,* 2018), especially in the flora of Egypt. Red plum, *Prunus domestica* and common buckthorn, *Rhamnus cathartica* belonging to Rosaceae and Rhamnaceae are common tropical plants cultivated in Egypt. *Prunus domestica* has been reported to possess antioxidant and antibacterial activities (Navarro *et al,* 2018; Alam and Barua, 2015), while the antibacterial activity of some compounds isolated from *R. cathartica* was approved by Hamed *et al,* (2015).

The present study evaluated the activity of red plum, *P. domestica* and common buckthorn, *R. cathartica* different extracts as larvicidal and repellent agents against lymphatic filariasis vector, *C. pipiens.*

MATERIALS AND METHODS

Testes Mosquitoes:

Larvae of *Culex pipiens* obtained from Medical Entomology Research Center, Egypt and reared for five generations in Mosquito Insectary, Animal House, Department of Zoology, Faculty of Science, Al-Azhar University under controlled conditions of temperature (25-27^{o}C), relative humidity (60-70%) and (12-12) light-dark regime. A standard rearing procedure of Michaelakis *et al,* (2014) applied to provide third larval instar needed for the bioassay.

Extraction of Plant Materials:

The red plum, *Prunus domestica* L. (Rosaceae) and common buckthorn, *Rhamnus cathartica* L. (Rhamnaceae) were collected Sadat City, Monofeiya Governorate (30º21´38.7" N, 30º29´58.3" E, altitude 42m), Egypt during April 2018. Away from sun rays, leaves of two plants dried at room temperature. The dried leaves (100 gm) were ground into powder using electrical stainless steel blender (Philips, HR2058). The extraction was performed using 300 ml of methanol, chloroform and petroleum ether separately using procedure described by Bream *et al,* (2018).

Larvicidal Activity:

Mosquito larvicidal assays were carried out using a procedure of Bream *et al,* (2018) with minor modifications. Different concentrations were performed in 250ml dechlorinated tap water contained in 500 ml beakers with 2 drops of $Tween_{80}$. Early third larval instar (25 larvae) were isolated from the colony and transferred to beakers contained concentrations of tested extracts. Two drops of $Tween_{80}$ were added to control larvae in 250ml dechlorinated tap water. Mortalities were determined daily until adult emergence. Abbott's formula (Abbott, 1925) used to correct percentage mortalities. The growth index calculated as growth index = a / b (a = percent of adult emergence and b = mean development in days). All experiments were conducted in triplicate, along with control.

Repellent Activity:

Three groups of one hundred *C. pipiens* starved females (3-4 days old) were kept in cages (30×30×30 cm). Females were starved of sucrose solution for 12h before the experiments to induce hunger. Five different doses of tested extracts were prepared in 2ml solvents with 2 drops of $Tween_{80}$ separately. The repellency test was carried out using a procedure described by Shehata, (2018). Three replicates were used along with control. Unfed females were counted and Abbott, (1925) formula was applied to calculate repellency percentages.

Statistical Analysis:

Mean larval mortality values were subjected to Probit analysis (Finney, 1971) for calculating LC_{50} and LC_{90}. ANOVA analysis was applied to find the differences between the activity of tested extracts using Tucky's HSD test at 5% probability level, where means with P>0.05 are not statistically significant. All the statistical analyses were carried out using Statistical Package Social Science (SPSS) software version 11.5 (SPSS, 2007). All values calculated as Mean±SD.

RESULTS

The obtained results recorded in tables (1-3) revealed that petroleum ether extract from leaves of *Prunus domestica* and *Rhamnus cathartica* recorded the highest larvicidal and pupicidal activities against *Culex pipiens* compared with chloroform and methanolic extracts. Complete larval mortality (100.0%) recorded at 200, 140 and 70ppm by methanol, chloroform and petroleum ether extracts of *P. domestica* (leaves), while three highest concentrations of petroleum ether extract of *P. domestica* (leaves) recorded complete pupal mortality (Table 1). Also, 100.0% larval mortality achieved by methanol, chloroform and petroleum ether extracts of *R. cathartica* (leaves) at 350, 250 and 100ppm, respectively; while methanol extract of *R. cathartica* (leaves) exhibited no pupicidal activity against *C. pipiens* pupae resulted from treated larvae (Table 2).

Table 1: Effect of *Prunus domestica* (leaves) tested extracts on *Culex pipiens* different stages.

Extract	Conc. (ppm)	Larval Mort. (%)	Pupal Mort. (%)	Adult Emergence (%)	Larval Period	Pupal Period	Developmental Period	Growth Index
Methanol	Control	0.0	0.0	100.0±0.0	6.1±0.2[a]	2.4±0.2[a]	8.5±0.3[a]	11.8±0.4[a]
	80	13.3±2.3	0.0	100.0±0.0	6.3±0.4[a]	2.5±0.2[a]	8.8±0.4[a]	11.4±0.5[a]
	100	22.7±2.3	10.2±8.5	89.8±8.5	6.5±0.1[a]	2.5±0.1[a]	9.0±0.1[a]	10.0±0.9[b]
	120	36.0±0.0	12.5±6.3	87.5±6.3	6.8±0.2[b]	2.6±0.1[a]	9.3±0.3[b]	9.4±0.6[c]
	140	56.0±4.0	15.3±5.6	84.7±5.6	7.0±0.1[c]	2.7±0.1[a]	9.6±0.1[c]	8.8±0.5[c]
	160	70.7±2.3	22.6±7.4	77.4±7.4	7.3±0.2[d]	2.9±0.1[c]	10.2±0.1[d]	7.6±0.8[d]
	180	90.7±4.6	100.0±0.0	0.0	—	—	—	—
	200	100.0±0.0	—	—	—	—	—	—
Chloroform	Control	0.0	0.0	100.0±0.0	6.0±0.3[a]	2.5±0.4[a]	8.5±0.7[a]	11.7±0.9[a]
	20	9.3±2.3	0.0	100.0±0.0	6.7±0.2[b]	2.8±0.2[a]	9.5±0.3[a]	10.5±0.3[a]
	40	24.0±4.0	0.0	100.0±0.0	7.0±0.1[c]	3.2±0.3[b]	10.2±0.4[c]	9.8±0.3[b]
	60	46.7±2.3	7.5±0.3	92.5±0.3	7.2±0.3[d]	3.7±0.2[d]	10.9±0.5[d]	8.5±0.4[d]
	80	57.3±2.3	15.8±5.8	84.2±5.8	7.4±0.3[d]	4.2±0.2[d]	11.7±0.4[d]	7.2±0.3[d]
	100	73.3±4.6	19.5±4.8	80.5±4.8	7.7±0.1[d]	4.7±0.2[d]	12.4±0.1[d]	6.5±0.4[d]
	120	86.7±4.6	41.7±14.4	58.3±14.4	7.8±0.2[d]	5.0±0.1[d]	12.8±0.3[d]	4.6±1.2[d]
	140	100.0±0.0	—	—	—	—	—	—
Pet. ether	Control	0.0	0.0	100.0±0.0	5.8±0.3[a]	2.4±0.2[a]	8.2±0.2[a]	12.2±0.3[d]
	10	18.7±2.3	11.5±3.0	88.5±3.0	6.8±0.2[c]	3.5±0.1[c]	10.2±0.2[d]	8.7±0.2[d]
	20	32.0±4.0	29.6±7.2	70.4±7.2	7.0±0.2[c]	3.7±0.2[d]	10.6±0.2[d]	6.7±0.7[d]
	30	46.7±2.3	57.5±3.9	42.5±3.9	7.3±0.3[d]	4.0±0.2[d]	11.4±0.5[d]	3.7±0.3[d]
	40	57.3±2.3	100.0±0.0	0.0	7.6±0.3[d]	—	—	—
	50	70.7±2.3	100.0±0.0	0.0	7.9±0.2[d]	—	—	—
	60	88.0±0.0	100.0±0.0	0.0	8.3±0.4[d]	—	—	—
	70	100.0±0.0	—	—	—	—	—	—

Pet. ether; Petroleum ether; All periods represented as Days±Standard Deviation; Means followed by the same letter are not significantly different (p>0.05).

Both larval and pupal periods were prolonged by all tested extracts as compared with control groups. Petroleum ether extract of *P. domestica* (leaves) significantly (P<0.001) prolonged *C. pipiens* larval periods to the longest periods (8.3 and 7.9 days) at 60 and 50ppm, compared with 5.8 days for the control group, respectively (Table 1). Meanwhile, petroleum ether extract of *R. cathartica* (leaves) recorded larval periods of 7.6 and 7.4 days at 90 and 80ppm, compared with 5.2 days for the control group, respectively (Table 2). The longest pupal period recorded by all tested extracts was 4.0

and 5.0 days for petroleum ether and chloroform extracts of *P. domestica* (leaves) at120 and 30ppm, compared with 2.5 and 2.4 days for the untreated groups, respectively (Table 1).

A marked reduction in the growth index values of *C. pipiens* larvae and pupae was induced by all tested extracts especially with *P. domestica* and *R. cathartica* petroleum ether extracts, which reduced the values from 12.2 and 13.3 in control groups to 3.7 and 5.2 at 30 and 90ppm, respectively (Tables 1&2).

Table 2: Effect of *Rhamnus cathartica* (leaves) tested extracts on *Culex pipiens* different stages.

Extract	Conc. (ppm)	Larval Mort. (%)	Pupal Mort. (%)	Adult Emergence (%)	Larval Period	Pupal Period	Developmental Period	Growth Index
Methanol	Control	0.0	0.0	100.0±0.0	5.7±0.4[a]	2.2±0.2[a]	7.9±0.5[a]	12.7±0.8[a]
	230	16.0±0.0	0.0	100.0±0.0	5.9±0.1[a]	2.5±0.1[a]	8.4±0.2[a]	12.0±0.2[a]
	250	30.7±2.3	0.0	100.0±0.0	5.9±0.1[a]	2.8±0.1[b]	8.7±0.2[b]	11.5±0.3[b]
	270	52.0±0.0	0.0	100.0±0.0	6.0±0.1[a]	3.0±0.1[d]	9.0±0.1[c]	11.1±0.1[c]
	290	62.7±4.6	0.0	100.0±0.0	6.2±0.2[a]	3.3±0.2[d]	9.6±0.3[d]	10.5±0.3[d]
	310	78.7±2.3	0.0	100.0±0.0	6.4±0.2[b]	3.6±0.1[d]	10.0±0.1[d]	10.0±0.1[d]
	330	93.3±2.3	0.0	100.0±0.0	6.6±0.1[c]	3.7±0.3[d]	10.4±0.3[d]	9.7±0.2[d]
	350	100.0±0.0	—	—	—	—	—	—
Chloroform	Control	0.0	0.0	100.0±0.0	5.8±0.3[a]	2.1±0.3[a]	8.0±0.5[a]	12.6±0.8[a]
	130	5.3±2.3	0.0	100.0±0.0	6.2±0.2[a]	2.5±0.2[a]	8.6±0.3[a]	11.6±0.3[a]
	150	12.0±4.0	0.0	100.0±0.0	6.5±0.3[b]	2.7±0.2[a]	9.1±0.2[b]	11.0±0.2[c]
	170	22.7±6.1	0.0	100.0±0.0	6.8±0.0[c]	3.0±0.3[b]	9.7±0.4[d]	10.3±0.2[d]
	190	49.3±2.3	7.9±0.3	92.1±0.3	7.0±0.2[d]	3.1±0.3[c]	10.1±0.2[d]	9.2±0.2[d]
	210	66.7±2.3	12.0±0.8	88.0±0.8	7.1±0.2[d]	3.4±0.2[d]	10.5±0.1[d]	8.4±0.2[d]
	230	81.3±2.3	21.7±2.9	78.3±2.9	7.2±0.2[d]	3.7±0.3[d]	10.8±0.5[d]	7.2±0.3[d]
	250	100.0±0.0	—	—	—	—	—	—
Pet. ether	Control	0.0	0.0	100.0±0.0	5.2±0.4[a]	2.4±0.3[a]	7.6±0.7[a]	13.3±1.2[a]
	40	16.0±4.0	0.0	100.0±0.0	6.5±0.3[c]	2.7±0.1[a]	9.2±0.4[c]	10.8±0.5[c]
	50	29.3±2.3	5.7±0.2	94.3±0.2	6.8±0.3[c]	3.0±0.2[a]	9.7±0.5[d]	9.7±0.5[d]
	60	49.3±2.3	7.9±0.3	92.1±0.3	6.9±0.4[d]	3.2±0.2[c]	10.2±0.4[d]	9.1±0.4[d]
	70	57.3±2.3	9.4±0.5	90.6±0.5	7.0±0.5[d]	3.4±0.2[c]	10.5±0.3[d]	8.7±0.3[d]
	80	74.7±2.3	15.9±1.4	84.1±1.4	7.4±0.2[d]	3.7±0.3[d]	11.1±0.2[d]	7.6±0.2[d]
	90	88.0±0.0	38.9±9.6	61.1±9.6	7.6±0.3[d]	4.1±0.2[d]	11.7±0.4[d]	5.2±0.9[d]
	100	100.0±0.0	—	—	—	—	—	—

See footnote of table (1).

Data in the table (3) showed that *P. domestica* extracts were more effective against *C. pipiens* larvae and pupae than those of *R. cathartica*. Also, petroleum ether extract of *P. domestica* and *R. cathartica* was more effective extract against *C. pipiens* third larval instar than those of chloroform and methanolic extracts with LC_{50} values equal to 33.3 and 63.4ppm, respectively. On the other hand, all tested extracts recorded a variable degree of repellency against *C. pipiens* starved females through the three hours post-treatment. Potent repellency (97.3 and 90.2%) was recorded by petroleum ether extract of *P. domestica* at the highest doses (3.33 and 5.0mg/cm^2), while petroleum ether extract of *R. cathartica* recorded 89.8 and 80% repellency at the same doses, respectively (Tables 4&5).

Table 3: Lethal concentrations (LC_{50} and LC_{90}) of *Prunus domestica* and *Rhamnus cathartica* (leaves) tested extracts against *Culex pipiens* larvae.

Plant Specie	Extract	LC_{50} (LC_{90}) ppm	Slope	95% Confidence Limits LC_{50} (LC_{90})		χ^2
				Lower	Upper	
P. domestica	Methanol	132.7 (184.7)	0.769	131.01 (182.4)	134.3 (187.1)	0.57 n.s
	Chloroform	70.8 (124.0)	0.757	65.5 (116.7)	76.0 (131.9)	0.25 n.s
	Petroleum ether	33.3 (62.8)	1.357	31.2 (62.6)	35.5 (63.0)	1.12 n.s
R. cathartica	Methanol	273.5 (328.9)	0.721	269.4 (324.5)	277.6 (333.4)	3.35 n.s
	Chloroform	192.1 (240.2)	0.833	185.1 (236.5)	199.1 (243.9)	1.11 n.s
	Petroleum ether	63.4 (91.8)	1.410	61.3 (91.2)	65.5 (92.5)	1.75 n.s

χ^2 Chi square value; n.s non-significant (P>0.05)

Table 4: Repellent activity of *Prunus domestica* (leaves) tested extracts against *Culex pipiens* females.

Extract	Dose (mg/cm²)	Unfed Females (%)	Average Repellency (%)	RD_{50} (mg/cm²)	(LCL-UCL)	RD_{90} (mg/cm²)	(LCL-UCL)
Methanol	Control	2.3±1.2	0.0	3.0	(2.5-3.5)	7.5	(7.3-7.6)
	0.42	24.7±4.2	22.8±5.0				
	0.83	34.7±2.1	33.1±2.1				
	1.67	43.3±4.9	42.0±4.7				
	3.33	51.7±2.1	50.5±2.1				
	5.0	69.0±2.6	68.2±2.9				
Chloroform	Control	2.7±1.2	0.0	2.0	(1.9-2.2)	6.1	(5.6-6.7)
	0.42	30.7±3.2	28.8±3.1				
	0.83	40.0±1.0	38.4±1.7				
	1.67	55.3±3.5	54.1±4.1				
	3.33	64.0±3.5	63.0±3.2				
	5.0	77.3±3.1	76.7±3.4				
Pet. ether	Control	1.3±0.6	0.0	0.4	(0.4-0.5)	3.7	(3.5-3.9)
	0.42	53.7±4.5	53.0±4.3				
	0.83	69.3±2.5	68.9±2.4				
	1.67	77.7±2.5	77.4±2.5				
	3.33	90.3±1.5	90.2±1.6				
	5.0	97.3±1.5	97.3±1.5				

See footnote of table (1).

Table 5: Repellent activity of *Rhamnus cathartica* (leaves) tested extracts against *Culex pipiens* females.

Extract	Dose (mg/cm²)	Unfed Females (%)	Average Repellency (%)	RD_{50} (mg/cm²)	(LCL-UCL)	RD_{90} (mg/cm²)	(LCL-UCL)
Methanol	Control	3.0±1.7	0.0	3.9	(2.8-5.1)	8.9	(6.4-11.4)
	0.42	18.3±1.5	15.8±0.5				
	0.83	30.0±3.0	27.9±2.1				
	1.67	37.7±2.5	35.7±1.8				
	3.33	45.7±3.8	44.0±3.0				
	5.0	59.3±5.5	58.2±5.1				
Chloroform	Control	2.0±1.7	0.0	2.6	(2.2-3.0)	6.5	(6.0-7.1)
	0.42	23.0±3.5	21.4±3.0				
	0.83	33.7±4.0	32.3±5.2				
	1.67	50.0±1.0	49.0±0.5				
	3.33	62.0±4.4	61.2±4.9				
	5.0	71.0±2.6	70.4±2.9				
Pet. ether	Control	1.7±1.2	0.0	0.6	(0.5-0.7)	4.6	(4.1-5.1)
	0.42	42.0±4.4	41.0±4.9				
	0.83	59.3±6.1	58.6±6.3				
	1.67	72.0±3.0	71.5±3.4				
	3.33	80.3±2.1	**80.0±2.0**				
	5.0	90.0±3.6	**89.8±3.7**				

See footnote of table (1).

DISCUSSION

Culex pipiens control is one of the most effective strategies in reduction/interruption of lymphatic filariasis transmission. The control of *C. pipiens* frequently dependent on the application of chemical insecticides, but the continuous applications of these insecticides result in a serious threat to human health, non-target organisms and environment (Tabanca *et al*, 2013 and Mathivanan *et al*, 2010). From this point of view, a large emphasis has been made on the usage of plant-derived materials as larvicides, which can provide alternatives to chemical insecticides with low-cost and risk-free properties (Junwei *et al*, 2006).

The findings of the present study revealed that the toxicity of *Prunus domestica* and *Rhamnus cathartica* tested extracts against *C. pipiens* larvae and pupae was varied according to plant species, the solvent used in extraction and the concentration of the extracts. Generally, *P. domestica* extracts were more effective against *C. pipiens* larvae than *R. cathartica* extracts; petroleum ether extraction of tested plants was more effective than those of chloroform and methanol.

Ghosh *et al,* (2012) attributed the toxicity of plant extracts against mosquito species to the presence of secondary metabolites (active toxic ingredients) that protect it from herbivores; these secondary metabolites potentially encountering toxic substances that affect a wide range of molecular targets including proteins, nucleic acids, biomembranes and different cellular components leading to disturbance in insect physiology by many different ways, especially the abnormality in nervous system (Chowdhury *et al,* 2007). Overall, the obtained results of larvicidal and pupicidal activities of tested extracts are in consistent with previously results recorded by Rahuman *et al,* (2009), where acetone, chloroform, methanol and petroleum ether extracts *Canna indica* (leaf) recorded LC_{50} and LC_{90} of 121.88, 118.25, 69.76, 56.31 and 624.35, 573.93, 304.27, 248.24ppm against *C. quinquefasciatus* fourth larval instar, Masotti *et al,* (2012), where ethanolic leaf extract from *Artemisia molinieri* recorded higher activity against *C. pipiens* larvae (from 50ppm) than those from *A. campestris* var *glutinosa* (from 500ppm), after 48 hours of exposure, El-Akhal *et al,* (2015), where ethanolic extract of *Nerium oleander* recorded LC_{50} and LC_{90} against applied against *Culex pipiens* larvae equal to 57.57 and 166.35mg/ml and Abutaha *et al,* (2018), where chloroform and ethyl acetate extracts of *Althaea ludwigii* were effective against *C. pipiens* fourth larval instar with LC_{50} of 42.6 and 85.4µg/mL after 72 hours of treatment. Also, the prolongation in larval and pupal periods as a result of tested extracts is similar to that observed by Sharma *et al,* (2006) using petroleum ether extract of *Artemisia annu* against *C. quinquefasciatus* larvae, Al-Mekhlafi *et al,* (2018) using chloroform extract of *Solenostemma argel* (fruit) against *C. pipiens* larvae and Bream *et al,* (2018) using ethanolic and petroleum ether extracts of *Musa acuminate* (leaves) against *C. pipiens* larvae.

On the other hand, tested extracts evoked a variable repellent activity against *C. pipiens* starved females depending on plant species and solvent used in extraction. However, the mode of action of botanical repellents against different mosquito species remains a controversial; botanical repellent may exert their effects through interactions with mosquito's specific odorant receptors and several gustatory receptors (Dickens and Bohbot, 2013). Results of repellent activity of tested extracts against *C. pipiens* confirm earlier results of several plant extracts which manifest repellent activity against different mosquito species as Kamaraj *at el.,* (2011) found that, methanol extract of *Nelumbo nucifera*, ethyl acetate and methanol extracts of *Piper nigrum* and methanol extract of *Trachyspermum ammi* provided the maximum repellent activity against *Anopheles stephensi* and *C. quinquefasciatus* females at 500ppm, respectively. Also, El-Sheikh *et al,* (2016) reported that petroleum ether extract of *Tribulus terrestris* exhibited 100.0% repellency against *Ae. aegypti* starved females at 1.5mg/cm^2 and Shehata, (2018) recorded that, hexane extract of *Deverra triradiata* evoked the highest repellent activity against *An. sergentii*, *C. pipiens* and *C. antennatus* starved females (RD_{50} = 0.704, 1.122 and 0.92mg/cm^2) compared with chloroform, methanol and ethyl acetate extracts.

Conclusion:

In conclusion, there is an urgent need to search for new natural insecticides in order to avoid hazards of synthetic ones on the human, environment and non-target organisms to reduce many health threats caused by insect-borne infectious diseases. *Prunus domestica* and *Rhamnus cathartica* extracts used in the present study represent new larvicidal and repellent agents against the mosquito vector, *Culex pipiens*. Also, more studies are needed to test the activity of *P. domestica* and *R. cathartica* against other different mosquito species.

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ARABIC SUMMARY

النشاط البيولوچى لمستخلصات أوراق نباتى *برونس دومستيكا* و *رامنس كاثارتيكا* ضد البعوضة الناقلة للأمراض، *كيولكس بيبنز* (ثنائية الأجنحة: كيوليسيدى)

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تم تقييم نشاط مستخلصات الميثانول، الكلوروفورم والإثير البترولى لأوراق نباتى البرقوق الأحمر، *برونس دومستيكا* والنبق، *رامنس كاثارتيكا* ضد الطور اليرقى الثالث للبعوضة الناقلة لداء الفيلاريا، *كيولكس بيبنز* والعذارى الناتجة منه. بالإضافة إلى ذلك، تمّت دراسة النشاط الطارد للمستخلصات المُختبرة ضد إناث البعوضة. النتائج بيّنت أن، جميع المُستخلصات المُختبرة لها نشاط ضد الطور اليرقى الثالث لبعوضة *كيولكس بيبنز* على الرغم من أن مستخلص الإثير البترولى لنباتى *برونس دومستيكا* و *رامنس كاثارتيكا* كان الأقوى تأثيراً (ت.ن.م 33.3 و 63.4 جزء فى المليون) من مستخلصات الكلوروفورم (ت.ن.م 70.8 و 192.1 جزء فى المليون) والميثانول (ت.ن.م 132.7 و 273.5 جزء فى المليون) تقريباً. أيضاً، هناك زيادة معنوية فى كلاً من مدة العمر اليرقى والعمر العذرى بواسطة جميع المُستخلصات المُختبرة مقارنةً بالمجموعة الضابطة.

على جانب اخر، جميع المُستخلصات المُختبرة أظهرت نشاطاً طارداً ضد إناث بعوضة *كيولكس بيبنز* إعتماداً على الجرعة المُستخدمة والمذيب المُستخدم فى الإستخلاص. أعلى نشاط طارد (97.3 و90.2%) تم تسجيله لمُستخلص الإثير البترولى لأوراق نبات *برونس دومستيكا* عند الجرعات العالية (3.33 و 5.0ملج/سم^2)، بينما مستخلص الإثير البترولى لأوراق نبات *رامنس كاثارتيكا* سجل 89.8 و 80.0% نشاط طارد عند نفس الجرعات تقريباً.

هذه النتائج أثبتت أن مستخلصات الميثانول، الكلوروفورم والإثير البترولى لأوراق نباتى *برونس دومستيكا* ورامنس *كاثارتيكا* بمثابة عوامل لمكافحة بعوضة *كيولكس بيبنز* حتى فى الشكل الخام مما يتيح فرصة للوصول إلى عوامل مكافحة للبعوض من النباتات الرخيصة المُتاحة والتى تكون آمنه ضد الكائنات الغير مستهدفة والبيئة.