Caspian Journal of Environmental Sciences
Online ISSN: 1735-3866
Print ISSN: 1735-3033

Toxic effects of various oil concentrations obtained from *Rosmarinus officinalis* on *Musca domestica* adults (Diptera: Muscidae) in different time periods

Khalid Mohammed Abbas[1], Athraa H. Jasim Al-Rahmanny[2]

1.Salah Al-Din Education Directorate, Salah Al-din Province, Iraq
2. Department of biology, College of Education, University of Samarra, Samarra, Iraq

** Corresponding author's E-mail: biology.insect@uosamarra.edu.iq*

ABSTRACT

This study evaluates the toxic impacts of *Rosmarinus officinalis* oil on the *M. domestisa* adults after 24- 48 h of treatment. The results showed that the activity of all oil concentrations have produced a mortality rate in laboratory when treating *M. domestica* adults. These results also revealed that the maximum significant difference was at the highest (100%) concentration among these treatments. The mortality rates in this insect were 86% and 100% after 24 and 48 h of the treatment respectively. The minimum mortality rates were 10% and 20% at the lowest concentration (25%) after 24 and 48 h of treatment respectively.

Keys word: *Rosmarinus officinalis* Oil, *Musca domestica* adults.
Article type: Research Article.

INTRODUCTION

Musca domestica is one of the house insects having a medical and veterinary importance in life of human being and animals. It took its well-known name after its living with human beings. The housefly almost was in all the clean and dirty buildings in our world. It shares with bugs the first enemy place for human being, because it is considered as a mechanical vector of over hundred pathogenic bacteria (Choo *et al.* 2011; Wales *et al.* 2010; Pruss & Mariotte 2000; Hammack & Olsen 2001). An average count of bacteria on one fly-body estimated about 1250,000, and the maximum count of these bacteria on the fly body is amounted at 6,660,000. The fly has transmitted the dangerous disease like typhoid fevers, Traohoma, Dysentery, Cholera, Tuberculosis and Leprosy, poliomyelitis, infections epidemic hepatitis A, B and C (Sukotason *et al.* 2004; Banjo *et al.* 2005; Cranshow & Pears 2009; Al-Haji Ismail *et al.* 2009; Khatter 2013). In Ogg (2007) reported that a great number of *M. domestica* living beside the poultry farms led to decrease in productivity of these poultry from meat and eggs. Due to the danger caused by this insect on public health, numerous routine measures bare used to kill by chemical insecticide. However, these materials have a potential toxicity and analysis slowly, meaning that they stay in environment for long time (Shaban *et al.* 1993). These chemical materials led to create resistance races of housefly and killing the useful microorganisms. Given the vast pollution caused by the traditional chemical pesticides and consequently having a negative direct effect on man and his environment, it is necessary to develop all types of biotical pesticides to kill all kinds of harmful insects and protect both man and environment from these dangerous organisms (Bettole 1976; Oliveira *et al.* 2002; Abd Al- Hussein 2019). After the bio- pesticides being in a great demand, the demand-bill declined and reduced on the chemical pesticides due to the damages happened in the environment. Bio-pesticides provide their analysis spontaneously without leaving negative effects or a toxic residues and they are active at using through targeting only the required insect (Muter 2017; Pterson *et al.* 2004).

Caspian Journal of Environmental Sciences, Vol. 20 No. 2 pp. 401-405 Received: July 23, 2021 Revised: Oct. 18, 2021 Accepted: Jan. 06, 2022
DOI: 10.22124/CJES.2022.5586

Publisher: University of Guilan, Iran

There are some studies about the effects of different plant extracts on some organisms in the world (Barrahi *et al.* 2020; Porusia & Septiyana 2021; Alwan 2022; Shareif *et al.* 2022).

The aims of this study included:
1-The toxic impact of various oil concentrations of *R. officinalis* on the adult of *M. domestica.*
2-Identifying the nature of damage made by the targeted insect.
3-*R. officinalis* oil took as biotical alternative to limit the damages occurred by *M. domestica* on the public health.

MATERIALS AND METHODS

Table 1. Materials and equipment used in this experiment.

series	Name of Material or Equipment	Count or quantity
1	Screw cap	24
2	Plastic Sprayer	4
3	Optical microscope and anatomy microscope	1-1
4	Glass slides	1 pocket
5	Adhesive pheromone traps	4

Sample collecting

The insect sample (*M. domestica* adults) were gathered from a group of 500 houses in Samarra City during the period 25/8/2019 to 24/3/2020. The gathering was carried out using insect's airlines (Abo Khushim 1992). We prepared dilution (25%, 50%, 75% and 100%) of *R. officinalis* oil and employed the concentrations using plastic sprayer range (250 mL) and then used in the treatments of the insect phase in lab.

Estimating the toxic efficiency for various concentrations of *R. officinalis* in oil on *M. domestica* adults

For evaluating the effect of *R. officinalis* oil, 25 samples were taken from *M. domestica* adults for each concentration (25%, 50%, 75% and 100%). One mL of each concentration was added and then the number and rate (%) of the killed adults in each concentration were calculated.

Table 2. The main chemical structure of *R. officinalis* oil (Isabel *et al.* 2014)

Compound	percentage
1.8- Conicol	47.77%
Camphor	12.53%
Pineneα	11.51%

Statistics analysis

Data analysis statistically by using ANOVA analysis, one-way variation through the application of Minitab. The mathematical averages of these treatments are compared by using multiple range test Duncan's at probability level of $p < 0.05$ (Al-Rawy & Khalifallah 1982).

RESULTS AND DISCUSSION

Table 3. Averages of activity for *R .officinalis* oil after 24 and 48 h of treatment in *M. domestica* adults.

Treatments	Average of all insects before treatment	After 24 h. of treatment	After 24 h. of treatment
Control (DW)	125	145	165
Oil without any additive	193	20	4

According to Table 3, *R. officinalis* exhibited higher efficiency in expelling and killing the *M. domestica* adults. The results revealed that the treatment by oil after 24 h killed all insects except 20 individuals, and after 48 h, only 4 were alive. In the control group, by increasing the infection spread, 145 insects remained after 24 h, and 165 after 48 h. These results are in agreement with study of Al-Zubaidi *et al.* (1998) and AL-Rahmanny (2019) who reported the activity of the *R. officinalis* oil in decreasing the infection acuity of *Bemisia tabaci* in cabbage after 24 and 48 h, in addition to its killing impact in both nymph and adult stages. As shown in Table 4, the mortality rate at 25% concentration of *R. officinalis* oil reached 10% after 24 h of treatment, while it was 20% after 48 h compared to the control which did not exhibit any mortality in *M. domestica* adults. At 50% concentration, mortality rate was 24% after 48 h. However, at 75%, the rate was 60% after 24 h, whereas it reached 70% after

48 h and at 100%, hundred percent mortality occurred after 48 h. We can conclude that the higher the oil concentration and the longer the period of exposure, the higher the mortality rate. It was also observed that the accumulative effects of the oil toxic materials on digestive system of housefly led to disturb and damage the enzymes responsible for removing the toxicity, called Mixed Function Oxidase (MFO; Wagner *et al.* 1986; Ian *et al.* 1986; Al-Alose 2008). It was also found that the time period of the adult exposure exhibited an impact on the housefly generation leading to cessation of completing its life cycle (AL- Mansour *et al.* 1998; Tabssum *et al.* 1998; Metspalu *et al.* 2001; Gad Allah 2012; Ibrahim 2018).

Table 4. Effects of various concentrations of *R. officinalis* oil on *Musca domestica* after 24 and 48 h of treatment.

Concentration	Mortality after 24 h	Mortality after 48 h	Average
25%	$10\%^{Aa}$	$20\%^{Ba}$	15^{Ca}
50%	$24\%^{Ab}$	$50\%^{Cb}$	37^{Bb}
75%	$60\%^{Ac}$	$70\%^{Dc}$	65^{Bc}
100%	$86\%^{Ad}$	$100\%^{Bd}$	93^{Cd}
Average	45^{Aa}	$60\%^{Bb}$	0.0

Note: The small similar letters in one column means there are no significant differences between them. The capital similar in one line means there are no significant differences between them after 24 and 48 h of treatment.

Our study revealed that a mechanical damage in its wings and breakings in veins occurred due to its exposure to the oil concentration leading to detached coat between wings and atmosphere and consequently, resulting in heaviness in wings and debarring the aviation. This is in agreement with the study of AL-Rahmanny (2019) who reported the activity of the *R. officinalis* oil in inhibiting the aviation process of *B. tabaci*. The results of our study are compatible with that of AL-Tikrity (2001). EL-Nahal *et al.* (1989) reported that the exposing period of effective material exhibits a great impact than the used dose which is in agreement with the study of Abod kaho (2015). Our study revealed that the most important effects of *R. officinalis* reflected in the analysis of body wall, fat coat of housefly which contains lipase enzyme and some acids to control the parasite and transmitting viruses' insects. This is compatible with Hamza's & Mahdi (2008) who worked on the effects of tobacco extracts on the first-stage larvae of the house fly. This study is also in line with AL-Rahmanny (2019) who reported that the concentrations for killing the *B. tabaci* which transmits many of various diseases in agricultural crops. Our study indicated that the taking *M. domestica* of various concentrations from *R. officinalis* oil led to disturb the balance of ions in housefly, resulted in some malfunction in digestive tract of this insect and its death. This is in agreement with the study of Chanlger (2005) who reported that the cactus leaves' extract and its jelly caused disturbing in ion balance in insect and then made some malfunction in its digestive tract and consequently its death, similar to our study. It is also observed in this study that gathering the toxic materials of *R. officinalis* oil in breath orifices of housefly led to blocking them and then stopping influx of enough quantities of oxygen to insect, causing to suffocate and death. The accumulation of toxic materials in *R officinalis* oil caused tremor and malfunction in body-movement. So, the dead insects exhibits stiff and dark structure, which verifies filling its body with toxic materials leading to total damage of nervous system, and death (Alwan 2017).

REFERENCES

Abdul Al Hussein, A 2019, Killing the cultural pests transmitted various diseases. International Conference Florida University, USA, Culture College, 1 p.

Abod kaho, ZMA 2015, Effect leaves remnants of tobacco plant, *Nicotiona tabacum* L on some biological aspects of performance dates moth *Ephestia cautella* (walker) (Lepidoptera: Pyralidae). MSc. Dissertation, College of Agriculture, University of Karbala, Karbala, Iraq.

Abu Khushim, NK 1992, Practical entomology. 2nd Edition, Al- Fatih ARAB, Lybia Republic House for Printing Books and Distribution, 2: 15.

Al Hajj, I, Yousif, I, Rakan, J & Abdialloh, I 2009, The number intension of the attracting fly kind to adhesive traps in the horses staple of horse – race club in Mosul waterfalls. *Iraqi Magazine for Veterinary Sciences*, 23: 15-20.

Al Rahmany, AH 2019, Effect of *Rosmarinus officinalis* on the female adults and nymphs of *Bemisia tabaci* (Alyrodidae). *Journal of Plant Archives*, 19: 2090-2093.

Al Tikirti, AAA 2001, The toxic effect of *Melia azedarach* and *Cyprus rontundus* on *Collosobrchus maculatus*. Tikrit University, College, pp. 21-69.

AL Asharok, ZM 1993, Hormonal control of insects using extracted natural plants. symposium on alternatives to chemical pesticides for pest control. Union of Scientific Research Councils and Research Center in Sudan.

Al Malah, SA 1993, Pesticides. Ministry of Higher Education and Scientific Research, Dar Al- Kutub for Printing and Publishing, University of Mosul, pp: 13-520.

AL Mansour, N, AL Zubaidi, S & AL Saadawi, I 1998, Effect of unicorn plant *Ibicella lutea* (Lindle) Van Eslet (Myrtaceae) on the biological performance of *Bemisia tabaci* (Homoptera: Alerodidae), *Journal of University of Babylon*, 3: 279-283.

Al Rawy, KM, Khallf Allah, A 1982, Designing and analysing the cultural experiment. *House of Books for Editing and Distributing, Mosul University*, Iraq, 488-489 p.

Alwan, SH 2017, The effect of different concentrations of the peel and gel of *Aloe Vera* plant leaves extract in the decimation of India meal moth adults *Plodia interpunctella*. *International Journal for Technology,* 12: 52-54.

Alwan, SH 2022, The toxic impact of the extract of the Dieffenbachia picta leaves on the ratio of death in the termites' workers *Microcerotermes diversus* (*silvestri*) [Isoptera: Termitidae]. *Caspian Journal of Environmental Sciences*, 20: 217- 220

Al Zubaidi, F, Al Rubeai, H & Al okaily, L 1998, Solvent extract off *Callistemon rugolosusming* affects growth, development and survival of house fly *Musca domestica* L. (Diptera: Muscidae) *Journal of University of Babylon*, 4:3.

Baldwin, IT, Schmelz, EA & Zhang, ZP 1996. Effects of octadecanoid metabolites and inhibitors on induced nicotine accumulation in economic insects. *Journal of Chemical Ecology*, 22: 1-61.

Banjo, AD, Lawal, OA, Adeduji 2005, Bacteria and fungi isolated from house fly (*Musca domestica* L) larvae. *African Journal of Biotechnology*, 4: 780.

Barrahi, M, Esmail, A, Elhartiti, H, Chahboun, N, Benali, A, Amiyare, R, Lakhrissi, B, Rhaiem, N, Zarrouk, A, Ouhssine, M 2020, Chemical composition and evaluation of antibacterial activity of fennel (*Foeniculum vulgare* Mill) seed essential oil against some pathogenic bacterial strains. *Caspian Journal of Environmental Sciences*, 18: 295-307.

Bettole, GBM 1976, Modern trends in the use of natural products for controlling pests and plant diseases. Pontifical Academy of Sciences, Italy, pp. 5-13.

Choo, LC, Saleh, AA & Fauziah, N 2011, Isolation of *Campylobacter* and *Salmonella* form houseflies (*Musca domestica*) in University Campus and a poultry farm in Selangor. *Malaysia Tropical Biomedicine,* 28: 16-20.

El Nahal, AKM, Schomidt, GH, Risha, EM 1889, Vapours of *Acorus calamus* L Aspire treatment for stored product insects. *Journal of Stored Products Research*, 25: 211-215.

Hamza, AK & Mahdi, MS 2008, Effect of aqueous and alcoholic extracts of wastes of tobacco plant *Tobaccum nicotiana* L. in some aspects of the life performance of the housefly, *Musca domestica* L. (Diptera: Muscidae). *Journal Al Qadisiyah for Pure Science*, 13: 21-26.

Ibrahim, AA 2018, Effect of using for kind of spices to control the adults of rice weevil insect *Sitophilus oryza* L. (Coleoptera: Curculionidae). Department of Crops Field, Academy of Technicia Kllar, University of Technicia of Sulamanyi, 5: 1.

Khatter, A 2013, Transmission of bacterial pathogen by the housefly *Musca domestica vicina* in University of King Abdulaziz. Biology Department, Faculty of Science for Girls, Jeddah, Saudi Arabia.

Metspalu, L, Hiiesaar, K, Joudu, J & Kuusik , A 2001, The effects of certain toxic plant extracts on the larva of Colorado potato beetle *Leptinotarsa decemlineata* (Say). Institute of Plant Protection, Estonian Agriculture University, pp. 93-100

Muter, HN, Mohammed, AS 2017, Use of crude plant extract of *Alhatola vasica* as insecticides against *Memisia tabaci*. *Iraqi Journal of Science*, 58: 442-446

Ogg, B 2007, Flies in the house. University of Nebraska, Lincoln, Academic Press, NE, 441 p.

Oliveira, AS, Pereira, RS, Lima, LM, Morsia, AH, Melo, FR & Franco, OF 2002, Activity toward bruchid pest of Akunitz-type inhibitor from seeds of the Algaroba tree, *Prosopis julifora* (Sw) DC. *Pesticide Biochemistry and Physiology*, 72: 122-132.

Olsen, AR & Hammack, TS 2000, Isolation of salmonella from the housefly *Musca domestica* L. and the dump fly *Hydrotaea aenescens* (Wiedemann) (Diptera: Muscidae) at caged layer houses. *Journal of Food Science*, 63: 958-960.

Pederson, MW, Brner, DK, Sorensen , EL *et al.* 1976, Effect of low and high saponin selection in alfalfa on ergonomic and pest resistance traits and the interrelationship of these traits. *Crop Science*, 15: 254-256.

Porusia, M, Septiyana, D 2021, Larvicidal activity of Melaleuca leucadendra leaves extract against Aedes aegypti. *Caspian Journal of Environmental Sciences*, 19: 277-285.

Pruss, A & Maritti, P 2000, Preventing trachoma through environmental sanitation: A review of the evidence base. *Bulletin (WHO)*, 78: 285-266.

Rattan, RS 2010, Mechanism of action of insecticidal Secondary metabolites of plant origin, *Crop Protection*, 29:913 – 920.

Shareif, ISM, Malik Al-saadi, SAA, Al-Kaaby, HK 2022, Allelopathic effect of *Nerium oleander* L. alcohol extract on growth and development of *Arabidopsis thaliana* (L.) Heynh. *Caspian Journal of Environmental Sciences*, 20: 155-163.

Sukontason, KL, Boochu, N, Plangiai, S 2004, Some ultrastructure and superficial changes in housefly (Diptera: Muscidae) and blowfly (Diptera: Calliphoridae) larval induced by eucalyptus oil. *Revista do Instituto de Medicina Tropical de São Paulo*, 46(5): 263-267.

Tabbassum, R, Narulain, SM, Nagvi, SNH & Azmi, MA 1998, Toxicity and IGR effect of two neem extraction on *Musca domestica* (PCSIR strain), *Turkish Journal of Zoology*, 125: 111-114.

Wagner, R, Feth, F & Wagner, KG 1986, The regulation of enzyme activities of the nicotine pathway in tobacco. *Physiologia Plantarum*, 68: 667-672.

Wales, AD, Carrique mas, JJ, Rankin, M, Bell, B, Thind, BB & Davies , Rh 2010, Review of the carriage of zoonotic bacteria by arthropods, with special reference to salmonella in mites, flies and litter,beetles. *Zoonoses and public health*, 57: 299-314 (Article First – published online) .

Bibliographic information of this paper for citing:

Abbas, K,M, Al-Rahmanny, A,H,J 2022, Toxic effects of various oil concentrations obtained from *Rosmarinus officinalis* on *Musca domestica* adults (Diptera: Muscidae) in different time periods. Caspian Journal of Environmental Sciences, 20: 401-405.