LARVICIDAL ACTIVITES OF SELECTED ESSENTIAL OILS AGAINST THE HOUSEFLY, MUSCA *DOMESTICA L*.

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Abstract

The *Musca domestica* I, II and III instar larvae was treated with different concentrations of essential oils *Curcuma aromatica* and *Cinnamomum zeylanicum. The* larval mortality was calculated after 24hrs,48hrs and 72hrs exposure periods.The LC50,LC90,95% confidence limit of and 95% confidence limit ,Lower confidence limit(LCL)and upper confidence limit (ULC),regression equation and chi-square values were calculated by probit analysis. The highest larvicidal activities was observed at 24hrs and lowest larvicidal activities was observed at 72hrs.The essential oils of *Curcuma aromatica* and *Cinnamomum zeylanicum* were found to be highly effective.

Key words; *Musca domestica, Curcuma aromatica* and *Cinnamomum zeylanicum*

Introduction

Musca domestica L,Diptera the common housefly is one of the most widespread fly species in the world.The synanthropic housefly Musca domestica is a mechanical vector of pathogens(bacteria,fungi,virus and parasites).some of which cause serious diseases in human and domestic animals(Graczyk et al.,2001 Tarelli *et al*., 2009; Hana, 2013. and Khamesipour,F et al.,2018).Increasing incidences of insecticides resistance in housefly population(Khan *et al*., 2013). ,rasing cost of insecticides and a growing public concern about actual (or)potential problems associated with insecticides ,interest in alternative housefly control strategies has increased (Meyer et al.,1987, Scott et al.,1989).Screening of plant extracts for deleterious effect on insects is one of the approaches in the search of novel biological insecticides (Ismam.,1995,Carlini et al.,2002 and Phasomkusolsil and Soonwera, 2012). Essential oils have a broad spectrum of bioactivity because of the presence of several ingredients that act through several modes (Liu et al.,2008). The essential oil also known as ethereal oils obtained by the steam distillation of plants. The essential oils are generally considered nontoxic to human beings(Bagvan et al.,2008). The essential oils of six plant species were screened for repellent,larvicidal and pupicidal activities against housefly *Musca domestica .Kumar et al.,2011.2012*). Moreover, plant essential oils considered for controlling house fly because of their selectivity, high toxicity for insect, target specificity, minimal environmental effects and safety to humans (Tarelli *et al*., 2009; Kumar

et al., 2013). In the present study to evaluate the larvicidal activities of plant essential oils of *Curcuma aromatica* and *Cinnamomum zeylanicum against Musca domestica L.*

Materials and Methods

Insecticidal activities of certain medicinal plant essential oils were tested against various developmental stages of common housefly Musca domestica L.These houseflies were reared in cylindrical box (90x140 mm) covered with muslin clothes and maintained at 28+2C,65% relative humidity in a growth chamber.Testing of the plant essential oils for larvicidal activity were carried out at different concentrations ranging from 100ppm to 1000ppm for *Cinnamomum zeylanicum against Musca domestica L.*The larval mortality in both treated and control were recorded after 24hrs,48hrs and 72hrs.The larvae without movement were considered dead(WHO1996).The percentage of mortality was calculated using Abbotts formula (Abbotts 1925).

$$\text{The percentage mortality} = \frac{\text{mortality treatment \%} - \text{mortality of control}}{100 - \text{mortality of control}} X\ 100$$

The statistical evaluation of LC50, LC90, regression equation and 95% confidence limit, Lower confidence limit(LCL)and upper confidence limit (ULC)were calculated from data, which was carried out by probit analysis (Finnery,1971).

RESULTS AND DISCUSSION

The LC_{50} value for *Curcuma aromatica* against *Musca domestica* I, II and III instar larvae range from 364.88 to 438.02ppm 339.43 to 505.53ppm and 359.51 to 551.88 ppm (Table 1,2,3) respectively. The highest larvicidal activity was observed at 24 hrs exposure period and the lowest larvicidal activity was observed at 72 hrs exposure period. The Lc_{50} value of essential oil *Cinnamomum leylanicum* against *Musca domestica* I, II & III instar larvae (Table 4,5,6) ranged from 358.60 to 480.40 ppm, 475.10 to 543.54ppm and 417.76 to 490.08ppm respectively. The highest larvicidal activity was observed at 24hrs exposure period and the lower larvicidal activity was observed at 72hrs exposure period. The two plant essential oils shown to possess significant activity against housefly in oils of *Curcuma aromatica* and *Cinnamomum zeylanicum* were found to be highly effective. This may be due to the effect of some active ingredients of D-camphor, sesquiterpenes, sequiterpene alcohols and a high amount of α-curcumene, β-curcumene, xanthorrhizol and presence of 2, 4 methylphenol of *Curcuma aromatic* and constituents of cinnamic aldehyde and coumarin of Cinnamomum *zeylanicum* present in the essential oils which exhibit potential to cause interference into the normal metabolism of the insects. *Curcuma aromatica showed* Lc50 of 505.53-339.43 ppm and 551.88-359.51ppm against II and III instar larvae respespectively,while *Cinnamomum zeylanicum* showed Lc50 for 543.54-475.10ppm and 490.08-417.76ppm against IIand III instar larvae respectively.Pavela (2008) screened 34 essential oils against the housefly and Pogostemon Cablin EO was found to be the most potent topical insecticide with Lc50 of 3µg/fly. Rashmi and Khandagle (2012) revealed that the highest larvicidal activity

i.e LC_{50}= 104 ppm was shown by *M. piperita* and *Z. officinalis* exhibited significant bio activities against *M. domestica* with larvicidal activity. Kumar et al., (2012) state that LC_{50} of *C. sinensis* essential oil against housefly larvae varied between 3.93 and 0.71 µi/cm^2 for different observation. On the LT50 values and LC50 values, the results revealed that *S. aromaticum* oil exhibited highest larvicidal effect against house fly larvae with LT50 values of 27.05 h. and LC50 values of 9.83%, followed by *C. nardus* oil and *C. odorata* oil with LT50 values of 38.99 and 52.08 h. and LC50 values of 13.60 and 29.36%, respectively (Soonwera, ,2015) The result also suggest that the significant activity of *Curcuma aromatic* and *Cinnamomum zeylanicum* against larvae of housefly, pave the way for its use as ecofriendly housefly control measures. The green products base on herbal essential oils is considered environmentally safe and offer safer human health alternatives to insect pest control with chemical insecticides.

Table.1

Larvicidal effect of essential oil *Curcuma aromatic* against I instar larvae of *Musca domestica*

Exposure Period (hrs.)	Concentration (ppm)	Larval Mortality (%)	LC_{50} (ppm)	LC_{90} (ppm)	Regression Equation	95% Confidence limit		Chi-square X^2
						LCL	UCL	
						LC_{50} (LC_{90})	LC_{50} (LC_{90})	
24	100 250 500 1000 Control	20 35 58 94 0	438.02	853.04	Y=0.090+8.25X	276.72 (625.87)	694.06 (1556.01)	15.03*
48	100 250 500 1000 Control	26 38 60 93 0	419.43	865.75	Y=0.086+11.61X	211.43 (600.53)	775.98 (2010.21)	20.48*
72	100 250 500 1000 Control	28 46 65 96 0	364.88	770.87	Y=0.088+14.61X	141.44 (516.83)	767.00 (2231.43)	24.05*

* Significant at P < 0.05

Table .2

Larvicidal effect of essential oil *Curcuma aromatic* against II instar larvae of *Musca domestica*

Exposure Period (hrs.)	Concentration (ppm)	Larval Mortality (%)	LC_{50} (ppm)	LC_{90} (ppm)	Regression Equation	95% Confidence limit		Chi-square X^2
						LCL	UCL	
						LC_{50} (LC_{90})	LC_{50} (LC_{90})	
24	100 250 500 1000 Control	20 36 45 89 0	505.53	1000.27	Y=0.082+4.56X	290.48 (701.06)	921.38 (2255.81)	19.60*
48	100 250 500 1000 Control	25 41 55 90 0	446.47	939.31	Y=0.082+11.93X	201.27 (635.51)	909.85 (2551.81)	23.06*
72	100	32	339.43	750.10	Y=0.034+10.88X	524.23	888.76	29.09*

	250 500 1000 Control	50 68 91 0				(481.35)	(3215.52)	

* Significant at P < 0.05

Table .3

Larvicidal effect of essential oil *Curcuma aromatic* against III instar larvae of *Musca domestica*

Exposure Period (hrs.)	Concentration (ppm)	Larval Mortality (%)	LC_{50} (ppm)	LC_{90} (ppm)	Regression Equation	95% Confidence limit		Chi-square X^2
						LCL	UCL	
						LC_{50} (LC_{90})	LC_{50} (LC_{90})	
24	100 250 500 1000 Control	13 26 40 92 0	551.88	995.42	Y=0.087+17.47X	404.45 (769.55)	782.26 (1549.11)	10.90*
48	100 250 500 1000 Control	20 40 60 92 0	432.91	872.88	Y=0.087+10.17X	233.36 (613.84)	769.21 (1902.22)	19.68*
72	100 250 500 1000 Control	25 50 68 95 0	359.51	765.35	Y=0.088+15.15X	103.79 (501.98)	836.65 (2642.90)	27.62*

* Significant at P < 0.05

Table. 4

Larvicidal effect of essential oil *Cinnamomum zeylanicum* against I instar larvae of *Musca domestica*

Exposure Period (hrs.)	Concentration (ppm)	Larval Mortality (%)	LC_{50} (ppm)	LC_{90} (ppm)	Regression Equation	95% Confidence limit		Chi-square X^2
						LCL	UCL	
						LC_{50} (LC_{90})	LC_{50} (LC_{90})	
24	100 250 500 1000 Control	20 35 50 91 0	480.40	944.10	Y=0.085+7.75X	292.69 (679.43)	802.45 (1865.41)	16.91*
48	100 250 500 1000 Control	23 45 52 94 0	427.08	876.95	Y=0.085+11.26X	180.15 (585.10)	940.37 (2685.29)	25.99*
72	100 250 500 1000 Control	28 46 65 97 0	358.60	749.01	Y=0.089+14.44X	147.98 (504.55)	745.09 (2129.93)	23.35*

* Significant at P < 0.05

Table .5

Larvicidal effect of essential oil *Cinnamomum zeylanicum* against II instar larvae of *Musca domestica*

Exposure Period (hrs.)	Concentration (ppm)	Larval Mortality (%)	LC_{50} (ppm)	LC_{90} (ppm)	Regression Equation	95% Confidence limit		Chi-square X^2
						LCL	UCL	
						LC_{50} (LC_{90})	LC_{50} (LC_{90})	
24	100 250 500 1000 Control	15 28 40 90 0	543.54	999.88	Y=0.085+2.99X	378.40 (751.52)	819.21 (1697.24)	13.29*
48	100 250 500 1000 Control	16 30 45 92 0	508.88	947.08	Y=0.085+4.18X	350.82 (712.23)	746.31 (1597.97)	13.16*
72	100 250 500 1000 Control	20 32 50 93 0	475.10	913.23	Y=0.088+6.61X	306.72 (670.64)	753.16 (1666.00)	15.07*

* Significant at P < 0.05

Table .6

Larvicidal effect of essential oil *Cinnamomum zeylanicum* against III instar larvae of *Musca domestica*

Exposure Period (hrs.)	Concentration (ppm)	Larval Mortality (%)	LC_{50} (ppm)	LC_{90} (ppm)	Regression Equation	95% Confidence limit		Chi-square X^2
						LCL	UCL	
						LC_{50} (LC_{90})	LC_{50} (LC_{90})	
24	100 250 500 1000 Control	23 36 48 89 0	490.08	992.08	Y=0.081+9.17X	267.93 (688.78)	917.29 (2335.40)	20.15*
48	100 250 500 1000 Control	26 40 53 91 0	447.16	935.09	Y=0.082+11.61X	205.25 (632.86)	912.76 (2539.37)	23.06*
72	100 250 500 1000 Control	28 42 56 93 0	417.76	884.74	Y=0.083+12.90X	169.42 (591.53)	892.69 (2599.17)	24.56*

* Significant at P < 0.05

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