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LETHAL TOXICITY STUDIES OF CHEMICAL AND BOTONICAL PESTICIDES AGAINST VECTOR *MUSCA DOMESTICA (*LINNAEUS, 1758) (DIPTERA: MUSCIDAE)

***V. Manjithkumar, K. P. Sanjayen, P. Martin, K. Elumalai and M. G. Ragunathan**

*Post Graduate and Research Department of Zoology, Government Arts College for Men(Autonomous), Nandanam, Chennai 600035, India.

Post Graduate and Research Department of Zoology, Gurunanak College, Velachery, Chennai 600042, India.

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***Corresponding Author**
V. Manjithkumar
Post Graduate and Research Department of Zoology, Government Arts College for Men(Autonomous), Nandanam, Chennai 600035, India.

ABSTRACTS

Toxicity studies were carried out against the vector *Musca domestica* by using chemical pesticides (Monocrotophos, Endosulphan and Diclorvos) and botanical pesticide (Neem oil). The maximum mortality was observed in Monocrotophos followed by Endosulphan, Neem oil and Diclorvos with respective LC_{50} values 0.56, 0.57, 0.89, 1.15 and 1.38 for 24 hour exposure period. The present study revealed that the Neem oil also showed toxic effect against *M. domestica*. Hence it may be used for the control of *M.domestica*.

KEYWORDS: *Musca domestica*, Botanical pesticide, Chemical pesticide.

INTRODUCTION

The housefly, *Musca domestica* L. is a well-known cosmopolitan pest. It has a worldwide distribution and is found throughout the country in close association with human activities. It receives the common name of housefly by virtue of being the most commonly found in and around houses (Moon 2002). It is an endophilic and eusynanthropic species, *ie.* it lives closely with humans and is able to complete its entire life cycle within residences of humans and their domestic animals. In addition to being a nuisance pest, it is a vector of many pathogens. It is a carrier of over 100 different pathogenic organisms including organisms for diseases, *viz.* typhoid, cholera, bacillary dysentery, tuberculosis, anthrax, ophthalmic neonatorum and infantile diarrhoea as well as parasitic worms (Fotedar *et.al.*, 1992; Iwasa

et.al., 1999; Sasaki *et.al.*, 2000; Sulaiman *et.al.*, 2000; Zurek *et.al.*, 2001 Fotedar 2001; Nayduch *et.al.*, 2002 and Clavel *et.al.*, 2002).

Housefly is a major domestic, medical, and veterinary pest that causes irritation, spoils food, and acts as a vector for many pathogenic organisms. Pathogenic organisms are picked-up by the flies from garbage, sewage and other sources of filth and transferred to human food either mechanically from contaminated external body parts or after consumption by houseflies through vomiting and defecation while feeding on food. The control of *M. domestica* is thus, vital to human health and comfort. The common control measures are sanitation, use of traps and insecticides. However, in some instances, integrated fly control has been implemented and found successful. The development of resistance in houseflies to insecticides and the associated toxicity has necessitated evaluation of safer alternatives for housefly control. The use of safer alternatives like biological control or insect growth regulators (IGR) is thus gaining attention as an important intervention in housefly management programmes (Axtell and Arends 1990, Hassan and Nedim (2004).

MATERIALS AND METHODS

Laboratory rearing and maintenance of stock culture.

Field collected insects were reared in the laboratory in plastic jars of 2 litre capacity. The lid of the jar was perforated to permit sufficient aeration. A slice of dead fresh fish obtained from the market was provided as the food source. No moist cotton wad was placed in the jar so that the natural environmental humidity could be provided in the container. The fish slice was replaced daily with new pieces. The eggs laid on the fish slice was incubated at room temperature and the maggots that emerged were allowed to feed on fresh food till they pupated. The adults that emerged from this stock culture was used for further experimental test.

Biological studies of *M. domestica*

Freshly emerged adults obtained from the stock culture were reared in plastic jars of 1litre capacity and fresh fish slice was provided as a source of food. A newly emerged male and female pair was introduced into this experimental cage and observations made daily on the number of eggs laid by the female until its death. In experimental jars where the males died before the death of the female, a newly emerged male was introduced. On the death of the female the experiment was terminated. Fresh fish food was provided daily. Data on several

biological parameters such as incubation period of egg, larval and pupal duration and fecundity of the females were recorded. There were 6 replicates for studying the biology.

Pesticides selected for the study

The following pesticides were selected for the study

The chemical and botanical pesticides such as Monocrotophos, Endosulfan**.** Dichlorvos**,** Dimethoate and Neem oil were purchased from commercial pesticides stores.

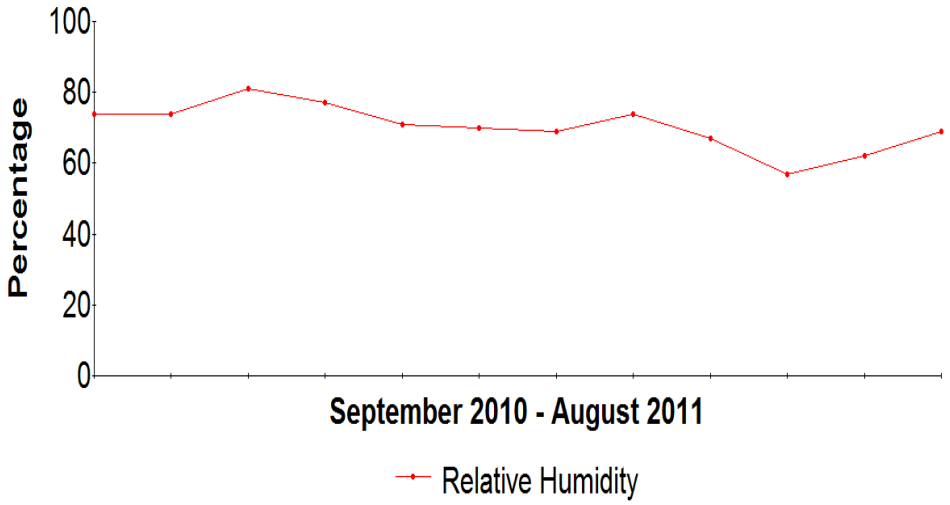


Figure 1: Fluctuations in the abiotic factors of the environment.

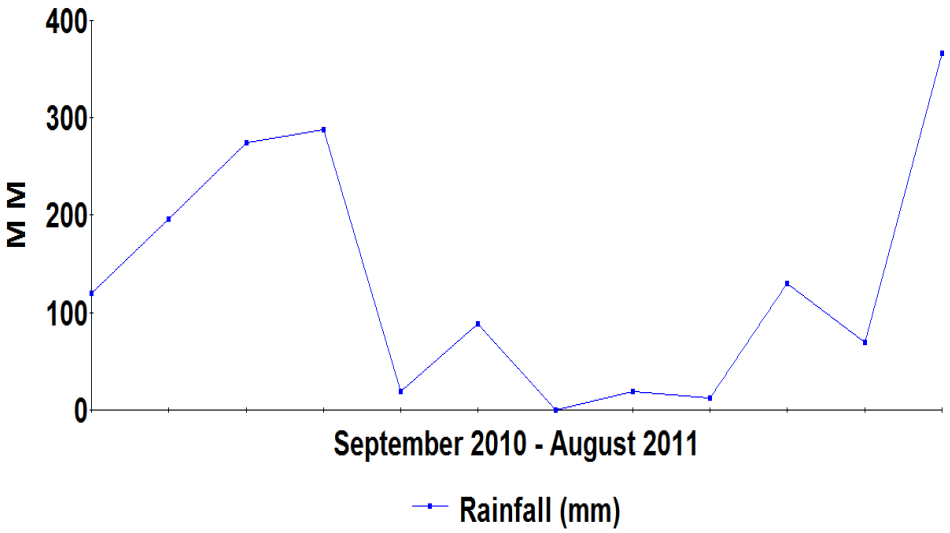


Figure 2

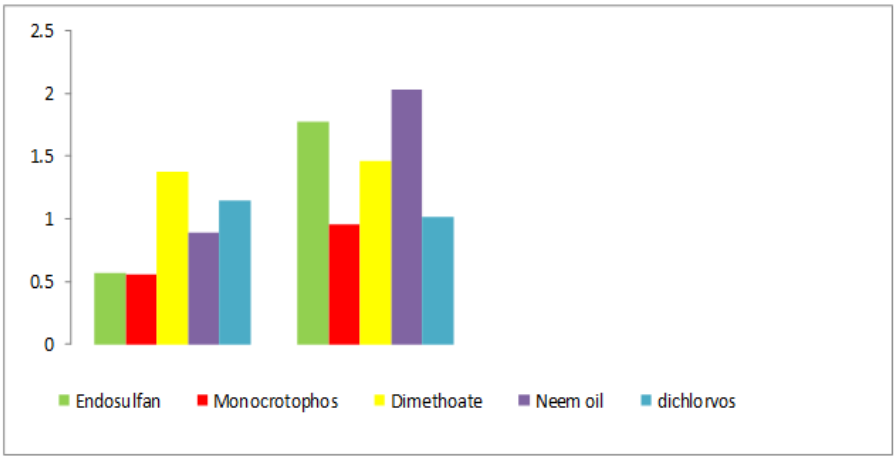
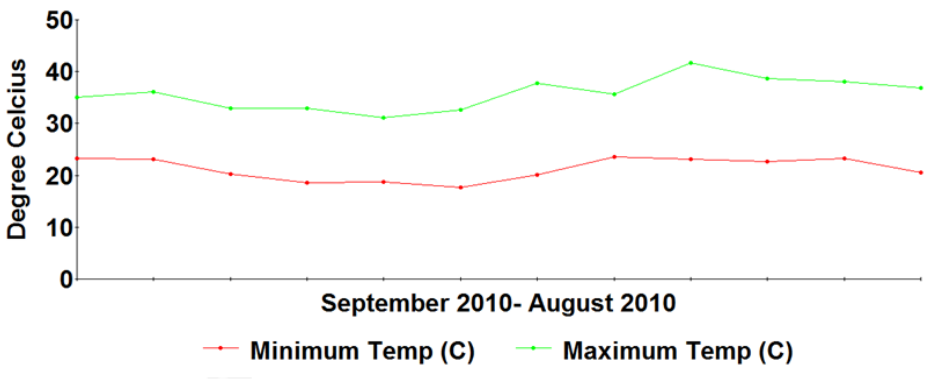


Figure-3

LC_{50} and LC_{50} values for each pesticide



RESULT AND DISCUSSION

General Biology of *Musca domestica*

The biology of *Musca domestica* under laboratory conditions of mean 35°C temperature and 70% RH was studied and the results are presented in Table 1. The larval phase lasts about 4 to 13 days with a mean of 8.83 days and the pupae complete their development inside the cocoons. The pupal phase typically lasts for 2 to 6 days with an average of 4.3 days. Adult houseflies emerge from their cocoon and typically lived for 15 to 25 days. Females were larger than male, and had an abdomen is longer than the males. Adult houseflies begin reproducing in 10 to 14 days. Mating tendencies was immediate upon moulting into the adult in the case of males, while females were receptive for mating only after 3-4 days. A single female laid on an average 500 eggs that hatched within 24 hours.

Table 1: General biology of *M. domestica* under laboratory conditions.

PARAMETERS	VALUE
No. of eggs laid per female	500 ± 24.23
Incubation period	1.2 ± 0.33 days
Larval duration	8.83 ± 2.67 days
Pupal duration	4.3 ± 1.8 days
Adult longevity	22.4 ± 8.6 days

Table 2: Correlation coefficient between housefly population and abiotic factors of the environment.

Parameters	*Max. Temp.*	*Min. Temp.*	*Rainfall*	*RH*
A	-75.5	-39.0	56.1	139
B	3.55	4.27	-0.0359	-1.25
R	0.814	0.694	-0.345	-0.61
P	0.001	0.012	0.272	-0.03

Toxicity of insecticides after a 2 hour exposure

Table 3: Mortality of housefly after exposure to different concentrations of insecticides.

Concentration	Monochrotophos	Dichlorvos	Dimethoate	Endosulfan	Neem oil
0.5 ml	62	44	40	52	49
0.75ml	87	84	83	74	65
1 ml	100	100	100	83	87
1.25ml	100	100	100	100	100

House flies, *Musca domestica* L., are major pests in and around dairy housing systems. Lowered levels of milk production, reduced feed conversion. and public health concerns have been attributed to house fly activity. Therefore, flies can have significant economic impact on dairy production if not controlled. Housefly is a major domestic, medical, and veterinary pest that causes irritation, spoils food, and acts as a vector for many pathogenic organisms. Pathogenic organisms are picked-up by the flies from garbage, sewage and other sources of filth and transferred to human food either mechanically from contaminated external body parts or after consumption by houseflies through vomiting and defecation while feeding on food. The control of *M. domestica* is thus, vital to human health and comfort. The common control measures are sanitation, use of traps and insecticides. House flies have developed resistance to virtually every insecticide used against them (Georghiou and Mellon 1983). Recently, there have been failures of the newly registered insecticide "permethrin" at dairies in New York; high resistance ratios to permethrin have been reported from dairies in California (Meyer et al. 1987), Canada (MacDonald et a1. 1983) and Europe (Keiding 1976; Sawicki *et al.* 1981). Clearly, success in managing house fly resistance problems would have

implications for livestock and poultry facilities worldwide. For the success of the control of houseflies, two aspects need to be addressed, namely first, the correct selection of insecticide and secondly the time of application.

With regard to assessing the time of application of control measures, the present study monitored the population of housefly in Chennai for the period from September 2010 to August 2011. It became evident through this study that although the houseflies were available in the habitat throughout the year, their population was the maximum during the summer months. Ironically, this time of the year coincided with the fruiting season and the availability of enormous quantities of waste thrown into the garbage. Also the sex ratio studied indicated the females to outnumber the males. With the high reproductive potential of the females and conducive environment, houseflies could increase in population during summer. The right time for adopting any control strategy could then be at this time of the year.

CONCLUSION

Although housefly resistance occurs to an alarming extent, we fortunately now have a larger variety of effective insecticides to choose from, as well as more time and knowledge than were available to deal with similar resistance situations in Europe and North America. Judging by previous experience elsewhere, we know a priori what to expect and how long it would take for a resistant strain to appear as a result of the continued use of several insecticides which are still effective. It is also known that alternation of two insecticides delays the development of resistance to either, even for insecticides of the same chemical group such as malathion and diazinon as long as the biochemical basis of resistance is different in the two cases. The use of insecticides should be integrated with other promising methods for housefly control, such as chemosterilization. Insecticides should be concentrated at strategic points, so that it is the fortunate individuals rather than the resistant ones that survive and reproduce, and so give a chance for dilution by susceptible houseflies. It is thus preferable to concentrate the use of insecticides on the loci of fly breeding existing in the vegetable, fruit and fish markets, slaughterhouses and dairy barns which are found on the outskirts of Indian cities.

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