RESEARCH ARTICLE

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Insecticidal Activity of Essential Oil of *Azadirachta indica* against *Musca Domestica* L.

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ABSTRACT

The housefly Musca domestica L. is a cosmopolitan insect prevalent in the warmer parts of the globe. It is a well known notorious pest and also transmits several disease causing agents. It vectors several pathogens causing human diseases throughout the tropical subtropical parts of the world.Chemical method even today is the most commonly used method to control housefly. This widely practiced method has significant disadvantages like development of insect resistance, mammalian toxicity and bioaccumulation. To avoid these disadvantages an alternative strategy must be developed and used.Presently, natural products, especially those derived from plant origin, has been progressivelyassessed in controlling pest/vectors of medical importance. In order to search for effective and user friendly control agents, the essential oil of Azadirachta indica was evaluated for the larvicidal, and oviposition attractant/deterrent activity against M. domestica. The larvicidal activity, i.e., LC_{50}= 102ppm was obtained under laboratory conditions while oviposition deterrence activity of 97.12 % was also exhibited by theoil at the concentration of 1%.

Key words: *Musca domestica, Azadirachta indica, larvicide, oviposition deterrent*

INTRODUCTION

House fly a very commonly occurring insect in the tropics and subtropical region is a pest of public importance and vector of several serious diseases affecting the regional socio-economic conditions. Flies feed and breed on decaying matter, human waste, andfood, and are therefore considered to be mechanical vectors of pathogenic groups such as bacteria, protozoa, and viruses. Disease causing agents are transmitted by house flies and thus are major threat to public health. Pathogenic bacteria, virus and few parasitic forms are amongst the agents to be vectored by flies. Some strains have become immune to most common insecticides (Forster, *et al*., 2009). Several chemicals such as organochlorines and organophosphates, and more recently pyrethroidsand spinosad, have been used against housefly. However, houseflies can develop resistance to these pesticides and health and environmental risks are associated with these compounds; thus, investigator continue to search for alternative methods of fly management. In this sense, essential oils and natural terpenes are potential alternatives and environmental friendly insecticides, Pohlit, *et. al.* 2006.

Chemical control strategy is widely used presently throughout the affected areas. They have adverse effects on environment and health, threat of persistence and biomagnifications and Secondary pest resurgence. Control measure against this insect in the short-term is the use of conventional insecticides (Malik, *et al*., 2007). House flies have an inherent capacity to develop behavioral and metabolic mechanisms to avoid and detoxify chemical insecticides. With the development of new chemicals to control flies within a short time span the flies showedresistance to organophosphate, carbamate, and pyrethroid insecticides (*Kozaki, et al.,* 2009; Memmi, 2010) as well as to growth regulators such as diflubenzuron and cyromazine (Bloomcamp, *et al.,* 1987). Spinosad, imidacloprid and nithiazine, were highly effective at the time of their introduction to the market however resistance to these products was documented within a short period

(within a couple of year) of their introduction (Kaufman, *et al.,* 2010). In view of the disadvantages of chemicals there is an urgent need to find out an ecofriendly alternative for fly control program. The present study deals with the evaluation of essential oils of *Azadirachta indica* (Commonly called Neem) against house fly. Parts of Neem plant are used in several traditional practices in India like leaves are kept in storages to avoid insectscausing nuisance to the grains and livestock. Mosquitoes are repelled by making smoke of the neem tree parts including leaves, while the flowers are of ritual importance. As an ayurvedic herb, neem is also used in baths. The deliberate use of such plant products may be an efficient alternative to the hazardous chemical control methods and thus can be helpful for the environment.

MATERIALS AND METHODS

The collected leaves were dried in shade at room temperature. The dried materialwas then powdered separately and subjected to steam distillation. The extracted essential oils were collected in vials and stored at 4 °C until further use.

Rearing of Housefly Colony:

The nucleus culture of *M. domestica* was obtained fromEntomology Section, National Chemical Laboratory, Pune. The colony was maintained at 28±2°C and 70-75% relativehumidity. Adults were reared in 30 cm ×30 cm ×30 cm metal frame cages. Aplywood floor was fixed at the base of each cage. A muslin sleeve was fitted on the side to serve as an access forthe rearing activities. A cotton swab soaked in 5 g of milkpowder; 2 g of yeast dissolved in 30 ml of water was offeredto these adults as food. The cotton swab served as substrate for oviposition.The eggs were transferred to a plastic jar, 25×15 cm, on fly rearing medium. The eggs wereallowed to develop in this medium only up to pupal stage.The pupae were collected and kept in another container foradult emergence. Fresh emergence was transferred to separate containers to know the exact age of the adults.

Larvicidal Bioassay:

Uniform residual film with desired concentration of the test plant oils in acetone was prepared on the petri dish (4"diameter on both lower and upper sides). Ten prepupal larvae were introduced in each filmed petri dish. In case of control only carrier solvent i.e. acetone was added. Food was provided and mortality was observed after 24 hours. For each experiment three replicates were used and each experiment was repeated five times.LC_{50} value was calculated using log probitanalysis (Finney 1971). Data obtained was subjected to statistical analysis.

Oviposition Attraction/Deterrence:

Five malesand five females (1-2 days old) were confined in a cage (size 18×24×24 in.). Cotton swab soaked with 1% test oil and milk was offered to these flies. For control, cotton swabsoaked with carrier solvent and milk was offered. After 24 h, egg count was taken. For this experiment, three replicateswere taken, and the experiment was repeated three times.Data obtained were subjected to statistical analysis. Thefollowing formula was used to calculate percentage of ovipositiondeterrence (Tare 1995).

Oviposition deterrence = {T – E/T} x 100

Where,

T= total number of eggs laid in both control and treated and

E= number of eggs laid in treated.

RESULT AND DISCUSSION

The overuse of the chemical methods to control fly populations have increased the risk of resistance development in flies. The chemicals moreover have been proven to enter the ecosystem at various levels and cause an imbalance in the same. Considering the several disadvantages of the indiscriminate use of chemicals in the environment the need for

alternatives to chemical control has become most important. Insecticides derived from biological origin, especially botanicals, have been increasingly evaluated in controlling the insect population of medical importance (Siriwattanarungsee, *et. al.* 2008). Plants and plant derivatives viz. essential oils are alternative agents for insect control as they are rich source of bioactive chemicals (Abdel Fattah, *et al.* 2009). Many studies have drawn attention of the toxic effects of plant extracts and dipterans (Dhar, *et al.* 1996). Plants are rich sources of alkaloids, flavanoids, terpenes, saponins and several bioactive compounds that can be used to develop environmentally safe vector and pest-managing agents. The botanical extracts from the plant leaves, roots, seeds, flowers, and bark in their crude form have been used as conventional insecticides for centuries (Bagavan, *et al.* 2009).

The result of the present work revealed that the essential oil of *Azadirachta indica* leaves has significant larvicidal and oviposition deterrent activities against *M. domestica*. The oil of *Azadirachta indica* was highly effective against *M. domestica* (LC_{50}=102ppm; Table 1). The LC_{90} values of *Azadirachta indica* was 156 ppm, while the same oil exhibited 97.12 % oviposition deterrent assay at 1 % concentration (Table 2)

Table 1: Larvicidal assay of plant essential oils against house fly

Essential oils	LC_{50}±SE (ppm)	95 % confidential limits		Regression equation	LC_{90} (ppm)
		LCL	UCL		
Azadirachta indica	102±0.64	72.12	162.18	Y=4.51X-6.06	156

*LC_{50} lethal concentration that kills 50 % of exposed larvae, LC_{90} lethal concentration that kills 90 % of exposed larvae, LCL lower confidence limit, UCL upper confidence limit, SE standard error, *P<0.05; at significant level.*

Table 2: Oviposition deterrence assay of plant essential oils against house fly

Essential Oils	Oviposition deterrence (%)
Azadirachta indica	97.12 (± 0.31)

The findings of the present study reveal that, the essential oil of *Azadirachta indica* exhibited multifarious activity against *M. domestica*, This oil upon further field trials and toxicological studies can be a good addition to the fly control program. They can also be a valuable component in the insect pest management practices.

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