In vitro Insecticidal Activity of Essential Oil of Eucalyptus globulus against Musca domestica*

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Abstract

Essential oil was extracted from the fresh leaves of Eucalyptus (Eucalyptus globulus) by hydrodistillation using Clevenger apparatus at 80° C for 3 - 4 hrs. Fifty gram of fresh leaves yielded maximum of 2 ml of oil. In vitro efficacy of the essential oil against larvae, pupae and adult flies at different concentrations viz., 50, 100, 150, and 200 µl was evaluated. The mortality of larvae, pupae and adult flies increased with the concentration of the oil increased. The LD⁵₀ values of oil against larvae and pupae were 48.2, and 15.69 µl respectively. In the control group, 10.16 ± 0.31and 10.16 ± 0.28 per cent mortality of larvae and pupae respectively were observed. The fumigant toxicity against adult flies showed that the highest concentration of 200 µl caused 100 per cent mortality in 6.5 ± 0.24 minutes against no mortality of flies up to 2 days in the control group. The dead larvae from treated group appeared shrunken and black in colour, while histopathological study revealed bleb formation and intestinal cell damage.

Key words: Essential oil, Eucalyptus globulus, Musca domestica

The house fly, Musca domestica L is a major pest species of man and animals in tropical countries like India. To control this challenging pest, various classes of insecticides and insect growth regulators are being used in the poultry farms. But, prolonged usage of chemical insecticides has led to emergence of resistant strain, environmental pollution and residues in products. Products obtained from certain medicinal plants have proved as alternatives to synthetic chemicals (Nithiyagowry, 2015).

Hence, insecticidal properties of essential oil of Eucalyptus (Eucalyptus globulus) belonging to the family Laminaceae was evaluated in this study.

Materials and Methods

Essential oil extracted from the fresh leaves of Eucalyptus by hydro -distillation as per method described by Radunz et al. (2002) was then submitted to the Indian Institute of Crop Processing Technology (IICPT), Thanjavur, Tamil Nadu, for chemical analysis. The oil was stored in glass vials at 4° C until use. The various developmental stages of house fly such as larvae, pupae and adult flies were harvested from house fly colonies maintained in the laboratory.

In vitro trials were conducted to evaluate larvicidal properties of essential oil of Eucalyptus. In essential oils, 50, 100, 150 and 200 microlitre were dispensed into four glass vials containing 1 ml of acetone each and mixed well. The oil dissolved in acetone was then transferred to specimen containers containing 24 ml of water in order to obtain 0.2, 0.4, 0.6 and 0.8 per cent concentrations. These diluted essential oils (25 ml) were then added to 4 plastic containers containing 25 g of larval medium for treatment group, while acetone mixed water was used to prepare control larval medium. One hundred number of third stage larvae were seeded into oil treated and control group container. Each trial was monitored for 4 days and larval mortality was recorded.

A total of six in vitro trials were conducted to evaluate efficacy against pupae of house flies. In these trials 100 numbers of 3 - 4 days old pupae were seeded into plastic containers containing treated and larval medium without
essential oil and thoroughly mixed. Each trial was monitored for 4 days and adult fly emergence was recorded.

Six trials were carried out to determine the adulticidal properties of essential oil against house flies by method as described by Wang et al. (2001) with some modifications. In these trials, the cotton balls soaked in 50, 100, 150 and 200 microlitre of essential oil in 1 ml of acetone solution, were placed into a glass jar containing 100 flies and monitored for fly mortality for half an hour.

The data collected in the in vitro trials were analyzed by probit analysis to determine the LD$_{50}$ values of oils against different stages of house flies (Fenny, 1971)

**Results and Discussion**

In the present study, essential oil of eucalyptus at different concentrations viz., 50, 100, 150 and 200 µl caused 55.16 ± 0.27, 65.50 ± 0.27, 81.83 ± 0.20, 92.30 ± 0.22 per cent mortality of larvae respectively with the LD$_{50}$ value of 48.27 against 10.16 ± 0.31 mortality in control group. Morey and Khandagle (2012) observed that percentage mortality of larvae was proportional with the increasing concentration of oil with LC$_{50}$ value of 104 ppm in in vitro trials conducted by direct dipping of larvae into the essential oils. The difference in the LD$_{50}$ value may be due to technique used.

Histopathological changes that include bleb formation and damages in the intestinal wall of larvae were observed in the present study. The intestinal damage in the larvae might have occurred as a result of detrimental effect of essential oils against digestive enzymes and subsequent destruction of midgut epithelium (Kumar et al., 2012). In this study, essential oil of eucalyptus produced 79.16 ± 0.26, 81.16 ± 0.26, 87.83 ± 0.28 and 98.0 ± 0.26 per cent mortality of house fly pupae at the concentrations of 50, 100, 150 and 200 µl respectively with the LD$_{50}$ value of 15.69 µl against 10.16 ± 0.28 per cent mortality in control group. The LD$_{50}$ values obtained in the present study, albeit the difference in the plant oil, were much lower than the LD$_{50}$ values of lemon grass oil (486 µl/L) against pupae in fumigation assay (Kumar et al., 2009).

In this study, the different concentration of oil viz., 50, 100, 150 and 200 µl resulted in 100 per cent mortality in adult flies in 21.16 ± 0.37, 14.10 ± 0.31, 09.30 ± 0.28 and 6.5 ± 0.24 minutes to cause 100 per cent mortality in adult flies as opposed to no mortality in control group up to 2 days. Further, the adult flies showed behavioural changes such as convulsion, hyperextension of legs and abdomen and lay on their back and died. Similar symptoms in house flies were recorded when treated with pure monoterpenes (Picollo et al., 2008). The occurrence of neurological symptoms is attributed to activation of receptor of octopamine, which is a neuromodulator and induce hyperextension of the legs and abdomen by increasing frequency of the legs. Further, the fumigant toxicity of the oil is also dependent on the volatility (Isman, 2000).

**Summary**

In vitro study on insecticidal efficacy of essential oil of Eucalyptus (Eucalyptus globulus) against house fly revealed that the efficacy was found to be proportional to the concentration of the oil. The histopathological changes observed in the dead larvae indicate that mortality of larvae might be due to intestinal damage.

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**References**


In the present study Beetal goats were supplemented with Antioxidants, viz. vitamin E- Se and vitamin C, given separately or in combination for two consecutive estrous cycles. Antioxidant supplementation resulted in an increase in the conception rate, and these effects were mediated by a rise in the early pregnancy plasma progesterone level.

Key word: Goat, Summer Stress, Antioxidant Status, Reproduction

Free radical oxidation is activated in animals under various types of stresses and lipid peroxidation products accumulate in various organs (Yarovan, 2008). In vitro studies by Adachi et al. (2009) highlight oxidative stress as a crucial factor affecting heat tolerance. Free radicals generated in steroidogenic cells and mononuclear phagocytes in the corpus luteum may influence progesterone synthesis and could cause reproductive problems. The role of oxidative stress in the control of female reproduction has not been elucidated in ruminants, thus it seems that pro and antioxidants can influence the reproductive axis at different levels (Celi, 2010). The present investigation was undertaken to evaluate the effect of antioxidants (vitamin C and E) supplementation on reproductive performance of summer stressed Beetal goats.

Materials and Methods

The study was conducted with twenty six apparently healthy Beetal goats (age 2-3 years in 2nd or 3rd parity) with normal reproductive history and sexual behavior. Before conducting the investigations, the summer heat stress status of the goats was confirmed by comparing their normal physiological parameters like, rectal temperature (38.8 ± 0.08 vs 39.9 ± 0.03°C), respiration rate (28.7 ± 1.30 vs 102.5 ± 0.57/min), heart rate (77.08 ± 0.94 vs 106.65 ± 1.04/min) and the levels of lipid peroxidation (127.84 ± 2.67 vs 265.66 ± 7.52 nmol MDA produced/ g Hb) during pre-summer and summer period.

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