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Original Research Paper

Effect of Ethanolic Extract of *Lantana camara* on II-Instar Stage of Development of *Anopheles, Aedes* and *Culex* Mosquito Larvae

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ABSTRACT

The II instar stage of *Anopheles, Aedes* and *Culex* mosquito larvae were treated with ethanolic extract of *Lantana camara* stem. The extract showed lethal effect on *Anopheles, Aedes* and *Culex* II-instar stage of mosquito larvae in different concentrations and mortality rate increased for every 24 hours continuously for 4 days. But it was remarkable to note that the mortality was maximum in 600 mg/100mL concentration of ethanolic extract of *Lantana camara* stem in 24 hours, which prompted to select the concentration.

INTRODUCTION

In many parts of the world, plant derived natural products have traditionally been used as repellents against insects, primarily to avoid nuisance biting (Curtis et al. 1991). Long before the advent of synthetic insecticides, plant and their derivatives were used to kill pests of agriculture, veterinary and public health. Insecticidal activity of plant derived compounds such as nicotine, rotenoids and pyrethroids have been evaluated and few of these compounds have been exploited commercially (Jacobson & Crosby 1971). The reports of laboratory tests and field trials of plant extracts and purified chemicals showed larvicidal activity against mosquitoes.

Lantana camara is one of the ten most noxious weeds in the world. It is toxic to animals and exerts allopathic action on neighbouring vegetation. The pathological and biochemical effects of the *Lantana* plant in cattle, sheep and guinea pigs have been determined (Sharma 1984). Activity of *Lantana camara* is also extended to find the repellent action against mosquitoes (Ghisalberti 2000). The need for the investigation of phytochemicals as repellents against mosquitoes has been stated by Novak (1985) in his review of non-chemical approaches to mosquito control. Sukumar et al. (1991) reviewed the use of botanical derivatives against mosquitoes. Recently, it was found that *Lantana camara* Linn. (Verbenaceae) flowers extract in coconut oil provides protection from *Aedes* mosquitoes (Dua et al. 1996).

MATERIALS AND METHODS

Collection of mosquito larvae: Mosquito larvae are aquatic and adapted to a wide range of habitats including swamps, marshes, free holes, septic ditches, rack pools, etc. All these breeding sites have a common characteristic of stagnant pools not subject to significant wind or wave action or water flow. Larvae are settled on the surface of water to get oxygen for respiration. The larvae were drained from the water surface, using a long handled tea-strainer causing least disturbance to the larval population in order to avoid their scattering. The II-instar stage of mosquitoes larvae of *Anopheles, Aedes* and *Culex* were categorized in the laboratory.

Collection of the plant material: The stems of *Lantana camara* plant were collected from Injambakkam area, 25 km away from Chennai.

Extraction procedure: Two kg of fresh stem of *Lantana camara* was collected and shade dried for 2.5 months and the dried powder (1 kg) was extracted with 85% ethanol by cold percolation method giving a yield of about 20% (20.45 g of ethanolic extract from 1 kg of dried plant material).

Bioassay test: Five groups of each containing 100mL of water with 50mg, 100mg, 200mg, 300mg, 400mg and 500mg of the extract were prepared. To each group, 10 number of *Anopheles* mosquito larvae were added and the bowls were covered with nets at room temperature (28° ± 2°C) in the laboratory. Same procedure was followed for *Aedes* and *Culex* mosquito larvae. Mortality of the mosquito larvae was recorded for 24 hr, 48 hr, 72 hr and 96 hr intervals. Control mosquito larvae were kept in similar conditions without any extract treatment.

RESULTS AND DISCUSSION

The II-instar stage of *Anopheles, Aedes* and *Culex* mosquito larvae was treated with different concentrations viz., 50mg, 100mg, 200mg, 300mg, 400mg and 500mg per 100mL of ethanolic extract of *Lantana camara* stem at different time intervals. The mortality rate increased with increase in concentration and exposure of time 24, 48, 72 and 96 hr (Figs. 1, 2 and 3). The results indicate that the mortality rate is proportional to concentration of the extract. But, it was remarkable to note that the mortality rate was maximum in 600mg/100mL concentration of the extract in 24 hr in all the three species of mosquito larvae. The larvae of II-instar stage of the three species were more susceptible to the extract.

Mosquito problem has become acute in recent years and the death of millions of people every year due to mosquito-borne diseases has resulted in the loss of socioeconomic wealth in many countries. Chemical control of mosquitoes is not favoured at present because of insecticide resistance among vectors and environmental imbalance. Therefore, alternative control methods are needed; plant sources possess a wide range of pharmaceutical and insecticidal properties. The insecticides of plant origin do not disturb the environment besides reducing the cost-factor. Biopesticides derived from the plants offer promising result in future mosquito control programme.

The repellent effect of *Lantana camara* flowers was evaluated against *Aedes* mosquitoes. *Lantana* flower extracts in coconut oil provided 94.5% protection from *Aedes alhopictus* and *Aedes aegypti*. The mean protection time was 1.9 h. One application of *Lantana* flower can provide more than 50% protection up to 1.9 h against the possible bites of *Aedes* mosquitoes. No adverse effects on the human volunteers were observed through three months after the application (Pandey et al. 1996).

The larvicidal effect of the volatile oils of *Lantana camera* leaves and flowers were tested against the maturation of *Musca domestic* larvae in the laboratory at concentrations of 0.0125%, 0.025%, 0.05%, 0.1% and 0.2%, which showed mortality rate ranging from 80%-100%. On the other hand, 10-20% of the developed pupae emerged to adults (Abdel-Hady et al. 2005).

Mortality of larvae *Culex quinquefasciatus* and *Aedes gambiae,* exposed to the plant extracts, increased with time of exposure and concentration of extracts. Mortality was also reported for larvae of *C. quinquefasciatus* and other mosquitoes exposed to the extracts of plants such as *Nerium indicum* and *Euphorbia royleana* (Jang et al. 2002, Singh et al. 2002, Srivastava et al. 2003, Choochote et al. 2004).

Chavan et al. (1979) showed that extract of *Azadirachta indica* and *Ocimum sanctum* were effec-

tive on larval stages of *Culex fatigans*. The laboratory tests done by Rajkumar & Jabanesan (2002) with different concentrations of *Solanum aerianthum* plant extract greatly influenced the egg laying capacity of *Culex quinquefasciatus*. The use of *Piper* extracts for both, antifeedant and oviposition deterrent activity, has been well documented for stored grain insects (Lale & Alaga 2001).

In the present study the mortality rate of the *Anopheles, Aedes* and *Culex* larvae of II-Instar stages was studied at different concentrations with ethanolic extract of *Lantana camara* stem. The ethanolic extract of *Lantana camara* stem showed lethal effect on *Anopheles, Aedes* and *Culex* mosquitoes larvae in the II-Instar stage in all concentrations, and mortality rate increased for every 24 hours continuously up to 96 hrs. But, it was remarkable to note that the mortality was maximum in 600 mg/100 mL concentration of ethanolic extract of *Lantana camara* stem in 24 hours, and the studies of Kothari & Chaudhary (2001) are in agreement with this study, wherein the leaf extract of *Lantana camara* was found to exhibit maximum allelopathic potentiality followed by stem and root extract and that has been interpreted to be the result of phytotoxic substances which are possibly synthesized in the leaf and translocated to other organs.

Mortality rate of the *Anopheles, Aedes* and *Culex* mosquito larvae, exposed to ethanolic extract of *Lantana camara,* is impressive. Hence, it may be inferred that ethanolic extract of *Lantana camara* stem at high concentration (600 mg/100 mL with 24 hr exposure time interval) proves to be larvicidal in activity with specific reference to II-instar stage of mosquitoes.

The use of certain plants for vector control has several appealing features. They are generally more easily biodegradable than synthetic insecticides; the plant products are less hazardous; they afford a rich storehouse of chemicals of diverse biological activities; and they are target specific. The repellent properties of plants to mosquitoes and other pest insects were well-known before the advent of synthetic chemicals (Curtis et al. 1989). Phytochemicals offer not only effective mosquito control agents but also bio-rational alternative to synthetic pesticides.

It may be concluded that nature possess numerous medicinal plants, which may be used to control vector-borne diseases. The scope on this subject is indeed currently necessary to overcome either environmental contamination or insecticidal resistance by using natural agents, instead of chemicals.

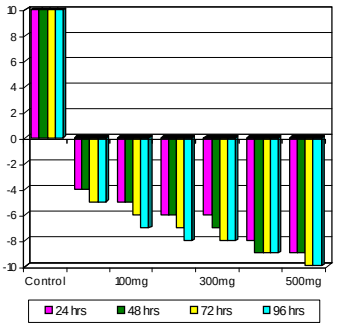

Fig. 1: Mortality rate of *Anopheles* larvae in different concentrations (mg/100mL) of *Lantana camara* stem ethanolic extract in different time interval (hrs).

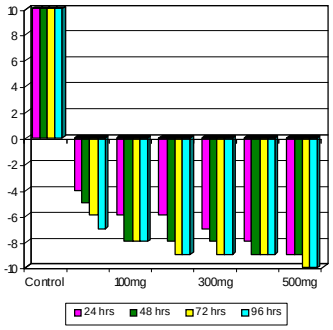

Fig. 2: Mortality rate of *Aedes* larvae in different concentrations (mg/100 mL) of *Lantana camara* stem ethanolic extract in different time interval (hrs).

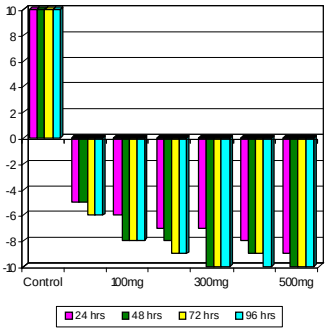

Fig. 3: Mortality rate of *Culex* larvae in different concentrations (mg/100 mL) of *Lantana camara* stem ethanolic extract in different time interval (hrs).

Millions of rupees are spent by Central and State governments, local bodies and World Bank to combat mosquitoes. Corporation of Chennai alone spends around 2 crores rupees per annum for mosquito eradication in Chennai city. Though chemical agents provide immediate relief, it is only temporary in nature. Only environmental friendly methods of controlling mosquitoes can provide total control. Lack of public awareness, poor economic conditions and inadequate budget provisions are the main limiting factors for effective environmental control. In this context, by organizing awareness programmes to public, and making their conscience better, we can control mosquitoes and vector-borne diseases.

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