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MODE OF ACTION OF *LANTANA CAMARA* EXTRACTS ON ENZYMES ASPARTATE AMINO TRANSFERASE AND ALANINE AMINO TRANSFERASE ACTIVITY IN TARGET AND NON-TARGET ORGANISMS

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ABSTRACT
The plant *Lantana camara* on the basis of study conducted found to show effective larvicidal activity. The present study deals with the mode of action of *Lantana camara* extract on enzymes, Aspartate Amino Transferase and Alanine Amino Transferase activity in target and non-target organisms. The major transaminase system of the body such as AsAT and AlAT were significantly inhibited by the plant extract. A significant decrease in the activity of above two enzyme systems were observed from the fourth h of incubation onwards. The transaminase system of mosquito larvae was more sensitive to *Lantana camara* extract than that of vertebrate system such as *Anabas testudineus* and *Rana hexadactyla* which are the non-target organisms seen in the aquatic habitat. The major transaminase systems of the body such as AsAT and AlAT were inhibited in a dose dependent manner under both invitro and invivo conditions. The change of pH from alkaline (normal larvae) to acidic (intoxicated larvae), may also be sufficient for inhibiting or blocking most of the enzymatic reactions leading to the death of the organisms. The results of this experiment indicated that the shrub *Lantana camara* could be studied further in detail and its benificial effects to the control of vector bron diseases could be utilised for healthy environments.

INTRODUCTION

In India, the most important communicable diseases spread by the mosquitoes are Malaria, Filaria, Dengue fever etc. *Aedes aegypti*, the carrier of dengue infection is known to exert for over a century causing significant morbidity and mortality in many parts of the world including India. The use of insecticides and chemicals on large scale disturbs the regional agro-ecosystem and the natural balance. The crisis resulted in the need for the development of an environmentally safe indigenous method for mosquito control. One approach among the many approaches developed to prevent mosquito born diseases is by killing mosquito at the larval stage. The present study provides a basis for the evaluation of *Lantana camara* extract as a useful source of renewable material for biological control. On the contrary, the biological control is safe, permanent and economical in long term.

The shrub *Lantana camara* was introduced to India from America in the 19th century and has been found the Indian soil very hospitable to the plant and large areas of tropical evergreen and deciduous forests are now covered with it. This exotic plant has a wild strain with orange flowers and other garden varieties such as white, yellow and pink flowers. *Lantana camara* commonly called the sleeper weed is such an herb used traditionally to treat various ailments like tetanus, rheumatism, malaria, asthma, cough, fevers, cold etc (Singh *et al*., 2004). Many of the traditional uses have been scientifically proved as reported by Jyothi *et al*. (2012). It has been regarded as one of the ten most

Noxious weeds in the world (Deepak *et al.,* 2009). *Lantana camara* is poisonous to stocks and humans. Ingestion of leaves from *Lantana camara* by grazing animals produces photodermatitis, jaundice, liver damage and death as reported by Fernando (2005).

Among the different varieties of *Lantana camara*, crushed leaves extract of wild variety with orange flowers (Fig. 1) on extraction with methanolic extract showed maximum larvicidal activity. Antifeedant,antifungal and anti-bacterial activities of *Lantana* leaves were previously reported (Rajesh *et al*., 2006)The present study deals with the mode of action of *Lantana camara* extract on the enzyme system-Aspartate Amino Transferase and Alanine Amino Transferase in target and non-target organisms. The study revealed that the plant *Lantana camara* can be suggested as a safe antilarval agent against mosquito larvae which are seen in various aquatic ecosystems containing various plants. In the present study the leaf extracts of *Lantana camara* obtained using methanol extract was thus found to have effective larvicidal activity proposing the utility of the leaves of *Lantana camara* as ideal mosquito control agents.

MATERIALS AND METHODS

Fresh plant material were weighed, crushed and put in 100mL pond water. After 12h, plant materials were separated using a sieve and fourth instar larvae of *Aedes aegypti* were released

in the aqueous extract of plant. The methanolic extract of *Lantana camara* showed significant toxicity and so, that extract was selected for mode of action study. In the laboratory condition, 80mg/ 100 millilitres was found to be very effective in creating 100% mortality of *Aedes aegypti* larvae within a period of six h. Fourth instar of larvae of *Aedes agypti* was put it in the lethal concentration of extract and kept for different periods such as 2, 4 and 6h and were separated from the drug containing

Medium washed in ice cold water and homogenized in ice cold condition in appropriate buffer system and that homogenate was used for estimating Aspartate amino transfearase and Alanine amino transferase activity. Appropriate controls were also maintained.

For making the comparative study the effect of plant extract on non-target organisms, the liver of *Anabus testudineus* and *Rana hexadactyla* were used.

RESULTS AND DISCUSSION

The major transaminase system of the body such as AsAT and AlAT were significantly inhibited by the plant extract. From the fourth h of incubation onwards, a significant decrease in the activity of above two enzyme systems were observed (Table 1). Under in vitro condition also the transaminases AsAT and AlAT were inhibited in a dose dependent manner (Table 1 and 2).

The comparative study on the effect of extract on non- target organisms indicated that at drug concentrations of 10 and 25 microorganisms, the AsAT of frog and fish did not showed any significant inhibition, but the insect system showed significant inhibition at the same concentration, the larvae showed visible symptoms of toxicity such as lack of co-ordination of movements, incapability of surfacing to take oxygen and poor response to stimuli such as touching with glass rods. This indicated more sensitivity of insect AsAT to

Table 1: *In vitro* action of *Lantana camara* extract on AsATof target and non-target organisms

Organism studies	Normal control	Different concentrations of plant extracts in micrograms working medium of 0.5 mL			
		10	25	50	100
Aedes aegypti	210 ± 1.8	208 ± 15	186 ± 12	169 ± 14	102 ± 8
Anabas testudineus	38 ± 3	36 ± 3	34 ± 3	28 ± 2	22 ± 2
Rana hexadactyla	27 ± 2.5	28 ± 2	24 ± 2	20 ± 1.5	18 ± 1.5

Table 2: In vitro action of *Lantana camara* extract on AlATof target and non-target organisms

Organism studies	Normal control	Different concentrations of plant extracts in micrograms working medium of 0.5 mL			
		10	25	50	100
Aedes aegypti	48 ± 301	42 ± 3	40 ± 3	28 ± 2	17 ± 1.2
Anabas testudineus	31 ± 2.5	N.D	30 ± 2.3	21 ± 2	14 ± 1.2
Rana hexadactyla	23 ± 2.1	N.D	21 ± 2.1	18 ± 1.2	12 ± 1.0

Table 3: In vivo action of *Lantana camara* extract on related enymes in *Aedes Aegypti* Larvae

Biochemical parameters	Normal control	Incubation in drug containing medium		
		2hr	4hr	6hr
AlAT Activity(#)	210 ± 18	211 ± 20	180 ± 12	142 ± 11
AsAT Activity($)	42 ± 6	40 ± 5	31 ± 3	21 ± 1.8

$ - Aspartate amino transferase activity is expressed as an International unit/minute/mg protein (Each IU is defined as amount of oxaloacetate in nanomoles).

- Alanine aminotransferase activity is expressed as International units/minute/mg protein (Each IU is defined as amount of pyruvate in nanomoles).

Figure 1: *Lantana camara*, wild variety with orange flowers

plant extract than that of vertebrate enzyme system. At drug concentrations of 100 microgram, the AsAT of mosquito larvae, inhibition was more than 50% but in vertebrate system the inhibition was only 40%. This indicated that AsAT of mosquito larvae was more sensitive to plant extract than that of vertebrate system. The pattern was identical incase of AlAT also. Thus in the present study invitro and invivo effect of *Lantana camara* extract on enzyme system tested was same and effect was inhibition of enzyme action (Table 3).

Both transaminases AlAT and AsAT plays a very important role in supplying pyruvic acid and oxaloacetic acid to Kreb's cycle and subsequent release of energy (Osborne, 1985). As both the above enzymes are inhibited by the plant extract, body cannot utilise the aminoacids alanine and aspartate, eventhough they may be seen in high concentration. The observed paralysis in the intoxicated larvae may be due to accumulation of glutamic acid in the body. Glutamic acid is a very important neurotransmitter at the myo-neural junction of insects (Kulkarni and Malhotra, 1973). Accumulation of neuro-transmitter at the myo-neural junction will lead to paralysis (Ray, 1964). A paralysed mosquito larva is unable to surface the water for getting oxygen. This might have indirectly contributed to the death of the larvae. This agrees with the findings of Evans and Kaleysaraj (1992) and Sathish and Maneemegalai (2008).

The methanolic extract of *Lantana camara* exhibited similar action on the activity of AsAT and AlAT under invitro and invivo conditions. Under invitro conditions inhibition was dose dependent. The transaminase system of mosquito larvae was more sensitive to *Lantana camara* extract than that of

vertebrate system such as *Anabas testudineus* and *Rana hexadactyla* which are the none target organisms seen in the aquatic habitat. The metabolic rate in *Aedes aegypti* seems to be much higher than that of other vertebrate system. The change of pH from alkaline (normal larvae) to acidic (intoxicated larvae), may also be sufficient for inhibiting or blocking most of the enzymatic reactions leading to the death of the organisms. The inhibition of the activity of transaminases also could result in an increase in the overall free aminoacid level and imbalance in metabolic activities. The study revealed the scope for effective application of the *Lantana camara* extract against *Aedes aegypti* larvae without causing any harm to humans.

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