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GROWTH-INHIBITING AND LARVICIDAL EFFECT OF *ADENANTHERA PAVONINA* SEED EXTRACTS ON *AEDES AEGYPTI* LARVAE

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Aqueous extract of ripe and unripe seeds of *Adenanthera pavonina* L. (Fabaceae) were evaluated for the larvicidal and growth inhibition activity against mosquito *Aedes aegypti* (Diptera: Culicidae). Both the seed extracts showed a strong larvicidal as well as growth inhibitory effect in laboratory bioassays. The LC_{50} (Lethal concentration required to kill 50% larvae) of larval mortality was 488.15 ppm with ripe red seeds as compared to 580.45 ppm with unripe green seeds. The growth inhibiting activity as expressed in percentage of emergence inhibition (% EI) was more pronounced with unripe seeds (EI_{50} 67 ppm) as compared to ripe seeds (EI_{50} 119 ppm) with complete inhibition of adult emergence with both the seed extract. Future application of these extracts to larval habitats may lead to promising results in mosquito management programmes.

Keywords : Adult emergence inhibition activity; *Adenanthera pavonina; Aedes aegypti;* Larvicidal activity.

Introduction

Adenanthera pavonina (L.) (Family Fabaceae, subfamily Mimosoideae) is native to India and Southeast China. The tree is known by a host of common names, including red-bead tree, red sandalwood, and Circassian-bean in English; raktakambal (India); There are historical accounts from Southeast Asia and Africa of using all parts of tree for traditional medicines[1,2].

Mosquitoes not only cause nuisance by their bites but also transmit deadly diseases like malaria, filariasis, yellow fever, dengue and Japanese encephalitis, contribute significantly to poverty and social debility in tropical countries[3]. However, control of such diseases is becoming increasingly difficult because some mosquito species have developed high levels of resistance to microbial control agents[4]. The mosquito *Aedes aegypti* is responsible for dengue and dengue hemoragic fever in India. Development of resistance in *A. aegypti* larvae has been reported against temephos, fenthion, malathion and DDT from different locations in India[5]. The herbal insecticides are generally pest specific and are relatively harmless to non-target organisms including man. They are also biodegradable and harmless to the environment. One plant species may possess substances with a wide range of activities, for example extracts from the neem tree *Azadirachta indica* showed antifeedant, antioviposition, repellent and growth regulating activity[6]. In our previous communication we have reported larvicidal activity of rotenoid extract of this plant against *Aedes aegypti* mosquito[7]. The growth inhibitory and larvicidal potential of aqueous seed extracts of *Adenanthera pavonina* has been reported for the first time.

Material and Method

Preparation of extract: Fully developed ripe and unripe pods of *A. pavonina* were collected from the campus of Haffkine institute and seeds were collected from the respective pods. Aqueous extract of ripe and unripe seeds were prepared separately.

Larvicidal bio-assay: Laboratory reared late 3rd or early fourth instars larvae of F_1 generation were treated with different concentration of aqueous extract of seeds. Susceptibility tests were carried out according to the standard guidelines of World Health organization pesticide evaluation scheme[8]. The fresh stock solution (1%) has been used for making subsequent serial dilutions (100 to 800ppm). Controls were simultaneously run with the experiment in similar conditions and were without extract. For each concentration five replicates comprising 25 larvae each were exposed. The larval mortality was recorded after 24 hours of continuous exposure to the test solution and expressed as per cent mortality.

Insect growth regulating (IGR) activity - Aqueous extract of *A. pavonina* was also tested for growth inhibitory activity against the *Aedes* larvae. Twenty-five larvae were

Table 1. Larvicidal activities (LC_{50} value in ppm) of ripe and unripe seed extract of *Adenanthera pavoniana* L. against *Aedes agypti* mosquito larvae.

Plant part	% Mortality of larvae after 24 hours*						LC_{50}** (ppm)
	Different concentrations in ppm						
	100	200	400	600	800	1000	
Unripe Seeds	00.00	10.33±1.21	38.66±1.64	54.00±1.12	65.34±1.40	93.57±0.00	580.45
Ripe seeds	02.00	16.25±1.44	44.00±1.03	66.00±0.94	94.28±1.19	100.00±1.34	488.15

*Mean of three replicates (Mean ± S.E.M.)
** Lethal concentration giving 50% mortality of larvae.

Table 2. Insect growth inhibitory activity of aqueous seed extracts of *Adenanthera pavonina against Aedes aegypti* larvae.

Plant part used	Growth Inhibiting activity (ppm)	
	*EI_{50}	**EI_{90}
Unripe Seeds	78	224
Ripe seeds	119	386

*EI_{50} and **EI_{90} Concentration giving 50 and 90% adult emergence inhibition respectively.

transferred into 500 ml beakers containing 250 ml of tap water. Each test concentration (50 to 500 ppm) was replicated five times. Two replicates of control were also maintained. Mortality of the larvae and pupae was recorded at 24 h intervals. Observation was continued in treated and control beakers until the last immature pupated in control. The treated and untreated beakers containing pupae were kept separately in one-foot cages for adult emergence. Percentage of emergence inhibition (% EI) in the treated and control was monitored.

Results and Discussion

Aqueous extract from ripe and unripe seeds of *A. pavonina* showed a strong larvicidal and growth inhibitory effect in laboratory bioassays against *Aedes aegypti* larvae. The LC_{50} (Lethal concentration required to kill 50% larvae) of larval mortality was 488.15 ppm with ripe red seeds as compared to 580.45 ppm with unripe seeds (Table 1). The growth inhibiting activity as expressed in percentage of emergence inhibition (% EI) was more pronounced with unripe seeds (EI_{50} 67 ppm) as compared to ripe seeds (EI_{50} 119 ppm).

Dead larval intermediates or pre-pupal stage larvae and many "albino" (white) pupae were found with soft body and without characteristic sclerotization of the pupal cuticle.

Today, the environmental safety of an insecticide is considered to be of paramount importance. Phytochemicals may serve as suitable alternatives to synthetic insecticides in future as they are relatively safe, inexpensive, and are readily available in many areas of the world. According to Bowers *et al.* the screening of locally available medicinal plants for mosquito control would generate local employment, reduce dependence on expensive imported products and stimulate local efforts to enhance public health[9]. The larvicidal and adult emergence inhibition activity of *A. pavonina* is also comparable to different species of plant extract in different families[10, 11].

The findings of the present investigation revealed that the seed extract of *A. pavonina* possess remarkable larvicidal and adult emergence inhibition activity against mosquito *Aedes aegypti.* Further investigations are needed

to elucidate this activity against a wide range of mosquito species and also the active ingredient(s) of the extract responsible for larvicidal and adult emergence inhibition activity in *Aedes aegypti* should be identified and utilized, if possible, in preparing a commercial product / formulation to be used as a mosquitocidal.

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