



ARGIMONE MEXICANA: FOR MANAGEMENT OF ANOPHELES BARBIROSTRIS IN TRIPURA

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Abstract: Sudden malaria outbreak in Tripura's border villages during the year of 2019. The state is co-endemic for both *Plasmodium falciparum* and *P. vivax* and transmission is perennial and persistent. Altogether 10 larval habitats from Agartala city were selected for ecological study, 6 from drains and 4 were stagnant water. Physico-chemical parameters of the larval habitats such as temperature, pH, Dissolved oxygen and free carbon-dioxide content of the water were taken into account. The life-history of Anopheles sp. was studied. Experimental trial on controlling mosquito larvae has been conducted using *Argimone Mexicana*. Drain water bodies are favoured more by mosquitoes for breeding. Findings confirm that low DO and high CO₂ content favoured existence of larvae. From egg to the emergence of adult need 25 days at 22.3° to 28.7° c and 74% mean RH in laboratory condition. Sex ratio (M : F) at emergence is 89:100. Plant extract of *Argimone* found in Tripura have insecticidal potentialities against Anopheles larvae.

Index term: *Anopheles barbirostris*, Malaria, plant extract, *Argimone mexicana*, Tripura

1. INTRODUCTION

Mosquito can transmit more disease than any other group of arthropods and affect millions of people throughout the world. They act as a vector for most of the life threatening diseases like malaria, yellow fever, dengue fever, chikungunya fever, filariasis, encephalitis *etc.*, in almost all tropical and subtropical countries and many other parts of the world. To prevent proliferation of mosquito borne diseases and to improve quality of environment and public health, mosquito control is essential. In recent years, many synthetic insecticides in mosquito control has been limited, it is due to lack of novel insecticides, high cost of synthetic insecticides, concern for environmental sustainability, harmful effect on human health and other non-target populations, their non-biodegradable nature, higher rate of biological magnification through ecosystem and increasing insecticide resistance on a global scale. Considering these, the application of eco-friendly alternatives such as biological control of vectors has become the central focus of the control programme in lieu of the chemical insecticides. One of the most effective alternatives is to explore the floral biodiversity and enter the field of using safer insecticides of botanical origin as a simple and sustainable method of mosquito control. Roark (1947) described approximately 1200 plant species having potential insecticidal value, while Sukumar et al., (1991) listed and described 344 plant species that only exhibited mosquitocidal activity.

Spread of malaria and other vector-borne diseases in the hilly parts of Tripura has been a common phenomenon.

Among northeastern States, the State of Tripura is strategically placed for sharing a vast international border with Bangladesh (84% of its total border length) in the north, south and west. It is a landlocked State with undulating terrain and homeland to different ethnic tribes rich in diversity and cultural practices. Malaria is a major public health concern in the State with history of focal disease outbreaks characterized by high rise in cases and attributable deaths with large concentration of cases in tribal population groups living along international border (Misra and Dhar, 1955, Dhiman et al., 2020, Dhiman et al., 2011). Disease transmission is persistent and *P. falciparum* is the predominant infection (>90%); the remaining are *P. vivax* cases (Shah et al., 2011, Goswami et al., 2013).

An exception occurred in 2014 in the form of a severe malaria outbreak in Tripura leading to high morbidity and mortality. The distribution of the disease is not uniform in Tripura and shows wide variation both spatially as well as temporarily. "The Tripura government has extended emergency medical care to villagers residing along the Tripura-Mizoram-Bangladesh border following a sudden outbreak of malaria and vector-borne diseases in the past few days" (Anonymous, 2019). If we are to mount an intelligent attack on the malaria problem of Tripura then a statewide survey of the mosquitoes, study of their habits and habitats, evaluation of the vectorial status of the mosquitoes are necessary. Such survey provides very useful information on the distribution and prevalence of these insects.

There exists very little information on seasonal abundance and infectivity of vector mosquito species, preferred breeding sources, and their present susceptibility status to residual insecticide in use for vector control. The present study was carried out to investigate biology and control measures by using plant extract.

II. MATERIALS AND METHODS

Biology

The life history of *Anopheles barbirostris* was studied in the month of February, 2019 to April, 2019 when mean minimum and maximum temperature was 25.4°C and 28.7°C and relative humidity was 68%. Thirty (30) blood fed mosquitoes collected from cowshed of different localities of Tripura viz., Colletilla, Jogendranagar, Town Pratapghar (west district) were released in a wooden framed box covered with net. Eggs were laid by the female mosquitoes within 2-3 days in water pot kept inside the box. The eggs hatched to hatchlings and subsequently developed to 1st, 2nd, 3rd, 4th and finally to pupal stage. Mixture of threptin biscuit and yeast powder (60:40) was given to the larvae as food and water was changed daily. Finally the adult mosquitoes emerged out in the wooden framed box. Male adults were fed on cotton pads soaked with glucose and females were given blood meal from white rat. After 7 to 10 days first generation of mosquitoes were produced in the laboratory and used for experimental studies.

Experiments on suitable control measures

To study the effect of *Argemone Mexicana* extract on the development of *Anopheles barbirostris*, aerial parts of the young plant (3 months old) were collected. The alcoholic extract of the dried shoot part of the plant prepared in the laboratory by Soxhlet extraction procedure was used in the present study. Replication, each containing 20 just emerged 1st instar larvae were added with different concentrations of the extract ranging from 0.01 gm/50ml to 0.05 gm/50ml of plant product. Proper control was maintained side by side.

III. RESULT AND DISCUSSION

Several generations of mosquitoes were produced under laboratory condition for experimental studies. Each female *a. barbirostris* female laid 22.5 eggs on an average. Incubation period is 2 days, hatchability is 71.6%. Each larval instar duration ranges between 4 to 5 days; pupal duration is 4 days. Thus the average duration of development from egg to adult is 25 days.

Findings relating to the biological studies are given in **Table 1**.

Findings showed that 0.05 gm/50ml of water of plant product was sufficient to bring 100% larval mortality during development in lower concentration (0.01 gm/50ml of water), 80% of the larvae emerged to adult mosquitoes with no morphological deformities of the visible parts of the adults. However, the sizes of the experimental adults were smaller compared to the control. The findings are summarized in **Table-2**.

IV. CONCLUSION

Today, environment safety is considered to be a paramount importance. Phytochemicals may serve as these are eco-friendly, relatively safe, inexpensive and readily available in many parts of the world. According to Bowers et al, 1995, the screening of locally available medicinal plants for mosquito control would generate local employment, reduce dependence on expensive and imported products and stimulate local efforts to enhance the public health system.

In this investigation, it was found that the younger larvae were more vulnerable to the extract contains the different alkaloids, glycosides etc., this plant extract may be used to formulate bio-insecticide against *Anopheles barbirostris* for effectiveness in control and intervention measures.

V. ACKNOWLEDGEMENT

Author is grateful to Head, Department of Zoology, Women's College, Agartala, Tripura (west) for providing the proper facilities for smooth running of research work.

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Table 1
Biology of *Anopheles barbirostris*

Number of Eggs	Incubation period	Number of eggs hatched	Hatchability (%)	Duration of larval Instar					Pupal duration (days)	Total duration (days)	Immature survival rate(%)	Emergence rate (%)	Sex ratio (M:F)
				I	II	III	IV	Total					
675	2	483	71.6	I	II	III	IV	Total	4	25	75	84	89:100
				4	5	5	5	19					

Table-2
Argimone extract as a control agent

Extract concn.(gm/50ml)	Control	0.01	0.02	0.03	0.04	0.05
Mean mortality(%)	20	30	45	74	85	100

