

Preliminary Studies on larvicidal activity of *Gloriosa superba* extract on developmental stages of *Culex quinquefasciatus* Say.

Dr. Soma Datta

Associate Professor,
Dept. of Zoology, Women's College, Agartala, Tripura

Abstract:

Background: Mosquito and mosquito borne diseases are some of the major tropical problems. *Culex quinquefasciatus* Say is a cosmopolitan mosquito species found in tropical, subtropical, and warm temperate regions. Numerous workers have tested the efficacy of several plant extract using different mosquito species.¹ *Gloriosa superba* contains high levels of colchicines, a toxic alkaloid.

Materials and methods: Adult female mosquitoes were collected and cultured in laboratory condition. Life cycle of *Culex quinquefasciatus* was studied. Plant extract of *Gloriosa superba* of different concentration ranging from 0.01 gm/50ml. to 0.05 gm/50 ml were exposed to 1st instar larvae of *Culex quinquefasciatus*.

Result: Maximum duration for completion of life-cycle was 21 days during January, 2019 whereas it was minimum in the month of May, 2019 (8 days). 0.05 gm/50ml of plant extract gave 100% mortality after 48 hours. 0.05 gm/50ml. was sufficient to bring about 100% mortality of the *Culex* larvae after 48 hours.

Conclusion: Plant extract of *Gloriosa superba* is a source of bio-insecticide for mosquito control.

Keywords: *Culex*, Plant extract, *Gloriosa*, Biology, larvaecidal activity

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I. Introduction

Culex quinquefasciatus acts as a vector of filarial worms^{2,3} and various arboviruses^{4,5,6} urbanization and industrialization without proper drainage facilities are responsible for the establishment of the *Cx. quinquefasciatus* in various cities of India⁷. The survival rates of the immature of *C. fatigans* in drains in the urban areas and in wells in the villages of Delhi which are found to be the major breeding habitats⁸. A preliminary survey has revealed that in Tripura, north eastern state of India, abundance of *Culex* is more due to availability of variety of habitats and suitable breeding sites (open drains). In recent years, control of different insect pest and mosquitoes by non-insecticidal methods particularly by using different plant -origin materials has received wide attention because of absence of toxicity hazards or any residue problem of such materials⁹. *Gloriosa superba* Linn. is an important medicinal plant belonging to the family Liliaceae. This plant is poisonous, toxic enough to cause human and animal fatalities if ingested. Every part of the plant is poisonous, especially the tuberous rhizomes. In the world market this plant is considered as rich source of colchicines and gloriosine.¹⁰ Within a few hours of the ingestion of a toxic amount of plant material, a victim may experience nausea, vomiting, numbness, and tingling around the mouth, burning in the throat, abdominal pain, and bloody diarrhea, which leads to dehydration, respiratory depression, hypotension, coagulopathy, haematuria, altered mental status, seizures, coma, and ascending polyneuropathy may occur¹¹. Longer-term effects include peeling of the skin and prolonged vaginal bleeding in women¹². Plants extracts from varieties of plants including species of *Ocimum* spp.¹³, *Lantana camara* and *Mentha* species¹⁴, *Curcuma* sp.¹⁵, species of *Plectranthus*¹⁶ have been demonstrated to exhibit good insecticidal and repellent activities against mosquitoes. Larger number of human Population in this world of about 80% depends largely in plants for its health care control of infectious and non infectious diseases¹⁷. Therefore, plants extracts are gaining acceptance in providing alternative majors in vector control of diseases and arboviruses due to their non toxicity, specificity, and are safe to the environment and ecosystem and have lesser effects to the flora and fauna¹⁸. Keeping this in view the present investigation has been carried out on the control of culicid fauna of Tripura.

II. Materials And Methods

Large number of adult female mosquitoes were collected from cattle shade of Agartala town and maintained in mosquito case under laboratory condition. The egg rafts were maintained in the laboratory and reared in enamel trays containing culture medium provided with powdered dog biscuits (60%) and yeast (40%) as the nutrient source and water changed daily. Male adults were fed on cotton pads soaked with glucose and females were given blood meal from white rat. Egg rafts were laid by female mosquitoes within 2-3 days in

water pot kept inside the cage. Eggs hatched to hatchlings and subsequently developed to 1st,2nd,3rd,4th instar larva and finally pupal stage. After 16 days (December,2018) the first generation of mosquitoes were produced in the laboratory and used for experimental studies.

Plant material extraction: To study the effect of *Gloriosa superba* Linn. on the development of *Culex quinquefasciatus* Say. percolation method was used. The leaves of *Gloriosa superba* were dried in shade, made into dust and 100gms. of dust leaves were soaked with 400ml. ethanol, kept for 2 days, pasted, filtered by filter paper and then filtrate was used in the present study. Replication, each containing 20 just emerged 1st instar larvae were added with various concentration of the extract ranging from 0.01 gm/50 ml. to 0.05gm/50 ml. of plant extract.

III. Result

Biology of *Culex quinquefasciatus* : Table 1. summarises the duration of the larval and pupal stadium during different months. The duration of the developmental period recorded was lowest in May, 2019 (8 days) and highest (21 days) in January, 2019. Fig. 1 elucidates the relationship of temperature and Relative humidity with the duration of developmental period. It is apparent that higher temperature during May 2019 (8 days) brought down the length of the developmental period while that was longer during January, 2019 (21 days) when the average air temperature was minimum (9.5°C).

Toxicity of *Gloriosa superba* Extract: It is observed that 0.05gms. /50ml. was sufficient to bring about 100% mortality of the *Culex* larvae after 48 hours exposure. Analysis of variance showed that this concentration was significantly superior to all the other concentrations while 0.04gm./50ml and 0.05gm/50ml. of extracts formed the second effective significant group. In all the cases the emergent adults were smaller in size than the control adults but no structural deformity was observed.

Table: 1: Duration of developmental stages of *Culex quinquefasciatus* (in days)

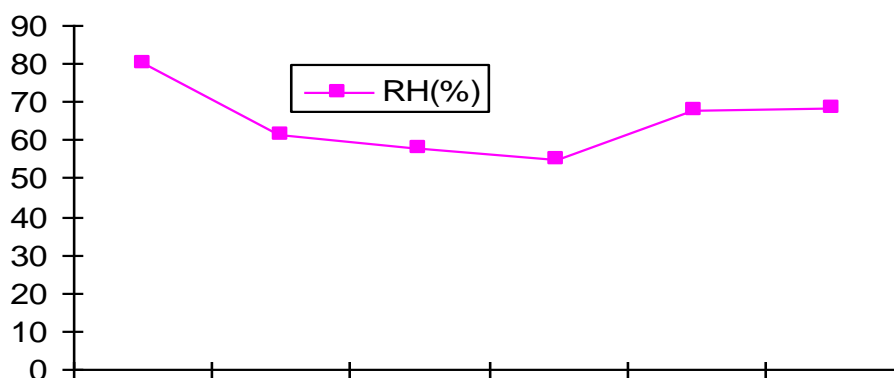
Month	Egg	Hatch	1st	2nd	3rd	4th	Pupa	Total duration	Temp.(°c)	RH(%)
Dec,2018	2	1	2	2	2	3	4	16	13.27	79.87
Jan,2019	4	2	3	3	2	2	5	21	9.5	61.54
Feb.,2019	2	1	2	2	2	2	3	14	12.74	57.89
Mar.,2019	1	1	2	2	2	2	2	12	21.3	54.87
Apr.,2019	1	1	2	1	1	1	2	9	23.06	67.6
May,2019	1	1	1	1	1	1	2	8	23.79	68.35

Table-2: Mortality produced by *Gloriosa superba* extract on *Culex quinquefasciatus* larvae

Concentration of extract(gm/50ml of water)	Mean mortality percentage		
	24 hours	48 hours	72 hours
0.01	0*	0	8.88(17.3)
0.02	2.22(8.5) **	15.55(23.2)	22.22(28.1)
0.03	33.3(35.2)	46.66(43.1)	53.33(46.9)
0.04	48.8(44.3)	71.11(57.5)	88.8(70.4)
0.05	66.6(54.7)	100(90)	-
Control	0	0	0
CD at 5%	27.54	24.13	20.78
CD at 1%	38.28	33.5	28.56

*No mortality was found in 0.01% concentration

**Figures in parenthesis are the average of transformed values = Arcsin√percentage



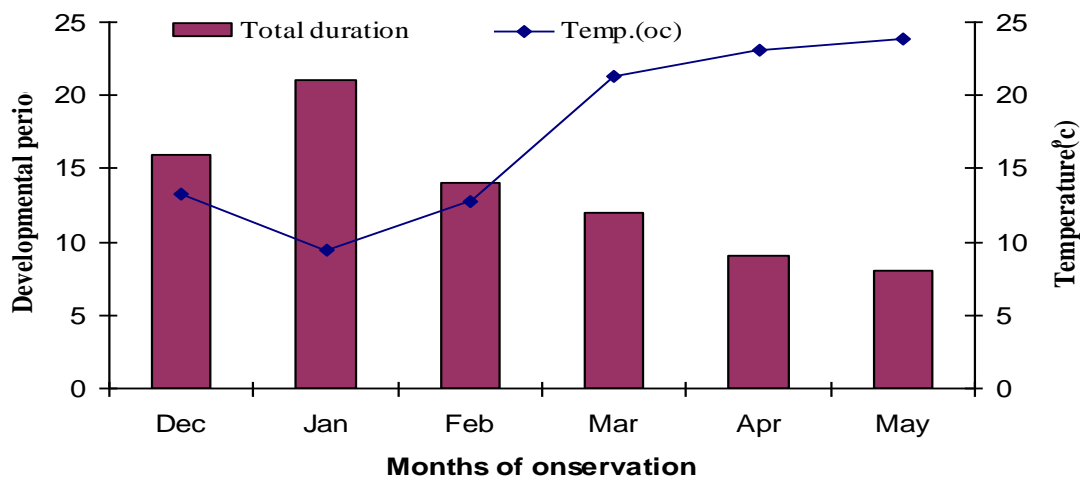


Fig.1: Relationship between air temperature, Relative humidity and developmental period of *Culex quinquefasciatus*

IV. Discussion

Several workers have attempted to study the biology of mosquitoes^{19,20,21,22}. Several generations of mosquitoes were produced under laboratory condition for experimental studies. Generally after laying of the eggrafts, depending on the size of the raft, 130-140 larvae emerged within 2 to 3 days. This prolonged developmental period might be attributed to cool climatic conditions in January during which period the study was carried out.^{23,24} Similar relationship between air temperature and developmental period not only in *Culex* but also for other species of mosquitoes was investigated by Clements, 1963¹⁹. Generally 100% of the larvae developed into adults indicating the appropriateness of the supplied food for *Culex* development. The adult male: female sex ratio was 10:1. This is in general agreement with the earlier observation of Rajagopalan et al, 1977.²⁵

Leaf Extract of *Gloriosa superba* at different concentration ranging from 0.01gm/50ml. to 0.05gms./50ml brought about various degrees of mortalities of the larvae. Table -2 summarizes the mortality effect of the extract. It is clear that 1st instar larvae were most adversely affected and more vulnerable to the extract.

V. Conclusion

From the present investigation, it is found that the studied mosquito is highly susceptible to the leaf extract of *Gloriosa superba* and it can be effectively used as a larvicide in the control of mosquito. As Mosquitoes are the vectors of the major infectious diseases of Public Health concern, more investigations are needed to elucidate the activities against a wide range of mosquito species.

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