The control of mosquitoes causing nuisance as well as carrier of dreaded diseases with predacious mosquito larvae had been the focus of the present paper. The larvae of species *Lutzia* were collected from breeding ground from the previously known site and smallest I instar larval stages were collected and fed on larvae of other species of mosquitoes for different larval stages. The 1\textsuperscript{st} instar of this species started consuming the skin cast and later stage started consuming the live larvae of other species of *Culex, Armigeres, Aedes* etc. hence actual reading started from II stage larva. When they are 3 days old, II stage single larva consume 8 larvae in 48 hours before they enter the next II stage, III stage consume 14 larvae and IV stage consume 20 live larvae of *Culex*. Depending the size of larvae, the time of consuming a single larva of II stage of larva of *Lutzia* varies e.g. *Culex* larva consumed in around 10 minutes while the bigger larvae like that of *Armigeres obturans* required at least 15 minutes to consume whole of larva. Smaller larvae like that of *Aedes albopictus* required only 6 minutes to consume. Till now there is no known literature of this species acting as carrier of certain mosquito borne disease besides this species did not bite humans, it can be safely argued that this species could be reared and released in spots where the other mosquitoes assumed to breed. The perspective of this boon of nature’s larvicides to control or limit certain mosquitoes if utilized after thorough knowledge of bionomics and efficacy, would be much ecofriendly and cost free for controlling the menace of mosquitoes.

**Keywords:** Manipur, India, mosquitoes, *Lutzia tigripes*, predacious larvae, larvicides

### 1. Introduction

Due to climate change, the problem in combating the mosquitoes and their effect is rather ineffective and there is need for urgent steps to minimize their effect. Besides the natural and artificial chemicals, the cannibalistic nature of *Lutzia* is very important. About 95\% of mosquito species are restricted to fresh water\(^{(1)}\) and feed generally on aquatic microorganisms such as bacteria, diatoms and algae and detritus. But some larvae from subfamily *Toxorhynchitinae* and genus *Lutzia* are predatory and feed on invertebrates and other mosquito larvae\(^{(2)}\). *Lutzia* was first established by Frederick Vincent Theobald in 1903 as distinct genus for a Mexican species *Lutzia bigotii*\(^{(3)}\). But latter Tanaka had divided the sub-genera into *Lutzia*, *Metalutzia* and *Insulultzia*\(^{(4)}\). At the moment there are eight extant species under the genus *Lutzia*. They are lone species under *Lutzia shinonagai*\(^{(5)}\), two species under subgenus *Lt. allostigma* Howard, Dyar and Knab, *Lt. bigotii* (Bellardi, 1862), and five species under *Metalutzia* Tanaka: *Lt. agranensis* Singh and Prakash 2008, *Lt. fuscana* (Wiedemann, 1820), *Lt. halifaxii* (Theobald, 1903), *Lt. tigripes* (de Grandpre and de Charmoy, 1901), *Lt. vorax* Edwards, 1921\(^{(6)}\). From India according to Tyagi\(^{(6)}\) reported four species of subgenus *Metalutzia* viz., *Lt. agranensis*, *Lt. fuscana*, *Lt. halifaxii* and *Lt. vorax*. Out of reported 111 mosquito species 83 are *Culicine* mosquitoes under 13 genera\(^{(7)}\) but no name mention of *Lutzia* from the mosquito diversity of Manipur.

In the present study the efficacy of larvae was analyzed in the light of the statistics. The prospect of this species as biological control is thoroughly study. The perspective of this boon of nature’s larvicides to control or limit certain mosquitoes if utilized after thorough knowledge of bionomics and efficacy, would be much ecofriendly and cost free for controlling the menace of mosquitoes.
Further studies on the prey preferences could through lights on the importance of the larvae for controlling particular species and obviously the particular disease.

2. Materials and Methods
Larval stages of mosquito were collected from three breeding ground of Urembam, Imphal West during 13th April and 21st April, 2018. The immature larval stages were reared with appropriate foods in beakers till the emergence of adults and identification of the species was done from larvae, pupa and adults (female + male individuals). The identification keys followed in present studies included: Darsie [3], Lane [8], Bram [9], Tanaka [5], Hopkins [10].

3. Results
The observation of consumption of larvae starts from 2nd instar since the 1st instar consumed only the cast skin. A single larva of Lutzia tigripes consumed 400 to 500 larvae of Culex with an average of 40 to 50 larvae a day (Table 1). The larvae of Lutzia tigripes were effectively feeding on any mosquito larvae of any species by chewing. The duration of each meal varied according to the size of larvae or species e. g. Armigeres sp. were fairly bigger than most of species of the Culex sp. while Aedes were intermediates. The duration of meal was ranging between 7 to 12 minutes for different species and size of the larvae. Each instar consumed in average of 156 larvae consuming 456 to 528 in all ((Table 1). The replication of four shows fairly constant rate of consumption and consistent structures (fig. 2).

<table>
<thead>
<tr>
<th>No. of larvae consume</th>
<th>Instar</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
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<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>96</td>
<td>72</td>
<td>48</td>
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<td>120</td>
<td>144</td>
<td>144</td>
<td>168</td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td>240</td>
<td>288</td>
<td>240</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>456</td>
<td>528</td>
<td>456</td>
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</table>

4. Discussion
Base on the available data there are 111 species of mosquitos, 83 species are Culcine under 13 genera from Manipur [7] in which seven species are new reports from the state. The present report of the Lutzia species from the state is first of its kind.

The genus Lutzia Theobald is a small genus with only seven [11] or eight species [12]. It was originally described as a genus by Theobald (1903) but reduced to a subgenus of Culex by Edwards (1932). Now it is elevated again to generic rank by Tanaka [5]. He also created three new subgenera, i.e., Metalutzia Tanaka for the Asian, African and Australasian species, the monotypic subgenus Insulalutzia Tanaka for Lt. shinonogai Tanaka, Mizusawa and Saugstad, while the subgenus Lutzia Theobald applies to the two Neotropical species. He likewise removed Lt. vorax (Edwards) from synonymy with Lt. halifaxii Theobald. All these changes were based on the morphology of the pupa [3]. From India according to Tyagi [6] reported four species of of subgenus Metalutzia viz., Lt. agranensis, Lt. fuscana, Lt. halifaxii and Lt. vorax. Lt. fuscana has been reported from Kolkata [13] and Rajasthan [14].
Report of this predacious mosquito from Manipur is unexpected as this species is exclusively for the Afrotropical region. Four species of the subspecies of *Lutzia* (*Lt*) are reported but not the *Lt. tigripes* from India. Is this the remnant of the Pangea or any introgression of the local species will be very valuable question to answer for academic as well as the bio-geographic point of view in future. Further studies on the larvae and adult mosquitoes of the subgenera *Metalutizia* from more study sites and through molecular as well as cytogenetic studies will be more concrete evidenced of the occurrence of the predacious mosquito from Manipur. In future controlling of the virus borne mosquito could be attempted studies through thorough bionomic studies of the species. The predatory preferences of *L. tigripes* reported by Himmat [14] and Jeyanthini and Vinobabha [15] included *Aedes* and *Chironomus*. *Culex* species were at the bottom. The present study was done mainly with the larvae of *Culex* species but study included the different species like *Aedes, Armigeres, Pseudoculex* etc to test whether they are eaten by the larvae. But in future the prey preference would be much better. The use of predatory larvae/insects is a safe means where use of chemicals or insecticides are not possible as water is used as potable. Limited available of water and very less available breeding containers as a result of that species of mosquito show niche sharing which might have changed this predatory species feeding preference from *Culex to Aedes* species or any other species. Therefore, the predatory species becomes more targeted in absence of large outdoor breeding sources [14].

Introduction of prey comes under environmental management strategies that can reduce or eliminate vector breeding through use of biological controls that target and reduce vector larvae without generating the ecological impacts of chemical use. The approach is cost-effective, ecological balanced and sustainable for vector control if used in this type of climatic condition where mostly outdoor breeder larvae are restricted in pockets. The fig. 2. shows that the increase of efficacy with increase in the stage of larvae as reported by Appawu et al. [16] Jin et al. [17] argued that the predatory larvae attack on most on its equal sized prey larvae attacking them at the joint of head and thorax but in present study there is no precision attack but random (fig. 2 left at the tail region). Ikesoji [18] used larvae of *Lutzia* (*Metalutizia*) *fuscana* to control *Cx* *quinquefasciatus* larvae in small ditches in simulated field conditions.

5. Conclusion

*Lt. tigripes* from Manipur, India is an unexpected but might be remnant of the Pangea. The larvae of this species could be used to control the pathogenic vectors at specific sites. Depending the size of larvae, the time of consuming a single larva of II stage of larva of *Lutzia* varies e.g. *Culex* larva consumed in around 10 minutes while the bigger larvae like that of *Armigeres obturans* required at least 15 minutes to consume whole of larva. Smaller larvae like that of *Aedes albopictus* required only 6 minutes to consume. Till now there is no known literature of this species acting as carrier of certain mosquito borne disease besides this species did not bite humans, it can be safely argued that this species could be reared and released in spots where the other mosquitoes assumed to breed. The perspective of this boon of nature’s larvicides to control or limit certain mosquitoes if utilized after thorough knowledge of bionomics and efficacy, would be much ecofriendly and cost free for controlling the menace of mosquitoes. Further studies on the prey preferences could through lights on the importance of the larvae for controlling particular species and obviously the particular disease.

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7. References


