Research Article

Influence of Type of Electric Bright Light on the Attraction of the African Giant Water Bug, *Lethocerus indicus* (Hemiptera: Belostomatidae)


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This study investigated the influence of type of electric bright light (produced by fluorescent light tube and incandescent light bulb) on the attraction of the African giant water bug, *Lethocerus indicus* (Hemiptera: Belostomatidae). Four fluorescent light tubes of 15 watts each, producing white-coloured light and four incandescent light bulbs of 60 watts each, producing yellow-coloured light, but both producing the same amount of light, were varied and used for the experiments. Collections of bugs at experimental house were done at night between the hours of 8.30 pm and 12 mid-night on daily basis for a period of four months per experiment in the years 2008 and 2009. *Lethocerus indicus* whose presence in any environment has certain implications was the predominant belostomatid bug in the area. Use of incandescent light bulbs in 2009 significantly attracted more *Lethocerus indicus* 103 (74.6%) than use of fluorescent light tubes 35 (25.41%) in 2008 \(P < 0.05; P (Z > 4.92) = 0.0001\). However, bug’s attraction to light source was not found sex dependent \(P > 0.05; P (Z > 0.18) = 0.4286 \text{ and } Z > 0.28 = 0.3897\). Therefore, this study recommends the use of fluorescent light by households, campgrounds, and other recreational centres that are potentially exposed to the nuisance of the giant water bugs. Otherwise, incandescent light bulbs should be used when it is desired to attract the presence of these aquatic bugs either for food or scientific studies.

1. Introduction

Of the belostomatid bugs (giant water bugs) that are both useful and harmful to man and lower animals [1–4] is the globally occurring genus *Lethocerus* [5]. They are brownish, dorsoventrally flattened and have strong, thick, raptorial forelegs and broad, flat middle, and hind legs fringed with swimming hairs [6]. Furthermore, members of this genus have their heads drawn out in front of their eyes as a triangular extension. The visible rostrum is three segmented, ocelli are absent, and the four-segmented antennae are usually concealed in pockets beneath the head [7–9].

Generally, even though belostomatids are strong swimmers, they are sedentary hunters [10]. They wait on submerged vegetation or other supports, their raptorial front legs positioned in preparedness to seize quickly any object that passes.

Specifically, the genus *Lethocerus* (whose about 24 species have been described) [5] plays a very significant role in freshwater ecosystems and therefore, the knowledge of these aquatic bugs is important for the study of fish biology and proper management of fish hatcheries [11, 12]. However, *Lethocerus* species can bite badly and squirt a foul-smelling fluid more than a metre [13]. They can be nuisance in out-door swimming pools (which are sources of good recreational aids and revenue) to which they may be attracted by lights. They are edible insects in some countries [1]. Adult *Lethocerus* spp. are known to be the most ferocious predators that feed voraciously on fishes as much as 0.2 m long [1, 3, 12], a very important source of human protein. They also feed on frogs and their tadpoles [2] whose conservation could be important in the preservation of beneficial fish species. The salivary secretion of *L. fakir* (Gistel) for instance contains a potent mixture of hydrolytic enzymes (proteases)
which liquefies the soft tissues of frogs [14]. Furthermore, by feeding on mosquito larvae, there is increasing evidence that early instars of Lethocerus may appear promising in the biological control of malaria vector, mosquitoes [15–17].

Attraction of these bugs to lights, especially bright light at night, has earned them the name “electric light bugs” [18]. These large and powerful creatures are as adept at swimming as they are at flying [1]. Given their high flight ability, Lethocerus individuals can easily reach households, campgrounds, hotels, and other recreational centres equipped with electric bright light (such as fluorescent and incandescent lights) located around their habitat.

However, previous studies on this economically important organism do not seem to have investigated into the influence of type of electric bright light on the attraction of Lethocerus species in particular. Findings from this study may recommend the type of electric bright light that may be used to prevent or at least curtail their nuisance. In addition, such findings may assist collections of these Hemipteran bugs either for food or scientific reasons [19, 20].

2. Materials and Methods

2.1. Site Description. This study was carried out in the Staff Quarters of Saint Peter Claver Seminary School Okpala in Ngor-Okpala Local Government Area, Imo state, Nigeria. The seminary with its quarters is located about 200 m away from the popular Imo River (4°53′7″ North; 7°10′25″ East) and is surrounded by swamps and dense vegetation. As normal, the quarters are equipped with electric bright lights which are consistently on at certain hours of night for academic and spiritual activities and precautionary reasons.

2.2. Data Collection

2.2.1. Experiment I (Light Source: Fluorescent Tube). The experimental living house which reasonably stands out from other houses in the Seminary was equipped with four fluorescent light tubes (15 watts each). Each of the four outside walls of the house received one centrally positioned fluorescent light tube. Collections of giant water bugs only were made on daily basis between the hours of 8.30 pm and 12 mid-night in the months of May, June, July, and December of 2008 and 2009. Months were selected on the basis that heavy rains and full moon are known to increase the emergence of giant water bugs [9, 15]. Electric light was consistently on at night (as normal in the Seminary) for these hours when collections were made. Giant water bugs which visited the experimental house per night were tracked and collected with rubber-gloved hands to limit damage from their biting. They were subsequently preserved in 4% formalin. At the end of each study month, captured specimens were taken to the Biology laboratory of Michael Okpara University of Agriculture Umudike for further identification amidst other entomologists using guides provided by Rankin [2], Menke [5], and Hunderford [18].

2.2.2. Experiment II (Light Source: Incandescent Bulb). Also in the months of May, June, July, and December but of 2009, the above procedures were repeated, but this time the four fluorescent light tubes were replaced with four incandescent light bulbs. Fluorescent light tube of 15 watts and incandescent light bulb of 60 watts were chosen for experiment I and II, respectively, because it is documented that 15 watt fluorescent tube produces the same amount of light as a 60-watt incandescent bulb [21], precluding difference in the amount of light.

2.3. Statistical Analysis. Mean number of collected giant water bugs during study with fluorescent light tubes was statistically compared with that obtained during experiment with incandescent light bulbs using z-statistic for estimation of the difference between two means. The mean numbers of collected male and female Lethocerus indicus might vary with the different light sources and thus were compared also using the z-statistic. The z-statistic employed is two tailed.

3. Results and Discussion

Population data on the giant water bugs (belostomatid bugs) collected during a study of the influence of type of electric bright light on their attraction revealed that the captured species is Lethocerus indicus. That the genus Lethocerus commonly called the African giant water bug abound in Africa which (Imo State), the study area is part is supported by literature [22, 23]. Their presence in any environment may have implications for fish biology, biological control of mosquitoes, man’s diet, and health [13, 14, 16, 17, 21].

Out of a total number of 138 Lethocerus bugs collected in the eight-month study in 2008 and 2009, 35 (25.4%) were attracted by fluorescent light tubes in 2008, while 103 (74.6%) were attracted by incandescent light bulbs in 2009 (Table 1). The difference proved significant ($P < 0.05$) and $P = 4.92 = 0.0001$. Incandescent light bulbs emit greater heat than fluorescent light tubes [22], and perhaps, Lethocerus indicus prefer light that emits reasonable heat probably to gain some warmth. That heat attracts certain insects has been documented by other authorities [22, 24]. It is now obvious why [22] hinted that bugs are not attracted by light that produces little or no heat. In addition, it could be possible that this species preferred the yellow colour of light produced by incandescent light bulbs that showed higher attraction. This is because [16] reported that flight activity of Lethocerus generally is higher during periods of full moon and incidentally, the colour of light usually produced by the full moon is yellow.

Furthermore, male and female Lethocerus indicus seemed to be equally attracted to both light sources (fluorescent tube and incandescent bulb) ($P > 0.05$) (Table 2) $P = 0.4286$ and $P = 0.3897$, and this may suggest an equilibrium between effective population size and actual population size, thus preventing loss of genetic diversity [25, 26].
Table 1: Population data on the giant water bug, *Lethocerus indicus* (Belostomatidae) collected during a study of the influence of type of electric bright light on their attraction in Ngor-Okpala local government area, Imo state, Nigeria during 2008 and 2009.

<table>
<thead>
<tr>
<th>Month</th>
<th>Experiment I [Fluorescent tube in 2008 [n (%)]]</th>
<th>Experiment II [Incandescent bulb in 2009 [n (%)]]</th>
<th>Overall [n (%)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>9 (6.52)</td>
<td>23 (16.7)</td>
<td>32 (23.2)</td>
</tr>
<tr>
<td>June</td>
<td>7 (5.07)</td>
<td>35 (25.4)</td>
<td>42 (30.4)</td>
</tr>
<tr>
<td>July</td>
<td>9 (6.52)</td>
<td>26 (18.8)</td>
<td>35 (25.4)</td>
</tr>
<tr>
<td>December</td>
<td>10 (7.25)</td>
<td>19 (13.8)</td>
<td>29 (21.0)</td>
</tr>
<tr>
<td>Total</td>
<td>35 (25.4)</td>
<td>103 (74.6)</td>
<td>138 (100)</td>
</tr>
<tr>
<td>Mean/month</td>
<td>8.75 (25.36)</td>
<td>25.75 (74.64)</td>
<td>34.50 (100)</td>
</tr>
<tr>
<td>Mean/trap</td>
<td>0.29 (25.22)</td>
<td>0.86 (74.78)</td>
<td>1.15 (100)</td>
</tr>
</tbody>
</table>

Table 2: Sex-related prevalence (sex ratio) of the captured *Lethocerus indicus* from the different light sources in Okpala local government area, Imo state, Nigeria during 2008 and 2009.

<table>
<thead>
<tr>
<th>Month</th>
<th>Experiment I [Male]</th>
<th>Experiment I [Female]</th>
<th>Experiment II [Male]</th>
<th>Experiment II [Female]</th>
<th>Overall [n (%)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>2</td>
<td>7</td>
<td>11</td>
<td>12</td>
<td>32 (100)</td>
</tr>
<tr>
<td>June</td>
<td>4</td>
<td>3</td>
<td>16</td>
<td>19</td>
<td>42 (100)</td>
</tr>
<tr>
<td>July</td>
<td>4</td>
<td>5</td>
<td>15</td>
<td>11</td>
<td>35 (100)</td>
</tr>
<tr>
<td>December</td>
<td>7</td>
<td>3</td>
<td>11</td>
<td>8</td>
<td>29 (100)</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>18</td>
<td>53</td>
<td>50</td>
<td>138 (100)</td>
</tr>
<tr>
<td>Mean/month</td>
<td>4.25</td>
<td>4.5</td>
<td>13.25</td>
<td>12.5</td>
<td>34.5 (100)</td>
</tr>
<tr>
<td>Mean/trap</td>
<td>0.14</td>
<td>0.15</td>
<td>0.44</td>
<td>0.42</td>
<td>1.15 (100)</td>
</tr>
</tbody>
</table>

4. Conclusion and Recommendation
*Lethocerus indicus* was the most prevalent belostomatid bugs in Okpala Community, Imo state, Nigeria and its presence in any environment has certain life implications.

However, the use of incandescent light bulbs (producing yellow-coloured light and glowing with much heat) significantly attracted more *Lethocerus indicus* than use of fluorescent light tubes (producing white-coloured light and glowing with minimal heat).

To that effect, this study recommends the use of fluorescent light by households, hotels, campgrounds, and other recreational centres potentially exposed to the nuisance of the giant water bugs. Otherwise, incandescent light bulbs should be used if one desires to attract the presence of these aquatic bugs either for food or scientific studies.

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References


