SPECIES DIVERSITY AND DYNAMICS OF SOME LIGHT TRAP ATTRACTED INSECTS

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ABSTRACT

An investigation was carried out to study the population dynamics and species diversity of some light trap attracted insects during July, 2021 to June, 2022 in the rice field near Bhattadev University, Bajali campus. The specimens were qualitatively and quantitatively sampled using light trap for 52 nights with the presence of total 2482 insects belonging to the order Coleoptera, Diptera and Lepidoptera. The Shannon- Wiener diversity index, Simpson index (1-D) and Equitability (J) values reached their peak in June, 2022. On the other hand, the highest index of Evenness and Berger-parker index of dominance values were observed in February, 2022. The dominance index exhibits a stable varied insect family in the study area and the phototactic behaviour can be vary due to light intensity.

Key words: Rice field, light trap, Coleoptera, Diptera, Lepidoptera, Shannon- Wiener diversity index, evenness, Berger-Parker index, Simpson index, equitability

Insects are fascinating group of animals that play an important role in old system and food webs. Some insects are positively phototropic (Williams and Davies, 1957), and the light trap is an effective instrument for sampling insects (Pachkin et al., 2022). Collections of light traps provide valuable information about the diversity of insects, their affinity for different wavelengths of light, and to understand how population functions (Southwood and Henderson, 2000). This information can be used by field researchers to select light traps that attract specific orders of insects. Despite the availability of various models of light traps with different light sources, there is a lack of scientific data on trap collection, diversity, number, and efficacy. Such data could help understand which insects are attracted to specific ranges of light. Therefore, it is necessary to conduct a comparative analysis of different light trap collections to study the effectiveness of different wavelengths of light in attracting insects of specific orders viz., Coleoptera (Sushil et al., 2004), Hemiptera (Rai and Khan, 2002; Manimaran and Manickavasagam, 2000), Lepidoptera (Rose et al., 2004), Hymenoptera and Diptera (Nair et al., 2004). The present study was undertaken to document the population dynamics and the species diversity of some light trap attracted insects in the Bajali area, Barpeta distict, Assam, India.

MATERIALS AND METHODS

A light trap was set up near the rice field at Bhattadev University, Bajali Campus, Pathsala, which is located in the north eastern part of Barpeta district of Assam (20°15' - 26°45' N, 91°5' - 91°30' E). The study area covers an area of 120 ha, characterised by mud, pits, swamps, and macrophytic vegetation and is used for rice cultivation. This trap consisted of a 100 watt regular tungsten bulb filament. On daily basis, the trapped insects were collected and then sorted out in the laboratory. The collected insects were preserved in a killing bottle, then transferred onto blotting paper and sorted out using a brush, needles, forceps, and lens. The total number of insects collected each week was recorded. Later the specimens were identified and classified upto species level following an introduction to the study of insects by Donald. J. Borror and Dwight. M. Delong (1964). The community structure was analysed using Shannon-Wiener index of diversity (H), index of evenness (C) Simpson index (1-D), Dominance (D), Equitability (J). The statistical analysis was performed using the statistical software PAST (version 1.3).

RESULTS AND DISCUSSION

A total of 33 light trap attracted insect were recorded in the rice field of which five species viz.,-*Cicindela sexguttata* (F.), *Holotrichia consanguinea* (Blanchard), *Anomola biharensis* (Arrow), *Myllocerus muculosus* (Desbrochers des Loge), Bark beetle belongs to Coleoptera; four species, such as *Leptogaster annulatus* (Say), *Tipula* spp and *Pegomya hyoscyami* (Panzer) and *Phytomyza atricornis* (Meigen) belongs to Diptera. The order Lepidoptera not consists of 24 species such as *Chilo zonellus* (Swinhoe), *Amsacta moorei* (Butler), *Heliothis armigera* (Hübner), *Earias fabia* (Stoll), *Thysanoplusia orichalcea* (F), *Achaea janata* (L), *Euproctis lunata* (Francis Walker), *Agrotis flammatra* (F), *Euxoa spinifera* (Hübner), *Agrotis ipsilon* (Hufnagel), *Marasmia trapezalis* (Guenée), *Leucinodes orbonalis* (Guenée), *Diacrisia obliqua* (Walker), *Utetheisa pulchella* (L), *Plutella xylostella* (L), *Ergolis merione* (Cramer), *Melanitis ismene* (Cramer), *Pterophorus periscelidactylus* (Fitch), *Gnorimoschema operculella* (Zeller), *Tryporyz aincertulas* (Walker), *Cnaphalocrocis medinalis* (Guenée), *Pieris brassicae* (L), *Malacosoma indicum* (Hübner) and *Acherontia styx* (Westwood). Lepidoptera was found to be most abundant. Contribution of each group of light trap attracted insect was in the following order Lepidoptera >Coleoptera>Diptera.

Diversity indices such as Dominance, Shannon-Wiener, Simpson, Equitability when computed revealed that light trap attracted insect diversity is maximum during monsoon and minimum during winter (Table 1; Fig. 1). Shannon- Wiener diversity index value (1.09) was found to be highest during June, while the lowest value (0) was found during February. The highest evenness value (1.0) was recorded during February, and the lowest value (0) was found during March. Berger-Parker index of dominance (D) value (1) was found highest in February, and the lowest value (0) was found during June, 2022. Simpson index (1-D) value (0.661) was found to be highest during June while the lowest value (0) was found during February. Equitability (J) value (0.993) was found to be highest during June while the lowest value (0) was found during February. Dominance index value below 1 signifies a varied insect family in all months excluding February.

At the research site, despite the use of plant protection, the index values suggest a relatively balanced entomocomplex. As the number of species exceeds 60, the impact of species richness on the index value significantly weakens (Magurran, 1992; Shannon, 1948; Pachkin et al., 2022). Simpson's diversity index is more sensitive to changes in the abundance of the most common species (Simpson, 1949). Temperature and water quality are well known to affect greatly the composition and abundance of benthic community (Ward, 1976; Ward and Stanford, 1979). Moreover, physiological factors including sex, mating status, age and adaptation period to darkness also contribute to phototactic behaviour (Kim et al., 2018). The measures of species diversity indicates that the more complex the community, greater is its species diversity and stability (MacArthur, 1955). The present investigation

Table 1. Diversity index values of insect species (July, 2021-June, 2022)

Index	July, 2021	August	September	October	November	December	January, 2022	February	March	April	May	June
Taxa_S	3	3	3	3	3	2	3	1	3	3	3	3
Individuals	649	859	493	203	41	5	8	5	307	741	436	665
Dominance_D	0.538	0.454	0.381	0.433	0.522	0.680	0.594	1	0.655	0.516	0.413	0.339
Shannon_H	0.813	0.863	1.022	0.959	0.782	0.500	0.736	0	0.565	0.773	0.973	1.091
Simpson_1-D	0.462	0.546	0.619	0.567	0.478	0.320	0.406	0	0.345	0.484	0.587	0.661
Evenness_e^H/S	0.752	0.790	0.927	0.870	0.729	0.825	0.696	1	0.586	0.722	0.882	0.992
Equitability_J	0.740	0.786	0.931	0.873	0.712	0.722	0.670	0	0.514	0.703	0.886	0.993

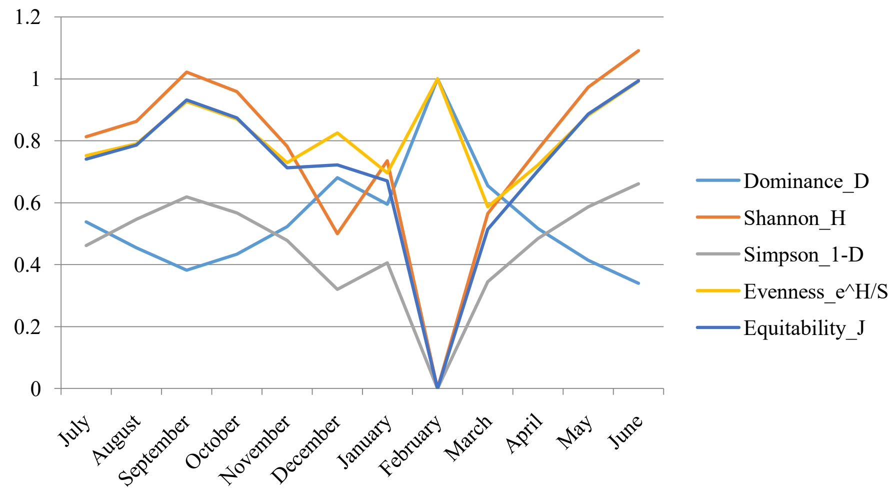

Fig. 1. Value of the indices of diversity of insect species.

on diversity and it's dynamics from the studied insect in the locality shows no marked fluctuation and it may be concluded that the study area is free from pollution. If certain insect species dominates a specific area, prompt action may be required to preserve a balance in the insect diversity (Na'im and Nasirudin, 2021).The analysis of light trap collections offers a valuable insights into the variety of nocturnal insects, their preferences for specific light wavelengths, and aids in comprehending and forecasting population dynamics (Southwood and Henderson, 2000). By utilizing light-trapping, a diverse range of native insects can be discovered, shedding light on their biodiversity across different seasons, landscapes, ecological areas, altitudes, and various times of the night (Patrick et al., 1992). It is important to note that light does not attract insects; rather, it confuses them and intercepts their intended flight path. Some insects may continuously circle around the light source, while others may settle at varying distances and eventually depart after different durations (Fry and Waring, 1996). There were significant variations in the insect composition observed in the catches using different light sources. This indicates that light sources not only differ in their attractiveness, but also capture different samples of the insect populations. Certain groups of insects were commonly found in traps with one light source, while they were almost absent in traps with other light sources. Although most insects have a similar basic pattern of spectral sensitivity in their photoreceptors, there is some variation in their specific spectral sensitivity (Briscoe and Chittka, 2003). As a result, it is expected that there will be differences in attraction among different groups of insects (Somers-Yeates et al., 2013). The phototactic behaviour of insects is primarily affected by environmental factors that are closely related to the optical characteristics of light and the surrounding conditions. Even when insects are exposed to the same wavelength of light, their phototactic behaviour can vary due to the differences in light intensity and the exposure time (Park and Lee, 2017). In general, light trap attracted insects exhibit a preference for higher luminance intensity of the light source, and a limited intensity of light can trigger a strong phototactic response among insects (Li N, 2016).

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Each author contributed equally.

CONFLICT OF INTEREST

No conflict of interest.

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