Asian Journal of Conservation Biology, December 2019. Vol. 8 No. 2, pp. 228-231 AJCB: SC0040
ISSN 2278-7666 ©*TCRP* 2019

Short Communication

Investigation on the effect of moonlight and lunar Periodicity on the Erebid moths (Insecta: Erebidae) attraction

Ramya Rajan[1], R S M Shamsudeen[1, 2]

[1]*Department of Zoology, Mananthavady Campus, Kannur University, Wayanad, Kerala- 670645, India*
[2] *Forest Entomology and GIS Research Laboratory, Department of Zoology, Sir Syed College, Taliparamba, Kannur, Kerala-670142, India*

(Received: October 25, 2019; Revised: November 15, 2019; Accepted: November 25, 2019)

ABSTRACT

The effect of moonlight and Lunar periodicity on the light trap catches of Erebid moths were probed by the usage of illuminated sheet method from Northern Kerala. The active periods of the moths seized in the traps were correlated with the light illumination of different days of a lunar cycle and it showed that trap catches were consistently very low on moonlit nights around full moon and last quarter more during new moon and first quarter periods. The significant linear and negative correlation between degree of moon phase and light trap catches was observed. This was statistically proved by regression analysis which was supported by analysis of variance.

Key words: Heterocera, Erebid moths, Moon light, lunar periodicity, Malabar, Kerala.

INTRODUCTION

Moths being photophilic in nature are attracted to the light sources .Hence the light traps are used to trap these nocturnal insects. Light traps are the best method used to survey nocturnal insects, especially moths (Young, 2005).Even the light traps are the pre-eminent method, there are many factors that effects the abundance and composition of light trap catches. There are a lot of studies which explains about many environmental factors that influence the effectiveness of the light trapping. The most important environmental effect on the number of individuals caught in light trap is that of temperature, wind, rainfall and moonlight (Nirmal *et al.*, 2017).The influence of moonlight on catches of insects in light traps was studied by some of the entomologists and the first systematic study (Williams, 1936, 1940; Willams &Singh, 1951; Williams *et al.*, 1956) was done and dealt with the effect of moonlight on several groups of insects. Sanyal *et al.* (2013) asserts that the lunar phases exert a great influence on the diversity and distribution of moth assemblages. The influence of moonlight on noctuid moths (Williams,1936) were done and he stated ,that the highest number of noctuid moths were trapped on 2nd,4th day after new moon, while the minimal values were observed in he catches during the same period after full moon. The effect of the moon phases and of the intensity of polarized moonlight on the light trap catches were done by Nowinszy *et al*., 1979 states the highest trap catches coincided with the maximal polarization rates. The effect of moonlight on the numbers of moths caught is generally negative (Williams 1936, Vaishampayan and shrivastava1978, Harstack, Nowinsky *et al.*,1979, Vaishampayan and verma1982, Nag and Nath 1991, Nirmal *et al.,* 2017).

MATERIALS AND METHODS

Collections of moths were carried out in five different areas of the Malabar region (Table 1) from August 2016 to December 2017. To assess the influence of moon light and lunar periodicity, the position of moon phase for each calendar day of observation was worked out form Indian Almanac. The brightness of moon light for each lunar day will be measured in terms of degree of moon phase or the relative illuminated area of moon disc. The 360° moon phase will be considered full moon and 0° moon phase as new moon with the division of 360° by 15, each day represent a change of 24° increase in ascending phase (24° - 360°) and of lunar cycle. (Mishra, 1999).

Table 1. Showing Study sites

Sl no.	STUDY SITES	COORDINATES
1	Madayipara	12.0323° N, 75.2567° E
2	Varayal	11.8385° N, 75.8991° E
3	Thalapuzha	11.8488° N, 75.9521° E
4	Kozhummal	12.1790°N,75.2173°E
5	Muyyam	12.0269° N,75.3893° E

The collection of Moths was carried out at each of the collection sites' using an illuminated vertical white sheet (Shamsudeen *et al.*, 2005) .The sheet method was used, which allows collection of all the specimens individually without any damage. A white cloth sheet (70cm ×55cm) was hung between two vertical poles in such a way that it touched the surface and

*Corresponding Author's E-mail: rajanramyarajan@gmail.com

Table 2. Number of species and individuals caught from different subfamilies of Erebidae in different moon phases

Sl no.	Sudfamilies	Taxa	Individuals	No of individuals in diff.Moon Phases			
				●	◐	○	◑
1	Aganinae	4	38	27	16	1	1
2	Arctiinae	35	88	57	29	3	5
3	Boleotobiinae	2	9	5	3	0	1
4	Calpinae	10	27	18	9	1	1
5	Erebinae	38	94	64	33	3	3
6	Eulepidotinae	1	3	3	1	0	0
7	Herminiinae	3	8	6	1	0	1
8	Hypeninae	3	13	7	4	0	2
9	Lymantriinae	20	59	26	19	6	8
10	Scoliopteryginae	3	10	7	3	0	0
11	Tinoliinae	1	6	4	2	0	0
12	Miscellaneous taxa	2	29	19	9	1	2
	Total	**122**	**384**	**243**	**129**	**15**	**24**

extended forward over the ground slightly away from direct source of light placed at such a point that the whole sheet from edge to edge brightly reflected the light. A 160 watt mercury vapour lamp was used as a light source through the night. Moths started collecting on the sheet just after sunset between 6.30pm to 10.30pm, after that the abundance of moths slowly declined. The correlation between the Erebid moths trapped and the moonlight was studied by subjecting the data to the correlation coefficient, regression analysis and ANOVA.

RESULTS

The study was carried out in five different sites of Malabar Region of Kerala for a period of 12 months. A total of 384 individuals (New moon-243, First quarter-129, Full moon-15, Last quarter-24) belonging to 122 species were recorded (Table 2). By the observation and data analysis it is found that the light trap catches in different moon phases showed a high significant difference in the attraction. Significant variation in catch success per night was observed with the highest catch success in New moon phase followed by first quarter and in the full moon and last quarter it was very low (Figure 1).

High significant difference in attraction of Erebidae was noticed in moonlit nights (Full moon phase and Last quarter phase) and dark nights (New moon phase and First quarter) (Figure 2). In all the lunar cycles, the attraction response of the moths was consistently very low during moonlit nights (Full moon to last quarter). Around full moon (360°) the attraction of Erebidae to the light trap was very less.

The attraction of moths was high during the dark nights (New moon and third quarter). Around the new moon (0°) the number of moths attracted to the trap was high. It is evident that there was a gradual decrease and increase in the attraction of moths on various nights in

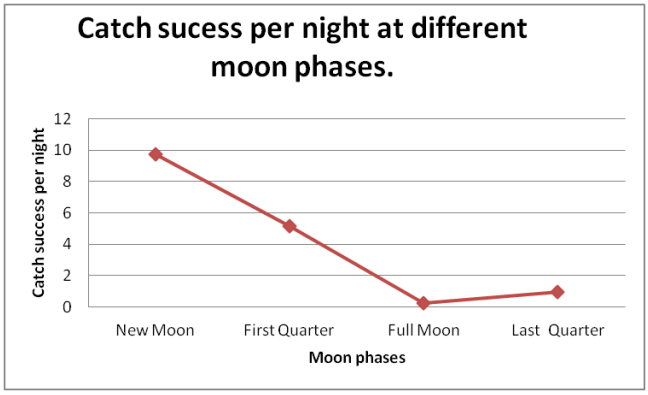

Figure 1. Catch success per night in different Moon Phase

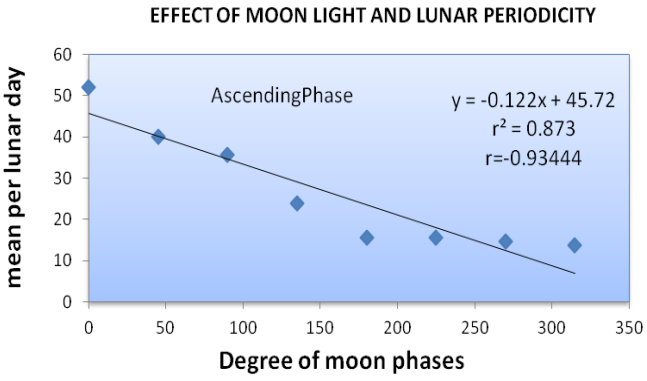

Figure 2. The effect of moon light and lunar periodicity in light trap catches in ascending phases of lunar **cycle**.

the first half (no moon to full moon) (Figure 2) and in the second half (full moon to no moon) (Figure 3) of lunar cycles, respectively. The attraction was clearly associated with the change in the degree of moon phase. Regression analysis showed a strong inverse linear correlation

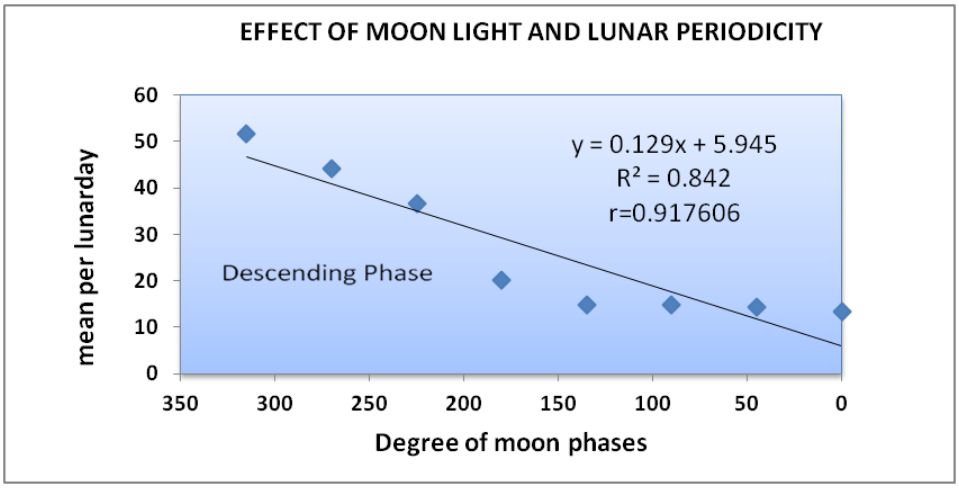

Figure 3. The effect of moon light and lunar periodicity in light trap catches in descending phases of lunar cycle.

between degree of moon phases and light trap catches. It was found out 87.3% of the variance in the light trap catches is due to the variance of different moon phases (r =0.93444; r^2=0.873) and the remaining 12.7% of the variance is due to other factors (Fig.2) and 84.2 % of the variance in the light trap catches is due to the variance of different moon phases (r=0.917606; r^2=0.842) and the remaining 15.8% of the variance is due to other factors. (Figure 3).The high correlation coefficient (r)indicates a very strong relationship between the two variables, mean catch per lunar day and degree of moon phase. The steeper slope indicates a strong response in descending moon phase (315°-0°), as compared to ascending moon phase (0°-315°) (Figure 3). In addition to regression analysis Analysis of Variance was carried out to find out the significant difference between collections of Erebidae at different moon Phase. The P value (0.0007) is less than 0.05, hence the value is significant. Accordingly calculated F (6.8348) value is greater than F critical value (2.8165). This implies a significant difference in the attraction of Erebid moths to the light trap in different moon phases.

DISCUSSION

Bowden and Church (1973), Bowden and Morris (1975) and Vaishampayan and Verma (1982) have reported the lunar effect and inferred that the reduction in the attraction of Photophilic insects around full moon are purely a physical phenomenon. Mishra (1999) recorded the same trend of attraction response in *Agrotis flammatara.* He observed highly inverse correlation between the light trap catches and the degree of moon phase. Williams 1936, Vaishampayan and shrivastava1978, Harstack, Nowinsky *et al.*.1979, Vaishampayan and verma1982, Nag and Nath 1991, Nirmal *et al.,* 2017 are also showing approbation in such a lunar effect and endorse the hypothesis that the reduction in trap catches on full moon is purely a physical phenomenon. Weber (1957) reported a periodicity in the number of insects trapped, which could be brought into correlation with the moon changes. Some of the entomologists like Taylor and Brown (1972) did not support these findings. Day and Reid (1969) found no significant difference between the numbers of *Conoderus falli* Lane collected during both moon phases. Vaishampayan and Srivastava (1978) in their study on *Spodoptera litura* reported significant inverse correlation ship between the trap catches and degree of moon phase. This is an attempt to evaluate the effect of moon on the trap catches of family Erebidae were the information is poor.

CONCLUSION

It is concluded that different moon phases have a strong effect in the attraction of Erebidae to the light traps. This was statistically proved by Regression analysis and supported by ANOVA.

REFERENCES

Bowde, J., & Morries, M. (1975). The Influence of moon light on catches of insects in light traps in Africa Part III. The effective radius of mercury vapour light traps and the analysis of catches using effective radius. Bull. Ent. Res. 65, 303-308.

Bowden, J., & Churchb, M. (1973).Influence of moon light on catches on insects in light traps in Africa Part 11. The effect on moon phase on light trap catch. Bull. Ent. Res. 63, 129.

Day, A., & Reid, W J Jr. (1969). Response of adult southern potato wireworms to light-traps. .Journ. Econ. Entomol. 62, 314-318.

Harstack, A W. (1979). Light sources, trap design and other factors affecting moth catch. 232-240.

Mishra, P N., Singh, M P., & Autiyal, M C. (1999). Effect of Moon Light and Lunar Periodicity on the Attraction of Black Cutworm Moth *Agrotisflammatara*on Light Trap. Pertanika J. Trap. Agric. Sci, 22(1), 69-72.

Nag, A., & Nath, P. (1991). Effect of moon light and lunar periodicity on the light trap catches of cut worm *Agrotis ipsilon* (H.) moth. Journal of applied entomology, 111(5), 358- 360.

Nirmal, A., & Kumar Sidar, Y. (2017). The effects of moonlight phases on light-trap catches of insects. Journal of Entomology and Zoology Studies, 5(2), 1209-1210.

Nowinsky, L., Szábo, S., Toth, G., & Kiss, M. (1979).The effect of the moon phase and of the intensity of polarized moonlight on the light light-trap catches. Z. Angew. Entomol, 88,337-353.

Sanyal, A., Uniyal, V., Chandra, K., & Bhardwaj, M. (2013). Diversity, distribution pattern and seasonal variation in moth assemblages along altitudinal gradient in Gangotri landscape area, Western Himalaya, Uttarakhand, India. *Journal of Threatened Taxa*, *5*(2), 3646-3653.

Shamsudeen, R S M., Chandran, R., & Mathew, G. (2005). Collection of Microheterocera: A Newer Method. Bug' R' All, 8(1):3.

Taylorl, R., & Browne, S. (1972). Effect of light trap design and illumination on samples of moths in the Kenya highlands. Bull. Ent. Res. 62, 91-112.

Vaishampayan, S M., & Shrivastava, S K. (1978). Effect of moon phase and lunar cycle on the light-trap catch of tobacco caterpillar, *Spodoptera litura* (F.) (Lepidoptera: Noctuidae). J. Bombay Nat. Hist. Soc. 75(1), 83-87.

Vaishampayan, S M., & Verma, R. (1982). Influence of moonlight and lunar periodicity on the light trap catches of gram podborer, Heliothis annigera (Hiibner) moths. Indian J. Entomol, 44, 206- 212.

Vaishampayan, S M., & Verma. (1982). New design of light trap for survey and management of insect pest population in agro and forestry ecosystems. Indian J. Ent, 44,201-205.

Weber, M. (1957). Meteorológiai tényezök szerepe a rovarok életében (The roles of meteorological parameters in the life of insects). Pécsi Müszaki 5zemle 3, 17-23.

Williams, C B. (1936). The influence of moonlight on the activity of certain nocturnal insects, particularly of the family Noctuidae as indicated by a light trap. Phi. Trans. Roy. 50C. (London); *B*226, 357-389.