ISSN: 2994-9556

Volume 3 Issue 1
www.escientificlibrary.com

ES Journal of Agriculture and Current Research

Light-Trap Catch of Lygus sp. (Heteroptera, Miridae) in Connection with the Stanford Mean Solar Magnetic Feld

Review Article

DOI: 10.59152/ESJACR/1010

Nowinszky L. [1], Puskás J. [1], Kiss M. 1, Hill L. [2]

[1] Eötvös Loránd University, Savaria University Centre, Hungary, Europe

[2] Formerly Principal Entomologist at Biosecurity Tasmania, Hobart, Australia

Received: March 10, 2023; **Accepted:** April 12, 2023; **Published:** April 14, 2023

***Corresponding author:** László Nowinszky, Eötvös Loránd University, Savaria University Centre, Hungary, Europe

Abstract

Introduction: In an earlier work we found that some Trichoptera species from Hungary, Lepidoptera species from Hungary, Australia and two states of the USA react to changes in the solar magnetic field values. We examined in the current study the Stanford mean solar magnetic field how affect the light-trap catches of the Lygus species (Heteroptera: Miridae).

Material: In our study we use the data of Stanford mean solar magnetic field published by the Wilcox Solar Observatory from 1980 to 1995.

The light-trap data of Lygus sp. were used 41,830 individuals, 2,588 monitoring data and 1,342 nights.

Methods: We have calculated the relative catch values of the number of specimens trapped by years.

For all species the relative catch (RC) data was classified into the appropriate values of solar magnetic fields. Values of solar magnetic fields and the corresponding catch data were organized into classes. By species we depicted in figures the data coming from the different solar magnetic field and the RC values.

Results: This result is very similar to the results reported in our latest book [7]. In this we found that some Trichoptera species from Hungary, Lepidoptera species from Hungary, Australia and USA react in the same way to changes in the solar magnetic field values. Stanford mean solar magnetic field, affects the efficiency of light trapping of various insect taxa. This influence can be experienced on three continents. Even if we process a huge amount of catch data, we cannot get significant results in two cases. One case is when we only have data from a single or a few light-traps. Then the standard deviations are large due to the significantly different catch data on different days. In this work, both conditions were met. According to the above, we accept our results as real.

Introduction

The majority of bug (Heteroptera) species can fly well onto the light [1]. However, several harmful species cannot be collected with light. In Hungary were published results of the light-trap catch of bugs [2- 4], but these authors selected their topics only according to ecological and faunal viewpoints. The species richness and abundance of the field bugs (Miridae), collected by the light-traps, are important. Among these the most considerable ones are *Lygus rugulipennis* Poppius, 1911 and *Lygus pratensis* Linnaeus, 1758 the individual number is high in both cases [1].

Jászainé [2] analysed the catching results of L*ygus pratensis* Linnaeus, 1758) (Heteroptera: Miridae) in normal and BL light-traps. The standard light-traps caught more individuals.

We mention the paper of [5] from the new studies. They collected in large number the *Lygus pratensis* (Linnaeus, 1758), *E. rugulipennis* (Poppius, 1911), *Adelphocoris lineolatus* (Goeze, 1778) and *Trigonotylus ruficornis* (Geoffroy, 1785) species of Miridae in Turkey.

We examined in the current study the Stanford mean solar magnetic field how affect the light-trap catches of the *Lygus* species (Heteroptera: Miridae). Earlier we made examination with the same ones in connection with the solar Q-index. However, the result was difficult to interpret.

That is clear, that the catch is very high at 0 value of the Q-index. These bugs are therefore most active when solar activity is low, so there are not many and strong solar flares. At high Q-index values, the catch is low. Then few bugs fly into the light. However, the catches belonging to the middle Q-index values cannot be interpreted [6].

Last year, we studied the light trapping of moth (Lepidoptera) and caddisfly (Trichoptera) species from Hungary, Australia and two states of the USA in the context of the Stanford mean solar magnetic field. The aim of our current work was to compare those results with similar results for Lygus sp [6].

Last year, we studied the light trapping of moth (Lepidoptera) and caddisfly (Trichoptera) species from Hungary, Australia and two states of the USA in the context of the Stanford mean solar magnetic field [7]. The aim of our current work was to compare those results with similar results for Lygus sp.

Material and Methods

In our study we use the data of mean magnetic field of the Sun published by the Wilcox Solar Observatory from 1980 to 1995. The solar mean magnetic field (SMMF) is the average field as observed over the entire visible disk of the Sun. A solar telescope was built in 1975 at Stanford University (Wilcox Solar Observatory (WSO) to study the organization and evolution of large-scale magnetic fields of the Sun. The WSO made daily observations of the mean solar magnetic field using a Babcock-type magnetograph which is connected to a 22.9 m vertical Littrow spectrograph [8].

The Stanford mean solar magnetic field values measured at the Wilcox Observatory are averages of the longitudinal (solar longitude) component of the Sun's photospheric magnetic field, averaging over the entire visible disk of the Sun and taking into account the instrument profile. Positive and negative values indicate the direction of the mean field (**+:** north polarity, **-:** south polarity).

In Hungary, similarly to several other countries (UK, several US states, Scandinavian countries), a light-trap network has been operating for many decades [9]. The light source of traps was 100 W normal bulb at 2 m height above ground level. We used chloroform as killing material.

The light trap catching data of Lygus Genus, were taken from the light-trap diary in Fejér and Tolna Counties (Hungary, Europe) between 1980 and 1995.

The material of caught bugs has not been determined by species, but its deciding majority belonged to individuals of *Lygus rugulipennis* Poppius, 1911 and *Lygus pratensis* Linnaeus, 1758. Altogether 41,830 individuals, 2,588 monitoring data and 1,342 nights were available for the investigation.

The names of light trap catch stations, their geographical coordinates and the years of collecting are shown in (Table 1).

Table 1. Years of trapping and geographical coordinates of light-trap stations

Town or village	Geographic coordinates	Years of operation
Dunaújváros	46º47′29″N; 18º56′13″E	1981-1983
Dunaföldvár (Tolna County)	46º58′03″N; 18º55′45″E	1980
Gánt	46º02′03″N; 18º23′26″E	1982
Nadap	47º15′44″N; 18º37′17″E	1981-1990
Rácalmás	47º01′51″N; 18º56′60″E	1984-85, 1991, 1995
Ráckeresztúr	47º16′60″N; 18º49′76″E	1991
Sárbogárd-Pusztaegres	46º53′22″N; 18º37′35″E	1980-1995
Sárosd	47º02′50″N; 18º39′12″E	1982-1983
Seregélyes	47º06′77″N; 18º34′80″E	1986
Sukoró	47º14′40″N; 18º35′99″E	1995
Székesfehérvár	47º17′45″N; 18º19′59″E	1980-1981
Velence	47º14′32″N; 18º39′28″E	1980
Zámoly	47º19′00″N; 18º24′64″E	1983-1990

Methods

We have calculated the relative catch values of the number of specimens trapped by years. Basic data were the number of individuals caught by one trap in one night. The number of basic data exceeded the number of sampling nights because in most collecting years more light-traps operated synchronously. In order to compare the differing sampling data of the Genus, relative catching values were calculated from the number of individuals. For examined Genus the relative catch (RC) data were calculated for each sampling day per site per year. The RC was defined as the quotient of the number of individuals caught during a sampling time unit (1 night) per the average catch (number of individuals) within the same generation relating to the same time unit. For example, when the actual catch was equal to the average individual number captured in the same generation/swarming, the RC value was 1 [10].

For all species the relative catch data was classified into the appropriate values of solar magnetic fields. Values of solar magnetic fields and the corresponding catch data were organized into classes. Their number was determined according to Sturges' method [11] using the following formula:

$k = 1 + 3.3 * 1gn$

Where: k = the number of divisions, n = the number of observation data.

By species we depicted in figures the data coming from the different solar magnetic field and the relative catch values. The data are plotted in (Figure 1)

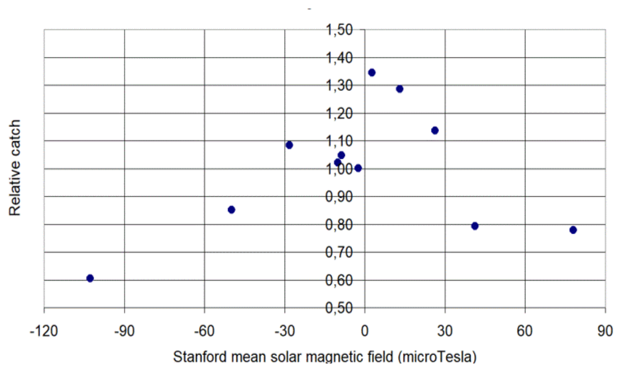

Figure 1: Light-trap catch of *Lygus sp*. in connection with the Stanford mean solar magnetic field

Results and Discussion

According to our hypothesis, our results have the following explanation. The low relative catch values always reflect situations in which the flight activity of the insects diminish. However, high values are not so simply interpreted. Major environmental changes bring about physiological transformation in insects. The imago is short-lived. Therefore, an unfavourable environment influences the survival of not just the individual, but also the population as a whole. In our hypothesis, the individual may adopt either of two opposite strategies to evade the impacts hindering its normal functions. It may either display more liveliness, by increasing the intensity of its flight, copulation and oviposition or take refuge in passivity to weather an unfavourable situation. And so by the present state of our knowledge we might say that high relative catch can accompany favourable and unfavourable environmental effects [7].

However, stronger solar activity subsequently forces insects into passivity.

The explanation of the increasing and then decreasing type, according to our hypothesis, may be as follows. Initially, solar activity enhances insect activity, whether favourable or unfavourable to the state of the environment.

This result is very similar to the results reported in our latest book [7]. In this we found that some Trichoptera species from Hungary, Lepidoptera species from Hungary, Australia and two states of the USA (Nebraska and North Carolina) react in the same way to changes in the solar magnetic field values. These are the following:

Trichoptera (Hungary): Hydropsychidae: *Hydropsyche instabilis* Curtis, 1834,

Hydropsyche contubernalis McLachlan, 1865

Lepidoptera (Hungary): Lasiocampidae: *Malacosoma neustria* Linnaeus, 1758

Lepidoptera (Australia): Oecophoridae: *Philobota productella* Walker, 1864,

Crambidae: *Uresiphita ornithopteralis* **Guenée, 1854,**

Ptochostola microphaeellus Walker, 1866

Lepidoptera (USA: Nebraska, North Carolina):

Erebidae: *Spilosoma virginica* Fabricius, 1798

Based on our previous and current results, we found that one of the characteristics of solar activity, the Stanford mean solar magnetic field, affects the efficiency of light trapping of various insect taxa. This influence can be experienced on three continents. However, from the results of our current work, our finding can only apply to one type of influence, the increasing and then decreasing type.

Our current result provided an important addition to the verification of our previous opinion.

Even if we process a huge amount of catch data, we cannot get significant results in two cases. One case is when we only have data from a single or a few light-traps. Then the standard deviations are large due to the significantly different catch data on different days. In the other case, some species, especially migrants, appear intermittently in time and patchily across observation sites. Occasionally there are many migrants flying but often there are few or none. The standard deviations are extremely large in this case as well. In this work, both conditions were met. According to the above, we accept our results as real.

Conclusions

The present study deals with the connection of Stanford mean solar magnetic field and light-trap catches of Lygus sp. from Hungary (Central Europe).

For bug (Lygus) species a relationship was found between the solar magnetic field and the number of individual captured. The type of flying behavior could be determined: The catch initially increased as the value of the solar magnetic field increased, but it decreased from its value close to 0. Our current result provided an important addition to the verification of our previous opinion.

Even if we process a huge amount of catch data, we cannot get significant results. This happens when the standard deviations are large due to the significantly different catch data on different days. In this work, both conditions were met. According to the above, we accept our results as real.

References

1. Kondorossy E. The selectivity of the light trap to the true bugs (in Hungarian). PATE Georgikon Mezőgazdaságtudományi Kar III. Ifjúsági Tudományos Fóruma, 1997; 1: 13-19.
2. Jászainé V.E. Miridae species (Heteroptera) in the material of normal and blacklight traps of Hungarian light-trap network in 1963 (in Hungarian). Fol. Ent. Hung., 1964; 17: 471-524.
3. Jászainé V.E. The localities of Heteroptera species, flying towards light, according to the data of National Light-trap Network in Hungary between 1963 and 1966 (in Hungarian). Proceedings of Berzsenyi D. Teachers Training College Szombathely 1998; 2: 35-44.
4. Rácz V. Bernáth I. Dominance conditions and population dynamics of *Lygus* (Het., Miridae) species in Hungarian maize stands (1976-1985), as functions of climatic conditions. J. Appl. Ent., 1993; 115: 511-518.
5. Önder F. Ünal E. Ünal A. Heteropterous insects collected by light traps in Edirne (Turkey). Türk. Bit. Kor. Derg., 1984; 8: 215-224.
6. Puskás J, Kiss M, Nowinszky L, Kúti Zs. Chapter 5 Light-Trap Catch of Heteroptera Species in Connection with the Solar Activity (Q-index) in Hungary In Puskás J. Nowinszky L Hill L (Eds.) Activity of Night Flying Insects in Connection with the Solar Activity (Q-index) Examined on Three Continents. Savaria University Press Hungary, Szombathely 2021; 75-78.
7. Nowinszky l., Puskás J., Kiss M., Kiss O., Hill L., Barta V. et al. Chapter 1. Solar Activity. In Nowinszky L., Puskás J., Hill L. (Eds.) Light Trapping of Insects Influenced by the Sun and Moon in Europe, Australia and USA. Cambridge Scholars Publishing. 2023; 1-39.
8. Jermy T. Investigation of the swarming of harmful insects using light-traps (in Hungarian). A Növényvédelem Időszerű Kérdései. 1961; 2: 53-61.
9. Scherrer P.H. Wilcox J.M. Svalgaard L. Duvall T.L.Jr. Dittmer P.H. Gustafson E.K. The mean magnetic field of the Sun: observations at Stanford. Solar Physics, 2017; 54. 2:353-361. Doi: 10.1007/BF00159925.
10. Nowinszky L. The Handbook of Light Trapping. Savaria University Press, Jungary, Szombathely. 2003; 276.
11. Odor P. Iglói L. An introduction to the sport's biometry (in Hungarian). ÁISH Tudományos Tanácsának Kiadása. Hungary, Budapest. 1987; 267.

Citation: Nowinszky L, Puskás J, Kiss M, Hill L. Light-Trap Catch of Lygus sp. (Heteroptera, Miridae) in Connection with the Stanford Mean Solar Magnetic Feld. ES J Agri Curr Res. 2023; 3(1): 1010.