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Light-Trap Catch of Heart and Dart (*Agrotis exclamationis Linnaeus*) in Connection with the Hourly Values of Geomagnetic H-Index

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Abstract

We deal in this paper with light trapping results of the Heart and Dart (*Agrotis exclamationis* Linnaeus, 1758 Lepidoptera: Noctuidae), depending on the horizontal component of the geomagnetic field (H-index). We calculated relative catch vales from the hourly collecting individuals of examined species by generation. These hourly relative catch values were classified to the hourly values of H-index. These hourly catch results were correlated to the hourly values of H-index. We calculated correlations to demonstrate the supposed relationship between the two data.

Our results suggest that more effective light trap catch belongs to higher H-index values.

Keywords: Light-trap; Geomagnetic; Horizontal component; Heart and Dart

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Introduction and Literature Background

It is well known for a long time that different species of insects are sensitive to geomagnetism and they use it in the spatial orientation.

Tshernyshev [1,2] suggest, the caught of some light trapped Coleoptera and Lepidoptera species increase during magnetic field perturbations that of other Lepidoptera and Diptera species to fall off by the phenomenon.

Pristavko and Karasov found correlation between the C and ΣK values and the number of collected individuals of the Spotted Ermel (*Hyponomeuta rorellus* Hbn) [3].

In a later paper Pristavko and Karasov suggest that ΣK had a greater impact on the flying activity of the same species at the time of geomagnetic storms [4].

Iso-Iivari and Koponen examined the influence of geomagnetism on light trapped insects in the far north of Finland [5]. They used the K-index values measured in every three hour, and the ΣK and δH values. They found a weak, but significant relationship between the geomagnetic parameters and the amount of trapped insects.

Becker and Gerisch examined the activity of a termite species (*Heterotermes indicola* Wasmann) found a stronger relationship between the vertical component of geomagnetism (Z) than with K-index [6].

Our recent results ascertained that in surroundings of New Moon when there is no visible moonlight, the higher values of the vertical component decreased the light-trap catch [7]. In the First Quarter, Full Moon and the Last Quarter, increasing values of the vertical component increased the catch in both the moonlit and moonless hours.

The examinations of Baker and Mather and Baker certified that the Large Yellow Underwing (*Noctua pronuba* L.) and Heart and Dart (*Agrotis exclamationis* L.) use both the Moon and the geomagnetism for their orientation [8]. If the nights are cloudy, the Large Yellow Underwing (*Noctua pronuba* L.) moths orientated with the help of geomagnetism. Kiss et al. and Nowinszky and Tóth was found that both the Moon and the geomagnetism are suitable for the orientation of the Turnip Moth (*Agrotis segetum* Den. et Schiff.) and the Fall Webworm (*Hyphantria cunea* Drury) [9-14].

Srygley and Oliveira and Samia et al. found, that the navigation of moths at night cannot be helped by the Moon, but by geomagnetism [12,13].

Material

We downloaded the earth's magnetic x and y data of Tihany Geophysical Observatory, Hungary (46º54'57"N and 17º53'42"E) from the World Data Centre for geomagnetism, Kyoto's website (http://wdc.kugi.kyoto-u.ac.jp/hyplt/). We calculated on the horizontal component values of H-index over 2,150 nanoTesla of the formula, according to the instruction of Mr. László Szabados's Tihany Geophysical Observatory):

$$H = \sqrt{x2 + y2}$$

We used the light-trap catching data of Heart and Dart (*Agrotis exclamationis* Linnaeus, 1758.) from the fractioning light-trap operated by Prof. Járfás in Kecskemét-Katonatelep (46º50'17"N and 19º41'57"E) in years between 1967 and 1969. This light-trap collected the insects every night and hour different container between 6 p.m. and 4 a.m. (UT). There were caught in 764 nights (observing data) and 2,436 specimens.

The fractioning light-trap had as its light source three F-33 type fluorescent tubes; one installed above the other, 120 cm long each, with colour temperature of 4300 ºK. This light-trap was in operation during every day between 6 p.m. and 4 a.m. (UT). The storing bottles were changed every hour by a changing device. We not separated the moths neither they coming from first and second generation nor ones caught on different trapping levels.

Methods

The number of specimen of a given species in variant years and catching locale is not the same. Therefore we computed relative catch (RC) values. This is for a given sampling time unit (one night) and the average number individuals per unit time of sampling, the number of generations divided by the influence of individuals [15]. The relative catch values were put on the H-index values of the given day and hour, and we summed up and averaged they. We arranged the catching geomagnetic H-index data pairs of in classes, and then averaged them. Regression equation was calculated H-index values and relative catch values of examined species data pairs. We determined the significance level which was shown in the **Figure 1**.

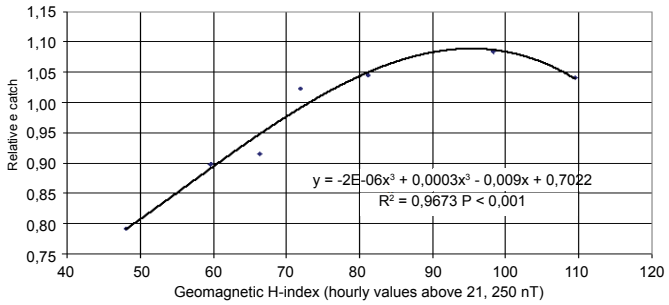

Figure 1 Light-trap catch of the Light-trap catch of Heart and Dart (Agrotis exclamationis Linnaeus) in connection with the hourly values of geomagnetic H-index.

Results and Discussion

Very few studies deal with the connection between the results of light trapping geomagnetic components, as the Kp, Cp, C, Ap and H-indices.

We examined therefore the connection of hourly light-trap catch of Heart and Dart (*Agrotis exclamationis* L.), spread in the whole Palearctic region, in nexus with the horizontal component of geomagnetic field (H-index).

According to all indications the light trap catch of Heart and Dart rises to the rising values of the H-index. We suggest that the higher geomagnetic intensity provides more trouble-free spatial orientation and therefore increases the catch.

Accordingly the higher geomagnetic horizontal component (H-index) and the increasing catch values probably can be expounded the fact, that in such cases the spatial orientation of the insects the geomagnetic field comes in great importance.

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