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Light-Trap Catch of the European Corn-Borer (Ostrinia Nubilalis Hübner) and Setaceous Hebrew Character (Xestia C-Nigrum L.) in Connection with the Height of Tropopause

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The data of European Corn-borer come from the Hungarian national light-trap network between 1959 and 1973, and the Setaceous Hebrew Character come from the forestry light-trap network between 1961-1970.

Groups were made for data of the height of tropopause. The relative catch values of the examined species were categorised according to the characteristics of tropopause on each day, after it these values were summarised, averaged and depicted. We defined the parameters of the regression equations. We have found a close positive correlation between the height of the tropopause and relative catch of Setaceous Hebrew Character, but only the lowest and highest values of the tropopause reduce or rather increase of the light trap catch of the European Corn-borer.

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I. Introduction

The tropopause is a surface separating the lower layers of the atmosphere (troposphere) from the upper layers (stratosphere). It is of varying height. In the presence of very cold air masses from the Arctic it may be a mere 5 kilometres, while in the presence of sub-tropical air it may grow to 16 kilometres. Sometimes there are two or three tropopauses one above the other. A low tropopause is related the presence of cold and high tropopause the presence of warm types of air, while insect activity is increased by warm and reduced by cold air. An over 13 km height of the tropopause often indicates a subtropical air stream at a great height. This has a strong biological influence. These results may lead us to assume that the electric factors in the atmosphere also have an important role to play, mainly when a stream of subtropical air arrives at great height. On such occasions the 3Hz aspheric impulse number shows a decrease, while cosmic radiation of the Sun will be on the increase [Örményi, 1984]. The preponderance of negative ions in polar air reduces activity, while the preponderance of positive ions in subtropical maritime air may spur flight activity [Örményi, 1967]. The warm air increases the activity of the insects; the cold reduces it on the other hand.

This fact will change the number of insects collected by light-trap. We published it already in the recent past the efficiency of his light-trap catch in connection with the height of the tropopause of the Heart and Dart (Agrotis exclamationis L.), the Common Cockchafer (Melolontha melolontha L.), the Turnip Moth (Agrotis segetum Den. et Schiff.) and Fall Webworm Moth (Hyphantria cunea Drury) [Puskás and Nowinszky, 2000], [Örményi et al., 1997] and Puskás and Nowinszky (2011). However we know of no other study besides our investigating the relationship between the height of tropopause and light trapping. In our present work we have examined the light-trap catch of European Corn-borer (Ostrinia nubilalis Hübner) and Setaceous Hebrew Character (Xestia c-nigrum L.) as a function of the height of the tropopause, too.

We found in our former studies that the light trapping efficiency of parallel increases if the tropopause height is about 13 kilometres. However, the tropopause is even higher values in the collection of different species can be seen continue to increase, but also decrease. Therefore, we refer to our earlier studies where the effects of air masses influencing the collection were investigated (Nowinszky et al, 1997; Örményi et al, 2003). In these studies the subtropical air masses were divided on the basis of their origin and the path as follows:

Sub-tropical air; Azores air moving from W and WSW; Continental sub-tropical air arriving from the Middle East from SE; Saharan air from the Middle East from SE (observing in the upper layers only); Saharan air from across the Mediterranean Sea; Saharan air from across the Black Sea and Warm air from the Black Sea.

It has been stated that the subtropical air masses, observed in the high altitudes, differently affect the efficiency of light-trap collection according to whether they come from that route over Hungary. The light-trap catch of Turnip Moth (Agrotis segetum Den. et

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Schiff.) and Heart & Dart (Agrotis exclamationis L.) is high during subtropical residence time of air masses, but during the Saharan air mass residence time it is low. It is just opposed the results to the Fall Webworm Moth (Hyphantria cunea Drury) light trapping catch.

II. Material

Data for Budapest on the height of the tropopause have been collected from the Annals of the Central Meteorological Institute of the Hungarian Meteorological Service. Because area of Hungary is 93 036 km2 only, so this data is valid for the entire territory of the country (Örményi et., 1997).

The development of light-trap network began in 1952 in Hungary. The traps were used in research institutes, for plant protection and forestry purpose. The three type light trap network works with uniformly Jermy trap which is still working.

The national light-trap network over the past decades, enormous and inestimable scientific worth of insect material is provided for entomological research and plant protection practice. We selected two moth species from this huge data from for the present work. They comprise:

- European Corn-borer (Ostrinia nubilalis Hübner 1769) (Lepidoptera: Pyraustinae) from the all collecting material of all light-traps between 1958 and 1973.

Setaceous Hebrew Character (Xestia c-nigrum Linnaeus 1758) from the materials of all forestry light-traps between 1961 and 1970. The examined species and their catching data can be seen in Table 1

Insert near here Table 1

The stations of light-traps, their geographical coordinates and the examined years can be seen in Table 2

Insert near here Table 2

III. Methods

Than the number of individuals of a given species in different places and different observation years is not the same. The collection efficiency of the modifying factors (temperature, wind, moonlight, etc.) are not the same at all locations and at the time of trapping, it is easy to see that the same number of items capture two different observers place or time of the test species mass is entirely different proportion. To solve this problem, the introduction of the concept of relative catch was used decades ago (Nowinszky, 2003).

The relative catch (RC) for a given sampling time unit (in our case, one night) and the average number individuals per unit time of sampling, the number of generations divided by the influence of individuals If The number of specimens taken from the average of the same, the relative value of catch: 1. The relative catch allows the processing of collecting aggregate data from different years and observation locations (Nowinszky, 2003).

From the collection data pertaining to European Corn-borer (Ostrinia nubilalis Hbn.) and Setaceous Hebrew Character (Xestia c-nigrum L.) we calculated relative catch values (RC) by light-trap stations and by swarming. Following we arranged the data on the height of the tropopause in classes.

Relative catch values were placed according to the features of the given day, then RC were summed up and averaged. The data are plotted for each species and regression equations were calculated for relative catch of examined species and tropopause data pairs.

IV. Results

The results are shown in the Figure 1 and Figure 2.

Insert near here Figure 1 and Figure 2

V. Discussion

In our above cited study (Puskás and Nowinszky, 2011), significant positive correlations were established at each of the three species' light-trap catch studied in contention with the height of tropopause (Common Cockchafer (Melolontha melolontha L.) and Heart and Dart (Agrotis exclamationis L.) specimens, but only the lowest and highest values of tropopause reduce or rather increase of the light trap of the Fall Webworm Moth (Hyphantria cunea Drury).

Our results show that the light-trap catch of European Corn-borer) (Ostrinia nubilalis Hbn), rising to 14.5 km tropopause height increases, but higher values have been greatly reduced. In contrast, the light-trap catch of Setaceous Hebrew Character (Xestia c-nigrum L.) after the initial modest rise 13 km from rising strongly as a whole in the tropopause height of 15 km. This result is contrary to the findings of earlier works (Nowinszky et al,, 1997) while the latter confirms. The reason of the contradiction can be explained, that the European Corn-borer (Ostrinia nubilalis Hbn.) in subtropical air masses residence at the time of very hot nights have reduced flight activity.

This hypothesis is based on the ability of a still unpublished result as the light-trap catch of species increased, however, measured to the 21 o'clock evening temperatures up to 25 °C, but at higher temperatures the catch decreased by nearly half value.

We do not know yet every detail of how effects the height of the tropopause the catch results. Further researches will hopefully lead to a clear answer.

VI. Acknowledgements

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References Références Referencias

1. Nowinszky, L. (2003): The Handbook of Light Trapping. Savaria University Press, Szombathely, 276.
2. Nowinszky, L., Puskás, J., Örményi, I. (1997): Light trapping success of heart-and-dart moth (Scotia exclamationis L.) depending on air masses and weather fronts. Acta Phytopathologica et Entomologica Hungarica. 32. 3-4: 333-348.
3. Örményi, I. (1967): Atmospheric ionization examinations surrounding of Lukács bath (in Hungarian). Magyar Balnoklimatológiai Egyesület Évkönyve. 105-129.
4. Örményi, I. (1984): Influence of 3 Hz atmospheric electromagnetic radiation for people on same territories of life (in Hungarian). Ph.D. Thesis. Budapest.
5. Örményi, I., Nowinszky, L., Puskás, J. (1997): Light trapping the adults of Heart and Dart (Agrotis exclamationis L.) (Lep.: Noctuidae) in relation to different air types and heights of the tropopause (in Hungarian). Növényvédelem. 33(9): 463-471.
6. Örményi, I., Nowinszky, L., Puskás, J. (2003): Air masses In. Nowinszky, L [ed.] (2003): The Handbook of Light Trapping. Savaria University Press. 143-154.
7. Puskás, J., Nowinszky, L. (2000): Light trapping of Common Cockchafer (Melolontha melolontha L.) in connection with the characteristics of tropopause (in Hungarian). Proceedings of Berzsenyi Dániel College Szombathely Natural Science Brochures 5: 5-8.
8. Puskás, J., Nowinszky, L. (2011): Light-trap catch of harmful insects in connection with the height of tropopause. Advances in Bioresearch. 2(2): 101-103.

Table 1 : Catching data of examined species

Species	Light-traps	Years	Number of Moths	Data	Nights
Ostrinia nubilalis Hbn.	49	15	70 203	11 573	1 648
Xestia c-nigrum L.	21	9	39 101	4 583	1 047

Table 2 : The stations of Plant protection light-traps, their catching years of and geographical coordinates

Light-trap stations	Years	Geographical coordinates Latitude	Longitude
Plant protecting light-traps			
Andorháza-Pacsa	1959–1971	46°43'N	17°00'E
Badacsony	1968	46°48'N	17°30'E
Balassagyarmat	1968-1973	46°43'N	17°00'E
Budapest-Rókushegy	1959-1968	47°28'N	19°09'E
Celldömölk	1968	47°15'N	17°09'E
Csopak	1959-1973	46°58'N	17° 55'E
Fácánkert	1959–1973	46°26'N	18°44'E
Gyöngyös	1959–1973	47°46'N	19° 55'E
Győr	1959–1964	47°41'N	17° 37'E
Hegyeshalom	1965–1973	47°54'N	17°09'E
Hódmezővásárhely	1959–1973	46°25'N	20°19'E
Kállósemjén	1959–1973	47°51'N	47°51'E
Kaposvár	1964–1973	46°21'N	17°47'E
Kenderes	1960–1973	47°13'N	20°43'E
Mikepércs	1959–1973	47°26'N	21°38'E
Miskolc	1959–1973	48°06'N	20°47'E
Mohora	1959–1973	47°59'N	19°20'E
Nagytétény	1959–1973	47°23'N	18°58'E
Pápa	1968–1973	47°19'N	47°19'E
Szederkény	1959–1973	45°59'N	18°27'E
Tanakajd	1959–1973	47°1'N	16°44'E
Tarhos	1959–1973	46°48'N	21°12'E
Tass	1959–1973	47°00'N	19°01'E
Toponár	1959–1962	46°21'N	17°47'E
Vasvár	1968	47°03'N	16°48'E
Velence	1959 –1973	47°14'N	18°39'E
Zalaegerszeg	1972–1973	46°50'N	16°50'E

Table 3 : The stations of Forestry and Research Institute light-traps, their catching years of and geographical coordinates

Light-trap stations	Years	Geographical coordinates Latitude	Longitude
Forestry light-traps			
Bakóca	1969-1970	46°12'N	17°59'E
Budakeszi	1961-1970	47°30'N	18°56'E
Erdősmecske	1969-1970	46°10'N	18°30'E
Felsőtárkány	1961-1970	47°58'N	20°25'E
Gerla	1967-1970	46°40'N	21°05'E
Gyulaj	1969-1970	46°30'N	18°17'E
Kőkút	1969-1970	46°11'N	17°34'E
Kömörő	1969-1970	48°01'N	22°35'E
Makkoshotyka	1961-1970	48°21'N	21°31'E
Mátraháza	1961-1970	47°46'N	19°55'E
Répáshuta	1962-1970	48°02'N	20°31'E
Sopron	1962-1970	47°41'N	16°34'E
Szakonyfalu	1967-1970	46°51'N	16°13'E
Szentpéterfölde	1968-1970	46°37'N	16°45'E
Szombathely	1962-1970	47°14'N	16°37'E
Tolna	1961-1970	46°25'N	18°46'E
Tompa	1962-1970	46°12'N	19°32'E
Várgesztes	1962-1970	47°28'N	18°23'E
Zalaerdőd	1969-1970	47°03'N	17°08'E
Research Institute light-traps			
Badacsony	1968	46°48'N	17°30'E
Budatétény	1960-1970	47°24'N	19°09'E
Kecskemét	1961-1968	46°54'N	19°41'E
Keszthely	1960–1971	46°46'N	17°15'E
Kisvárda	1959-1968	48°13'N	22°04'E
Kompolt	1959–1968	47°44'N	20°14'E
Martonvásár	1961	47°19'N	18°47'E
Sopronhorpács	1959–1968	47°29'N	16°44'E
Tarcal	1964–1968	48°07'N	21°20'E

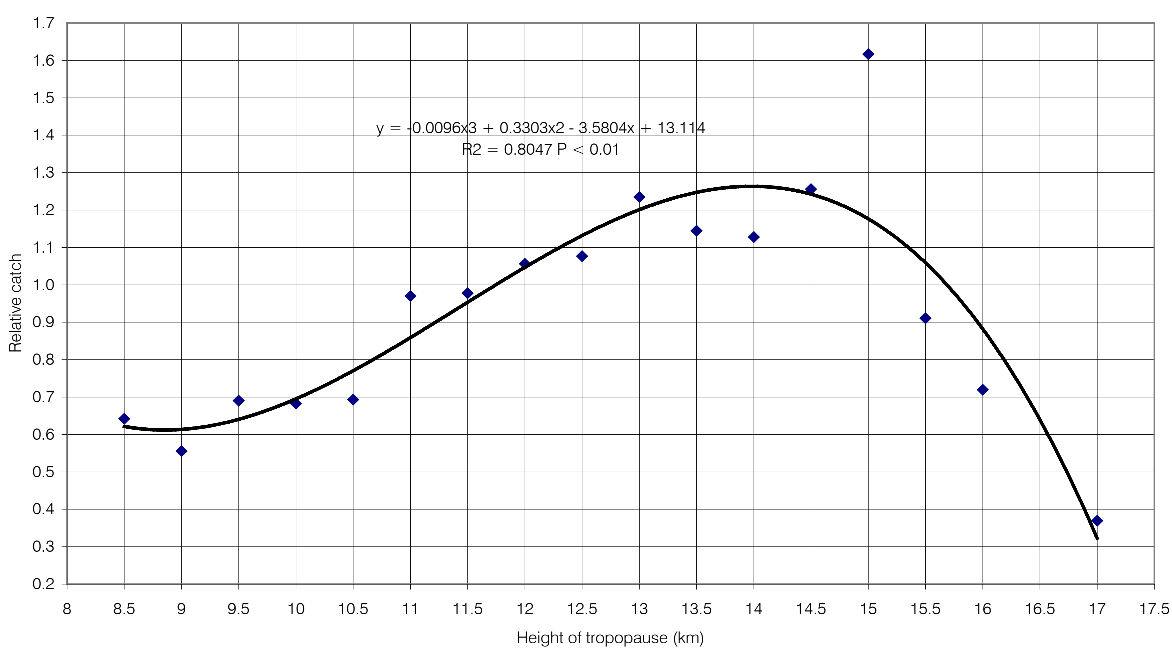

Figure 1 : Light-trap catch of European Corn-borer (Ostrinia nubilalis Hlon.) depending on the height of tropopause between 8.5 and 17 kilometres

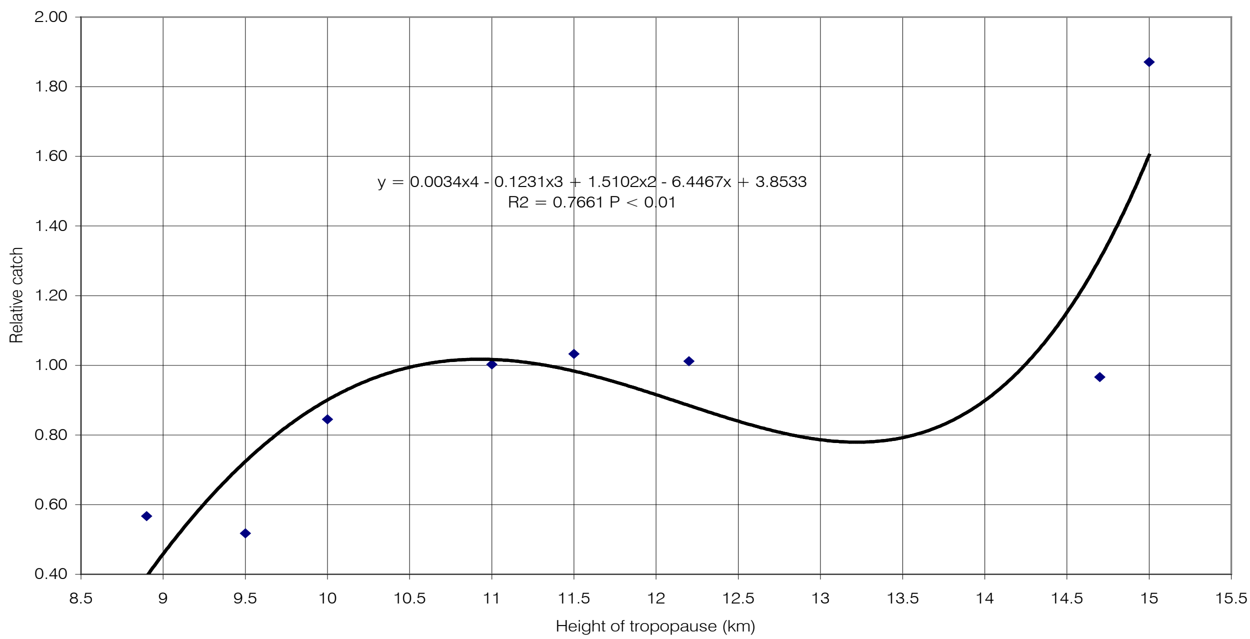

Figure 2 : Light-trap catch of the Setacoeus Hebrew Character (Xestia c-nigrum Linnaeus) depending on the height of tropopause between 1961 and 1970