

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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Received: 9 December 2012 Accepted: 5 January 2013 Published: 15 January 2013

Abstract

In present paper we examined the connection between height of tropopause and the light-trap catch two moth species. 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.

Index terms— light trapping, tropopause, *Ostrinia nubilalis*, *Xestia c-nigrum*.

1 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 exclamatoris* 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

2 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 lighttraps 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.

3 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.

4 Results

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

Insert near here Figure 1 and Figure 2 V.

5 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 Cornborer (*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.

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1. Nowinszky, L. (2003)^{1 2}



Figure 1:

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²Light-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 Handbook of Light Trap-ping. Savaria University Press, Szombathely, 276. 2. Nowinszky, L., Puskás

5. Örményi, I., Nowinszky, L., Puskás, J. (1997): Light

trapping the adults of Heart and Dart (Agrotis

Species Light

traps

Ostrinia nubilalis Hbn. 49 15

Xestia c-nigrum L. 21 9

Figure 2: Table 1 :

Light-trap stations		Years 1959-1971	Geographical coordinates	Longitude	013
Plant protecting light-traps Andorháza-Pacsa				17°00'E	2
			Latitude 46°43'N		Year
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Badacsony	Balassagyarmat	1968 1968-1973	46°48'N 46°43'N	17°30'E 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	
Gy?r		1959-1964	47°41'N	17° 37'E	
Hegyeshalom		1965-1973	47°54'N	17°09'E	
Hódmez?vásárhely		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	
Nagyttény		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	

Figure 3: Table 2 :

3

		Light-trap stations
		Forestry light-traps
		Bakóca
		Budakeszi
		Erd?smecske
		Fels?tárkány
		Gerla
		Gyulaj
		K?kút
013		Kömör? Makkoshotyka Mátraháza
2		
Year		Répáshuta Sopron
44		Szakonyfalu Szentpéterfölde
Volume		Szombathely Tolna Tompa Várgesztes Zalaerd?d Research Institute light-traps Badacsony
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	1.7	
Global Relative	0.6	
Jour- catch	0.7	
nal	0.8	
of	0.9	
	1.0	
	1.1	
	0.5	
	0.4	
	0.3	
	0.2	
	8 8.5	9 9.5 10 10.5 11

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Figure 4: Table 3 :

.1 Acknowledgements

We thank Anikó Nagy, assistant lecturer at National University of Public Service for help with the statistical analysis of the study.

[References Références Referencias] *References Références Referencias*,