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Research Article

Effects of Multiple Tropopause and Changes of Height of Tropopause on the Light Trapping of European Corn-borer (*Ostrinia nubilalis* Hübner, 1796)

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Abstract

This study deals with the light-trap catch of European Corn-borer (*Ostrinia nubilalis* Hübner, 1796) in the context of multiple tropopauses and nocturnal changes in the tropopause. The catch is most effective in the case of a simple tropopause. It decreases with double and triple tropopause. The catch is most effective if the height of the tropopause remains unchanged during the night. Both a sharp decline and an increase significantly reduce the catch.

Keywords: ECB; Light-Trap; Multiple Tropopuse; Nightly Changes

Introduction

The tropopause is a surface separating the lower layers of the atmosphere (troposphere) from the upper layers (stratosphere).

The height of the tropopause is 15 - 30 km in the tropics and 8 - 10 km in the Arctic areas. The meridional transition is not continuous: around latitudes 30 and 60, tropopausal surfaces have ruptures of several kilometres. Multiple tropopause is not uncommon either.

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 [1]. The preponderance of negative ions in polar air reduces activity, while the preponderance of positive ions in subtropical maritime air may spur flight activity [2]. 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.

We published it already in the recent past [3] the efficiency of light-trap catch in connection with the height of the tropopause of the 8 Microlepidoptera and 26 Macrolepidoptera species.

In later years, we also examined the effectiveness of light trapping of various Trichoptera [4], Heteroptera and Coleoptera [5], Microlepidoptera species [6] and Scarce Bordered Straw (*Helicoverpa armigera* Hübner) [7] in relation to tropopause height.

We found that the catch maximum of each species can be found at different heights of the tropopause.

We do not know any studies dealing with the contact of tropopause height and the light trapping only own papers.

In our current study, we examined the effectiveness of light trapping of European Corn-borer in the context of multiple tropopause and nocturnal changes of tropopause. We haven't even dealt with this topic before.

Materials

Data on the height of the multiple tropopause and changes of his height at nights were taken from the Year Books of National Weather Service of Budapest Central Meteorological Institute.

Data for multiple tropopause could be obtained from the years 1980-2000, and data for changes in the tropopause from 1962-1979.

Multiple tropopause and nocturnal changes in the tropopause are relatively rare. Therefore, we used the ECB's collection data from the collection records of the Hungarian light-trap network, because this species is the most common in these records.

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 [8].

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 [8].

From the catching data pertaining to European Corn-borer (*Ostrinia nubilalis* Hbn.) we calculated relative catch values (RC) by light-trap stations and by swarming. Following we arranged the data on the height of all three tropopause layers in classes. The same procedure was used for changes of the tropopause at nights.

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.

T-test calculations were performed between the relative catch values for the three levels of tropopause with our own program. T-test calculations were also performed between the relative catch values for nocturnal changes in the tropopause.

Results, Discussion and Conclusion

Our results can be seen in figure 1-5.

These significance levels can be found between relative catches of European Corn-borer (*Ostrinia nubilalis* Hübner, 1796) in connection with the height of tropopauses and changings of the height of tropopause:

Figure 1: Light-trap catch of European Corn-borer (*Ostrinia nubilalis* Hübner, 1796) in connection with the height of single tropopause.

Figure 2: Light-trap catch of European Corn-borer (*Ostrinia nubilalis* Hübner, 1796) in connection with height of the double tropopause.

Figure 3: Light-trap catch of European Corn-borer (*Ostrinia nubilalis* Hübner, 1796) in connection with the difference between height of triple and single tropopause.

Figure 4: Light-trap catch of European Corn-borer (*Ostrinia nubilalis* Hübner, 1796) in connection with the difference between height of double and single tropopause.

Figure 5: Light-trap catch of the European Corn-borer (*Ostrinia nubilalis* Hübner, 1796) in connection with the changes in the height of the tropopause.

- Single tropopause and double tropopause $P \leq 0,05$
- Single tropopause and triple tropopause $P \leq 0,05$
- Double and triple tropopause $P \leq 0,05$
- Difference between double and single tropopause $P \leq 0,05$
- Decreasing and unchanged tropopause $P \leq 0,05$
- Unchanged and increasing tropopause $P \leq 0,05$
- Decreasing and increasing tropopause $P \leq 0,05$.

Light trapping of European Corn-borer (*Ostrinia nubilalis* Hübner, 1796) is most effective in the case of a simple tropopause. It decreases with double and triple tropopause. An increase in the height of single and double tropopause results is an increase in catch due to the presence of increasingly warmer air masses [1]. In the case of triple tropopause, the relationship cannot be clearly explained. The catch decreases if the difference between the double and single tropopause increases. The catch is most effective if the height of the tropopause remains unchanged during the night. Both a sharp decline and an increase significantly reduce the catch. Our results are unprecedented in the literature.

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