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# Light-Trap Catch of Harmful Insects in Connection with the Height of Tropopause

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### ABSTRACT

In present paper we examined the connection between height of tropopause and the light-trap catch of the Common Cockchafer (*Melolontha melolontha* L.), Heart and Dart (*Agrotis exclamationis* L.) and the Fall Webworm (*Hyphantria cunea* Drury). The light-trap catch data of the Common Cockchafer come from the material of national light-trap network in Hungary between 1966 and 1978, of the Heart and Dart and the Fall Webworm among 1959-1979.

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 discovered a close positive correlation between the height of the tropopause and the number of light trapped Common Cockchafer and Heart and Dart specimens, but only the lowest and highest values of tropopause reduce or rather increase of the light trap catch of the Fall Webworm.

**Key words:** light-trap, tropopause, harmful insects

### 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. A low tropopause is related to the presence of cold and high tropopause the presence of warm types of air. This fact will change the number of insects collected by light-trap.

We published it already on a Hungarian language in the recent past the Common Cockchafer (*Melolontha melolontha* L.) and the Heart and Dart (*Agrotis exclamationis* L.) the efficiency of his light-trap catch in connection with the height of the tropopause [1] and [2]. However we know of no other study besides our investigating the relationship between the characteristics of the tropopause and light trapping. In our present work we have examined the light-trap catch of Fall Webworm (*Hyphantria cunea* Drury) as a function of the height of the tropopause, too.

### MATERIAL AND METHODS

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.

The light-trap catching data are as follows:

Common Cockchafer – *Melolontha melolontha* Linnaeus, 1758 (Coleoptera: Melolonthidae) Years: 1966-1978, number of the specimens: 18 389, number of the nights: 651, number of the observing data: 3 504;

Heart and Dart – *Agrotis exclamationis* Linnaeus, 1758 (Lepidoptera: Noctuidae) Years: 1959-1979, number of the specimens: 7 239, number of the nights: 1762, number of the observing data: 3 461;

Fall Webworm – *Hyphantria cunea* Drury, 1773 (Lepidoptera: Arctiidae) Years: 1959-1979, number of the specimens: 42 212, number of the nights: 1787, number of the observing data: 9 150.

With several light-traps operating in the various regions of the country each night, we have had the number of our observing data more, than the number of the nights.

From the collection data pertaining to examined species we calculated relative catch values (RC) by light-trap stations and by swarming. Following the method of Sturges [3] we arranged the data on the height of the tro-

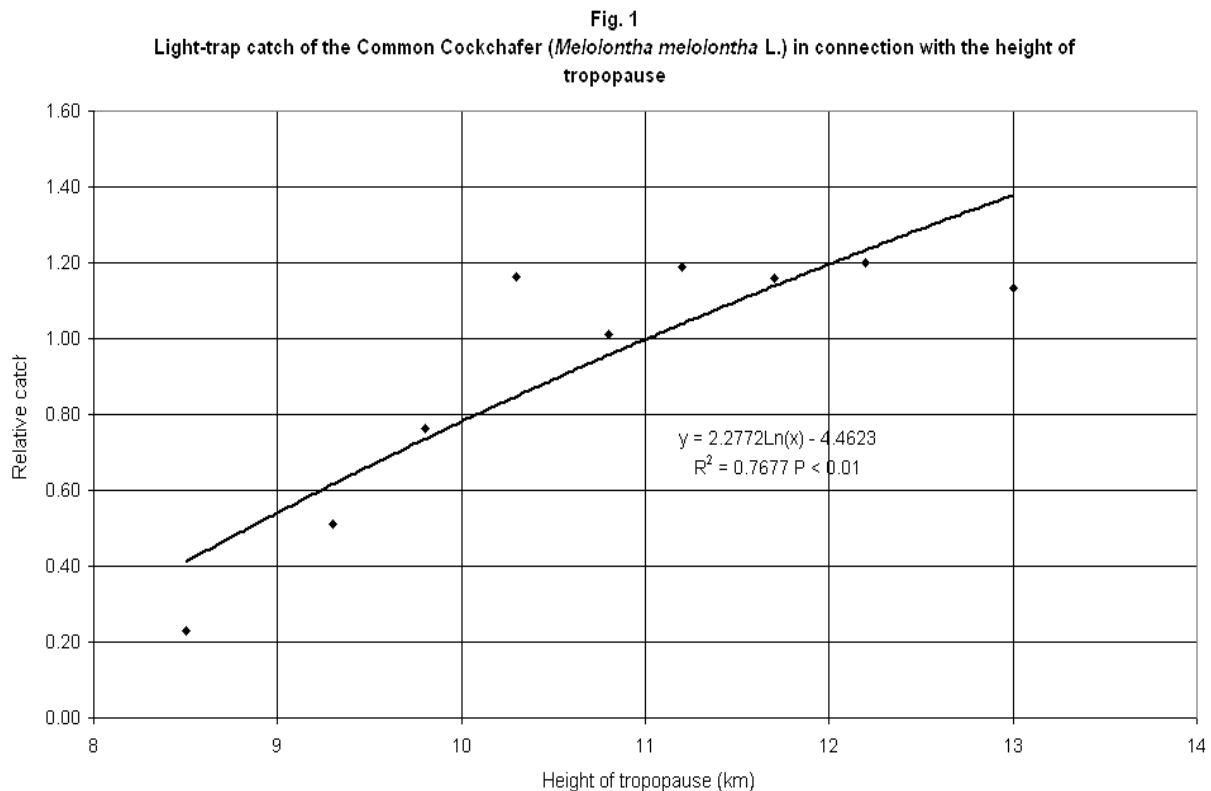
popause in classes. Relative catch values were placed according to the features of the given day, then were summed up, averaged and depicted. We defined the parameters of the regression equations. For the Fall Webworm we checked with a t-test the significance level of the relative catch values belonging to the low and high values of the tropopause.

## RESULTS AND DISCUSSION

The results are shown in the Fig. 1, Fig. 2 and Fig. 3.

The significant differences of light-trap catch results of the Fall Webworm (*Hyphantria cunea* Drury) are: lower than 9 km and between 9-15 km  $P < 0.01$ ; between 9-15 km and 15 km higher:  $P < 0.01$

We have discovered a close positive correlation between the height of the tropopause and the number of light-trapped 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 (*Hyphantria cunea* Drury).



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 spherics impulse number shows a decrease, while cosmic radiation of the Sun will be on the increase [4]. The preponderance of negative ions in polar air reduces activity, while the preponderance of positive ions in subtropical maritime air may spur flight activity [5]. The warm air increases the activity of the insects; the cold reduces it on the other hand. Our results justify this fact. We do not yet know every detail of how the height of the tropopause effects the catch results. Further research will hopefully lead to a clear answer.

Fig. 3  
Light-trap catch of the Fall Webworm (*Hyphantria cunea* Drury) in connection with the height of tropopause

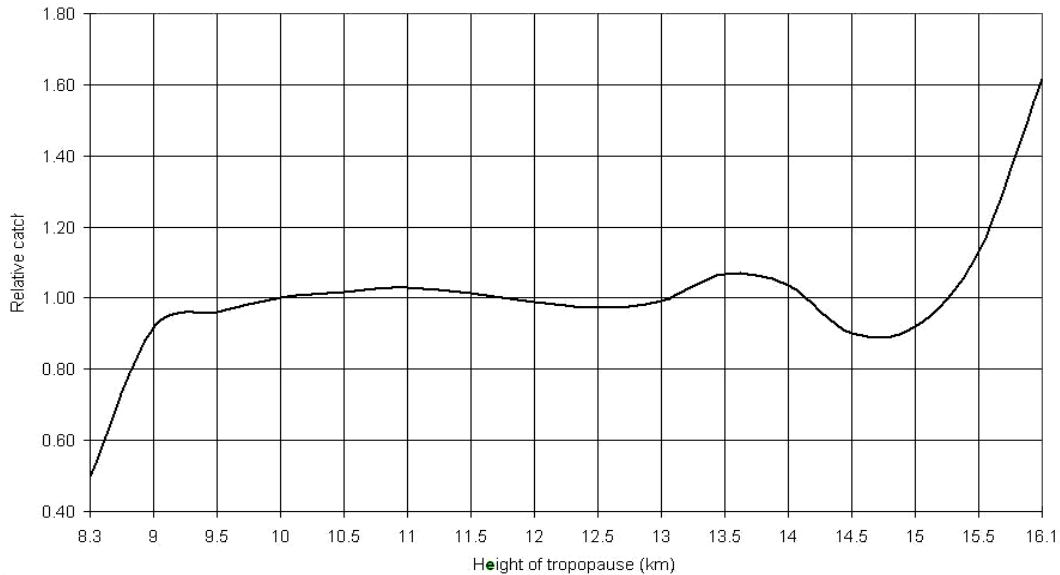
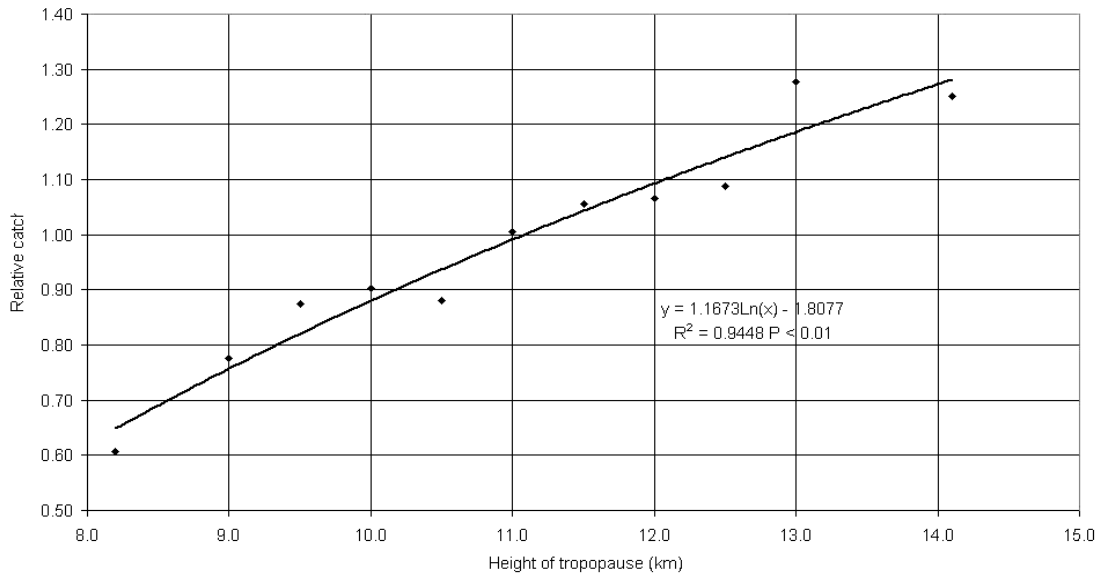


Fig. 2  
Light-trap catch of the Heart and Dart (*Agrotis exclamationis* L.) in connection with height of tropopause



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