Short Communications

Light-trap Catch of the Common Cockchafer (*Melolontha melolontha* L.) Depending on the Atmospheric Ozone Concentration

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Abstract – The study deals the efficiency of light trapping of the Common Cockchafer (*Melolontha melolontha* L.) (Coleoptera: Melolonthidae) in connection with the ozone concentration of air. The data of the Hungarian forestry light trap network were used for the years 1997 through 2006. We calculated relative catch values of from the number of caught insects. We assigned these to the ozone values of the respective days. For the classified date pairs regression equations were calculated. We established that the light trapping is most effective if the ozone concentration is high. As opposed to this, low ozone concentration reduces the success of the catch. Our results may be utilized in plant protection and forest protection prognoses.

***Melolontha melolontha* L. / light-trap / ozone**

Kivonat – A májusi cserebogár (*Melolontha melolontha* L.) fénycsapdázása a légköri ózonkoncentráció függvényében. A tanulmány a májusi cserebogár (*Melolontha melolontha* L.) (Coleoptera: Melolonthidae) fénycsapdás fogásának eredményességét tárgyalja a levegő ózontartalmának függvényében. Gyűjtési adataink az erdészeti fénycsapda hálózat anyagából származnak, az 1997 és 2006 közötti évekből. Az adatokból relatív fogás értékeket számítottunk. Ezeket hozzárendeltük az adott naphoz tartozó ózon értékekhez. Az adatpárokat osztályokba rendeztük és elemeztük a regressziós kapcsolatot. Megállapítottuk, hogy a levegő alacsony ózontartalmához alacsony fogás, a magas ózontartalomhoz pedig magas fogás tartozik. Eredményünk hasznosítható az erdővédelmi prognosztikában.

***Melolontha melolontha* L. / fénycsapda / ózon**

1 INTRODUCTION

The ozone concentration of the air influences the intensity of UV-B radiation, which bears an impact on the effectiveness of collecting insects by light-trap (Puskás et al. 2001). Therefore it seemed reasonable to try and find a connection also between the ozone concentration of the air and the number of insects trapped. In Hungary, ozone monitoring is carried out at four stations of the Hungarian National Meteorological Service (K-puszta, Hortobágy, Farkasfa and Nyírjes). Monitoring at K-puszta has been done since 1990 and at the other three locations since 1996. Presently10 minute average concentration values are

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detected at every station with the help of the ozone monitors. Since 1998 having been collected earlier by a local data collecting programme (SCANAIR) and stored in PCs. SCANAIR reduced 15-minute data into half-hour averages which were then entered in the data base. At the station (K-puszta), registration is performed by an Environment type monitor. A Thermo Electron type monitor at K-puszta makes also parallel monitoring possible. The ozone monitors are UV photometric ozone analysers which establish ozone concentration by illuminating with an UV lamp an air sample drawn into an absorption cell, then measuring the decline of illumination at a wavelength of 254 nm, which is proportionate to the ozone concentration. The instrument establishes the ozone concentration in ppb units, by taking samples in every 10 minutes. The data are in the range of 0–150 ppb. Database handling is described in detail by Puskás et al. (2001).

Kalabokas and Bartzis (1998), Kalabokas et al. (2000), Kalabokas (2002), Papanastasiou et al. (2002 and 2003), Papanastasiou and Melas (2006) have been studying the monthly and diurnal changes of the ozone concentration.

Ozone concentration in the summer months – from May until August – is higher than in other months of the year. There are typical daily changes. The ozone content is high from noon to evening and decreases from evening to dawn. It hits its lowest point in the dawn hours and begins to rise again in the early morning. Ozone concentrations in the atmosphere depend also on several meteorological factors (Tiwari et al., 2008).

The high concentration of ozone is detrimental to insects. For instance Kells et al. (2001) evaluated the efficacy of ozone as a fumigant to disinfest stored maize. Treatment of 8.9 tonnes of maize with 50 ppm ozone for 3 days resulted in 92–100% mortality of adult Red Flour Beetle, *Tribolium castaneum* (Herbst), adult Maize Weevil, *Sitophilus zeamais* (Motsch.), and larval Indian Meal Moth, *Plodia interpunctella* (Hübner). Biological effects of ozone have been investigated by Qassem (2006) as an alternative method for grain disinfestations. Ozone at concentration of 0.07 g/m^3 killed adults of Grain Weevil (*Sitophilus granarius* L.), Rice Weevil (*Sitophilus oryzae* L.) and Lesser Grain Borer (*Rhyzopertha dominica* Fabr.) after 5–15 hours of exposure. Adult death of Rice Flour Beetle (*Tribolium confusum* Duv.) and Saw-toothed Grain Beetle (*Oryzaephilus surinamensis* L.) was about 50% after 15–20 hours of exposure. Total adult death of all insect species was achieved with 1.45 g/m^3 ozone concentration after one hour of exposure. Valli and Callahan (1968) light-trap observations indicated an inverse relationship between O_3 and insect activity.

2 MATERIAL

We analysed the ozone data registered at K-puszta between 1997–2006 (http://tarantula.nilu.no/projects/ccc/emepdata. hzml/). The geographical coordinates of K-puszta are the following: 46° 58’ N and 19° 35’ E. Data for Common Cockchafer (*Melolontha melolontha* L.) (Coleoptera: Melolonthidae) originated from numerous light-traps which operated up to 100 km away from K-puszta in the years 1997–2006 and have caught in total 1255 beetles on 422 nights. 2627 observation data were analysed. Observation data means the catch of one trap in one night, regardless of the number of insects. The number of observations exceeds the number of the nights because light-traps operated simultaneously. As the Common Cockchafer flies from mid April to mid May in the twilight hours only, and the ozone levels change only slightly during this period, we used ozone concentration at 20 o’clock (GMT).

3 METHODS

From the catch data we calculated relative values far all the observation points. The relative catch (RC) is the ratio of the number of individuals trapped at one sampling point, in one night, and of the average number of specimens of a generation. Regression equations were calculated for relative catch and ozone data pairs.

4 RESULTS AND DISCUSSION

Regression equations and significance levels are displayed in *Figure 1*. The results suggest that the flying activity of the Common Cockchafer (*Melolontha me-lolontha* L.) increases when the ozone concentration is high.

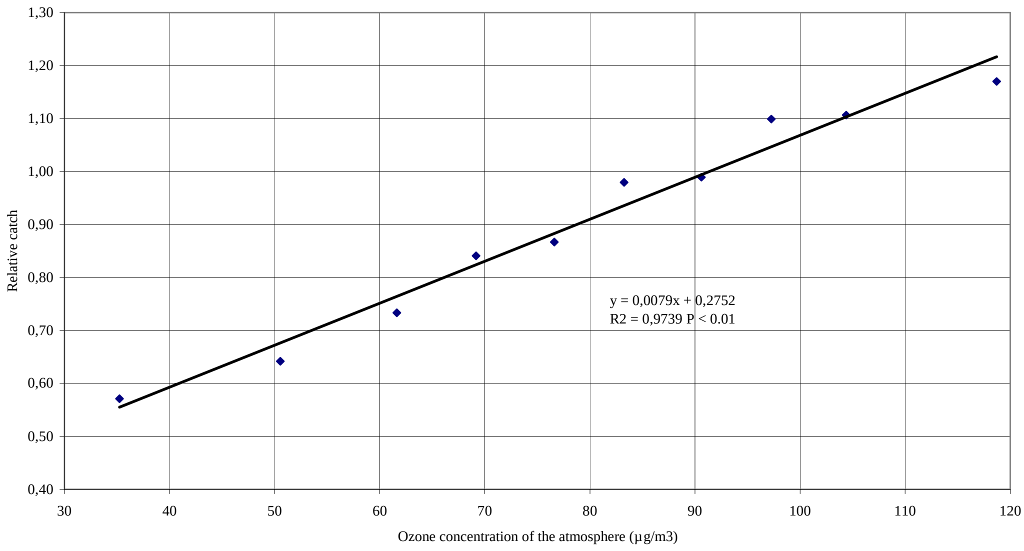

Figure 1. Light-trap catch of the Common Cockchafer (Melolontha melolontha L.) depending on the ozon concentration of the atmosphere

We suggest similar examinations on other insect species with other sampling methods (for example pheromone-, suction-, Malaise traps) to prove that high ozone concentration of air increases the flying activity also of other insect species. If this fact is verified, the influence of ozone concentration should be considered for the preparation of plant protection prognoses to increase their accuracy. Our result contradicts that of Valli and Callahan (1968), who experienced a decrease in the activity of Corn Earworm (*Heliothis zea* Boddie) with the increase of the ozone concentration. A reason for the contradiction might be that low relative catch values always refer to environmental factors in which the flight activity of insects diminishes. However, high values are not so easy to interpret. Major environmental changes bring about physiological transformations in the insect organism. The imago is short-lived; therefore unfavourable environmental endangers the survival of not just the individual, but of the species as a whole. In our hypothesis, the individual may adopt two kinds of strategies to evade the impacts hindering the normal functioning of its life phenomena. It may either display more vitality by increasing the intensity of its flight, copulation and egg-laying activity or take refuge in passivity to unfavourable environmental factors. According to the present state of our knowledge we might say therefore that both favourable and unfavourable environmental factors might equally contribute to a high catch (Nowinszky 2003).

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