

Pheromone trap catch of harmful Microlepidoptera species in connection with the particulate matter (PM10)

Kártevő Microlepidoptera fajok feromon csapdás fogása a levegő szálló por szennyeződésével (PM10) összefüggésben

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Abstract: The study presents the pheromone trap collection of six Microlepidoptera pest species connected with particulate matter (PM10) in the air. Csalomon type pheromone traps were operating in Bodrogkisfalud (48°10'N; 21°21'E; Borsod-Abaúj-Zemplén County, Hungary, Europe) between 2004 and 2013. The data were processed of following species: Spotted Tentiform Leafminer (*Phyllonorycter blancardella* Fabricius, 1781), Hawthorn Red Midedged Moth (*Phyllonorycter corylifoliella* Hübner, 1796), Codling Moth (*Cydia pomonella* Linnaeus, 1758), European Vine Moth (*Lobesia botrana* Denis et Schiffermüller, 1775), Oriental Fruit Moth (*Grapholita molesta* Busck, 1916) and Plum Fruit Moth (*Grapholita funebrana* Treitschke, 1846). According to our results pheromone trap catch of the investigated species has positive correlation with the dust aerosol contamination in the air. The relationship is linear and it can be characterized with logarithmic and polynomial functions.

Keywords: Microlepidoptera, pests, pheromone traps, air pollution, particulate matter, Hungary.

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Összefoglalás: [Kártevő Microlepidoptera fajok feromon csapdás fogása a levegő szálló por szennyeződésével (PM10) összefüggésben] – A tanulmány 6 kártevő Microlepidoptera faj feromon csapdás gyűjtési eredményeit mutatja be a levegő por aeroszol szennyezettség függvényében. A Csalomon típusú ragacos csapdák Borsod-Abaúj-Zemplén megyében üzemeltek 2004 és 2013 között Bodrogkisfaludban. Az alábbi fajok adatait dolgoztuk fel: almalevel-aknázómoly (*Phyllonorycter blancardella* Fabr.), almalevel-sátorosmoly (*Phyllonorycter corylifoliella* Hbn.), almamoly (*Cydia pomonella* L.), tarka szőlőmoly (*Lobesia botrana* Den. et Schiff.), keleti gyümölcsmoly (*Grapholita molesta* Busck) és szilvamoly (*Grapholita funebrana* Tr.). Eredményeink szerint a vizsgált fajok feromon csapdás fogása pozitív korrelációban van a levegő por aeroszol szennyezettségével. Az összefüggés lineáris, logaritmikus vagy polinom függvénnyel jellemezhető.

Introduction

The particulate matter adsorb toxic materials (e.g. metals, mutagenic substances) as well as bacteria, viruses, fungi and promote their getting into the body. PM10 can be cause irritation in the lung and mucous membrane (Dockery 2009, Vágföldi 2011). 211 lives could have been saved in Hungary yearly by the reduction of PM10 to yearly mean of $20 \mu\text{g}/\text{m}^3$ (Bobvos et al. 2014). Research groups studied in Europe in several cities of PM10 pollution (Makra et al. 2011, 2013; Papanastasiou & Melas 2004, 2009; Papanastasiou et al. 2010). According to Vaskövi et al. (2014) and Chłopek (2013) the yearly mean concentration of PM10 is generally higher near the main traffic roads than in areas with less traffic. However, the studies examining the activity and trapping the insects in connection with air pollution are not found in the literature.

Material and Methods

Between 2004 and 2013 Csalomon type pheromone traps were in operation in Bodrogkisfalud ($48^{\circ}10'41''\text{N}$, $21^{\circ}21'77''\text{E}$; Borsod-Abaúj-Zemplén County, Hungary, Europe). These traps attracted six Microlepidoptera species. In every year 2-2 traps per species were collected. So one night 2-2 catching data were available. Data on the Hawthorn Red Midget Moth (*Phyllonorictor corylifoliella* Hbn.) were collected only between 2008 and 2013. The catch data of the collected species is displayed in Table 1.

The distance between the traps were 50 meters and they were in operation all the year on the same branch of leafy trees or vines. The height of each species was different from 1.5 to 2 meters. The traps operated from start of April to the end of September. The capsules exchange was in every 6–8 weeks as it was proposed by Tóth (2003). The number of caught moths was daily recorded. This is different from the general practice, because generally the catch of the traps is counted two or three days cumulatively in most cases.

The values of the particulate matter (PM10) were measured in nearest automatic measurement station Hernádszurdok ($48^{\circ}28'98''\text{N}$, $21^{\circ}12'38''\text{E}$).

Distance between the two villages from each other is 37 km as the crow flies.

From the catching data of the examined species, relative catch (RC) data were calculated for each observation posts and days. The RC is the quotient of the number of individuals caught during a sampling time unit (1 day) per the average number of individuals of the same generation falling

to the same time unit. In case of the expected averaged individual number the RC value is 1. The introduction of RC enables us to carry out a joint evaluation of materials collected in different years and at different traps.

The values of the particular matter (PM₁₀) and the caught moths were calculated with consideration to the method of Sturges (Odor & Iglói, 1987). The RC values of a species from all sites and years were arranged into the proper classes. The results obtained are plotted. We determined the regression equations, the significance levels, which were shown in the figures.

Results and Discussion

Our results are without antecedents in the literature. Partly because the catching results of pheromone traps are not suitable for tests on daily events, and partly because of flight activity and trapping insects have not been studied by entomologists as we know.

Our results may be explained at present only with assumptions, but they cannot even prove or disprove. The increase the content of particular matter in air may therefore increase the catch, because the light is reflected from the solid particles, thus increasing the amount of polarized light by day and night. The pheromone traps collect all day long these male moths.

As we have previously demonstrated the polarized light increases the activity of insects (Nowinszky et al, 1979, 2010a, 2010b, 2012a, 2012b, 2014, Nowinszky & Puskás 2009, 2010, 2011, 2012, 2013a, 2013b, 2014). Another possibility is that the solid particles of the pheromone molecules bind well, so greater activity need for finding the females by male moths.

Further studies are planned. We will continue our research in other insect species, trap types and air pollutants for analyses. Preliminary results are published with a view that researchers should be aware that the tests should be conducted on this neglected but important topic of study.

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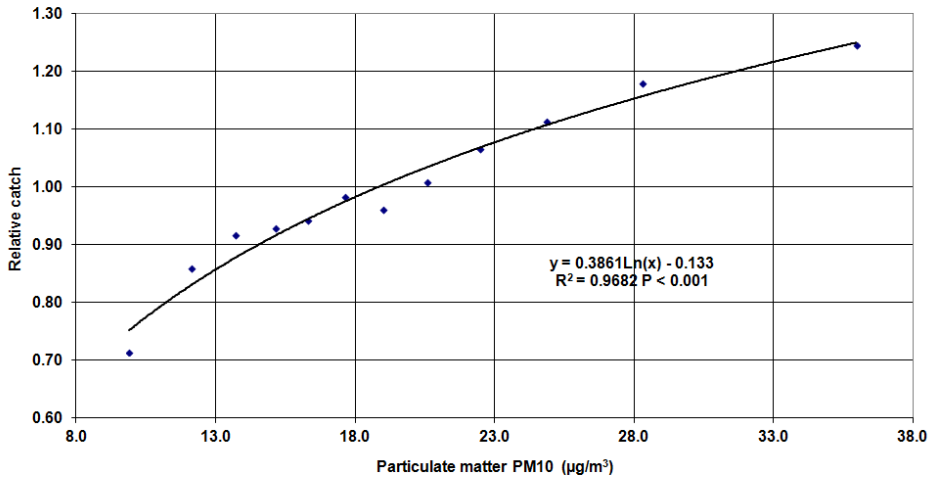


Figure 1. Pheromone trap catch of the Spotted Tentiform Leafminer (*Phyllonoricta blancardella* Fabricius) depending on the particulate matter (PM10) (Bodrogkisfalud, 2004-2013)

1. ábra. Az almalevél-aknázómoly (*Phyllonoricta blancardella* Fabricius) feromon csapdás fogása a levegő szálló por (PM10) szennyezettségének függvényében (Bodrogkisfalud, 2004-2013)

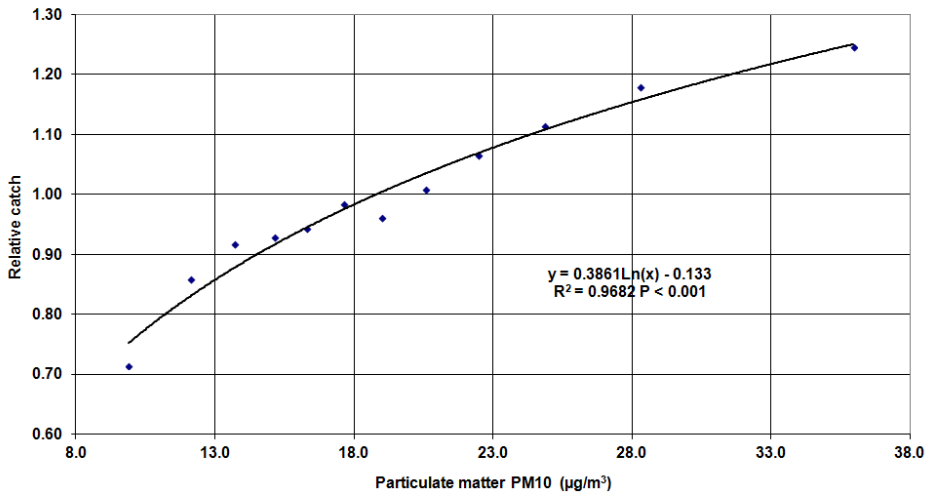


Figure 2. Pheromone trap catch of the Hawthorn Red Midget Moth (*Phyllonoricta corylifoliella* Hübner) depending on the particulate matter (PM10) (Bodrogkisfalud, 2004-2013)

2. ábra. Az almalevél-sátorosmoly (*Phyllonoricta corylifoliella* Hübner) feromon csapdás fogása a levegő szálló por (PM10) szennyezettségének függvényében (Bodrogkisfalud, 2008-2013)

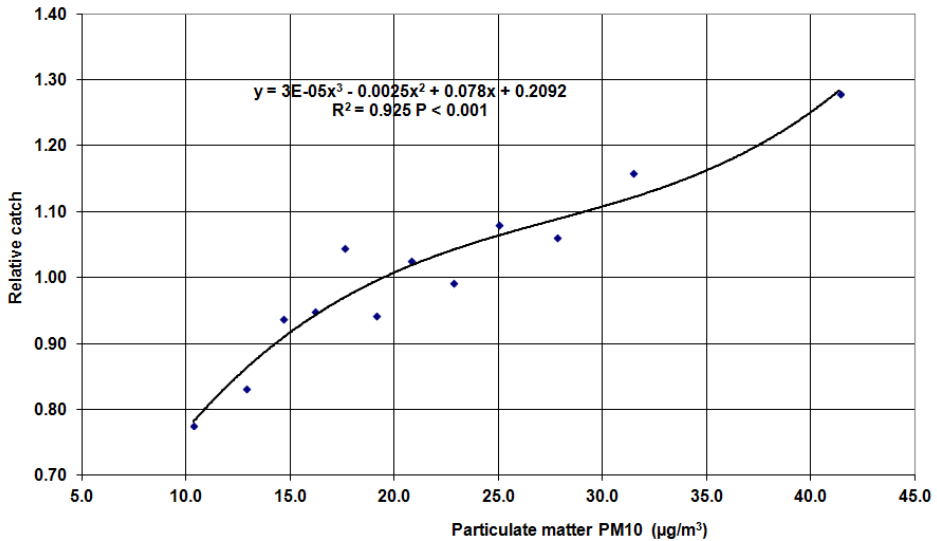


Figure 3. Pheromone trap catch of the European Wine Moth (*Lobesia botrana* Den. et Schiff.) depending on the particulate matter (PM10) (Bodrogkisfalud, 2004-2013)

3. ábra. A tarka szőlómoly (*Lobesia botrana* Denis et Schiffermüller) feromon csapdás fogása a levegő szálló por (PM10) szennyezettségének függvényében (Bodrogkisfalud, 2004-2013)

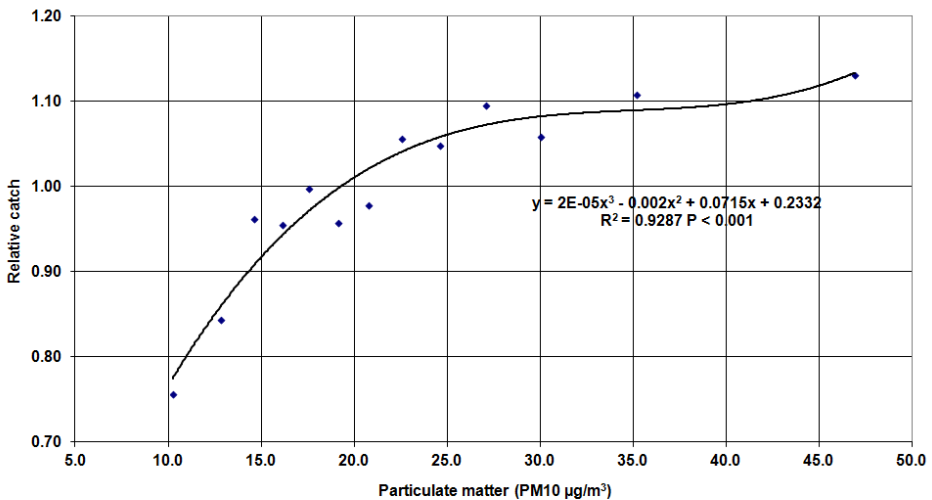


Figure 4. Pheromone trap catch of the Plum Fruit Moth (*Grapholita funebrana* Treitschke) depending on the particulate matter (PM10) (Bodrogkisfalud, 2004-2013)

4. ábra. A szilvamoly (*Grapholita funebrana* Treitschke) feromon csapdás fogása a levegő szálló por (PM10) szennyezettségének függvényében (Bodrogkisfalud, 2004-2013)

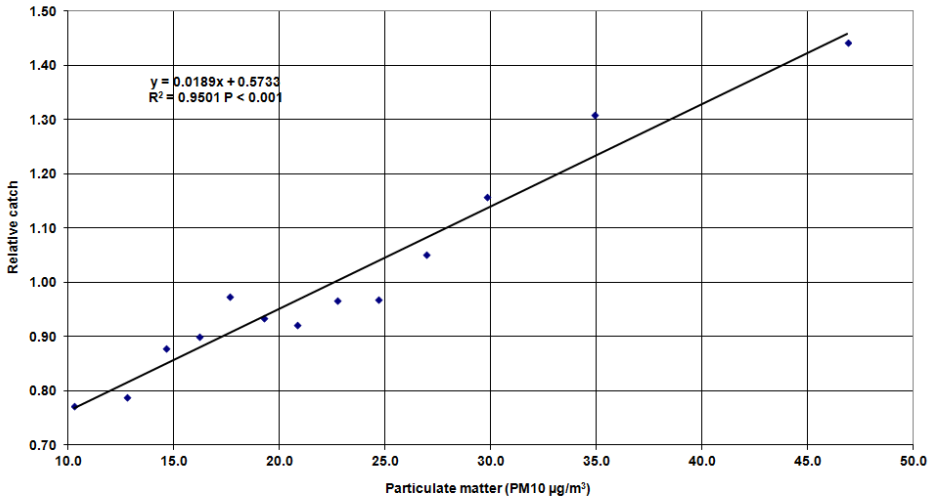


Figure 5. Pheromone trap catch of the Oriental Fruit Moth (*Grapholita molesta* Busck) depending on the particulate matter (PM10) (Bodrogkisfalud, 2004-2013)

5. ábra. A keleti gyümölcsmoly (*Grapholita molesta* Busck) feromon csapdás fogása a levegő szálló por (PM10) szennyezettségének függvényében (Bodrogkisfalud, 2004-2013)

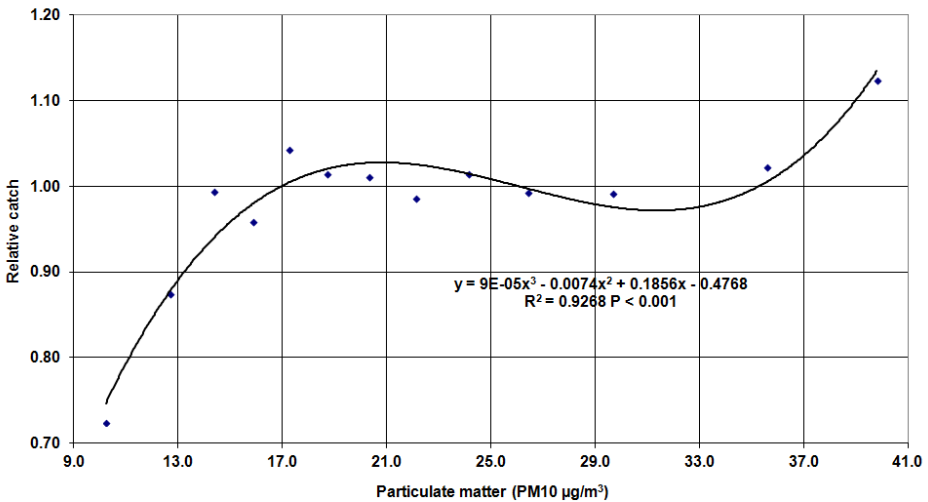


Figure 6. Pheromone trap catch of the Codling Moth (*Cydia pomonella* Linnaeus) depending on the particulate matter (PM10) (Bodrogkisfalud, 2004-2013)

6. ábra. Az almamoly (*Cydia pomonella* Linnaeus) feromon csapdás fogása a levegő szálló por (PM10) szennyezettségének függvényében (Bodrogkisfalud, 2004-2013)

Figure 7.

(7a) Localities in Hungary:

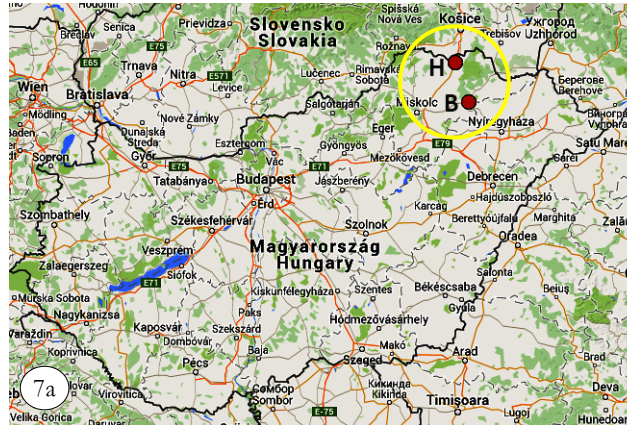
Bodrogkisfalud (B),
Hernádszurdok (H);

(7b) landscape of
Bodrogkisfalud;

(7c) *Phyllomorcyta corylifoliella*;

(7d) pheromone trap;

(7e) the site of the examina-
tion in Bodrogkisfalud.



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