Comparison of the effectiveness of different types of pheromone traps and lures on the plum fruit moth (*Grapholita funebrana*)

Zaneta Prazanova, Hana Sefrova
Department of Crop Science, Breeding and Plant Medicine
Mendel University in Brno
Zemedelska 1, 613 00 Brno
CZECH REPUBLIC

xprazano@mendelu.cz

Abstract: In 2019 (May–July) the efficiency of two delta traps and pheromone lures from two manufacturers (Pherobank B.V. and Propher s.r.o.) for the plum fruit moth (*Grapholita funebrana*) were compared. The monitoring was carried out in 3 study areas, namely Kyjov, Starý Lískovec and Soběšice. In total, 6 traps from the manufacturer Pherobank and 6 traps from the manufacturer Propher were placed. *Grapholita funebrana* was found in all the study areas and 5,667 adults were caught in total. Most individuals were caught in Kyjov (3,083 in total). The green traps attracted 3,081 adults and the transparent traps 2,586 adults. A total of 3,581 adults were captured using the Pherobank pheromone lure, and 2,086 using the Propher lure. A total of 459 non-target species individuals were captured from the families *Tortricidae*, *Noctuidae*, and *Autostichidae*. The Pherobank pheromone lure attracted 201 less of the non-target species than the Propher pheromone lure. The largest number of non-target species were attracted in Kyjov (191 adults).

Key Words: delta pheromone trap, pheromone lure, *Grapholita funebrana*, monitoring

INTRODUCTION

Monitoring and signalling are essential in integrated plant protection. The pheromone lure is a very useful tool for monitoring a number of harmful insect species (Hrdý and Pultar 1998), allowing the course and intensity of flight activity of the pest to be determined (Kocourek 2012). In plant protection, pheromone lures are primarily used to monitor the occurrence of harmful moth species.

Tortrix moths (*Tortricidae*) belong to the most diverse family of moths (Hrdý et al. 1979, 1997, Hrudová 2003, 2005, Jakubíková et al. 2016, Stará and Kocourek 2004), with 11,365 species known worldwide (Gilligan et al. 2018), and 476 found in the Czech Republic (Laštůvka and Liška 2011). The caterpillars of these moths are significant pests in agriculture and forestry. They particularly attack the leaves, shoots and fruits of plants. About 28 species are harmful to ornamental plants, about 15 species to fruit trees, 12 species to coniferous trees, 6 species to field crops and vegetables, 3 species to other deciduous trees, and 1 species to hops and hemp (Šefrová 2014, 2015).

The plum fruit moth – *Grapholita funebrana* (Treitschke 1835) is a key fruit pest. It introduces maggots into fruit, attacking mainly plum trees, but can also harm peaches and apricots. It regularly impacts fruits and precautions must be taken against it almost every year (Šefrová 2003). The effectiveness of such regulatory intervention depends on its timing.

MATERIAL AND METHODS

Defining the study areas

The monitoring took place from May to August 2019 in three study areas: gardens in Kyjov, orchards in Starý Lískovec and in an old orchard near Soběšice – U Jezírka. The orchards in Kyjov and Soběšice are not chemically treated. The characteristics of the study areas are given in Table 1.

Table 1 Description of individual locations (https://www.google.cz/maps, https://www.jablka.cz/, https://obeckyjov.cz/, http://www.lipka.cz/jezirko)

Study area	Kyjov	Starý Lískovec	Soběšice
Coordinates	49°00'33.3"N, 17°08'29.5"E	49°09'31.4"N, 16°34'25.1"E	49°16’9.640"N, 16°37’47.925"E
Altitude	192 m	237 m	390 m
Area	1.8 ha	2 ha	1.2 ha
Type of fruit tree	apricot	plum	apple

Material

Two types of plastic delta-type pheromone traps were used; green traps (from the Czech company Propher s.r.o.) and transparent traps (from the Dutch company Pherobank B.V.). The adhesive boards for the green traps had an area of 246 cm^2 (12 × 20.5 cm), and the boards for the transparent traps had an area of 170 cm^2 (10 × 17 cm). Pheromone lures for *Grapholita funebrana* from the two different manufacturers were placed in each trap. The lure from Propher was labelled CZ GF, and the lure from Pherobank was labelled NL GF.

Monitoring

The traps were set on May 6, 2019. They were placed in trees approximately 160 cm above the ground. Two green traps and 2 transparent traps were placed in each study area. A total of 6 green and 6 transparent pheromone traps were deployed. The traps were spaced at least 50 m apart. The adhesive boards were inspected weekly in each study area and changed as needed. The pheromone lures were changed after four weeks. The adhesive boards used were labelled and inserted into plastic envelopes. The types of moths captured were determined in laboratory conditions using normal entomological methods. A monograph by Razowski (2001) was used for the determination of plum fruit moths.

RESULTS AND DISCUSSION

Capture of *Grapholita funebrana* in the individual study areas.

Grapholita funebrana is one of the most abundant fruit-tree pests, especially for stone fruit (plums), therefore their occurrence was expected mainly in the areas of Starý Lískovec and Kyjov. The most abundant occurrence was recorded in Kyjov, totalling 3,083 adults (Figure 1).

Figure 1 Total number of Grapholita funebrana in the 3 areas

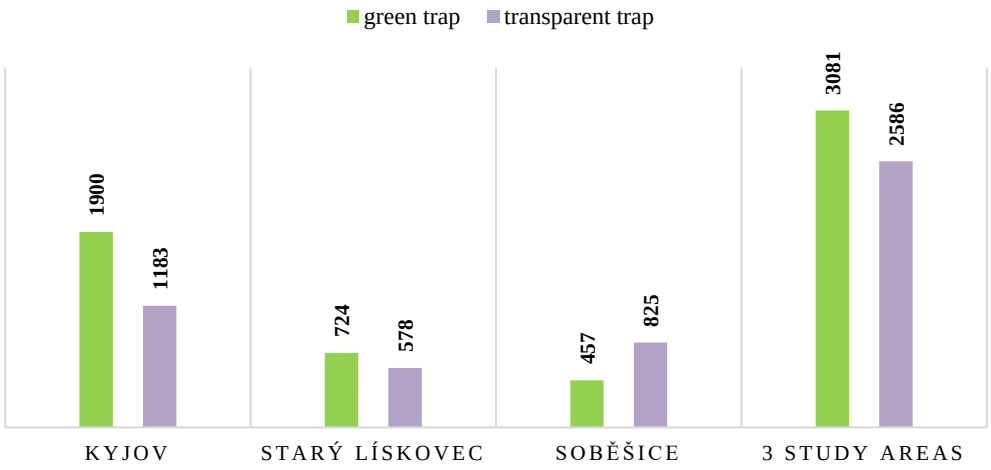
Apricots prevail in this area, but there are also other fruit trees and shrubs and the trees are not chemically treated, so this could be why the occurrence was so high. 1,302 adults were captured in Starý Lískovec and 1,282 in Soběšice (Figure 1). The difference in the numbers of adults in Starý Lískovec and Soběšice is only 20. The almost comparable numbers in these two study areas could be due to the chemical treatment of trees in Starý Lískovec, leading to low occurrence. High occurrence was not expected in Soběšice because the area is an old apple orchard and *G. funebrana* does not thrive

on apple trees. Hrnčířová (2009) also recorded *G. funebrana* in abundant numbers in apple orchards in Svinčany and Ostřešany. The results could be influenced by the location of the trap, the exposure of the land and the weather conditions.

Capture of *Grapholita funebrana* using different types of pheromone traps

A total of 5,667 individuals of the species *Grapholita funebrana* were captured during the study. 3,081 adults were captured using the green traps, 2,586 adults using the transparent ones (Figure 2). In the study areas in Kyjov and Starý Lískovec, more adults were always found in the green traps. Only in the study area in Soběšice were there more adults recorded in the transparent trap. In the green trap in Kyjov, 717 more adults were captured than in the transparent one, in Starý Lískovec 146 more, but in Soběšice there were 368 adults less in the green trap. The size of the adhesive board, which is larger in the green trap than in the transparent one, could play a role in the numbers of individuals caught.

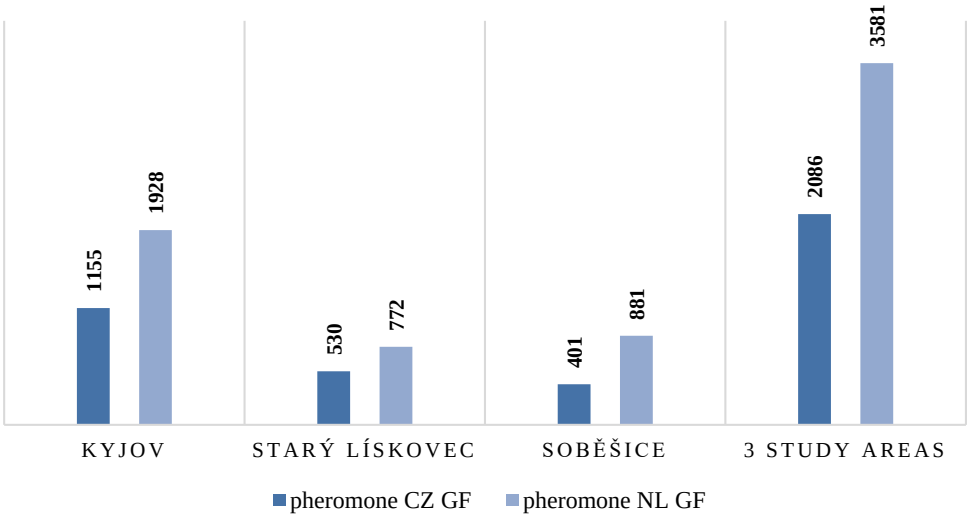
Figure 2 Total numbers of Grapholita funebrana individuals in the pheromone traps



Capture of *Grapholita funebrana* using different types of pheromone

The Propher s.r.o. pheromone (CZ GF) caught 2,086 *Grapholita funebrana* adults and 330 non-target species adults; the Pherobank B.V. pheromone (NL GF) a total of 3,581 *Grapholita funebrana* adults and 129 non-target adults (Figure 3).

Figure 3 Total numbers of individuals of the Grapholita funebrana species caught using the different pheromones



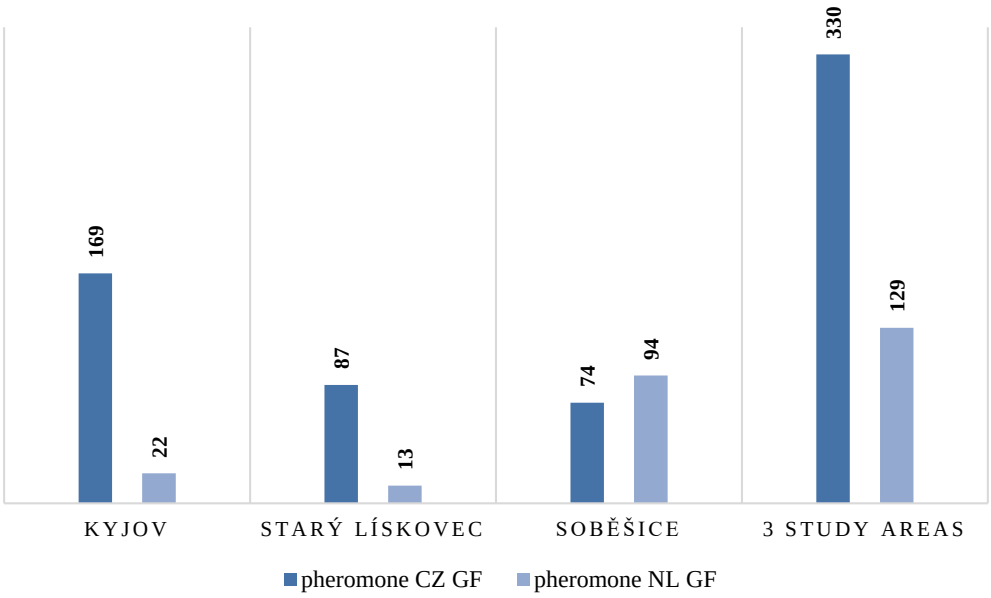
The chemical structures of the two lures cannot be compared because Pherobank does not have this information freely available. Similar results were found by Jakubíková et al. (2016) in the Czech-

Moravian Highlands in 2014, when 1,509 individuals were found on the Pherobank pheromone but only 217 target-species individuals on two trapsfrom the Czech company. In addition, there were no non-target species on the pheromone lure from the Dutch company (Jakubíková et al. 2016). Jakubíková et al. had the same experience with the pheromone lures from these companies in areas in Moravia, when monitoring was carriedout in 2013. Jakubíková's (2016) results showed that although the Pherobank pheromone lure was not completely successful in selection by target, it did catch more target individuals than the Propher pheromone.

Non-target species

A total of 459 non-target species adults from the families *Tortricidae, Noctuidae, Autostichidae* were captured. A total of 330 non-target species adults were captured using the CZ GF pheromone and 129 adults using the NL GF pheromone (Figure 4). With the Pherobank pheromone, 201 less non-target species were recorded than with the Propher pheromone. Most non-target species individuals were recorded in the study area in Kyjov (191), followed by Soběšice (168) and Starý Lískovec (100). In Kyjov, 147 more non-target species individuals were lured to the CZ GF pheromone than the NL GF pheromone; and in the Soběšice study area, 74 more non-target species were also attracted to the CZ GF pheromone. However, the number of captured non-target adults was far lower than in the study areas in Kyjov and Starý Lískovec. A total of 249 non-target adults were captured with the green traps and 210 with the transparent ones. The colour of the trap did not play a big role for non-target species, with the difference being only 39 individuals, or 8.5% of the total number of non-target individuals.

Figure 4 Total numbers of non-target species with the different pheromones



CONCLUSION

The occurrence of *Grapholita funebrana* was detected in all three study areas, and a total of 5,667 adults were captured. The greatest abundance was in the study area in Kyjov (3,083 individuals), the least in the study area in Soběšice (1,282 individuals). The green traps caught 495 (8.7%) more adults than the transparent ones. The Pherobank pheromone (NL GF) proved more effective than the Propher pheromone (CZ GF) during our experiment. The Pherobank pheromone (NL GF) attracted 1,495 plum fruit moth (*G. funebrana*) individuals more than the Propher pheromone (CZ GF). The Pherobank pheromone's efficiency is further evidenced by the additional finding that fewer non-target species were caught with this pheromone (201 non-target individuals less than with the Propher pheromone).

ACKNOWLEDGEMENTS
The research was financially supported through grant No. AF-IGA2019-IP014.

REFERENCES

Gilligan, T.M. et al. 2018. Online světový katalog Tortricidae (ver. 4.0) [Online]. Available at: http://www.tortricid.net/catalogue.asp. [2019-08-22].

Hrdý, I. et al. 1979. Sexual pheromone activity of 8-dodecenyl and 11-tetradecenyl acetates for males of several lepidopteran species in field trials. Acta Entomologica Bohemoslovaca, 76(2): 65–84.

Hrdý, I. et al. 1997. Výskyt potenciálních škůdců sadů, obaleče slivoňového, *Cydia lobarzewskii* a obaleče trnkového, *C. Janthinana* (Lepidoptera: Tortricidae) v České republice a poznámky k dalším druhům podle úlovků do feromonových lapačů. Klapalekiana, 33: 155–172.

Hrdý, I., Pultar, O. 1998. Feromonové lapáky – systémy pro monitorování hmyzích škůdců. Agro, 3(9): 19–21.

Hrnčířová, Ž. 2009. Sezónní dynamika a význam obalečů škodících na ovocných stromech na Pardubicku. Diploma thesis, Mendel University in Brno.

Hrudová, E. 2003. The presence of non-target lepidopteran species in pheromone traps for fruit tortricid moths. Plant Protection Science, 39(4): 126–131.

Hrudová, E. 2005. Nontarget lepidoptera species found in the pheromone traps for selected tortricid species in 2002 and 2003. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 53(1): 35–44.

Jakubíková, K. et al. 2016. Target and non-target moth species captured by pheromone traps for some fruit tortricid moths (Lepidoptera). Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 64(5): 1561–1568.

Kocourek, F. 2012. Uplatňování systému integrované ochrany rostlin v souvislosti se změnou legislativy (4.) Monitoring a systémy varování v ochraně rostlin. Agromanuál, 6(7): 42–45.

Laštůvka, Z., Liška, J. 2011. Komentovaný seznam motýlů České republiky. Biocont Laboratory, Brno, pp. 148.

Razowski, J. 2001. Die Tortriciden (Lepidoptera, Tortricidae) Mitteleuropas. Bestimmung – Verbreitung – Flugstandort – Lebensweise der Raupen. Bratislava: F. Slamka.

Stará, J., Kocourek, F. 2004. Flight pattern of Archips podana (Lep.: Tortricidae) based on data from pheromone traps. Plant Protection Science, 40(3): 75–81.

Šefrová, H. 2003. Změny ve škodlivosti druhů řádu Lepidoptera na polních, zahradních a okrasných rostlinách v průběhu 20. století. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 51(5): 7–18.

Šefrová, H. 2014. Zavíječi (Pyraloidea) a obaleči (Tortricidae). Listy cukrovarnické a řepařské, 130(9–10): 304–308.

Šefrová, H. 2015. Škůdci okrasných rostlin. Brno: Mendelova univerzita v Brně.