International Journal of Horticultural Science 2010, 16 (2): 17–20.
Agroinform Publishing House, Budapest, Printed in Hungary
ISSN 1585-0404

Selectivity of the oriental fruit moth sex pheromone trap in peach and apricot orchards

Hári, K. & Pénzes, B.

Corvinus University of Budapest, Faculty of Horticultural Science, Department of Entomology; H-1118 Budapest, Ménesi út 44, E-mail: katalin.hari@uni-corvinus.hu

Summary: One of the most important pests of the stone fruit orchards is the oriental fruit moth (*Grapholitha molesta* B.). Chemical control targeted against the young larvae is the most effective way of protection, so the timing of treatments has to be based on the observation of emergence. Emergence may be monitored with sex pheromone traps. It is already known from former publications, that the traps for oriental fruit moth are also effective in the case of the plum moth (*Grapholitha funebrana* Tr.), which external morphology is very similar to the oriental fruit moth. As the emergence of the oriental fruit moth in peach and apricot orchards has not been observed in details in Hungary, we started a study in this field. Our aim was to measure the selectivity of the sex pheromone traps. On the basis of examining more than 5000 males caught and the investigation of male genitalia, it could be established that the pheromone traps, Csalomon and Deltastop, for oriental fruit moth, caught the plum moth in the same ratio. The ratio of the oriental fruit moth and the plum moth trapped in the peach orchards was 1:1, while in the apricot orchards the number of the caught plum moth males was seven times as many as that of the oriental fruit moths. Consequently, it can be established that data based on oriental fruit moth trap catches can not be used without additional investigations of genitalia for the prediction of larval hatch. The selectivity of the plum moth trap, used as a control, was acceptable in both orchards.

Key words: oriental fruit moth, plum moth, sex pheromone trap, selectivity

Introduction

The presence of the oriental fruit moth (*Grapholitha molesta* B.), as one of the most important pests of fruit orchards was indicated first in the '60-s in Hungarian orchards (*Seprős & Tisza,* 1970). The larvae of the oriental fruit moth are polyphagous, but prefer plants belonging to the family Rosaceae, first of all peach, apricot, apple, quince, pear and medlar. Its damage appears in spring. The wilt of the young shoots is caused by the larvae. The damage of next generations has been observed in the fruit (*Reichart & Bodor,* 1972, *Seprős & Tisza,* 1970). There are three generations a year, but the climatic conditions may allow a fourth, incomplete generation to develop. The oriental fruit moth is recorded, besides the peach twig borer (*Anarsia lineatella* Z.), as one of the most important pests of peach and apricot. Contrary to the peach twig borer, the natural enemies of the oriental fruit moth are not able to control the pest adequately, as there are hardly any of them present in the orchards. The damage caused by the oriental fruit moth might be prevented by chemical control. As the number of the overwintering caterpillar population is not large, the protection against the offspring of this population is very important. Young larvae may be controlled the most effectively, but detailed investigation is required on the emergence of the overwintering generation (*Reichart & Bodor,* 1967). Nowadays, chemical treatments against the young larvae proved to be the best way of protection, too, in the practice of plant protection. The forecast of larval hatch based on the observation of emergence is required to carry out chemical treatments against the larvae. For the observation of emergence sex pheromone traps can be used (*Szabó,* 1996, *Mucsi & Tatár,* 2000, *Tóth,* 2003, *Hegyi,* 2004).

By experiments of the sex pheromone trap selectivity *Sziráki* (1978a, 1978b) established that the traps attracted other, closely related species. The number of trapped species depends on the environment of the orchard. He proved that the traps caught the plum moth males (*Grapholitha funebrana* Tr.), too, the morphology of which is similar to the oriental fruit moth. The related species can be separated with absolute certainty only after the investigation of the genitalia. The reason why the trap attracts both species is that the main component of their pheromones is the (Z)- and (E)-dodecenyl acetate, and the ratio of the mentioned components is also similar (*Sziráki* et al., 1985). The difficulty in the evaluation of trap catches in case of the oriental fruit moth traps is that a lot of plum moth males are also attracted by the traps (*Tóth,* 2001). *Sziráki* et al. (1985) found that the ratio of plum moth males in oriental fruit moth traps placed in large peach orchards is also 40–50%. According to Hegyi and Szántóné (2007) the ratio of the caught plum moths may vary from orchard to orchard. While mainly oriental fruit moth males were found in the traps placed in peach orchards, the number of plum moths was higher in plum orchards. However, when both fruit species are present in the same orchard, the flight pattern of the pest

might be altered significantly. *Tabilio* et al. (2001) carried out similar research in Italy, as little information was available about the selectivity of the oriental fruit moth traps. They found that independently of the orchard the selectivity of plum moth sex pheromone traps is acceptable, but the oriental fruit moth traps attracted a large amount of the plum moth males. *Raundler* (2007) got similar results in Germany. According to his investigations the oriental fruit moth traps are suitable for the observation of emergence only after investigation of genitalia. As in Hungary there have not been any detailed data about the selectivity of the oriental fruit moth traps and the emergence of the pest, we started to carry out observations in peach and apricot orchards.

Material and method

The selectivity of oriental fruit moth and plum moth sex pheromone traps was investigated in a private apricot orchard and in a peach orchard of the Pilis-Kert Kft, Pomáz, Hungary. The study was carried out from April to October, 2009. The sex pheromone traps were placed out in the orchards on April 10. The captured moths were removed and counted every week until October 4.

The first experimental field (the private orchard) is a 2 ha plot, and it is a part of a 30 ha large, old orchard. The plantation is treated with pesticides moderately, cultivated regularly and not irrigated. Mainly Hungarian cultivars ('Gönczi magyar kajszi', 'Ceglédi bíbor kajszi', 'Ceglédi arany', 'Pannónia', 'Magyar kajszi C.235', 'Ceglédi óriás', 'Ceglédi Piroska') are planted in the orchard, but there are also some foreign cultivated varieties ('Bergeron', 'Harcot', 'Aurora'). Old, neglected apricot, cherry plum and almond trees can be found around the orchard. The other experimental field (formed by two plots), which belongs to the Pilis-Kert Kft, is a 2,5 ha, 17 years old peach orchard with 'Michelini', 'Fairlane' and 'Flame Kiss' cultivars and a 4 ha 21 years old pech orchard with 'Redhaven' and 'Early Redhaven' cultivars. Both plantations are cultivated, not irrigated, and integrated pest control is applied in them. Arable crops, pear and the private apricot orchard can be found around the orchards.

In order to trap oriental fruit moth, Csalomon 9 and Deltastop sex pheromone traps of oriental fruit moth were used. For trapping the plum moth, Csalomon 18 sex pheromone traps were placed in the orchards. In the apricot orchard, 2–2 Csalomon 9 and Deltastop traps of oriental fruit moth and 1 Csalomon 18 trap of plum moth were placed. In the peach orchard 2–2 Csalomon 9 and Deltastop traps of oriental fruit moth, and 1 Csalomon 18 trap of plum moth were placed, too. The lures were changed every 4–6 weeks, while sticky inserts of the traps were replaced weekly during the examination period.

The abdomenal part of trapped males was cut off and immersed in 10% KOH solution. In order to separate the investigated species the taxonomic key for adults by *Seprős* (1971) was used *(Figure 1 and Figure 2)*. Separation on the basis of male genitalia was carried out in the laboratory of Department of Entomology, Corvinus University of Budapest.

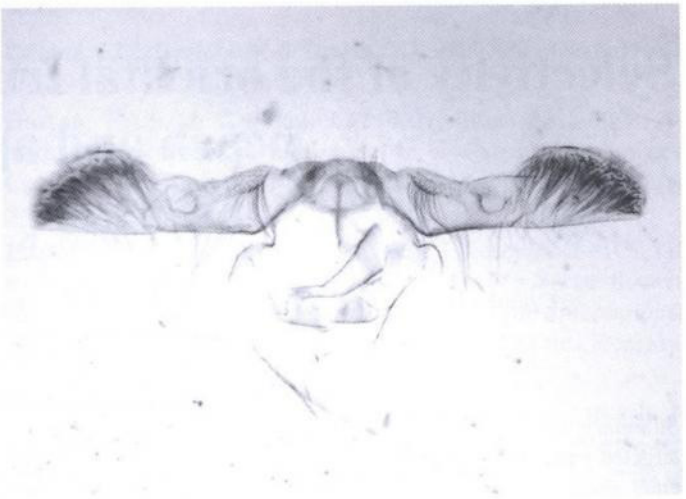

Figure 1. Male genitalia of *Grapholitha molesta* (Photo: Hári, K.)

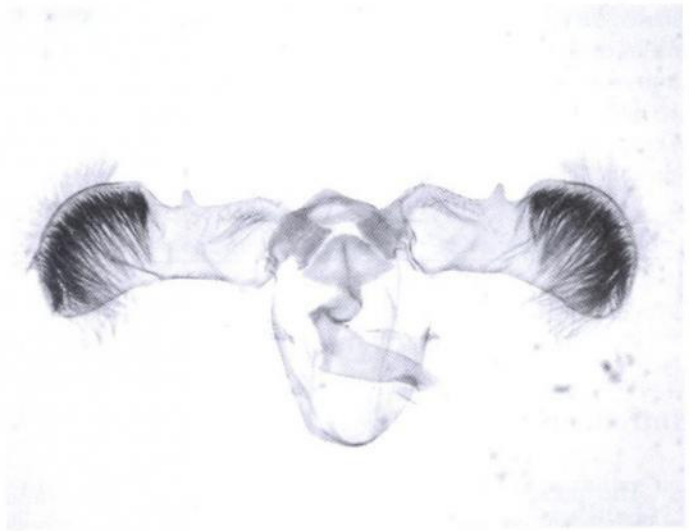

Figure 2. Male genitalia of *Grapholitha funebrana* (Photo: Hári, K.)

The data were analysed by the SPSS 14.0 program. Wilcoxon Rank test was used to find a difference between the number of trapped oriental fruit moth and plum moth males ($p=0.05$).

Results

2717 males were found in the oriental fruit moth and the plum moth traps in the peach orchard, while 3066 male were caught in the plum orchard in 2009. The number of the trapped males was different in the investigated orchards *(Figure 3 and Figure 4)*.

In the *G. molesta* Csalomon traps, the numbers of oriental fruit moths and plum moths were not significantly different in the peach orchard ($p>0.05$). Based on these findings, the ratio of both species was similar in the traps of *G. molesta*. Comparing the two *G. molesta* Deltastop traps, Trap 1 caught significantly more ($p<0.05$) oriental fruit moth (72%) than plum moth males

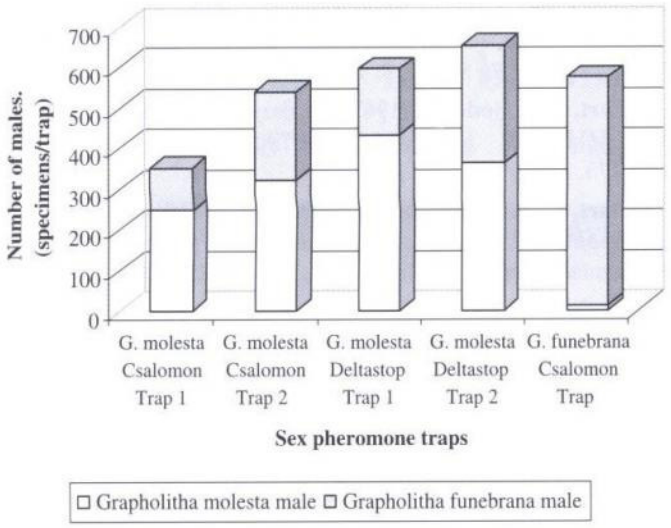

Figure 3. The oriental fruit moth and plum moth males caught by sex pheromone traps in the peach orchard (Pomáz, 2009)

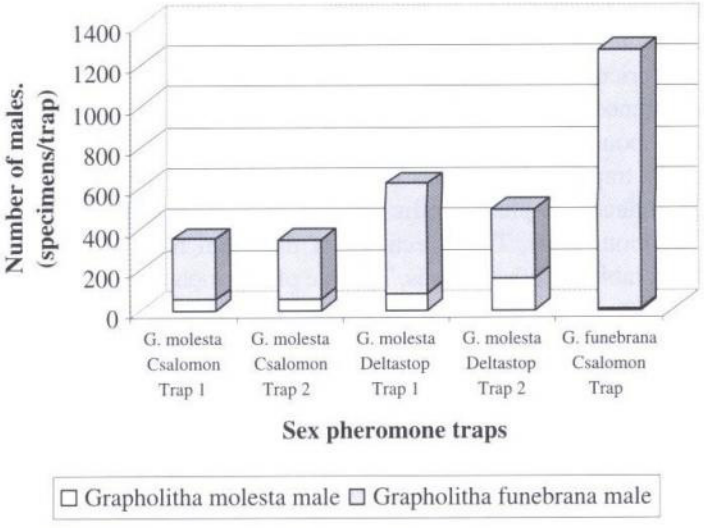

Figure 4. The oriental fruit moth and plum moth males caught by sex pheromone traps in the apricot orchard (Pomáz, 2009)

(28%). In the other Deltastop trap, the ratio of trapped oriental fruit moths (55%) and plum moths (45%) was similar. In the *G. funebrana* Csalomon Trap 1, the rate of the oriental fruit moths was only 2%, while that of the plum moth was 98%. The results of the examination, so the data on the trapped oriental fruit moths and plum moths, which were trapped by sex pheromone traps in the peach orchard during the period of the examination, can be found in the *Table 1*. The number of species and the ratio of the trapped males are also shown.

Table 1. The number of oriental fruit moth and plum moth males caught by sex pheromone traps in the peach orchard (Pomáz, 2009)

	Total	Grapholitha molesta		Grapholitha funebrana	
		Piece	%	Piece	%
G. molesta Csalomon Trap 1	351	248	71	103	29
G. molesta Csalomon Trap 2	540	322	60	218	40
G. molesta Deltastop Trap 1	597	432	72	165	28
G. molesta Deltastop Trap 2	653	362	55	291	45
G. funebrana Csalomon Trap	576	12	2	564	98
Total	**2717**	**1376**		**1341**	

Less oriental fruit moth were caught in the sex pheromone traps placed in the apricot orchard than in those placed in the peach orchard.

The number of oriental fruit moth males, which were found in the *G. molesta* traps, was between 13 and 31%, and the other specimens were plum moths. The *G. funebrana* Csalomon Trap caught only 6 oriental fruit moth males, and the other 1263 specimens were all plum moths. This means that almost 100% of the captured specimens were plum moths. Considering the two species, the catches of all traps are significantly different ($p<0.05$) in the apricot orchard. On the basis of these data, the number of plum moth males caught always exceeded that of the oriental fruit moths regardless to trap type. The results of the examination, so the data on the trapped oriental fruit moths and plum moths, which were trapped by sex pheromone traps in the apricot orchard during the period of the examination, can be found in the *Table 2*. The number of species and the ratio of the trapped males are also shown.

Table 2. The number of oriental fruit moth and plum moth males caught by sex pheromone traps in the apricot orchard (Pomáz, 2009)

	Total	Grapholitha molesta		Grapholitha funebrana	
		Piece	%	Piece	%
G. molesta Csalomon Trap 1	346	52	15	294	85
G. molesta Csalomon Trap 2	343	55	16	288	84
G. molesta Deltastop Trap 1	618	81	13	537	87
G. molesta Deltastop Trap 2	490	152	31	338	69
G. funebrana Csalomon Trap	1269	6	0	1263	100
Total	**3066**	**346**		**2720**	

Discussion

All 5783 males were determined by examining the genitalia after the collection of sticky inserts. 1376 oriental fruit moth and 1341 plum moth males were captured in the peach orchard, while 346 oriental fruit moth and 2720 plum moth males were trapped in the apricot orchard. We found that the selectivity of sex pheromone traps, which were tested by us, is unsatisfactory. Data from pheromone trap catches, without examining the genitalia, are unsuitable for the forecast of larval hatch and calculating the optimal time of pesticide treatments. The ratio of species was different in the apricot and

the peach orchard on the basis of traps catches. In our experiments, the traps caught more plum moth specimens in the apricot orchard than in the peach orchard. In this case, the difference in the catches might have been affected by the neighbouring flora. Hence, it may be supposed that the number of the trapped plum moths in the oriental fruit moth traps can be reduced if plum moths are not able to develop in the neighbour flora. The selectivity of the plum moth trap was acceptable in both orchards. The rate of the oriental fruit moths was 2% in the peach orchard only. This kind of selectivity makes it possible to observe the emergence of the plum moth, which helps the planning of plant protection treatments. Our results are in accordance with the previous results of *Tabilio* et al. (2001) (Italy) and *Raulender* (2007) (Germany). In order to get reliable results from the available oriental fruit moth traps, the improvement of the trap selectivity would be necessary. Until the effectiveness of the oriental fruit moth trap remains the same as shown in our research work, it will not help the planning of plant protection treatments.

Acknowledgement

The present research was supported by OM00034/2007 grant. We thank the Pilis-Kert Kft. for allowing access to the plantations.

References

Hegyi, T. (2004): A kajszi fontosabb állati károsítói és az ellenük való védekezés. Kertészet és Szőlészet. Kerti Növények védelme, 3: 11–13.

Hegyi, T. & Szántóné, V. M. (2007): Keleti gyümölcsmoly (*Grapholita molesta*). Agrofórum, 18 (2): 45–50.

Mucsi, K. & Tatár, Zs. (2000): A gyümölcsmolyok ismételt felszaporodása várható a csonthéjasokban. Gyakorlati Agrofórum, 11 (13): 52–54.

Rauleder, H. (2007): Beobachtungen zum Flugverlauf des Pfirsischwicklers (*Cydia molesta*) – Vergleich der Effizienz von Pheromonfallen im Steinobst. Erwerbs-Obstbau, 49:18–22.

Reichart, G. & Bodor, J. (1967): Az őszibarack fontosabb kártevői és védelme. 17. Növényvédelmi Tudományos Értekezlet, 1: 171–175.

Reichart, G. & Bodor, J. (1972): Biology of Oriental Fruit Moth (*Grapholitha molesta* Busck) in Hungary. Acta Phytopathologica Academiae Scientiarum Hungaricae, 7 (1–3): 279–295.

Seprős, I. (1971): A szilvagyümölcsöt károsító egyéb molylepkék. In: Deseő K., Sáringer Gy., Seprős I. (Eds.) *A szilvamoly.* Mezőgazdasági Kiadó, Budapest, 29–42.

Seprős, I. & Tisza, G. (1970): Gyümölcsmolyok. Mezőgazdasági Kiadó, Budapest.

Szabó, P. (1996): Gyümölcsmolyok a csonthéjasokban. Agrofórum, 7 (1): 28–29.

Sziráki, Gy. (1978a): Examinations on Tortricid moths trapped by synthetic attractants (Lepidoptera). Folia Entomologica Hungarica, 31 (2): 259–264.

Sziráki, Gy. (1978b): Specificity of sexual attractant traps for signalization of oriental fruit moth (*Grapholitha molesta* Busck). Acta Phytopathologica Academiae Scienatiarum Hungaricae, 13 (1–2): 205–212.

Sziráki, Gy., Tóth, M., Szőcs, G. & Sáringer, E. (1985): Első eredmények a magyarországi viszonyok között is szelektiv keleti gyümölcsmoly szex-feromon készítmény kifejlesztésében. Növényvédelem. 21 (5): 221–222.

Tabilio, M.R., Sciarretta, A., Prospero, Di P. & Nobili, P. (2001): Osservazioni sulla selettivitá delle trappole a feromoni per il monitoraggio di *Cydia funebrana* e *Cydia molesta*. Rivista di Frutticoltura e di Ortofloricoltura, 63 (1): 71–74.

Tóth, M. (2001): Előrejelzés feromoncsapdával. Növényvédelmi tanácsok, 10 (4): 24–26.

Tóth, M. (2003): A feromonok és gyakorlati alkalmazásuk. In: Jenser G. (Eds.) *Integrált növényvédelem a kártevők ellen.* Mezőgazda Kiadó, Budapest, 21–50.