The Presence of Non-target Lepidopteran Species in Pheromone Traps for Fruit Tortricid Moths

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Abstract

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In the localities Brno-Tuřany (Brno-město) and Prakšice (Uherské Hradiště) pheromone traps were used to monitor tortricid moths *Adoxophyes orana*, *Archips podanus*, *A. rosanus*, *Hedya nubiferana*, *Pandemis heparana*, *Spilonota ocellana*, *Cydia pomonella*, *Cydia funebrana* and *Cydia molesta*. Other moths species were also present in these pheromone traps for target species: *Pammene albuginana*, *Cydia coronilana*, *Notocelia rosaecolana*, *Hedya pruniana*, *Noctua pronuba*, *Ypponomeuta malinellus*, *Pyrausta rectefascialis* and *P. aurata*.

Keywords: fruit tortricid moths; pheromone traps; South Moravia; non-target moth species; *Noctuidae*

The practical use of pheromone traps for tortricid moths can be complicated by the presence of non-target moth species. Especially the presence of non-target tortricid moths that are habitually similar to the pest is important because it may distort the data used for treatment prediction. Therefore it is important to know what pheromone can attract non-target species and what the cause of this effect is like.

The tortricid moths, summer fruit tortrix *Adoxophyes orana* (Fischer, 1834), fruit tree tortrix *Archips podanus* (Scopoli, 1763), rose tortrix moth *A. rosanus* (Linnaeus, 1758), green budworm *Hedya nubiferana* (Haworth, 1811), eye-spotted bud moth *Spilonota ocellana* (Denis & Schiffermüller, 1775), codling moth *Cydia pomonella* (Linnaeus, 1758), plum fruit moth *Cydia funebrana* (Treitschke, 1835) and Oriental fruit moth *Cydia molesta* (Busck, 1916) are important pests of fruit trees from the family *Rosaceae*. Many authors investigated their occurrence and flight period using pheromone traps in which the presence of other non-target species was also detected.

Hrdý *et al.* (1979) tested sex pheromones for *C. funebrana* – mixture of (Z)-8-dodecenyl acetate and (E)-8-dodecenyl acetate, and *C. molesta* – mixture of (Z)-8-dodecenyl acetate, (E)-8-dodecenyl acetate and (Z)-8-dodecen-1-ol; they found the attractivity of *C. funebrana* pheromone for *Pammene aurana* (Fabricius, 1775) (*Cydia aurana* in Hrdý *et al.* 1979), *Enarmonia formosana* (Scopoli, 1763), *Epiblema foenellum* (Linnaeus, 1758), *E. scutulanum* (Den. & Schiff., 1775) and *Pammene suspectana* (Lng. & Zeller, 1849). Sex pheromone of *C. molesta* was an attractant for *Cnephasia stephensiana* (Doubleday, 1849) (Hrdý *et al.* 1979). The presence of non-target moth species in pheromone traps for *C. molesta*, *C. funebrana* and *Anarsia lineatella* Zeller, 1839 – (E)-5-decene-1-yl acetate and (E)-5-decene-1-ol – was reported by Hrdý *et al.* (1993). These species of the

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family *Tortricidae* were present in traps for *C. molesta* and *C. funebrana*: *Celypha striana* (Den. & Schiff., 1775), *Cnephasia genitalana* Pierce & Metcalfe, 1922, *Cnephasia stephensiana* (Doubleday, 1849), *Cydia tenebrosana* (Duponchel, 1834), *Enarmonia formosana* (Sopoli, 1763), *Epiblema scutulanum* (Den & Schiff., 1755) and *Pammene fasciana* (Linnaeus, 1761), all species of the family *Tortricidae* (Hrdý *et al*. 1993). These noctuids were found in traps for *Anarsia lineatella* (Zeller, 1839): *Dyachrisia chrysitis* (Linnaeus, 1758), *Mesapamea secalis* (Linnaeus, 1758), *Lacanobia suasa* (Den. & Schiff., 1775) (reported as *Mamestra suasa* (Denis & Schiffermüller) in Hrdý *et al.* 1993) and *Apamea sordens* (Hufnagel, 1766) (Hrdý *et al.* 1993). Hrdý *et al.* (1997) recorded the presence of the species *Pammene amygdalana* (Duponchel, 1842), *P. aurita* (Razowski, 1991) and *P. suspectana* (Lug. & Zeller, 1846) in pheromone traps for *C. funebrana* – mixture of (Z)-8-dodecenyl acetate and (E)-8-dodecenyl acetate. The species of the tribe *Archipini* have a common component of pheromone (Z)-11-tetradecenyl acetate (Oku 1993). The pheromone of *C. molesta* and *C. funebrana* was an attractant for *Pammene spiniana* (Duponchel, 1843) (Mayer & McLaughlin in Hrdý *et al*. 1997) while the pheromone of *C. funebrana* attracted the species *Pammene aurana* (Hrdý *et al*. 1997). The presence of *Hedya pruniana* (Hübner, 1799) in pheromone traps with experimental pheromone for *C. molesta* – mixture of (Z)-8-dodecenyl acetate, (E)-8-dodecenyl acetate and (Z)-8-dodecene-1-ol – was reported by Hrdý *et al.* (1989), the pheromone for *P. heparana* (Den & Schiff., 1775) attracted *Noctua fimbriata* (Schreber, 1759) (Noctuidae) and the presence of other non-target species was also identified in traps for the observed species. *Epiblema scutulanum* was present in pheromone traps for *C. funebrana* and *C. molesta* (Hrdý *et al.* 1979). During the monitoring of *C. pomonella* in Japan Hiramatsu *et al.* (1992) detected that the pheromone of this species attracted males of the genus *Aterpia, Hedya, Eucosma, Grapholita* and *Pammene*. The experimental pheromone of *Hedya nubiferana* (Hawoth, 1811) – (E,E)-8,10-dodekadien-1-ol-acetate, (Z)-8-dodecenyl acetate and dodecenyl acetate, and *C. moles*ta attracted *Cydia janthiana (*Duponchel, 1835) (Hrdý *et al.* 1997).

MATERIAL AND METHODS

In 2002 in the localities Brno-Tuřany (Brno-město district) and Prakšice (Uherské Hradiště district) pheromone traps were used to monitor these important tortricid moths species: *Adoxophyes orana, Archips podanus, A. rosanus, Hedya nubiferana, Spilonota ocellana, Cydia pomonella, Cydia funebrana* and *Cydia molesta*.

Delta type traps were used for monitoring; they were placed in an orchard in tree crowns at a distance of ca. 20 m and at a height of 150 cm, in Tuřany (apple and peach trees) approximately in the middle of the tree crown, in Prakšice (apple and plum trees) 1–2 m from the trunk. Commercial pheromone traps were supplied by ZD Chelčice under the mark Biolatrap. Pheromone dispensers contained these substances: for *A. orana* (Z)-11-tetradecenyl acetate, (Z)-9-tetradecenyl acetate, *A. podanus* (Z)-11-tetradecenyl acetate and (E)-11-tetradecenyl acetate, *A. rosanus* (Z)-11-tetradecenyl-acetate, (Z)-11-tetradecene-1-ol, *Hedya nubiferana* (E,E)-8,10-dodekadiene-1-yl-acetate, (Z)-8-dodecene-1-yl-acetate, *Spilonota ocellana* (Z)-8-tetradecene-1-yl-acetate, *Pandemis heparana* (Z)-11-tetradecene-1-yl-acetate, *Cydia pomonella* (8,10)-8,10-dodekadiene-1-ol, *Cydia funebrana* (Z)-8-dodecene-1-yl acetate, (E)-8-dodecene-1-yl acetate, (Z)-8-tetradecene-1-yl acetate and tetradecyl acetate and for *Cydia molesta* (Z)-8-dodecene-1-yl acetate, (E)-8-dodecene-1-yl acetate and (Z)-8-dodecene-1-ol (www.nysaes.cornell.edu; www.pherolist.slu.se)

The morphology of male genitalia was studied to determine the caught moth species (Razowski 2001; Nowacki 1998; Slamka 1997). The study of male genitalia morphology was necessary especially for determination of *C. funebrana* and *C. molesta*. The names of moths are according to Laštůvka (1998).

Characteristics of the localities. Biogeographically Prakšice belong to the Carpathian area, Zlín bioregion. This area is characterised by the presence of thermophilic vegetation high in the mountains and by a descent of mountainous species into lower locations, which results in great species diversity. Flysch deposits are dominant there. The climate is continental, but with local differences caused by the height above sea level, windward or leeward of the slopes. Oak, beech-oak, oak-beech and beech vegetation zones occur in this area.

The observed locality is situated in the Nature Park Prakšická vrchovina (beech vegetation zone). It is a slope of south orientation, at a height of 250 m a.s.l. In the south-west and in the north it is bounded by a beech wood (*Fagetum*), in the

ecotone with a majority of oak *Quercus* sp., field maple (*Acer campestre* L.), common privet (*Ligustrum vulgare* L.) and dog rose (*Rosa canina* L.).

It is an extensive plantation of fruit trees without chemical protection: apple-trees, pear-trees, cherry-trees, plum-trees and some service trees (*Sorbus domestica* L.) also occur there (supposedly autochthonous ones), the undergrowth is mainly grass with an admixture of herbs e.g. *Astragalus* sp., *Coronilla varia* L., *Inula ensifolia* L., *Rosa gallica* L. occurs there too.

The other investigated plantation is situated in Tuřany. Biogeographically it is a part of the North Pannonian area that has upland topography with highlands character around Pálava.

The biota of this area is thermophilic; the area lies in the oak vegetation zone with *Quercus pubescens*, beech-oak vegetation zone with natural representation of hornbeam (*Carpinus betulus* L.) and scarce beech (*Fagus sylvatica* L.) occurs on its border.

Pheromone traps were placed in intensive orchards of the firm Novotný where chemical protection was carried out. It is a totally open and unprotected peneplain at a height of 227 m a.s.l., with precipitation sum 509 mm and average annual temperature 8.4°C. There are single bushes of rose (*Rosa canina* L.) and *Prunus* sp. Adjacent fields were used for production of fodder plants (alfalfa).

Apple-tree and peach-tree plantations were investigated. The orchard has grass undergrowth consisting of *Lolium perenne* L., *Dactylis glomerata* L. and *Taraxacum officinale* Zinn.

RESULTS

Besides the monitoring of tortricid moth species *Adoxophyes orana, Archips podanus, A. rosanus, Hedya nubiferana, Spilonota ocellana, Pandemis heparana* and *Cydia molesta, Cydia pomonella* and *Cydia funebrana* as references species, other species of moths were found in pheromone traps for these target species: from the family *Tortricidae Pammene albuginana, Cydia coronilana, Notocelia rosaecolana, Spilonota ocellana, Adoxophyes orana, Pandemis cerasana, Archips rosanus* and *Hedya pruniana,* from the family

Table 1. The occurrences of individuals of non-target species in pheromone traps for specific species (year of observation 2002

Locality	Target species	Non-target species	Regularity of occurrence / number of individuals
Brno-Tuřany	*Pandemis heparana*	*Noctua pronuba*	regular / 28
	Cydia funebrana	*Notocelia rosaecolana*	regular / 8
		Cydia molesta	regular / 79
	Cydia molesta	*Notocelia rosaecolana*	sporadic / 3
		Spilonota ocellana	sporadic / 2
		Adoxophyes orana	sporadic / 1
		Archips rosanus	sporadic / 1
		Pandemis cerasana	sporadic / 1
		Cydia funebrana	regular / 104
	Cydia pomonella	*Hedya nubiferana*	sporadic / 1
	Spilonota ocellana	*Hedya pruniana*	sporadic / 2
	Hedya nubiferana	*Pammene albuginana*	sporadic / 1
Prakšice	*Cydia pomonella*	*Pammene albuginana*	sporadic / 2
	Cydia funebrana	*Cydia coronilana*	regular / 13
		Cydia molesta	regular / 65
	Cydia molesta	*C. funebrana*	regular / 81
	Pandemis cerasana	*Yponomeuta malinella* (*Yponomeutdae*)	sporadic / 4
		Pyrausta rectefascialis (*Pyralidae*)	sporadic / 3
		Pyrausta aurata (*Pyralidae*)	sporadic / 1

Pyralidae Pyrausta rectefascialis and *P. aurata*, from the family *Noctuidae Noctua pronuba* and from the family *Yponomeutidae Yponomeuta malinellus* (Zeller, 1838).

The occurrence of non-target species was either regular (the individuals of non-target species were present in the pheromone catch in a large number or in a 14-day interval) or sporadic (the individuals of non-target species were present in the pheromone catch individually).

The reciprocal attractivity of pheromones for the species *C. funebrana* and *C. molesta* was observed in both localities. The catching of *C. coronilana* to the pheromone traps for *C. funebrana* is not possible, regarding the large number of caught individuals and the length of the period when these species were present in traps; it is considered as accidental. A similar situation was in the pheromones of *Pandemis heparana*, whose pheromone attracted *Noctua pronuba*. The pheromones of *C. funebrana* and *C. molesta* attracted *Notocelia rosaecolana*, supposedly there exists a common pheromone compound, this theory can be supported by reciprocal attractivity of pheromones of *C. funebrana* and *C.molesta*. The attractivity of these pheromones for *N. rosaecolana* may be caused by an admixture in the pheromones for target species.

DISCUSSION

The reciprocal attractivity of the pheromone for *C. funebrana* and *C. molesta* is known. Hrdý *et al.* (1997) reported the presence of the species *Pammene amygdalana*, *P. aurita* and *P. suspectana* in pheromone traps for *C. funebrana.* The species of the tribe *Archipini* have a common component of pheromone (Z)-11-tetradecenyl acetate (Oku 1993). *Pammene spiniana* was also caught into pheromone traps for *C. molesta* a *C. funebrana* (Mayer & McLaughlin in Hrdý *et al.* 1997) while the pheromone for *C. funebrana* was an attractant for the species *Pammene aurana* (Hrdý *et al*. 1997). The presence of *Hedya pruniana* in pheromone traps for *C. molesta* was mentioned by Hrdý *et al.* (1989). *Hedya pruniana* was attracted by the pheromone of *S. ocellana* in Tuřany, where the nutritive plants of this tortricid species (family *Rosaceae*) occur on the border of the plantation. The species *C. molesta* and *S. ocellana* have common components of pheromone (Z)-8-dodecenyl acetate and (E)-8-dodecenyl acetate (McBrien *et al.* 1992). (Z)-8-dodecenyl acetate is the component present in the sex pheromone of *Hedya* (Frérot *et al.* 1979). The pheromone of *P. heparana* attracts *Noctua fimbriata* (Noctuidae) (Hrdý *et al.* 1989). In Tuřany *Noctua pronuba* was caught in the traps for *P. heparana*, a commonly spread species living on a wide spectrum of nutritive plants. Hrdý *et al.* (1979) reported the presence of *Epiblema scutulana* in pheromone traps for *C. funebrana* and *C. molesta*. By the monitoring of *C. pomonella* in Japan Hiramatsu *et al.* (1992) found out that the pheromone of this species was an attractant for males of the genus *Aterpia, Hedya, Eucosma, Grapholita* and *Pammene*. This data correspond with findings of *Pammene albuginana* in pheromone traps of *C. pomonella* in Prakšice. The pheromone for *Hedya nubiferana* and *Cydia moles*ta attracted *C. janthiana* (Hrdý *et al.* 1997). The pheromone of *Hedya nubiferana* was an attractant for *Pammene albuginana* in Tuřany, where oaks are present in the nearest wind-break. This effect may be caused by (Z)-8-dodecenyl acetate, which is a common component of sex pheromones of both these species (Frérot *et al.* 1979). Reciprocal presence of *C. funebrana* and *C. molesta* in pheromone traps for either of these species was recorded in both observed localities. The average representation of *C. funebrana* in pheromone traps for this species was 79.4%, the representation of *C. molesta* in pheromone traps for *C. molesta* was 62.5%. Rauleder (2002) gave on average 97.4 % males of these species in the traps for *C. funebrana*.

In the extensive orchard in Prakšice the pheromone traps for target species of the family *Tortricidae* caught seven non-target lepidopteran species, out of which *Cydia coronilana*, *Pammene albuginana*, *Pyrausta rectefascialis* and *P. aurata* are not pests of fruit trees of the family *Rosaceae* and their presence at a site depends on ecological conditions, especially on the presence of host plants. In Tuřany twelve non-target species were caught, out of which only *Noctua pronuba*, *Notocelia rosaecolana*, *Hedya pruniana* and *Pammene albuginana* are not pests of fruit trees.

The characteristics of non-target species

Cydia coronilana (Lienig & Zeller, 1846) (*Grapholitini*): caterpillars appear from June to September, moths fly from the end of April to July. It is a relatively abundant species in meadows, on forest borders and in other localities where *Coronilla varia* (*Fabaceae*) occurs (Razowski 2001).

Pammene albuginana (Guenée, 1845) (*Eucosmini*): caterpillars appear from September and October to March on oak (*Quercus*: *Fagaceae*) in galls of hymenopteran insects (*Hymenoptera*). This moth occurs locally in oak forests of Central Europe (Razowski 2001).

Notocelia rosaecolana (Doubleday, 1850) (*Tortricidae*, *Eucosmini*): caterpillars appear from May to June, the flight period of moths begins at the end of May and lasts until July, sometimes till August. The nutritive plant is rose (*Rosa*: *Rosaceae*). This species is relatively abundant on borders of parks, forests, shrubby biotopes and in gardens (Razowski 2001).

Noctua pronuba (Linnaeus, 1758) (*Noctuidae*) is a euryoecous species spread in open habitats, including anthropically affected ones. The caterpillars live on different species of plants. The flight period of moths lasts from June to September (Nowacki 1998).

The moths of *Yponomeuta malinellus* (Zeller, 1838) (*Yponomeutidae*) fly from June to August. Caterpillars spin nests from leaves of apple-trees. They may cause clear-eatings in extensive plantations (Hluchý *et al.* 1997).

Pyrausta rectefascialis Toll, 1936 (*Pyralidae*) is a species spread in Central Europe in Moravia, Slovakia, in Poland, Austria, Hungary, Romania and Bavaria. It occurs in dry and warm habitats on the open land. Caterpillars supposedly live on plants of the family *Lamiaceae* (Slamka 1997).

Pyrausta aurata (Scopoli, 1763) (*Pyralidae*) is a moth spread in dry habitats on the open agricultural land. It has two generations per year, moths fly from April to September. Caterpillars live spinning leaves from June to May of the next year on plants of the genus *Thymus, Origanum, Mentha* and *Salvia.*

Conclusion

Especially the presence of non-target tortricid moths that are habitually similar to the pest is important because it may distort the data used for treatment prediction. During the tortricid bud moth monitoring *Pammene albuginana, Cydia coronilana* and *Notocelia rosaecolana* from the family *Tortricidae* were present in pheromone traps for target tortricid species. The presence of *Noctua pronuba* in pheromone traps may cancel the sticky board out. *Pyrausta rectefascialis* and *P. aurata* have no practical value.

Therefore it is important to know what pheromone can attract non-target species and what the cause of this effect is like. One of the reasons may be the presence of common components in pheromones prepared for the individual observed species. These components may be natural ingredients of the pheromone or impurities from the production process.

Another reason of the presence of non-target species in pheromone traps may be false responses of males of non-target species to synthetic pheromones for the observed species.

References

Frérot B., Priesner E., Gallois M. (1979): A sex attractant for the green budworm moth (*Hedya nubiferana*). Z. Naturfors., **34c**: 1248–1252.

Hiramatsu I., Ohkubo K., Kadoi M. (1992): Tortricid moths caught by sex pheromone traps for codling moth. Res. Bull. Plant Protect. Service Jpn, **28**: 33–39.

Hluchý M., Ackermann P., Zacharda M., Bagár M., Jetmarová E., Vaněk G. (1997): Obrazový atlas chorob a škůdců ovocných dřevin a révy vinné. Ochrana ovocných dřevin a révy vinné v integrované produkci. Biocont Laboratory, s.r.o., Brno.

Hrdý I., Marek J., Krampl F. (1979): Sexual pheromone activity of 8-dodecenyl and 11-tetradecenyl acetates for males of several lepidopteran species in field trials. Acta Entomol. Bohemoslov., **76**: 65–84.

Hrdý I., Vrkoč J., Hochmut R. (1989): New records on sex attractants for males and faunistic comments on moths (Lepidoptera) from Czechoslovakia. Acta Entomol. Bohemoslov., **86**: 252–268.

Hrdý I., Marek j., Krampl F., Kuldová J., Barabás L. (1993): Distribution of the fruit tree pests *Cydia molesta, Cydia funebrana* and *Anarsia lineatella* (Lepidoptera: Tortricidae, Gelechidae) in former Czechoslovakia as recorded by pheromone traps. Acta Soc. Zool. Bohem., **58**: 53–60.

Hrdý I., Krampl F., Kuldová J., Kalinová B. (1997): Výskyt potenciálních škůdců sadů, obaleče slivoňového, *Cydia lobarzewskii* a obaleče trnkového, *C. janthiana* (Lepidoptera: Tortricidae) v České republice a poznámky k dalším druhům podle úlovků do feromonových lapáků. Klapalekiana, **33**: 155–172.

Laštůvka Z. (ed.) (1998): Seznam motýlů České a Slovenské republiky. Konvoj, Brno.

McBrien H., Gries G., Gries R., Borden J.H., Judo G.J.R., King G.G.S., Slessor K.N. (1992): Sex phe-

romone components of the eye-spotted bud moth, *Spilonota ocellana* (Denis and Schiffermüller) (Lepidoptera: Olethreutinae). Can. Ent., **124**: 1391–1394.

Nowacki J. (1998): The Noctuids (Lepidoptera, Noctuidae) of Central Europe. F. Slamka, Bratislava.

Oku T. (1993): Suppression of lepidopterous pest populations in apple orchards through mating disruption with synthetic sex-pheromones. JARQ – Jpn Agr. Res. Q., **26**: 271–76.

Rauleder H. (2002): Beobachtungen zur Lebensweise des Pflaumenwicklers (*Cydia funebrana*). Gesunde Pflanzen, **54**: 241–248.

Razowski J. (2001): Die Tortriciden (Lepidoptera, Tortricidae) Mitteleuropas. F. Slamka, Bratislava.

Slamka F. (1997): Die Zünslerartigen (Pyraloidea) Mitteleuropas. Bestimmen-Verbreitung-Flugstandort--Lebensweise der Raupen. F. Slamka, Bratislava.

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Souhrn

Hrudová E. (2003): **Přítomnost necílových druhů motýlů ve feromonových lapácích pro pupenové obaleče.** Plant Protect Sci., **39**: 126–131.

Na lokalitách Brno-Tuřany (Brno-město) a Prakšice (Uherské Hradiště) byly pomocí feromonových lapáků sledovány následující druhy obalečů: *Adoxophyes orana*, *Archips podanus*, *A. rosanus*, *Hedya nubiferana*, *Pandemis heparana*, *Spilonota ocellana*, *Cydia pomonella*, *C. funebrana* a *C. molesta*. V lapácích pro cílové druhy obalečů byly přítomny i další, necílové druhy motýlů: *Pammene albuginana*, *Cydia coronilana*, *Notocelia rosaecolana*, *Hedya pruniana*, *Noctua pronuba*, *Ypponomeuta mallinellus*, *Pyrausta rectefascialis* a *P. aurata*.

Klíčová slova: pupenoví obaleči; feromonové lapáky; Jižní Morava; necílové druhy motýlů; *Noctuidae*

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