(*E,Z*)-7,9-Dodecadien-1-yl Acetate Acts as Attractant for Males of the Genus *Idaea* (Lepidoptera: Geometridae: Sterrhinae)

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Abstract

MAREK J., KRAMPL F., HRDÝ I. (2000): **(*E,Z*)-7,9-Dodecadien-1-yl acetate acts as attractant for males of the genus** *Idaea* (Lepidoptera: Geometridae, Sterrhinae). Plant Protec. Sci., **36**: 95–100.

Ten species of *Idaea* were recorded by pheromone trapping in the Czech Republic during 1981 to 1999. Attractancy of (*E,Z*)-7,9-dodecadien-1-yl acetate for males of the species *I. deversaria, I. degeneraria, I. emarginata, I. dimidiata, I. inquinata* and *I. fuscovenosa* was recorded for the first time. The compound, according to relatively high catches of *I. emarginata, I. biselata, I. dimidiata* and *I. inquinata*, seems to be an efficient sexual attractant for these species and can be used for monitoring in faunistic, ethological and ecological studies. Catches of further species can be considered as chance findings.

Key words: sexual attractant; pheromone trapping; Lepidoptera; Geometridae; Sterrhinae; *Idaea* spp.; Czech Republic

Sexual pheromones and/or other insect attractants are commonly used for monitoring moths, especially in connection with integrated pest management programs. However, pheromone baited traps can also be used as an efficient tool for ethological studies and in faunistics. The knowledge of pheromones and other attractants of Lepidoptera was comprehensively summarised by MAYER and MCLAUGHLIN (1991) and by ARN *et al.* (1992, 1997).

(*E,Z*)-7,9-Dodecadien-1-yl acetate (E7,Z9-12:Ac) was isolated and identified as sexual pheromone of the European grape vine moth, *Lobesia botrana* (Denis et Schiffermüller) (Tortricidae) by ROELOFS *et al.* (1973) and occurs as attractant or pheromone component of only few other moths, especially geometrids. New data on pheromone identification in three species of *Idaea* were published recently (ZHU *et al.* 1996).

The genus *Idaea* Treitschke (= *Sterrha* Hübner) with 30 species recorded in the Czech Republic is the richest within the subfamily Sterrhinae (Geometridae). Most *Idaea* species inhabit natural xerothermic biotopes with steppe and forest-steppe vegetation, some of them dry deciduous oak or mixed forests, and only few species are ubiquitous and occur also in cultivated agricultural areas. Three species live even indoors on stored dry plant materials (hay, straw). Most species are univoltine in Central Europe, but a few are bivoltine (dependent on actual climatic conditions), with moths of the aestival generation being substantially smaller (and often darker) than those of the vernal generation (BLESZYNSKI 1960; FORSTER & WOHLFAHRT 1981; KOCH 1988; SKOU 1986). A few of the 30 recorded species live in the Czech Republic at or close to their northern limit (STERNECK 1929; KRAMPL 1973). LAŠTŮVKA (1994) recorded 27 *Idaea* species from Pálava, the warm protected landscape area in South Moravia, adjacent to investigated locations.

Three species of *Idaea* were mentioned in connection with pheromone trapping in our previous papers. *I. subsericeata* (Haworth) was attracted to RBLR (redbanded leafroller, *Argyrotaenia velutinana* [Walker]) attractant based on a mixture of (*Z*)-11-tetradecen-1-yl acetate and (*E*)-11-tetradecen-1-yl acetate (HRDÝ *et al.* 1979). *I. aversata* (L.) was caught when traps were baited with a mixture of (*Z*)- and (*E*)-9-dodecen-1-yl acetates (BREWER *et al.* 1985). *I. biselata* (Hufnagel) was lured by E7,Z9-12:Ac (HRDÝ *et al.* 1989).

During the search for the most efficient and specific lure for *L. botrana* (see VRKOČ *et al.* 1988) we registered catches of several species of the genus *Idaea*; some others are chance findings as summarised in this contribution.

MATERIAL AND METHODS

Pheromone dispensers used in the trials were loaded with E7,Z9-12:Ac and prepared in the Institute of Organic Chemistry and Biochemistry Prague or in the chemical laboratory of Propher Ltd. Vizovice, and supplied by the Companies Zoecon, Albany, Montedison, Hoechst and by the Swiss Federal Research Station Wädenswil. Different types of traps with sticky inserts were used and exposed early in spring: 16.4.1981, 28.4.1982, 26.4.1983, 25.4.1984. Catches were checked several times during the season until October. The numbers of traps per locality are given in the explanations of graphs. In all instances, traps with other lures than E7,Z9-12:Ac were also exposed. Field trials were performed in vineyards of the former State Farm Mikulov at two locations:

Spálená hospoda (7165 *) situated between villages Perná and Horní Věstonice on the north-western slope of Pavlovské kopce (hills) with natural wood-steppe vegetation and in the lower part with conventional agricultural land.

Březí (7165) situated between the villages Dolní Dunajovice and Březí in the Southern part of Dunajovické kopce (hills) with large vineyard complexes, surrounded by seminatural vegetation (including *Prunus spinosa*, *Rosa* spp. and other shrubs) with rests of steppe herb vegetation.

Table 1. List of species of the genus *Idaea* and their affinity to sexual attractants according to observations in the Czech Republic and Slovakia

Species	Attractant	Male catches	Observation
I. aversata	1	+	*
	2	+	BREWER *et al.* (1985)
I. straminata	1	++	*
	2	+	*
I. deversaria	1	+	*
I. degeneraria	1	++	*
I. emarginata	1	+++	*
I. biselata	1	+++	HRDÝ *et al.* (1989) and *
	2	+	*
I. dimidiata	1	++	*
I. inquinata	1	+++	*
I. fuscovenosa	1	+	*
I. subsericeata	3	+	HRDÝ *et al.* (1979)

1 – E7,Z9-12:Ac; 2 – Z9-12:Ac and E9-12:Ac; 3 – Z11-14:Ac and E11-14:Ac
* original finding
+ single specimens
++ from 10 to 50 specimens
+++ over 50 to hundreds of specimens

*Indicated grid numbers have been used in accordance with the international grid-mapping system (NOVÁK 1989).

From this location additional data during field trials from 1989 to1995 were obtained.

Relevant information on the chance findings from other locations and other habitats than vineyards is noted in Results.

RESULTS AND DISCUSSION

With exception of two males of *I. biselata*, all *Idaea* males referred to in this article as caught at natural sites were found only in traps baited with E7,Z9-12:Ac. Traps with Z9-12:Ac as the major pheromone component of *Eupoecilia ambiguella* (Hübner) were simultaneously present in all vineyard localities and served as reference.

Idaea aversata (L.)

One of the widely distributed and frequent bivoltine species occurring in both natural and cultivated areas, forests and gardens in colder as well as warm regions from lowlands to the montane zone. Larvae feed on a great number of plants, e.g., on *Taraxacum, Plantago, Melampyrum, Calluna, Vaccinium, Clematis, Genista*, including deciduous trees.

The catch of two males in traps from Březí baited with E7,Z9-12:Ac may be considered as exceptional. According to female gland extracts the specific pheromone is a mixture of (Z,Z)-7,9-dodecadien-1-yl acetate (Z7,Z9-12:Ac) and (Z,Z)-11,14-tetradecadien-1-yl acetate (Z7,Z11-14:Ac) (ZHU *et al.* 1996). Accidental catches of two males attracted by Z9-12:Ac and E9-12:Ac were registered previously (BREWER *et al.* 1985).

Idaea straminata (Borkhausen) (= *inornata* [Haworth])

This species, similar and related to *I. aversata*, is also widespread, both in warm and colder areas. It often occurs in forests but also in woodless biotopes; in warm lowlands it is regularly bivoltine, whereas in colder areas and highlands (in the montane zone to about 1000 m) it is univoltine. Larvae feed on various plants such as *Rumex, Ononis, Lysimachia, Sonchus* etc.

One male was trapped at Spálená hospoda during 3.6. to 11.6.1982, and eight males in 1984 at Březí – three of them were recorded in spring and six in summer (catches from 6. 6.–26. 6. and from 8. 8.–19. 9.). The pheromone trap catches confirm the occurrence of two generations in warm regions of our territory, and a probably higher attractancy of E7,Z9-12:Ac for this species than for *I. aversata* and *I. deversaria*. This corresponds with the findings of ZHU *et al.* (1996) who detected E7,Z9-12:Ac as one of the three components of the sex pheromone in *I. straminata*. An accidental catch in a trap baited by Z9-12:Ac and E9-12:Ac, attractant for *Eupoecilia ambiguella*, was noted.

Idaea deversaria (Herrich-Schäffer)

Externally similar and related to *I. aversata* and *I. straminata*, this species is also widely distributed in the Czech

Republic, locally frequent, but prefers dry, warm and natural biotopes, especially with steppe or wood-steppe vegetation. It also occurs in dry forests from lowlands to the submontane zone. *I. deversaria* is univoltine; larvae feed on herbs and deciduous trees.

Eleven males were caught by means of E7,Z9-12:Ac baited pheromone traps (one at Spálená hospoda and 10 males at Březí) between 29.6. and 15.8. (data from years 1983 and 1989). A specific sex pheromone is not known yet.

Idaea degeneraria (Hübner)

Somewhat smaller than *I. aversata*, occurring regularly in two generations but only locally and never abundantly in the warm areas of southern Moravia, preferably at localities with natural or seminatural vegetation; larvae feed on *Achillea, Convolvulus, Scabiosa* as well as on *Frangula alnus*.

As the species is generally not frequent and from the adjacent protected area Pálava is known from two sites only (LAŠTŮVKA 1994), the catch of one male at Březí on 12.5.– 17.5. 1983 in the trap baited with E7,Z9-12:Ac may not be accidental. The trap was baited with a polyethylene cup overloaded (100 mg) with the attractant. A number of males were also caught when testing the same attractant for *Lobesia botrana* in vineyards in the vicinity of Tashkent, Uzbekistan, 28.5.–5.6.1984. The moths for determination were supplied to us kindly by Dr. J. Vrkoč (Institute of Organic Chemistry and Biochemistry, Czech Academy of Sciences, Prague).

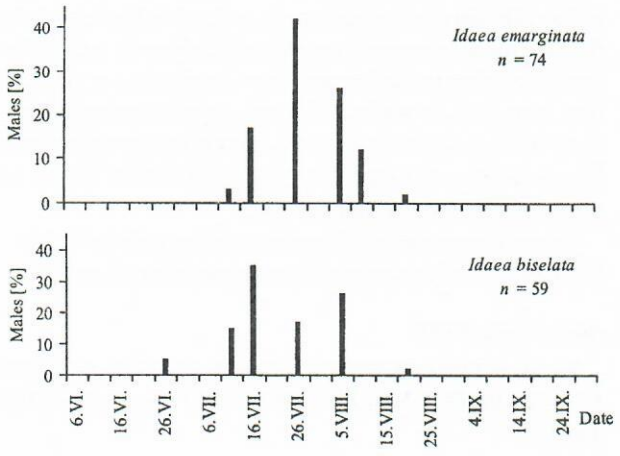
Idaea emarginata (L.)

The only species characterised by an emarginate outer margin of the forewing, occurring only locally, both in warm and colder areas from lowlands to about 500 m above s.l., on uncultivated meadows, riversides, floodplain or deciduous forests; larvae on various herbs, e.g., *Convolvulus, Taraxacum, Plantago* and some trees (*Alnus, Corylus* and others).

The second most often captured species. The high all-season catch of 74 males was recorded in 1982 at Březí (Fig. 1). The total catch from 1981 to 1984 was 96 males. According to data from pheromone trapping, the flight begins in July and ends in August. Lures responsible for high catches of *I. emarginata* were of relatively low efficacy for the target species *L. botrana* (perhaps because of impurities and isomerisation of the compound). The catches of high numbers in vineyards are remarkable because the species is generally considered to be rather infrequent, inhabiting preferably natural biotopes. The presence in vineyards is probably associated with occurrence of its host plants, especially *Convolvulus*, growing abundantly along the fences and fixing wires. High attractancy of E7,Z9-12:Ac was proved; a sex attractant of this species was previously not known.

Idaea biselata (Hufnagel)

This middle-sized species is widely distributed and usually common, both in deciduous forests and natural woodless areas from lowlands to the submontane zone. Adults of this univoltine species occur from the end of June until late August or beginning of September, as confirmed by the present observation (Fig. 1). Larvae feed on various herbs, e.g., *Taraxacum, Trifolium* and others, and from late August on either hibernate like other representatives of the genus, or pupate already in autumn (according to recent observations from West Siberia by VASILENKO 1997).



n – size of catches in per cent of the year catch

Fig. 1. Flight of *Idaea emarginata* males according to pheromone trap catches at Březí (1981) and *Idaea biselata* males according to pheromone trap catches at Spálená hospoda (1982). Nine E7,Z9-12:Ac baited traps per location

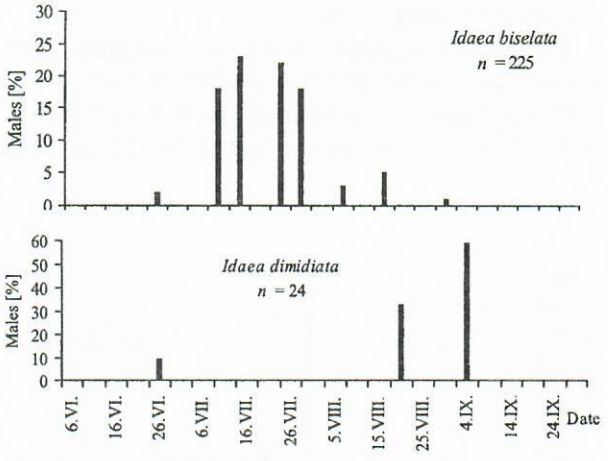


Fig. 2. Flight of *Idaea biselata* males and *Idaea dimidiata* males according to pheromone trap catches at Březí (1982). Nine E7,Z9-12:Ac baited traps per location

In vineyards at Spálená hospoda and Březí the catches of this species were numerous: more then 500 males were caught during 1981 to1984. Males of *I. biselata* were also trapped in an orchard at Písek (6650) – three males in a catch from 12.6.–31.8.1997; in the park of Prague-Kunratice (5952) – 20 males 15.7.–30.10.1997; and in Lednice (7266) – 32 males on a meadow and 49 males in a mixed forest between 1.7.–11.7.1997; only one E7,Z9-12:Ac baited trap was exposed at these locations.

Catches of *I. biselata* in traps with "high quality" pheromone dispensers in comparison with poor catches by other dispensers in the same trial may be caused by impurities and isomerisation of the compound which occurred in "low quality" dispensers. Conjugated dienes in general, and the E,Z isomer especially, are very susceptible to isomerisation, as was shown e.g., in the previous study (VRKOČ *et al.* 1988). According to our field trials and previous findings (BIWER *et al.* 1975; ANDO *et al.* 1987; SZÖCS *et al.* 1987) E7,Z9-12:Ac is really a potent attractant for males of this species, even though ZHU *et al.* (1996) have detected in extracts from females only the *Z,Z* isomer. The abundant occurrence in vineyards is probably associated with the common presence of host plants growing as weeds in or near the vineyards.

Two males were caught, perhaps accidentally, when testing pheromone dispensers in vineyards (Březí), in the trap baited with Z9-12:Ac + E9-12:Ac, an attractant for *Eupoecilia ambiguella*.

Idaea dimidiata (Hufnagel)

One of small *Idaea* species, widespread in the Czech Republic both in natural biotopes and in agricultural landscape, suburbs and in light forests. Larvae on various plants, often on drying and withering plant material or fallen leaves. Mostly one generation in a year, but in warm areas two generations may occur, as confirmed by observations in South Moravia.

The species was caught only at the location Březí. Twenty four males in 1982, 19 males in 1983, and two males in 1984 were caught in traps baited with different formulations of the *Lobesia botrana* pheromone (Montedison, Hoechst, Wädenswil and Institute of Organic Chemistry and Biochemistry Prague). The catches were registered in two waves, as can be seen from the graph (Fig. 3). Comparatively numerous catches confirm attractivity of E7,Z9-12:Ac for males of this species, which is usually not abundant in the biotope.

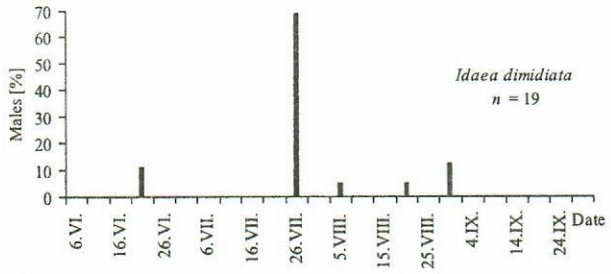


Fig. 3. Flight of *Idaea dimidiata* males according to pheromone trap catches at Březí (1983). Twelve E7,Z9-12:Ac baited traps per location

Idaea inquinata (Scopoli) (= *herbariata* [Fabricius])

This small species, together with *I. seriata* (Schrank) (= *virgularia* [Hübner]), is usually more often and sometimes numerously found indoors rather than in natural habitats. It is widely distributed and moths regularly occur in two generations, vernal from mid-May to the end of July and aestival from August to the beginning of September. Larvae feed on dry plants, especially on dry petals of various herbs.

Three males were caught in the vineyard Březí during July and August 1981. Nine other males were attracted to freshly prepared pheromone cups targeted for *L. botrana*. The cups were exposed for drying in a laboratory at Zlín-Louky (6771) in the first half of June 1996. The moths were supplied to us for determination by Ing. J. Bořucký (Propher, Zlín). To confirm this finding, one trap was exposed at Písek (6650), South Bohemia, on the loft of a family house where hay had been stored for years. 89 males were caught between 22.6.–28.9.1997, 93 males between 24. 5.–30. 9. 1998 and 82 males between 2.5.–30.9.1999. Catches both in vineyards and indoors show evident attractivity of E7,Z9-12:Ac for males of *I. inquinata*. We consider this finding to be important because the attractant might be occasionally used for monitoring of *I. inquinata* as a potential pest of stored dry plant material (e.g., for pharmaceutic or cosmetic purposes).

Idaea fuscovenosa (Goeze)

One of three similar small species relatively widespread but usually not too frequent, with far fewer reliable records than the more common *I. humiliata* (Hufnagel). Adults fly from mid-June to the beginning of August in one generation, especially in warm and dry biotopes, exposed slopes with thermophilic vegetation, sunny forest edges etc. Larvae feed on mosses, low plants and fallen leaves of various herbs and deciduous trees.

The sole record of pheromone trapping in Březí, 25.6.–2.7.1981, may be accidental like the catches of *I. aversata*.

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Souhrn

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Při zkouškách feromonových lapáků byly v České republice zaznamenány úlovky deseti druhů píďalek rodu *Idaea* Treitschke, (tab. 1). Poprvé byly zaznamenány úlovky samců druhů *I. deversaria* (Herrich-Schäffer), *I. degeneraria* (Hübner), *I. emarginata* (L.), *I. dimidiata* (Hufnagel), *I. inquinata* (Scopoli) a *I. fuscovenosa* (Goeze) do lapáků navnaděných (*E,Z*)-7,9-dodekadien-1-yl acetátem (E7,Z9-12:Ac), který je sexuálním feromonem obaleče mramorovaného, *Lobesia botrana* (Denis et Schiffermüller). S ohledem na poměrně vysoké úlovky *I. emarginata, I. biselata, I. dimidiata* a *I. inquinata* lze předpokládat dobrou účinnost E7,Z9-12:Ac a využitelnost této látky ve faunistických, etologických a ekologických studiích uvedených druhů (grafy na obr. 1 až 3 znázorňují průběh letu *I. emarginata, I. biselata* a *I. dimidiata*). Využití E7,Z9-12:Ac pro monitorování *I. inquinata* může být účelné také s ohledem na potenciální škodlivost tohoto druhu při skladování suchých rostlin např. pro farmaceutické účely. Úlovky dalších zmiňovaných druhů lze považovat spíše za náhodné (pokud nebudou získána další přesvědčivá data). Vinice, odkud pochází většina údajů, nejsou běžným biotopem uvedených druhů píďalek. Úlovky do feromonových lapáků umístěných ve vinicích lze přičítat přítomnosti některých hostitelských rostlin, zejména bylin (plevele) přímo ve vinicích nebo v jejich

blízkém okolí. To, že se samci některých druhů objevili v lapácích jen ojediněle, může být důsledkem jejich řídkého výskytu nebo malé účinnosti použitého atraktantu. Současně však upozorňujeme na veliké množství ulovených samců *I. biselata*. Tyto úlovky, i přes velice zřejmé habituální rozdíly mezi píďalkou *I. biselata* a obalečem mramorovaným, by mohly vést nezkušené pozorovatele k chybným závěrům a tedy případně i k neúčelným ochranným zásahům ve vinicích.

Klíčová slova: pohlavní atraktant; feromonové lapáky; Lepidoptera; Geometridae; Sterrhinae; *Idaea* spp.; Česká republika

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