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HORSE-CHESTNUT LEAFMINER (*CAMERARIA OHRIDELLA* DESCHKA ET DIMIĆ, 1986) IN SLOVENIA (INSECTA, LEPIDOPTERA, LITHOCOLLETIDAE)

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ABSTRACT

Horse-chestnut leafminer (Cameraria ohridella) *is a serious pest of horse-chestnut, which has in the last decade been introduced from the south of the Balkan Peninsula to Central Europe. Distribution and life history of the moth in Slovenia is presented in the paper. In the period between 1996 and 1998 we studied the life cycle of the pest. Mechanical traps have been used to determine the number of generations. In Slovenia, the occurrence of three generations per year has been confirmed. Some information on density and mortality of the pest has been obtained.*

Key words: *Cameraria ohridella*, Lepidoptera, *Aesculus hippocastanum*, life history, Slovenia

INTRODUCTION

The Lithocolletid genus *Cameraria* is distributed in Europe, Middle and Far Easts and America. The only European species, *Cameraria ohridella*, was for the first time detected in 1984 in Ohrid, Macedonia (Simova-Tošić & Filev, 1985). Two years later, the moth was recognized and described as a new species by Deschka & Dimić (1986). A few years later, *C. ohridella* was detected in Upper Austria (1989); it had been brought there from the south of the Balkans and started to spread very rapidly over Austria and the neighbouring countries.

C. ohridella, a horse-chestnut leafminer, is a monophagous species attacking horse-chestnut (*Aesculus hippocastanum* L.) and is a serious pest in Europe. Adults and pre-imaginal stages have been studied by Deschka & Dimić (1986) and Pschorn-Walcher (1994).

Damage in horse-chestnut is caused by the larval stages of the moth (Figs. 3, 4, 5). The mines are on the upper surface of the leaves, and each mine usually contains a single larva (Fig. 2). Many mines occur on a single leaf (Figs. 3, 4). The larvae feed on mesophyll between larger veins of the leaf. The larva pupates in a cocoon inside the mine. *C. ohridella* overwinters as a pupa in dry leaves.

Adults occur from April to September. Females lay eggs on the upper side of the leaves. The larvae (Figs. 2, 6, 7) hatch in 2-3 weeks, entering the leaf directly from the egg. The first three instars live as sap feeders mining the leaf in a circle (Pschorn-Walcher, 1994). Instars 4 and 5 are the so-called tissue feeders enlarging the mine in asymmetric areas. Instar 6 starts the pupation by depositing the feces from the digestive system (Pschorn-Walcher, 1994).

The larvae grow more than three weeks. After that period pupation begins. Pupal stage (Fig. 8) lasts for about two weeks (in summer) or six months (in the overwintering generation), until new adults emerge from the silken cocoon (Deschka & Dimić, 1986; Pschorn-Walcher, 1994). Some authors (Deschka & Dimić, 1986; Pschorn-Walcher, 1994) presume that *C. ohridella* develops three overlapping generations per year. The possibility of four or even more generations has also been mentioned (Maceljski & Bertić, 1995).

Fig. 1: First occurrence of the pest in the European countries.
Sl. 1: Prvo pojavljanje škodljivca v evropskih državah.

Since 1989, the species has expanded in the following European countries (Fig. 1): Austria, Croatia, Czech Republic, Germany, Hungary, Italy, Slovakia and Slovenia (Puchberger, 1990; Butin & Führer, 1994; Lastuvka, 1994; Pschorn-Walcher, 1994; Maceljski & Bertić, 1995; Liska, 1997; Milevoj & Maček, 1997; Sivicek *et al.*, 1997; Szaboky, 1997). Additional information on distribution and biology of the pest has been published by Blümel & Hausdorf (1997), Holzschuh (1997), Jurc (1997), Kenis (1997), Lethmayer & Grabeneger (1997), Perny (1997), Pschorn-Walcher (1997), Schmidt (1997), Stolz (1997), Tomiczek (1997) & Wieser (1997).

The first occurrence of *C. ohridella* in Slovenia was recorded in 1995 (Maceljski & Bertić, 1995; Milevoj & Maček, 1997). In this paper distribution of the species in Slovenia and its life history are presented.

Fig. 2: The larva of** C. ohridella **inside its leafmine
Sl. 2: Larva vrste** C. ohridella **v rovu.

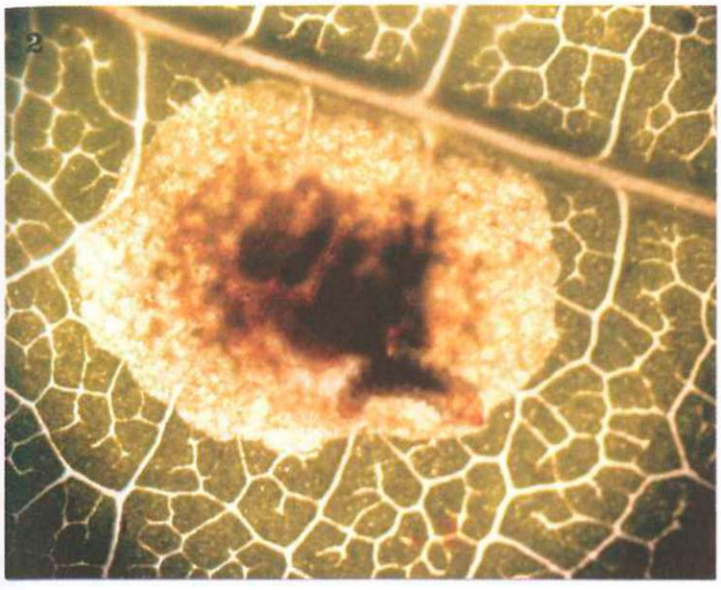
Figs. 3, 4: Leafmines on the leaf of horse-chestnut.
Sl. 3, 4: Rovi v listu divjega kostanja.

Fig. 5: A strongly damaged leaf.
Sl. 5: Močno poškodovan list.

Fig. 6: Second instar larva. Bar 100 µm.
Sl. 6: Larva druge stopnje. Merilo 100 µm.

Fig. 7: Fourth instar larva. Bar 100 µm.
Sl. 7: Larva četrte stopnje. Merilo 100 µm.

Fig. 8: Pupal exuviae. Bar 1 mm.
Sl. 8: Exuviae bub. Merilo 1 mm.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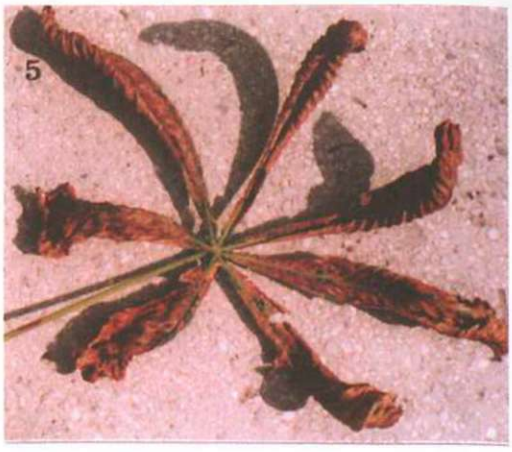
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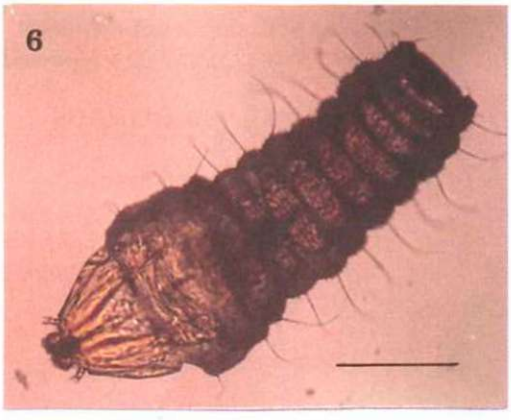
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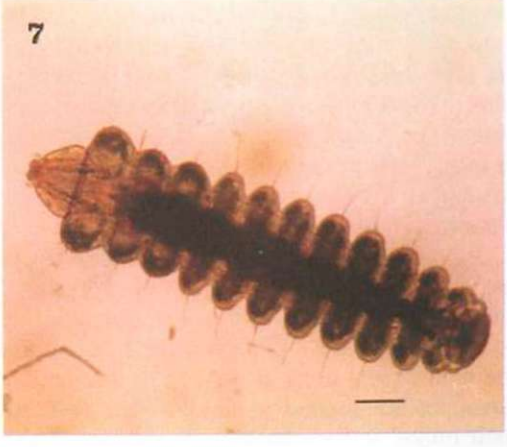
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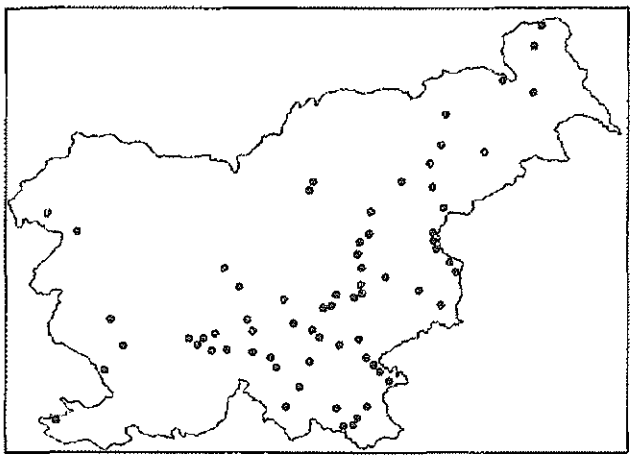

Fig. 9: Distribution of** C. ohridella **in Slovenia.
Sl. 9: Razširjenost vrste** C. ohridella **v Sloveniji.

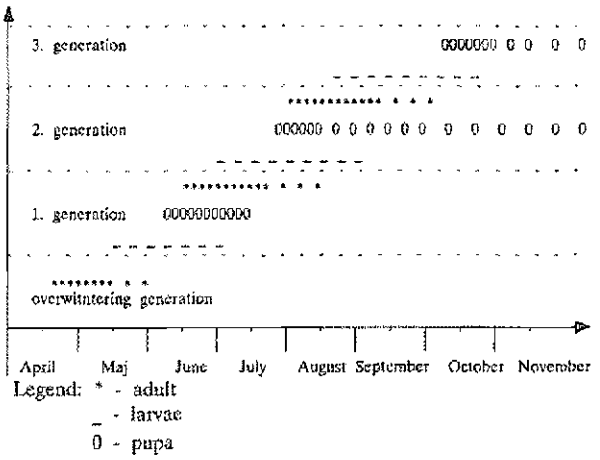

Fig. 10: The life cycle of** C. ohridella **in Maribor in the year 1997.
Sl. 10: Razvojni cikel vrste** C. ohridella **v Mariboru v letu 1997.

MATERIAL AND METHODS

Distribution in Slovenia

In the period from 1996 to 1998 many horse-chestnut locations in Slovenia were investigated. The locations are listed with the UTM coordinates.

Observation of life cycle

To define the number of generations, we observed development of *C. ohridella* in leaves inside mechanical traps and in intact leaves. As mechanical traps, 120 x 60 cm large textile bags (Vrteks, Tosama) were used. They were placed on horse-chestnut branches in the area of Magdalenski park in Maribor. Observation of the larvae in intact leaves was carried out at three different localities in Maribor (Magdalenski park, Tomšičeva ulica and Strossmayerjeva ulica).

Individuals inside the traps were marked with different paints (Edigs, Pelikan). We marked the leaf mines caused by the larvae of the first generation with white paint. Thereafter we observed their development inside the mechanical traps as well as in free land. When the larvae of the second generation occurred, we marked their mines with pink paint. Beside six old mechanical traps we mounted four new ones, on four branches closer to the centre of the tree canopy. In first six traps the leaves were damaged to such an extent that the development of the larvae of the third generation could not be completed. When the larvae of the third generation occurred, we marked their mines with blue paint. The observation has been carried out until the middle of November 1997.

Density of the larvae was expressed as the number of the larvae per leaf area. Leaves were collected in Maribor at the following localities: Popovičeva ulica, Magdalenski park, Tomšičeva ulica and Strossmayerjeva ulica. We collected 20 leaves at each locality (4 trees; from each 5 leaves).

RESULTS

Distribution in Slovenia

C. ohridella has been recorded in the following places (Fig. 9):

Ajdovščina (VL 18) 22.V.1998, Bakovci (WM 86) 30.VI.1997, Begunje (Cerknica) (VL 57) 24.V.1997, Bistrica ob Sotli (WM 50) 3.IX.1997, Brezovica (Poljanska gora) (WL 59) 3.IX.1997, Brežice (WL 48) 3.IX.1997, Buče (Kozje) (WM 40) 3.IX.1997, Cajnarje (Velike Bloke) (VL 57) 3.IX. 1998, Celje (WM 22) 24.V.1997, Cerknica (Rakek) (VL 57) 3.IX.1997, Čepinci (WM 99) 30.VI.1997, Črnomelj (WL 14) 3.IX.1997; Dolenja vas (Ribnica) (VL 86) 3.IX.1997, Dolga vas (Kočevje) (VL 95) 3.IX.1997, Dragatuš (WL 14) 3.IX.1997, Dvor (Žužemberk) (VL 97) 3.IX.1997, Fram (WM 54) 10.VII.1997, Grahovo (Cerknica) (VL 56) 3.IX.1997, Imeno (WM 41) 3.IX.1997, Ivančna Gorica (VL 88) 3.IX.1997, Jugorje (Metlika) (WL 16) 3.IX. 1997, Kobarid (UM 82) 21.VIII.1997, Kočevska Reka (VL 84) 3.IX.1997, Krmelj (Mokronog) (WL 19) 3.IX. 1997, Krško (WL 39) 3.IX.1997, Kvasica (Črnomelj) (WL 14) 3.IX.1997, Livold (VL 95) 3.IX.1997, Ljubljana (VM 50-VM 60) 24.V.1997, 20. X.1998, Maćkovci (WM 98) 19.VI.1997, Maribor (WM 55) 20.VII.1996, 20.X.1998, Metlika (WL 25) 3.IX.1997, Mirna (WL 08) 3.IX.1997, Mokronog (WL 18) 24.V.1997, Mozirje (VM 93) 7.VIII.1997, Nazarje (VM 93) IX.1997, 7.VIII.1998, Novi Łazi (Kočevska Reka) (VL 84) 3.IX.1997, Novo mesto (WL 17) 24.V.1997, Ortnek (VL 77) 3.9.1997, Podčetrtek (WM 41) 3.IX.1997,

Poljčane (WM 43) 20.V.1997, Rakek (VL 47) 3.IX.1997, Ribnica (VL 76) 3.IX.1997, Rimske Toplice (WM 10) 24.V.1997, Rogaška Slatina (WM 52) 20.V.1997, Sežana (VL 16) VIII.1997, Slovenska Bistrica (WM 43) 21.VII.1996, 20. X. 1999, Sodražica (VL 76) 3.IX.1997, Stari Log (VL 96) 3.IX.1997, Stari trg (WL 03) 3.IX.1997, Strunjan (UL 94) 8.VI.1997, IX.1997, Škofljica (VL 69) 24.V.1997, Štalcerji (VL 94) 3.IX.1997, Tolmin (VM 01) 21.VIII.1997, Trebnje (WL 08) 3.IX.1997, Tržišče (WL 19) 3.IX.1997, Turjak (VL 68) 24.V.1997, Velike Lašče (VL 77) 3.IX.1997, Vrhovo (VL 19) 3.IX.1997, Zagradec (Žužemberk) (VL 87) 3.IX.1997, Zamostec (VL 76) 3.IX.1997, Zidani Most (WM 10) 24.V.1997, Žužemberk (VL 97) 3.IX.1997.

Life cycle of *C. ohridella* in Slovenia

In Slovenia, *C. ohridella* develops three overlapping generations. A certain number of the pupae of the second generation and all the pupae of the third generation overwinter (Fig. 10).

Studying the insects inside the traps it was concluded that the larval stage lasts longer in every successive generation. The result was confirmed also in free-land investigation. Duration of the instars of different generations in the mechanical traps and in free-land is shown in Fig. 11. Larval stages were shorter in Tomšičeva ulica and Strossmayerjeva ulica than in Magdalenski park. Each successive larval stage is prolonged. Pupal stage in the second and the third generations lasts longer than in the first one. Duration of all pupae of the first and of some pupae of the second generation lasts approximately 14-16 days (Fig. 11).

In the year 1997 adults of the overwintering generation occurred from the end of April to the end of May. In the traps adults of the first generation were detected from mid June to the beginning of August, and adults of the second generation from the beginning of August to the end of September (Fig. 10). In free-land, adults were sporadically detected even on 10th October 1997. Important information regarding the number of generations is the period at the end of the season when young larvae still occur. First and second instar larvae were still detected at the end of September.

The larval density of each generation was the highest in the area of Magdalenski park (Fig. 12). At this locality, the densities of the third generation was lower in comparison to the first and second ones (Fig. 12). At the other three localities, the density increased with the generations number.

Strong relationship between percentage of the pupae of the second generation that overwinter and the number of the larvae of the same generation in the traps was established (Fig. 14); the correlation was high (r = + 0.94).

The defoliation of horse-chestnut trees, caused by *C. ohridella*, was completed in Magdalenski park at the beginning of September, at the other localities with a lower pest density even in mid November.

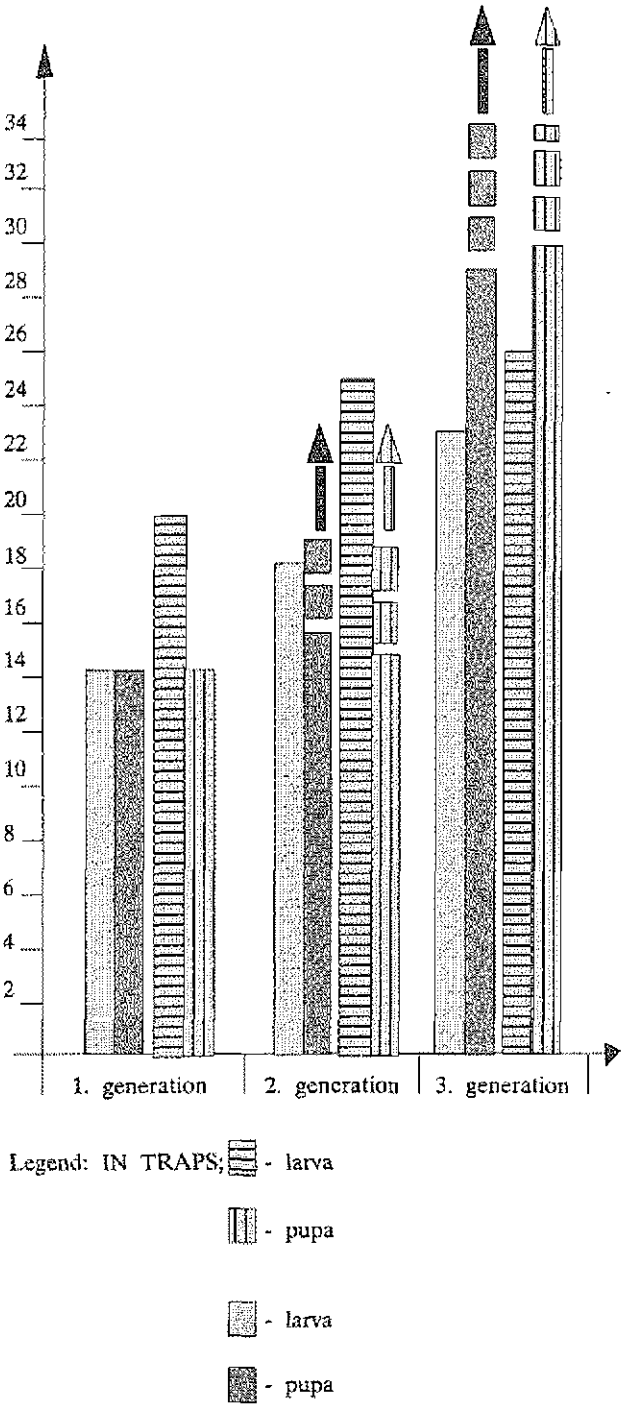

Fig. 11: Duration of the pre-imaginal stages of different generations in traps and in free-land.
Sl. 11: Trajanje preimaginalnih stadijev različnih generacij v pasteh in na prostem.

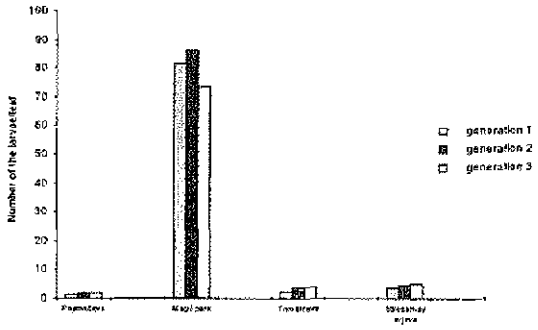

Fig. 12: Density of each generation at different localities.
Sl. 12: Gostota generacij na različnih lokalitetah.

Potential parasites

In the traps three pupae of an unidentified hymenopteran parasite were found.

DISCUSSION

C. ohridella is a serious pest of horse-chestnut in many European countries.

The occurrence of the insect in Slovenia was reported for the first time by Maceljski & Bertić (1995). As Tomiczek (1997) and Sivicek et al. (1997) reported, the species expands rapidly.

To determine the number of generations, the method with mechanical traps has been used in *C. ohridella* for the first time. Investigations of the development in the traps and in free-land in Maribor confirmed that three overlapping generations occurred in the period from April to November 1997. The life cycle of the moth in Slovenia is comparable with the cycle in Austria (Pschorn-Walcher, 1994).

At one locality, the density of the third generation was lower in comparison to the first and second ones (Fig. 12). Here, the high density of the second generation influenced high mortality (Fig. 13), resulting in lower density of the third generation. At low density localities the duration of the larval stages is shorter than at high density places.

The pest overwinters as pupa of the second or third generation. The larval density of the second generation is positively correlated with the percentage of the pupae of the same overwintering generation; the relationship is high ($r = +0.94$).

At three localities in Maribor, the larval densities were different. The highest density in Magdalenski park could be explained as a result of a less intensive removing of the leaves during the last autumn, so the higher number of the pupae has survived the winter.

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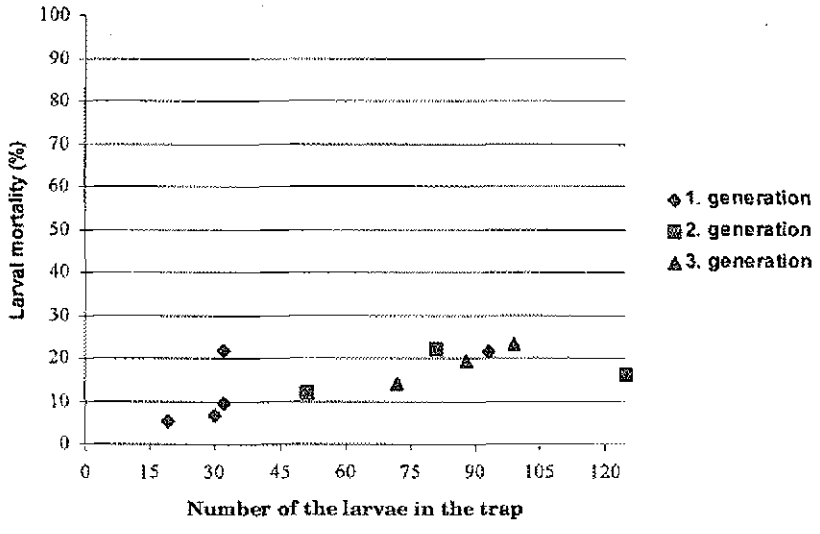

Fig. 13: Relationship between mortality and density of the larvae within the same generation.
Sl. 13: Povezava med mortaliteto in gostoto larv iste generacije.

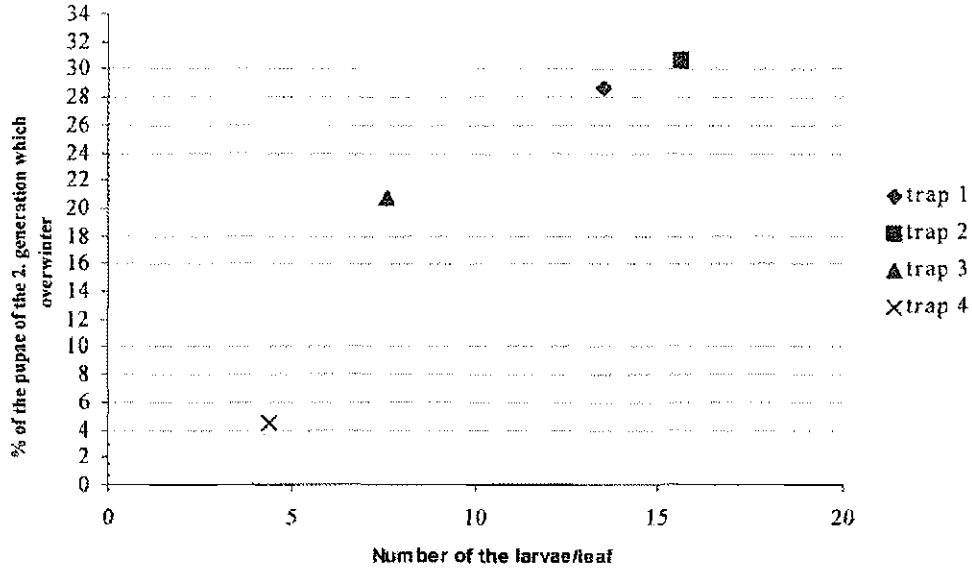

Fig. 14: Relationship between the percentage of the pupae of the second generation which overwinter and the number of the larvae of the same generation in the trap.
Sl. 14: Povezava med odstotkom prezimujočih bub druge generacije in številom larv iste generacije v pasteh.

LISTNI ZAVRTAČ DIVJEGA KOSTANJA (*CAMERARIA OHRIDELLA* DESCHKA ET DIMIĆ, 1986) V SLOVENIJI (INSECTA, LEPIDOPTERA, LITHOCOLLETIDAE)

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POVZETEK

Cameraria ohridella *Deschka et Dimić je nevaren škodljivec divjega kostanja. Škodljivca so odkrili v Makedoniji leta 1984. Od leta 1989 se je vrsta razširila po deželah srednje in vzhodne Evrope (zanesena v Avstrijo se je nato razširila na Češko in Hrvaško, v Italijo, na Madžarsko, v Nemčijo, Slovaško in Slovenijo).*

Zavrtača divjega kostanja so v Sloveniji prvič ugotovili leta 1995. V pričujočem prispevku navajamo podatke o razširjenosti škodljivca v Sloveniji. Z mehanskimi pastmi vrečaste oblike smo onemogočili migracije osebkov. Ugotovili smo, da se pri nas razvijejo tri generacije škodljivca in da prezimujejo bube tretje in nekaj bub druge generacije.

Ključne besede: *Cameraria ohridella*, Lepidoptera, *Aesculus hippocastanum*, življenjski ciklus, Slovenija

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