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The catch of tortricid moths to pheromone traps in apple orchards Part I. Dynamics of moths flight

Odłowy motyli zwójkówek liściowych do pułapek feromonowych w sadach jabłoniowych
Część I. Dynamika lotu motyli

Summary. The studies were conducted in three apple orchards in the Lublin province in the years 1999–2001. Their purpose was to establish the flight dynamics of three species of leaf tortricids (*Spilonota ocellana*, *Pandemis cerasana*, *Archips podana*) on the basis of the catch to pheromone traps. The flight of *S. oceallana* males was extended in time and it lasted from 6 to 9 weeks. *P. cerasana* mostly occurred in two generations and sometimes the population of the second generation was higher than that of the first. Two generations of *A. podana* were observed, and their population was low.

Key words: leaf rollers, pheromone traps, flight dynamic, apple orchards

INTRODUCTION

The majority of insects communicate through the exudated pheromones. Information on the behaviour of insects as a result of these physiologically active chemical substances contributed to the development of different kinds of traps used to catch insects [Carde and Elkinton 1984]. Synthetic pheromones are widely used with the aim of obtaining information about the populations of many species of pests [Emeljanov and Bulyginskaja 1999]. So far pheromones of several pest species occurring in orchard cultivations have been synthesized, for example, 10 species of leaf tortricids. At present, traps of Delta type are most frequently used to catch the males of tortricids. The catch of moths into pheromone traps makes it possible to find the presence of a given species in an orchard, establish the beginning of moths' flight, the necessity to perform the treat-

ment and – possibly – to fix the date of control, or even to estimate the effectiveness of the treatment [Olszak 1998, Olszak and Płuciennik, 1999, Płuciennik 1999].

The purpose of the present studies was to establish the flight dynamics of four species of leaf tortricids on the basis of the catch to pheromone traps in three apple orchards in the vicinity of Lublin.

MATERIALS AND METHODS

The studies were conducted in three apple orchards in the Lublin province in the years 1999–2001. Particular orchards differed with the system of cultivation and the number of plant protection treatments performed there. **An orchard without any chemical control** situated at Leonów, where no protective treatments or fertilization have been applied for a few years. This orchard was surrounded by arable fields. **An orchard with a limited control program** in Motycz, where the chemical plants protection was used when the population of the pest exceeded the threshold of danger. Two or three chemical treatments (Owadofos 540 EC, Decis 2,5 EC, Zolone 35 EC) were used each year. This orchard was surrounded by fallow land and other apple orchards. Site 3 is **an intensively protected orchard** in Jastków. Every year five-six insecticide treatments were used (Sumithion 500 EC, Zolone 350 EC, Owadofos 540 EC, Karate 0,25 EC, Bulldock 0,25 EC). Arable field, pond and hop plantation were around this orchard.

The flight dynamics of tortricid moths was determined on the basis of the catch to Delta type pheromone traps produced by P.P.H. „Medchem". Within three years of studies, traps were used for four tortricid species: *Spilonota ocellana* (Den. et Schiff.), *Pandemis cerasana* (Hbn.), *Adoxophyes orana* (Fisch. v. Rösl.) and *Archips podana* (Scop.). A detailed dynamics of the flight of *A. orana* is presented in the paper by Kot [2006].

One trap for each species was placed in particular orchards. Those traps were hung in the outside part of tree crown at the height of about 1.5 above the ground. Pheromone traps were placed in the orchards a few days before the flight of the first moths, and next the number of caught males of a given species was checked 3 times a week. Observations were performed till the end of the vegetation period.

RESULTS

Spilonota ocellana (Den. et Schiff.)

The flight of *S. ocellana* moths began in 2000 the earliest (in third ten days of May) (Fig. 1), which was connected with very early vegetation. In 1999 the first moths of this species were caught during the first ten days of June, and in 2001 in the second and third ten days of that month. The moth flight was extended in time and it lasted from about 6 weeks in 2001 to about 9 weeks in 2000, mainly taking place in June and July, when more than 90% of all moths were caught. The highest number of males was observed in July. In 2000 and 2001 the last single moths were observed at the end of August and at the beginning of September.

Pandemis cerasana (Hbn.)

Two generations of *P. cerasana* occurred in all years of studies and in particular apple orchards (Fig. 2). In an intensively protected orchard the second generation was not numerous and it consisted of single individuals. In 2001, both in the orchard without any chemical protection and in the one with a limited program of protection, the population of summer generation males was almost twice as high as in the winter generation, whereas in the other years of studies the proportion was reverse. The first males were most frequently observed in the traps in the second half of May and at the beginning of June, depending on the year and the site. The flight of moths of the wintering generation lasted till the middle of July, and the maximum was found out in the third ten days of May of 2000 and in the second ten days of June in 1999 and 2001 (Fig. 2). The flight of the summer generation individuals in 2000 and 2001 began in the first half of July and it lasted till the middle of September, whereas in 1999 the summer generation was not numerous and the male flight finished in the middle of August. The maximum flight of males of the summer generation took place in the years of studies in the second and third ten days of August.

Archips podana (Scop.)

The first moths of the wintering generation were most frequently observed in the traps in the second and third ten days of June, while the last males of that generation were seen within the first ten days of July (Fig. 3). The second generation of *A. podana* occurred in almost each year of studies, and it was usually less numerous than the first one, or it was on the same level. The flight of second generation mostly began in the second ten days of August and it lasted till the first days of September.

DISCUSSION

The analysis of the catch of males of selected species of leaf tortricids into pheromone traps makes it possible to state that due to the location of the research objects in the same climatic region, the dates of the beginning and the length of moth flights of particular species as well as their dynamics were similar.

Three-year-long observation point out that the flight of *S. ocellana* males in the conditions of south-eastern Poland was extended in time and it lasted from 6 to 9 weeks. In other regions of the country the flight of the same species does not last longer than 7 to 11 weeks [Koślińska *et al*. 1990a]. The highest number of males was found out in June and July. Similar observations are presented by Razowski and Woroniecka [1925] and Wiąckowski [1959].

In all years of studies *P. cerasana* occurred in two generations, and in some cases the population of the second generation was almost twice as high as the first. The maximum of the first generation was most frequently observed in the second ten days of June. On the other hand, the maximum of males flight of the second generation was observed in the second and third ten days of August. Similar result were presented by Koślińska [1982].

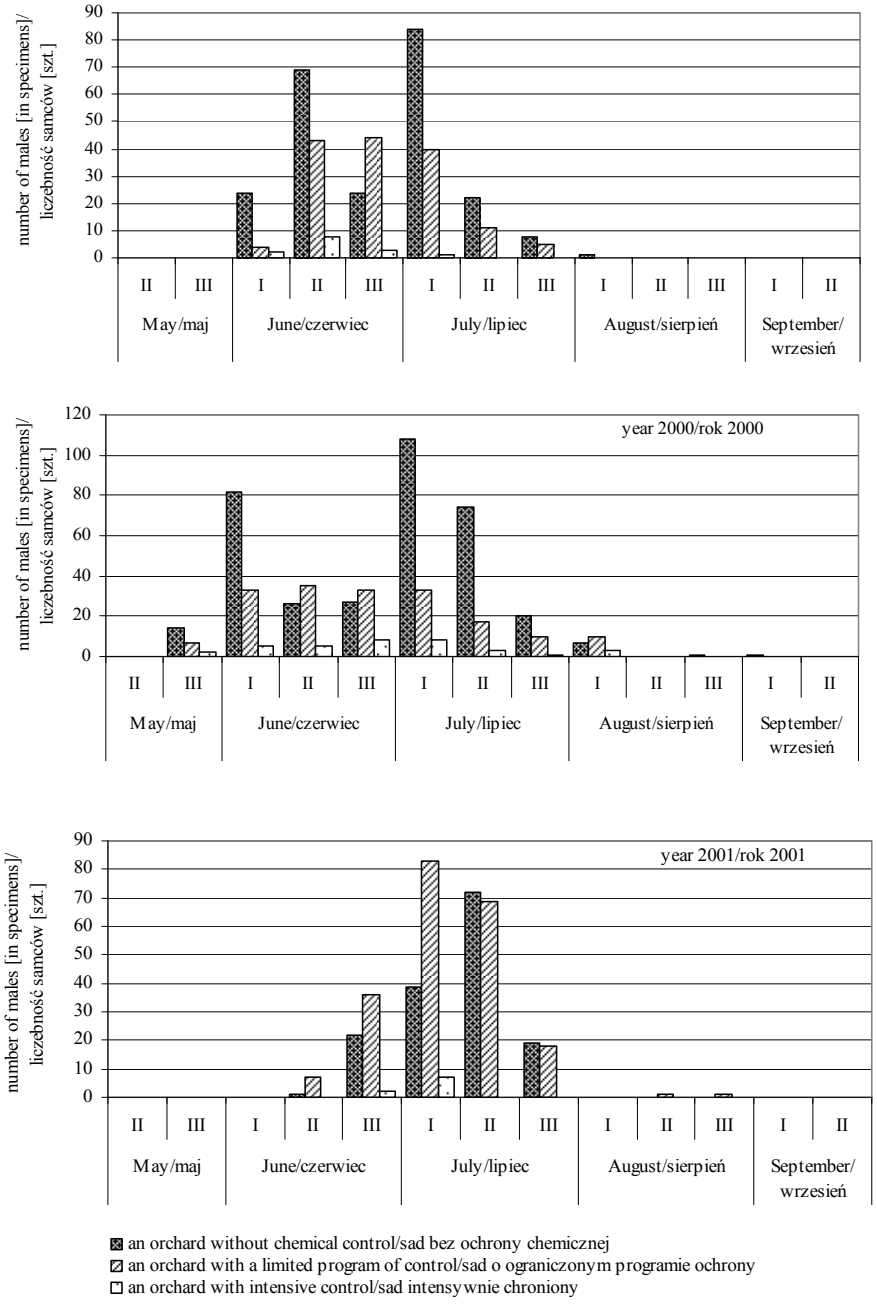

Fig. 1. The flight dynamics of *Spilonota ocellana* (Den. et Schiff.) in the praticular apple orchards in 1999–2001

Rys. 1. Dynamika lotu *Spilonota ocellana* (Den. et Schiff.) w poszczególnych sadach jabłoniowych w latach 1999–2001

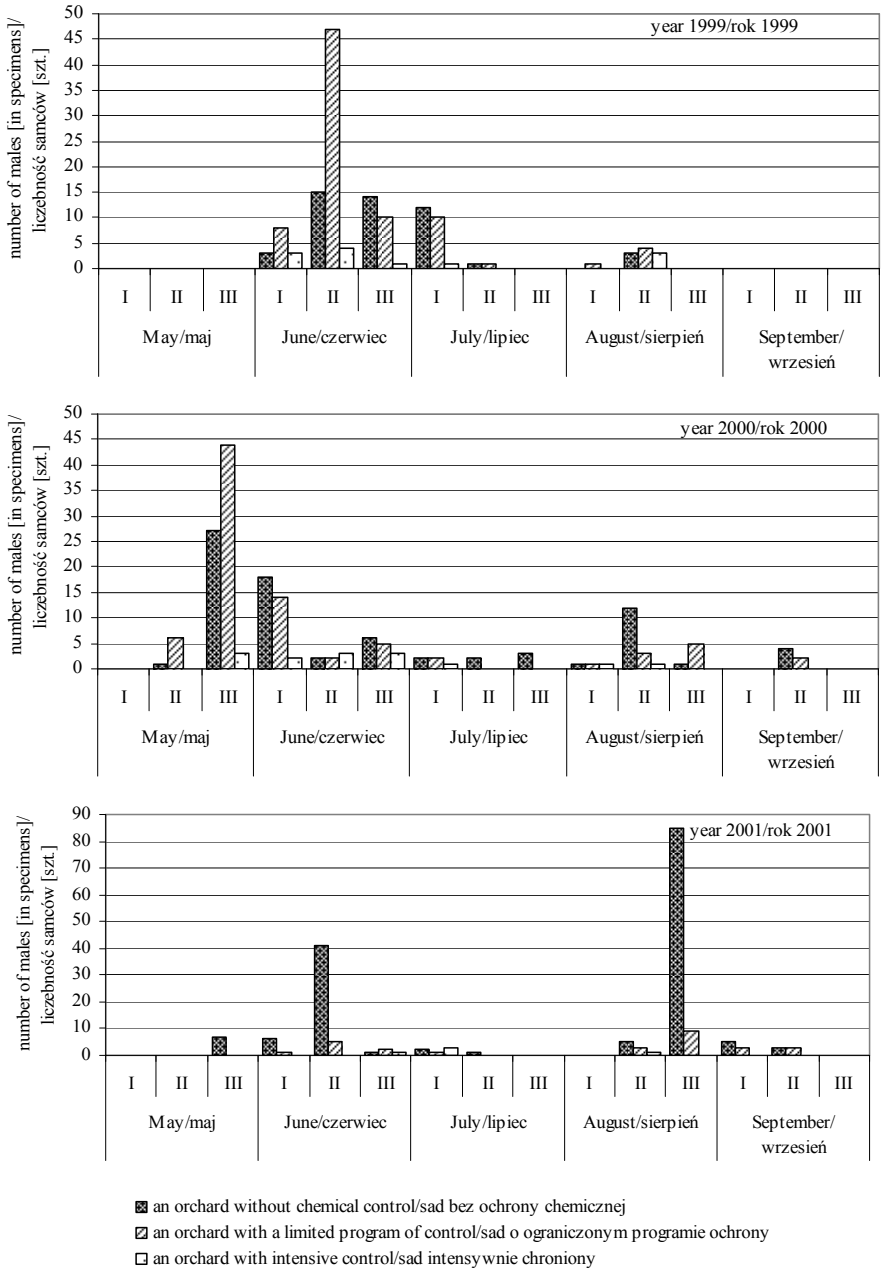

Fig. 2. The flight dynamics of *Pandemis cerasana* (Hbn.) in particular apple orchards in 1999–2001

Rys. 2. Dynamika lotu *Pandemis cerasana* (Hbn.) w poszczególnych sadach jabłoniowych w latach 1999–2001

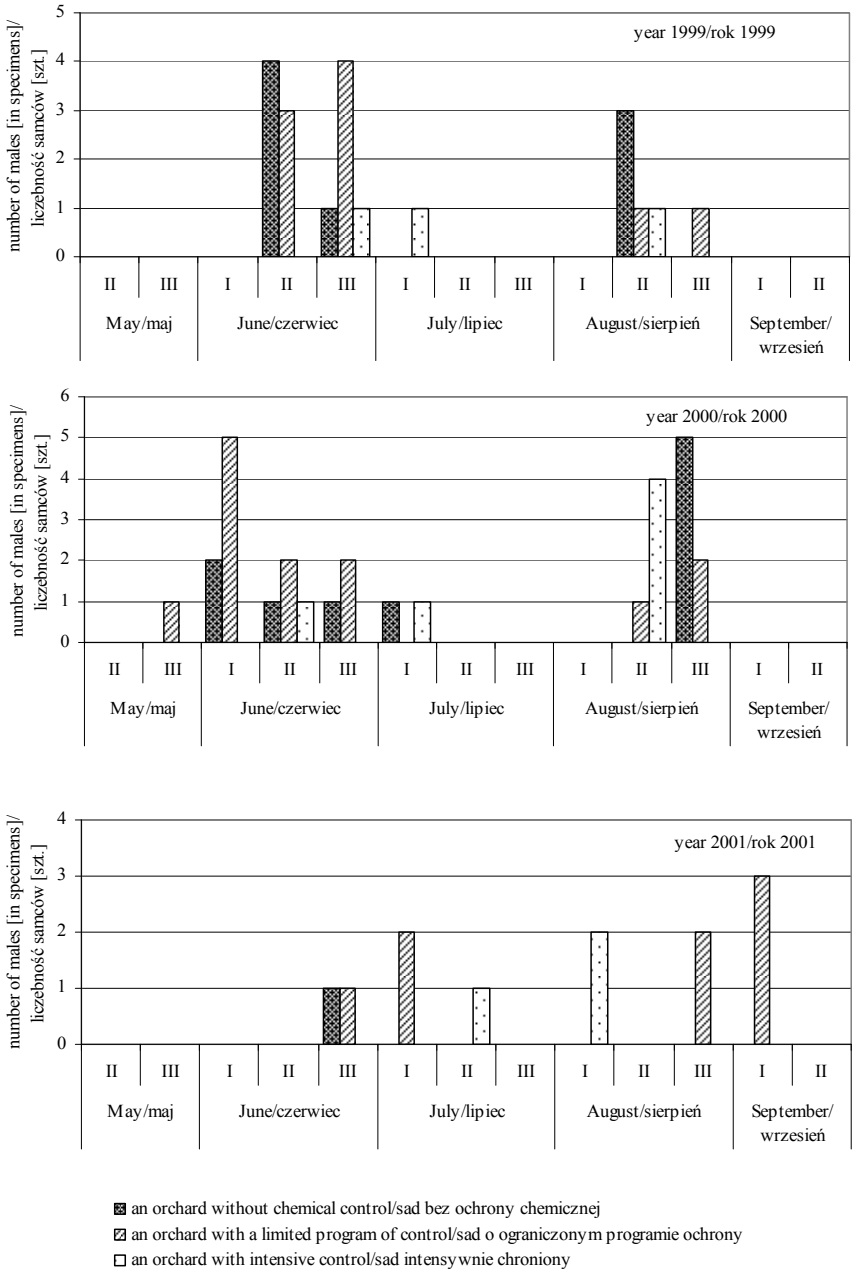

Fig. 3. The flight dynamics of *Archips podana* in particular apple orchards in 1999–2001
Rys. 3. Dynamika lotu *Archips podana* (Scop.) w poszczególnych sadach jabłoniowych w latach 1999–2001

In each year of studies two generations of *A. podana* were observed; however, their populations were low. The flight of the wintering generation males usually lasted between the second ten days of June and the first of July. From the studies conducted by Koślińska *et al.* [1990b] follows that in different regions of Poland the flight of the first moths of this species takes place at the same time and it lasts intermittently for about 6–8 weeks. In the authors' own studies the moths of the second generation were observed from the second ten days of August.

CONCLUSIONS

1. The flight of *S. oceallana* males was extended in time and it lasted from 6 to 9 weeks.

2. *P. cerasana* usually occurred in two generations and sometimes the population of the second generation was higher than that of the first. The highest number of the wintering generation was observed in the second ten days of June, and that of the summer generation in the second and third ten days of August.

3. Almost in all years of studies two generations of *A. podana* were observed, and their population was low. The flight of the first generation moths was observed from the middle of June till the middle of July, whereas that of the second generation – from the second ten days of August till the first days of September.

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Streszczenie. Badania prowadzono w trzech sadach jabłoniowych na terenie województwa lubelskiego w latach 1999–2001. Ich celem było ustalenie fenologii lotu trzech gatunków zwójkówek liściowych (*Spilonota ocellana*, *Pandemis cerasana*, *Archips podana*) na podstawie odłowów do pułapek feromonowych. Lot samców *S. ocellana* był rozciągnięty w czasie i trwał od 6 do 9 tygodni. *P. cerasana* występowała zazwyczaj w dwóch pokoleniach, a liczebność drugiego pokolenia była niekiedy dwukrotnie wyższa niż pierwszego. Stwierdzono również występowanie dwóch pokoleń motyli *A. podana*, ale ich liczebność była niska.

Słowa kluczowe: zwójkówki liściowe, pułapki feromonowe, dynamika lotu, sady jabłoniowe