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## FLIGHT DYNAMICS OF SOME *LEPIDOPTERA* SPECIES OF SUGAR BEET AND POSSIBILITIES THEIR CONTROL (TRANSYLVANIA—ROMANIA)\*

**ABSTRACT:** In this paper, the authors present the obtained results regarding the flight dynamics of some *Lepidoptera* species in sugar beet crops in Transylvania (the central part of Romania). In order to limit the appearance of mentioned pests to the economic threshold, *Trichogramma* spp. were obtained in laboratory conditions at ARDS Turda and SBRDS Brasov. The experiments were conducted in production areas on 0,5 ha minimum for each variant. The variants included four *Trichogramma* species: *T. dendrolimi*, *T. evanescens*, *T. maidis*, *T. buesi* that were manually released three times: the first release, 10.000 individuals/ha, the second, 120.000 individuals/ha and the third, 150.000 individuals/ha. The first release was performed at the beginning of the *Lepidoptera* flight, the second at the maximum flight and the third 5 days after the second.

The efficiency of *T. maidis* was between 75—90%, of *T. evanescens*, it was between 73—88%, of *T. dendrolimi*, it was between 85—92% and of *T. buesi* 79—82%. Among the *Trichogramma* species utilized, *T. dendrolimi* and *T. evanescens* were very efficient in the reduction of mentioned pests. Root production was significantly higher compared to the untreated variant, 4,0—4,7 t/ha more were recorded after the application of biological treatments with *T. evanescens* and *T. dendrolimi*.

**KEY WORDS:** Biological treatments, flight dynamic, *Lepidoptera* species, pheromonal traps, *Trichogramma* spp., roots production

### INTRODUCTION

In Romania, sugar beet areas were significantly reduced in the last years. Nowadays, there are approximately 20.000 ha of sugar beet, about 6.000 ha in Transylvania. It is very important to study the fauna composition inhabiting that biocenosis, as well as the activity of present species. In this way, it is necessary to know the ecology, biology of pests, behaviour and the population

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size of these. On the basis of the obtained results, the monitoring of species evolution was done.

At the Chemistry Institute of Cluj Napoca, a large spectrum of sexual pheromones was synthesized which were then tested on a series of lepidopterous pests harmful for sugar beet crops. Further on, some abundance aspects of the most harmful lepidopterous pests in Transylvania were presented (Turda and Braşov area) and some biological control aspects, also.

## MATERIAL AND METHOD

Researches regarding the flight dynamics of lepidopterous pests were performed at ARDS Turda and SBRDS Braşov, between 1994—2003. The monitored species were: *Autographa gamma*, *Agrotis segetum*, *Agrotis exclamatoris*, *Agrotis ypsilon*, *Amathes c-nigrum*, *Mamestra suasa*, *Mamestra trifolii*, *Mamestra brassicae*. For setting the population dynamics of these pests, Romanian sexual pheromones were used. The experiment included three repetitions, the traps being placed at 50 m distance between them and the captured insects were recorded. The abundance of target species and other species of captured lepidopterous pests were monitored for pointing out the attractiveness of sexual pheromones for target species. The results of these observations were materialized through flight curves, which show the species evolution depending on climatic conditions, which can serve as a warning that chemical or biological treatments should be applied. Some experiments with biological treatments with *Trichogramma* species, *T. dendrolimi*, *T. evanescens*, and *T. maidis* *T. bues* were conducted in field conditions. The area of a variant was 0,5 ha. There were three releases of *Trichogramma* spp.: 100.000 individuals/ha at the first release, 120.000 individuals/ha at the second and 150.000 individuals/ha at the third release. The first release was done at the beginning of the lepidopterous pests flight, the second one at the maximum flight and the third one 5 days after the second one. The observations regarding the treatments efficiency were done on the frequency of the attacked plants and on the obtained root yield.

## RESULTS AND DISCUSSIONS

Between 1994—2004 (May—September), the medium value of temperature was between 15—22°C, in May, a medium temperature of 17°C was recorded, in July and August 20—22°C and in September 15—16°C. The amount of rainfall was between 27—46 mm, the highest value recorded in June, in May and July being 27 mm and up to 21,5 mm in August and September. These climatic conditions proved that the flight of lepidopterous pests is harmful for sugar beet crops. Since being thermophile, the maximum flight was at 18—21°C.

The specific sexual pheromones for lepidopterous pests presented the attractiveness between 85—96% in Turda and between 87—94% in Braşov. Other lepidopterous species were in pheromone traps accidentally and not be-

cause of their attraction to sexual pheromones which are specific and selective for target species in a considerable proportion (Table 1).

Table 1. Specific attractiveness (%) of sexual pheromone in the both counties (May—September, 1994—2003)

The species	Specific attractiveness of sexual pheromones (%)	
	ARDS Turda	SBRDS Braşov
<i>Autographa gamma</i>	85,0	89,2
<i>Amathes c-nigrum</i>	93,0	91,3
<i>Agrotis segetum</i>	96,0	87,0
<i>Agrotis ypsilon</i>	95,0	93,8
<i>Agrotis exclamationis</i>	94,0	94,0
<i>Mamestra trifolii</i>	95,4	90,4
<i>Mamestra suas</i>	94,3	93,4
<i>Mamestra brassicae</i>	95,1	94,0

Owing to good attractiveness and selectivity of sexual pheromones for monitoring the species, high abundance of them was present during the whole period of the studying years in both areas (over 18.000 and 30.000 adults in Turda and Braşov respectively) (Figure 1).

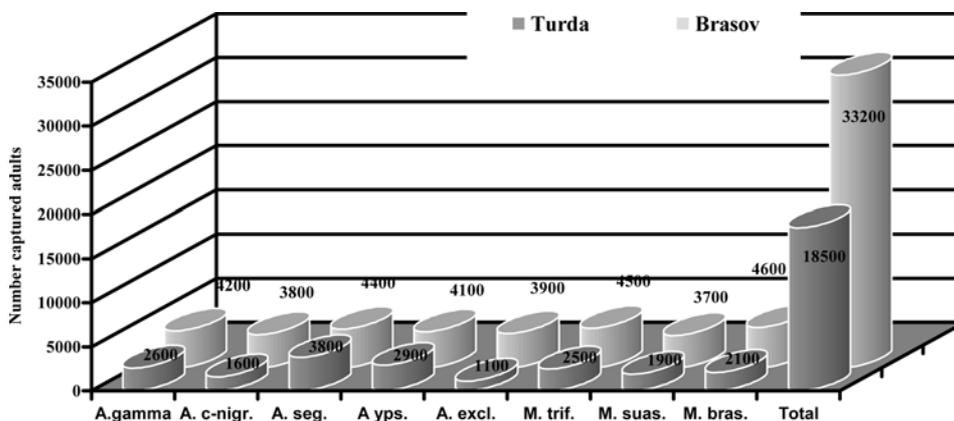


Figure 1. Abundance of *Lepidoptera* damaging sugar beet captured in sexual pheromone traps (May—September, 1994—2003)

The evolution of mentioned species depending on climatic conditions is presented in the flight curves. The adults flight of *Autographa gamma* and *Amathes c-nigrum* began in May, growing higher in June when the medium temperature was 18—19°C, the period when besides the native exemplars, those from Southern Europe migrating to North also appear. The first maximum flight was recorded in the second (*A. gamma*) and third (*A. c-nigrum*) decade of June, afterwards the flight continued but at lower values, followed by intensification in August when the second maximum flight was recorded, *A. c-ni-*

*grum* in the first and *A. gamma* in the second decade. The species were also present in September but in reduced number (Figure 2).

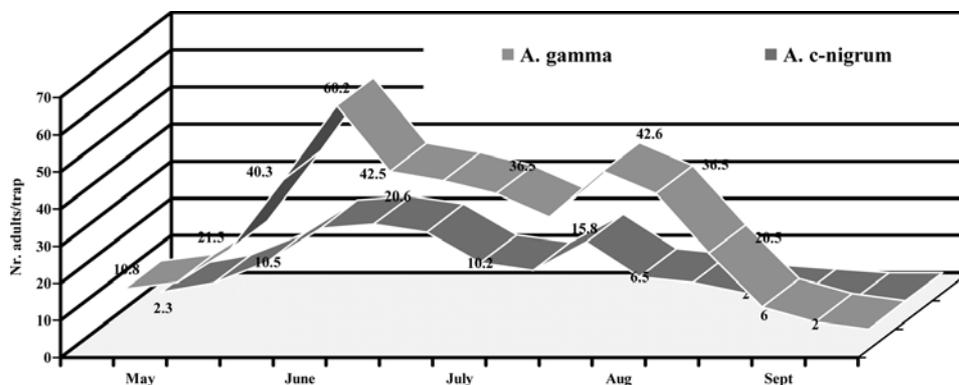


Figure 2. Flight curves of *Autographa gamma* and *Amathes c-nigrum* in sugar beet crops (Turda, 1994—2003)

The number of male species of *Agrotis segetum* and *Agrotis exclamationis* recorded in pheromone traps was higher than that of *Agrotis ypsilon* species. For the first two mentioned species, the first maximum flight was recorded at the end of June and the beginning of July when the medium temperature was about 19—20°C. The flight also continued with another maximum at beginning of the second decade of August at 21°C and with the amount of rainfall being 10—14 mm. For *A. ypsilon*, the first maximum was recorded in the second decade of July and the second one in the third decade of August (Figure 3).

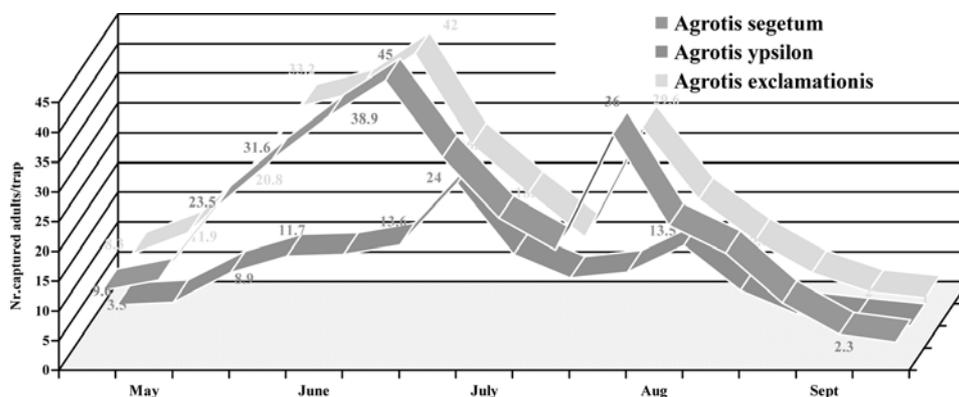


Figure 3. Flight curves of *Agrotis segetum*, *A. ypsilon*, *A. exclamationis* in sugar beet crops (Turda, 1994—2003)

The *Mamestra* genus was represented by *M. trifolii*, *M. suasa* and *M. brassicae*. In the pheromone traps, there was a higher number of *M. trifolii* and *M. brassicae* species. The first flight maximum was recorded in the first

decade of July for all these species. Afterwards, the flight continued with low oscillations and another maximum recorded in the second decade of August (Figure 4).

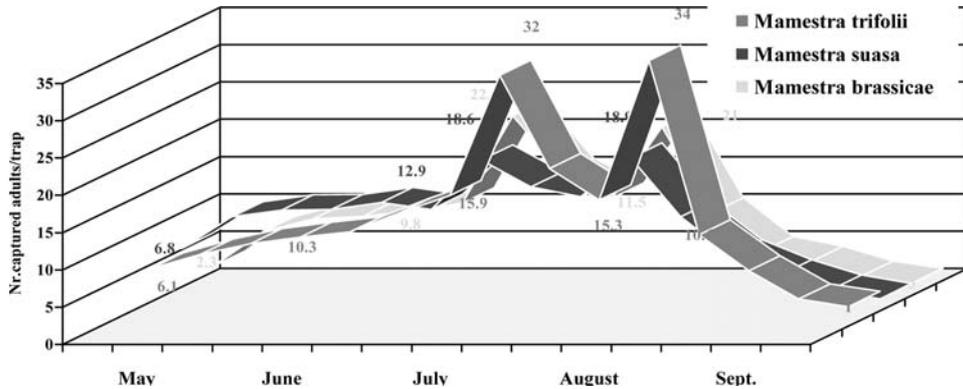


Figure 4. Flight curves of *Mamestra trifolii*, *M. suasa*, *M. brassicae* in sugar beet crops (Turda, 1994—2003)

In order to limit the number of these species, biological treatments with some *Trichogramma* species, *T. maidis*, *T. dendrolimi*, *T. evanescens*, *T. buesi*, were applied. The efficiency of these treatments was between 88—95% in Turda, the highest efficiency presented by treatments using *T. dendrolimi* and *T. evanescens* (Figure 5). In Braşov, the efficiency was between 92,6—94,6%, where besides two mentioned species, treatments with *T. buesi* also presented high efficiency (Figure 6). Statistical calculations resulted in that root yield obtained after the treatments with *Trichogramma* species was significantly higher, especially after treatments with *T. dendrolimi* and *T. evanescens*. The yield increase was about 4,4—4,7 to/ha compared to untreated variant (Figure 7).

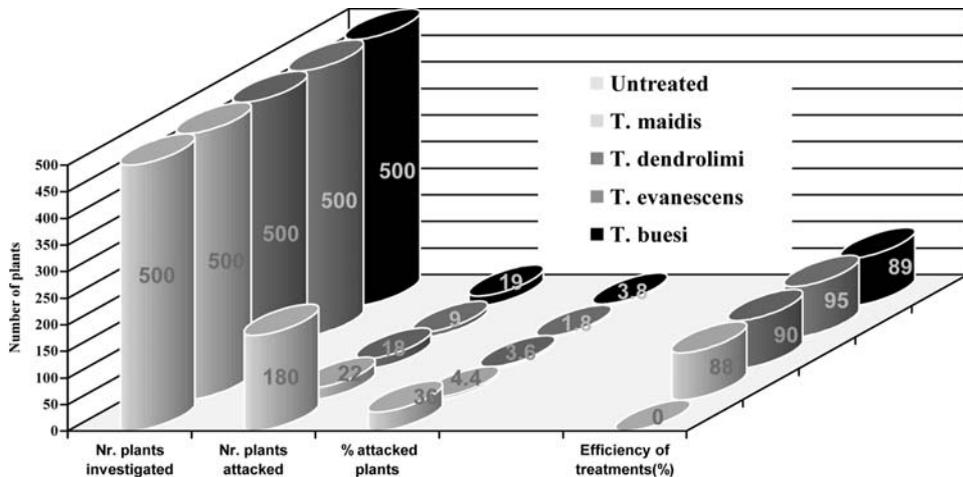


Figure 5. Efficiency of treatments with *Trichogramma* spp. in sugar beet crops (Turda, 1994—2003)

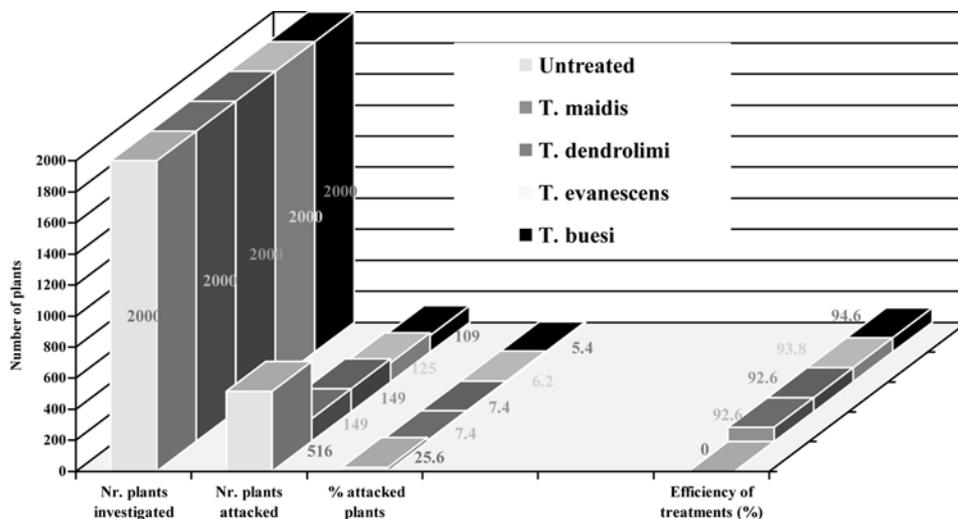


Figure 6. Efficiency of treatments with *Trichogramma* spp. in sugar beet crop (Braşov, 1994—2003)

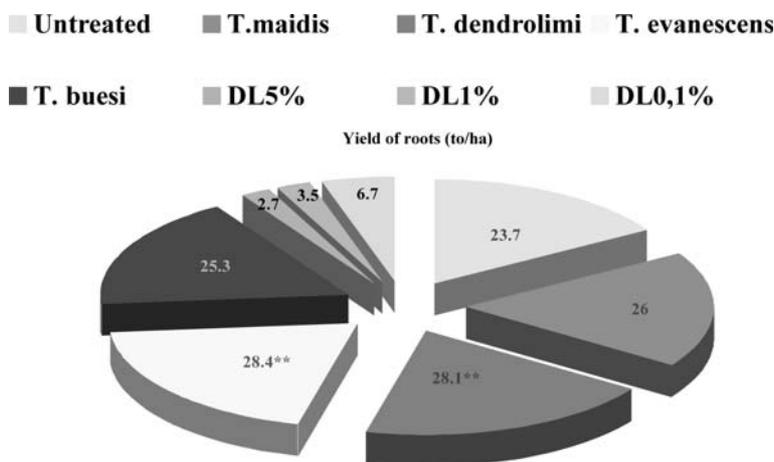


Figure 7. Root production (to/ha) obtained after treatments with *Trichogramma* spp. in sugar beet crops (Braşov, 1994—2003)

## CONCLUSIONS

1. During 10 years of studying sugar beet at ARDS Turda and SBRDS Braşov, over 50.000 individuals of the mentioned species were captured in sexual pheromone traps.

2. High number of individuals was captured because of great capacity of sexual pheromones attractiveness for each species, which oscillated between 85—96% in both areas in Transylvania.

3. The placing of sexual pheromones in natural habitat of species and recording the captured number in correlation with climatic factors enabled the mapping out of flight curves which through their forms, number and capture period pointed out the number of generations of species developed in a certain ecological area.

4. The efficiency of biological treatments with four *Trichogramma* species which was between 73—92% depends on the species utilized. *T. dendrolimi* and *T. evanescens* significantly reduced the attack frequency, compared to untreated variant. Also, a significantly higher root yield with 4—4,7 to/ha more was recorded in treated variants.

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ДИНАМИКА ЛЕТА НЕКИХ ВРСТА *LEPIDOPTERA* У ШЕЋЕРНОЈ РЕПИ  
И МОГУЋНОСТИ ЊИХОВОГ СУЗБИЈАЊА  
(ТРАНСИЛВАНИЈА — РУМУНИЈА)

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Резиме

У условима Трансилваније (Пољопривредна истраживачко-развојна станица Турда и Пољопривредна истраживачко-развојна станица за шећерну репу Брашов), у периоду мај—септембар 1994—2003, у усеву шећерне репе је у феромонским клопкама прикупљено преко 40.000 јединки *Lepidoptera*: *Autographa gamma*, *Agrotis segetum*, *Agrotis exclamationis*, *Agrotis ypsilon*, *Amathes c-nigrum*, *Mamestra suasa*, *Mamestra trifolii*, *Mamestra brassicae*. До великог броја одраслих јединки поменутих врста дошло је због изразито доброг капацитета привлачења сексуалних феромона, за сваку врсту између 60 и 95%.

У овом раду аутори износе резултате добијене у односу на динамику лета неких врста *Lepidoptera* у усеву шећерне репе из Трансилваније (централни део Румуније) За ограничавање поменутих штеточина у економском прагу употребљене су *Trichogramma* spp. добијене у лабораторијским условима у ПИРС Турда и ПИРСБР Брашов. Експерименти су изведени у производним условима области на минимално 0,5 ha за сваку варијанту. Варијанте су сачињавале четири врсте *Trichogramma*: *T. dendrolimi*, *T. evanescens*, *T. maidis*, *T. buesi*. Уношење ових врста *Trichogramma* у поље је урађено ручно, са три уношења: прво уношење — 10.000 јединки/ha, друго — 120.000 јединки/ha и треће — 150.000 јединки/ha. Прво избацивање изведено је на почетку лета *Lepidoptera*, друго у време максималног лета, а треће 5 дана након другог.

Посматрање ефикасности третмана изведено је на учесталости нападнутих биљака и постигнутој производњи корена. Ефикасност *T. maidis* је била између 75 и 90%, *T. evanescens* између 73 и 88%, *T. dendrolimi* између 85 и 92%, а *T. buesi* 79 и 82%. Примећено је да су, од примењених *Trichogramma* врста, *T. dendrolimi* и *T. evanescens*, *T. evanescens* и *T. dendrolimi*, уз забележено повећање приноса 4,0—4,7 t/ha.