MASS TRAPPING OF *Synanthedon tipulifornis* ON BLACKCURRANTS AND *Grapholitha funebrana* ON PLUMS WITH PHEROMONE GLUE TRAPS IN BELARUS

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A B S T R A C T

Mass trapping as pest control method is based on the principle of the intensified insect male attraction into pheromone glue traps as a result of which females turn out to be unfertilized what brings phytophage number and harmfulness decrease. *Grapholitha* (= *Laspeyresia, Cacoecia, Aspila*) *funebrana* Tr. is a phytophage spread and harmful everywhere on stone fruits in Belarus, but on black currant plantings – *Synanthedon* (= *Aegeria, Sesia*) *tipulifornis* Cl. Since 2000 the researches have been carried out at the Institute of Plant Protection on studying the attractiveness of the synthetic sex pheromones (SSP) synthesized at Belarusian State University and possibilities of their use for mass pest trapping.

It is determined that an equal location of 25 traps per 1 ha in a distance of not less than 20 m from each other allows to decrease *Grapholitha funebrana* harmfulness for 84% in isolated plum orchard for 4 years of annual catching, *Synanthedon tipulifornis* by catching in the course of one season for 50-54%.

Key words: *Grapholitha funebrana* Tr., *Synanthedon tipulifornis* Cl., synthetic sex pheromones, attractiveness, mass trapping

INTRODUCTION

Environment protection and the negative impact of widespread pesticide use have stimulated research into the principles and practice of regulating pest populations. The best solution is to create integrated plant protection systems which control pests over the long term with minimal harm to the environment (Samersov and Trepashko, 1998). Pheromones are one component of integrated protection systems. Synthetic sex pheromones (SSP) are widely

used to collect information on the population of many insects, especially the *Lepidoptera.* On the basis of the insects caught in the traps, one can determine which individual species are present or not. By using attractants, pests can be detected long before they multiply and spread. By using traps with synthetic sex pheromones, it is possible to precisely monitor pest populations, predict crop damage, determine threshold levels and establish the best time to apply protective measures (Sakhautdinov, 1994; Sayed at al., 1998; Nikolaeva and Ovsyannikova, 1999). Using pheromone preparations in combination with pesticides makes it possible to reduce the amount of pesticides used and to use them in a more targeted way. SSP's are also used to regulate insect populations by disorienting them and by catching them in large numbers with the help of pheromone glue traps.

In blackcurrant plantations in Belarus which are not protected from pests, the currant clearwing moth (*Synanthedon tipulifornis* Cl.) can damage 8 to 10% of the shoots. In unprotected plum orchards, the plum coddling moth (*Grapholitha funebrana* Tr.) can reduce yields by 80 to 100% (Supranovich et al., 2003).

In 2000, at the Institute of Plant Protection of the Belarusian NAS and the Belarusian State University, research began on developing SSP techniques for use in integrated pest protection against these serious pests.

RESEARCH SITE AND METHODS

SSP synthesis in *S. tipulifornis* and *G. funebrana* was studied at the Department of Organic Chemistry of the Belarusian State University under the supervision of Professor O.G. Kulenkovich.

Studies on the attractiveness of SSP's and trapping of *S. tipulifornis* and *G. funebrana* were carried out in the Fruit Crop Protection Laboratory of the Institute of Plant Protection. Studies were carried out on plum and blackcurrant plants on the "Zubki" fruit farm in the Minsk district.

Mass trapping of *S. tipulifornis* and *G. funebrana* was generally carried out in accordance with methods described elsewhere (Burov and Sazonov, 1987; Dzhekobson, 1976; Voinyak, 1988).

The SSP attractant used for *S. tipuliformis* was trans-, cis-2,13-octadecadiene-1-ol + cis-13-octadiene-1-ol acetate. The attractant used for *G. funebrana* was cys-8-dodecenilacetate. Attracon-A pheromone glue traps smeared with Vanilon glue were used at a density of 25 traps per hectare. For blackcurrants, traps were hung on the upper part of the bushes a week after blossoming. For plums, traps were hung up to 1.5 meters above ground level on the periphery of the tree crown before blossoming.

RESULTS AND DISCUSSION

From 1991 to 1998, a method for mass trapping *S. tipuliformis* in pheromone glue traps was developed at the Fruit Crop Protection Laboratory

of the Institute of Plant Protection of the Belarusian NAS. The pheromone used was synthesized in the Republic of Moldova (Yarchakovskaya, 1997; Yarchakovskaya and Bezruchenok, 2000). Since 2000, research has been underway on the attractiveness of an SSP for *S. tipuliformis* which was synthesized in the Republic of Belarus. Fourteen preparations were evaluated to determine which was the most attractive. The effect of the frequency of changing dispensers on the attractiveness of the SSP was also studied. Changing the dispenser once a month did not have any effect on the attractiveness of the SSP (Yarchakovskaya et al., 2004).

In 2004, a method for mass trapping *S. tipulifornis* males with a highly attractive SSP synthesized in the Republic of Belarus was evaluated. The method was tested before buds opened in spring. The trial was carried out in a six-year-old blackcurrant plantation planted with the cultivar 'Titanic'. Shoot damage caused by *S. tipulifornis* had reached 10 to 12%. The experimental plot was six hectares in area. The experiment was carried out with two replicates of 25 traps per hectare. The following scheme was used:

- Variant 1: SSP synthesized in the Republic of Belarus;
- Variant 2: SSP synthesized in the Republic of Moldova;
- Variant 3: Control (no traps).

The trapping period lasted from May 27 to September 1, 2004. Traps were examined every seven days. The moths caught in the traps were identified and removed from the sticky surface. In the traps baited with the SSP synthesized in Belarus, 700 moths were caught. In the traps baited with the SSP synthesized in Moldova, 1080 moths were caught. The efficiency of the mass trapping method was evaluated based on the decrease in the amount of shoot damage compared to the control. To assess shoot damage, two replicates of 100 two-to-four-year-old shoots were collected in autumn after the leaves fell. The shoots were dissected in the laboratory and the number of caterpillars found was recorded. Mass trapping of *S. tipulifornis* males reduced shoot damage by 50 to 54% compared to the control (Tab. 1).

Table 1. Biological efficiency of *Synanthedon tipulifornis* Cl. mass catching by pheromone glue traps in the blackcurrant cultivar 'Titania' in the Minsk district in 2004

Variant	Moths caught during the flight period (May 27 to Sept. 1, 2004)	Shoots damaged by caterpillars [%] (Nov. 10, 2004)	Biological efficiency [%]
SSP synthesized in the Republic of Belarus	700	9.5	50.0
SSP synthesized in the Republic of Moldova (standard)	1080	8.8	54.0
Control (no traps)	-	19.0	-

Beginning in 2000, a method for mass trapping *G. funebrana* has been under development. Five preparations synthesized in the Republic of Belarus were evaluated, and the most attractive was chosen for further study (Yarchakovskaya et al., 2004).

From 2001 to 2004, a method for mass trapping *G. funebrana* was carried out in an isolated plum orchard five hectares in area. Ever year at blossoming time, traps were hung at a density of 25 traps per hectare at least 25 meters apart. Traps were examined every seven days. The moths caught in the traps were identified and removed from the sticky surface. The glue plate was changed every week throughout the flight period. The dynamics of the flight is presented in Fig. 1.

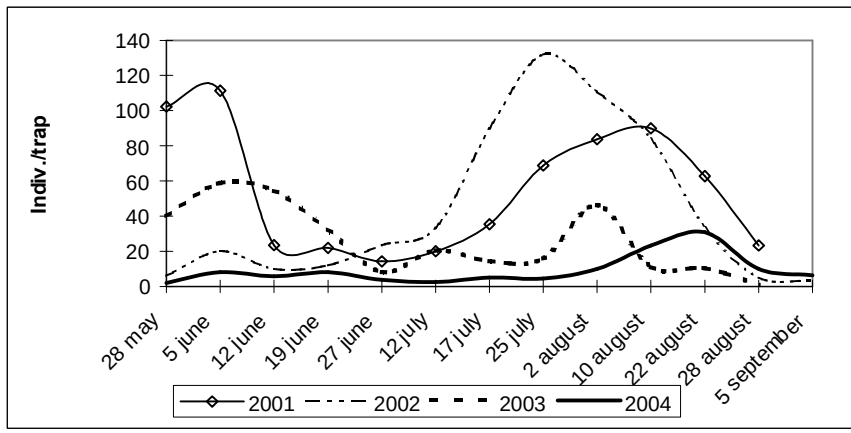

Figure 1. Dynamics of *Grapholitha funebrana* Tr. flight in plum orchards in the Minsk district from 2001 to 2004

The average number of *G. funebrana* males caught per trap was 657 in 2001, 586 in 2002, 309 in 2003, and 76 in 2004. The population density of *G. funebrana* decreased from year to year (Fig. 1).

The efficiency of the method was evaluated based on the decrease in the amount of fruit damage. Fruit damage was assessed every year at harvest time. Fruits were collected from ten trees on every hectare. The percentage of fruits damage by *G. funebrana* larvae was recorded. The percentage of fruit damage caused *G. funebrana* larvae was 100% in 2001, 92% in 2002, 57% in 2003, and 16% in 2004 (Tab. 2). Annual trapping of *G. funebrana* males reduced fruit damage by 84% in four years.

Table 2. Efficiency of mass trapping of *Grapholitha funebrana* with pheromone glue traps in a plum orchard planted with the cultivar 'Edinburgskaya' in the Minsk district from 2001 to 2004

Year	Average number of males caught per trap during the flight period	Percentage of fruits damaged
2001	657	100
2002	586	92
2003	309	57
2004	76	16

CONCLUSIONS

Mass trapping *Synanthedon tipulifornis* Cl. males with pheromone glue traps baited with a pheromone synthesized in the Republic of Belarus reduced shoot damage in a blackcurrant plantation by 50 to 54% during the course of one vegetative season.

Trapping *Grapholitha funebrana* Tr. males every year with pheromone glue traps baited with a pheromone synthesized in the Republic of Belarus reduced fruit damage in an isolated plum orchard by 84% in four years.

REFERENCES

Burov V.N., Sazonov V.P. 1987. Biologichesky aktivnye vetschestva v zatschite rastewniy. M. "Agropromizdat", pp. 117-138.

Dzhekobson M. 1976. Polovye pheromony nasekomykh.– Mir., 313 p.

Nikolaeva Z.V., Ovsyannikova E.I. 1999. Sinteticheskie polovye pheromony dlya monitoringa vseyadnoy listovertki na Severo-Zapade Rossii. AGRO XXI (11): 14.

Sakhautdinov R.A. 1994. Evaluation of biological activity of synthetic sex pheromone during different outbreak periods of leafrollers (*Archips*). PHEROMONES 4 (3/4): 71-82.

Samersov V.F., Trepashko L.I. 1998. Kritery ekologicheskoy bezopasnosti. ZATSCHITA RASTENY 8: 18-19.

Sayed A., Unelius R.C., Liblikas I., Lfqvist J., Bengtsson M., Witzgall P. 1998. Effect of codlemone isomers on codling moth (*Lepidoptera, Tortricidae*) male attraction. ENVIRONM. ENTOMOL 27(5): 1250-1254.

Supranovich R.V., Koltun N.E., Yarchakovskaya S.I., Mikhnevich R.L., Meleshko N. I. 2003. Plodovo-yagodnye kultury. In: S.V. Soroki (ed.), Integrir. Sistemy Zatschity S.-kh. Kultur ot Vrediteley, Bolezney i Sornyakov Rekomendatsii. NIRUP "Belorussky Institut Zatschity Rasteniy"- Minsk: UP "IVTs Minfina", vol. 2, pp. 150-243

Voinyak V.I. 1988. Metodicheskie Ukazaniya po Ispolzovaniyu SPF dlya Borby s Grozdevoy Listovertkoy Putem Massovogo Otlova i Dezorientacii Samtsov. Kishinev, p. 11.

Yarchakovskaya S.I. 1997. Ecologically safe protection of fruit-bearing black currant against pests in Belarus. Intern. Conf. Plant Protect., 21-23) Oct. 1997, Varna, Bulgaria. Abstrakts, p. 12.

Yarchakovskaya S.I., Bezruchenok N.N. 2000. Mery borby so smorodinnoy steklyannitsey (*Synanthedon tipuliformis* Cl.) v Belarusi. SB. NAUCH. TRUDOV BElNIIZR (24): 15-23.

Yarchakovskaya S.I., Koltun N., Mikhnevich R. 2004. Attractiveness of pheromones synthesized in Belarus. V Congress of Plant Protection, Zlatibor, 22-26 November 2004: Book of Abstracts p. 231.

MASOWE ODŁAWIANIE *Synanthedon tipulifornis* NA PLANTACJACH PORZECZKI CZARNEJ I *Grapholitha funebrana* W SADACH ŚLIWOWYCH Z ZASTOSOWANIEM PUŁAPEK FEROMONOWYCH

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S T R E S Z C Z E N I E

Masowe odławianie motyli, jako metoda zwalczania, oparta jest na wzmożonym procesie przywabiania samców do pułapek feromonowych, co prowadzi do spadku liczebności zapłodnionych samic, a tym samym do spadku liczebności populacji szkodnika. Owocówka śliwkóweczka *Grapholitha* (= *Laspeyresia, Cacoecia, Aspila*) *funebrana* Tr. należy do groźnych i powszechnie występujących szkodników owoców pestkowych na Białorusi. W przypadku plantacji porzeczki czarnej taki sam status należy przypisać przeziernikowi porzeczkowemu *Synanthedon* (= *Aegeria, Sesia*) *tipulifornis* Cl. Począwszy od roku 2000, w Instytucie Ochrony Roślin w Priłuki na Białorusi prowadzono badania nad przydatnością feromonów płci zsyntetyzowanych na Uniwersytecie Białoruskim do masowych odłowów wspomnianych gatunków szkodników.

W badaniach prowadzonych przez cztery lata w odizolowanym sadzie śliwowym na jeden hektar stosowano 25 pułapek feromonowych, wieszanych równomiernie w odległości względem siebie nie mniejszej niż 20 m. Pozwoliło to zredukować uszkodzenia powodowane przez *G. funebrana* o 84%. Ta sama metoda stosowana przez jeden rok przeciwko *S. tipulifornis* zredukowała uszkodzenia powodowane przez ten gatunek o 50-54%.

Słowa kluczowe: *Grapholitha funebrana* Tr., *Synanthedon tipulifornis* Cl., syntetyczne feromony płci, masowe odławianie motyli