

USE OF SEXUAL PHEROMONES FOR MONITORING THE POPULATION OF THE PEST *DELIA ANTIQUA* (onion fly)

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Abstract: There were synthesized and tested: 2 variants for the *Delia antiqua* pheromone. The attack produced by the onion fly larvae in the onion culture was below 2%. In the climatic conditions of the year 2019, adults from generation 1 were captured in June, decades 1 and 2. The pheromonal variant V1 V1 - D (dipropyl disulfide) captured a greater number of adults, 57, 1%, compared to the control V2 - E (2 \emptyset ethanol). - 42.9% of the total captured. Comparative study of the experiments carried out, setting up, experiments and testing of variants.

Keywords: *Delia antiqua*, pheromones, onion fly

INTRODUCTION

In order to keep the pest populations below the harmful economic threshold, respectively, in order to reduce these populations in time, without affecting the plants and the environment, prevention and control strategies, which are part of the integrated pest management, are needed.

The unconventional methods of combating harmful insects in agricultural crops mainly use substances identified as being emitted by insects or component elements of their environment, with the role of informational messages.

The classic insecticide treatments, considered "chemical weapons", are effective against pests, but there are side effects like:

- not being specific, chemical insecticides also affect other species in the food chain, eventually leading to biocenotic imbalances and ecosystem destruction.
- their repeated application inevitably leads to accumulation in the soil, thus polluting it and the groundwater.
- over the years, generations of pests acquire resistance and require increasing doses or other insecticides with new structure and higher efficiency.

Under the pressure of these shortcomings and the development of new techniques for chemical analysis and isolation of compounds with the role of chemical messengers emitted by insects, the pheromones of certain insects were identified and synthesized. Their use in prognosis-warning, mass capture of male or disruption of normal pheromone transmission is the basis of plant protection biotechnics. This alternative, using semi-chemical compounds, especially pheromones, may have

potential for applicability in the context of the tendencies required to practice sustainable agriculture with environmentally friendly protection products.

The pests of onion (*Allium cepa*) and garlic (*Allium sativum*) were studied:

- onion - *Delia antiqua* onion fly Meig, Diptera, Anthomyidae,
- garlic - garlic fly *Suillia Lurida*, Diptera, Heleomyzidae.



Fig. 1. Onion fly (*Delia antiqua*, Diptera, Anthomyidae)

It winters in the soil as a pupae and has two generations a year. The adults have a grayish-yellow body of 6-7 mm, yellow wings and black legs, and the larvae of about 8 mm have a yellow-white color. Onion flies attack plant species from the Liliaceae family, but the largest damage is recorded in onion and garlic crops.

(Drawing Alexandru Căprariu <https://alexandrucapriariu.wordpress.com>)

In spring from pupae appear adults which attack the onion plants. In May they lay 50 to 70 eggs in soil around the attacked plants.

The first generation larvae attack the leaves which turn yellow and dry, and in the bulbs they dig galleries in which they deposit faeces, primary hosts for some bacteria and fungi.

The larvae of the next generation attack only the bulbs, so they can halve the production.

The larvae can migrate from one bulb to another in soil. The leaves of the attacked plants lose their turgescence, turn yellow, dry and the onion becomes unfit for fresh consumption.

Damage from second-generation larvae, wintered in the soil

In onion bulbs affected by the attack of pests the tunics become damp brown and malodorous. On the surface of the bulbs are installed mushrooms and saprophytic bacteria that cause tissue rotting.

Biological control is done through preventive and curative measures.

Preventively, to reduce the pest's biological reserve it is recommended:

- collecting the remaining plant residues in the field after harvest,
- deep autumn plows,

- the application of mechanical and manual seedlings during the migration of larvae into the soil and their impregnation
- the use of plant extracts with repellent role for adults. [Dindonis, L.L., and Miller, J.R., 1981].

Pheromones are chemical signals emitted by living organisms to send messages to individuals of the same species. The most studied are the sex pheromones produced by insects, like the ones females use to attract males of the same species for breeding purposes. Insect sex pheromones are generally mixtures of one or more chemical components, in very well defined proportions, to trigger specific behavior of the recipient organism. These compositions can be used in traps, for diagnosis - warning, when tracking the appearance of the insect and the level of the pests' population in a culture or for mass control, the technique "attract and kill" when the level of the populations of pests is low. Moreover, the synthetic pheromone can be used in a pest control technique called "mating disruption"(MD), which disrupts normal chemical communication between insects. The purpose of this method is to avoid mating by launching, in an area, a large amount of synthetic sex pheromones, 10-180 g / ha, throughout the period of attack. Oversaturating the air with pheromones produces the confusion of the males, which are unable to find the females, thus they remain unfertilized, and the next generation is greatly diminished.

The disruptive effect of pheromones depends on their concentration in the atmosphere and on the uniformity of the impregnation of the atmosphere with pheromone molecules. The concentration of the pheromone in the atmosphere depends on the dose used, its volatility, the air currents, the way the disruptor diffuses. The MD technique is successfully used in the US, Japan, Switzerland and Germany to combat Lepidoptera species: *Cydia pomonella*, *Lobesia botrana*, *Eupoecilia ambiguella*, *Trichoplusiani*, *Pectinophara gossipyella*, *Grapholita molesta*, *Grapholita funebrana*, *Adoxophyes reticulana*, *Argyrotenia velutinana*, *Pyraes oleae* .

Pheromones analogues are compounds that mimic the chemical structure of the sex pheromone, obtained by isosteric replacements of some atoms or groups of atoms, without major, electronic or spatial disturbances at points considered key in pheromone perception. With the help of analogues, theoretical studies related to the mechanism of chemoreception as well as practical applications can be carried out by using them in MD pest control biotechnology. The literature mentions the synthesis and testing of some sex pheromone analogues, namely analogs obtained by introducing fluorine atoms into the hydrocarbon chain, analogues with carbon chain modifications, analogues with functional group modifications, sulfur analogues and oxine structure analogues. Of these, only some pheromone analogues containing halogens showed attractiveness, otherwise by modifications of the pheromone molecule, their attractiveness disappeared.

MATERIALS AND METHODS

The research was carried out on a 0.1 ha culture of onion - variety Rosie de Aries, at SCDL Iernut under conditions of organic agriculture.

Observations and determinations were made within the natural framework of plant development, without the use of growth isolators.

To establish the *Delia antiqua* (DA) population dynamics in close correlation with the living conditions, pheromone traps with adhesive were used in the following variants:

- V1 - DA D (dipropyl disulfide)
- V2 - DA E control (2 \emptyset ethanol).

Pheromone traps have been installed in the third decade of May.

Observations were made every 10 days by counting the captured *Delia antiqua* specimens.

The data obtained were entered in the tables and charts, their interpretation being carried out in correlation with the crop phenophase.

The frequency and intensity of attack of onion fly larvae were calculated as a percentage, by direct observation.

RESULTS AND DISCUSSIONS

1. Use of sex pheromones to establish population dynamics in close correlation with habitat conditions.

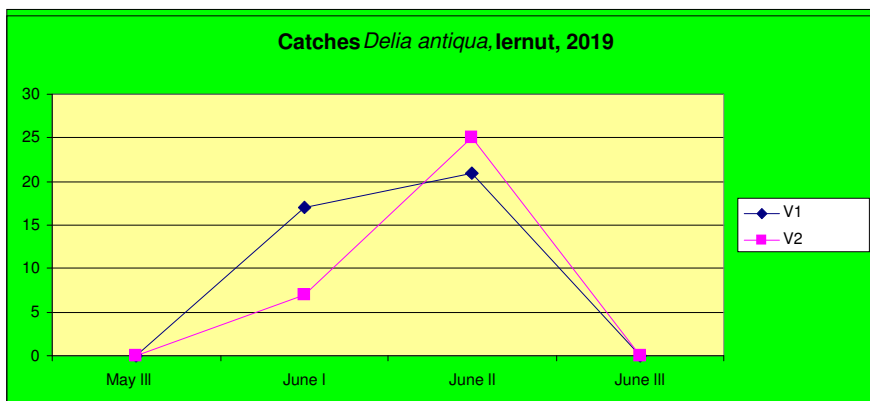
Traps with pheromone baits containing sex pheromones have been used to establish population dynamics in close correlation with habitat conditions.

Under the climatic conditions of the year 2019, the dynamics of onion fly catches (*Delia antiqua* Meig.) can be found in Table 1. Analyzing the presented data it is observed that adults from the 1st generation were captured in the 1st and 2nd decades of June.

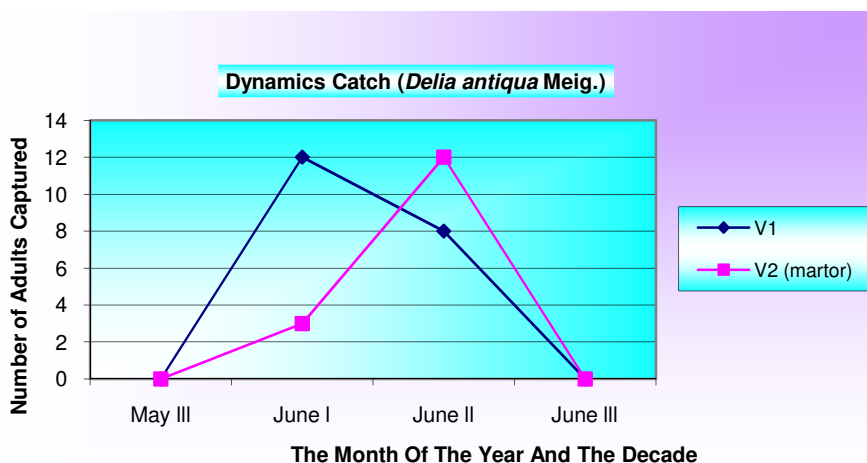
Table 1.

Dynamics of *Delia antiqua* catches on the onion crop

| SCDL IERNUT | | | | | | |
|-------------|------------------|----------|------|------------------|------|---|
| Nr. crt. | Period | Variant | | | | Observations |
| | | V1 - DAD | | V2 - DAE control | | |
| | | Nr. | % | Nr. | % | |
| 1 | May – decade III | 0 | 0 | 0 | 0 | The pest was present in the culture under the larval and pupae stage. |
| | C1 | 0 | 0 | 0 | 0 | |
| | C2 | 0 | 0 | 0 | 0 | |
| | C3 | 0 | 0 | 0 | 0 | |
| 2 | June – decade I | 17 | 24.2 | 7 | 10 | |
| | C1 | 2 | 2.9 | 4 | 5.7 | |
| | C2 | 10 | 14.2 | 2 | 2.9 | |
| | C3 | 5 | 7.1 | 1 | 1.4 | |
| 3 | June – decade II | 21 | 30 | 25 | 35.8 | |
| | C1 | 12 | 17.1 | 19 | 27.2 | |
| | C2 | 7 | 10 | 6 | 8.6 | |
| | C3 | 2 | 2.9 | 0 | 0 | |
| | Total | 38 | 54.2 | 32 | 45.8 | |



The data presented show that V1 captured a larger number of adults - 54.2%, compared to the V2 control, which captured 45.8%.



2. Establishing the frequency and intensity of the *Delia antiqua* attack in close correlation with the existing climatic conditions.

The attack produced by the onion fly larvae in the onion culture was under 4% in Transylvania Mures area. Thus,

- In the climatic conditions of the year 2019, adults from generation 1 were captured in June, decades 1 and 2.
- The pheromonal variant V1 captured a greater number of adults, 54.2%, compared to the control - 45.8% of the total specimens captured.
- Traps with pheromone baits can be used for monitoring - warning, the pest population at generation 1 being maintained below the economic threshold of damage.

CONCLUSIONS

Insect sex pheromones, emitted in small quantities and over long distances, mediate attraction, encounter and mating within insect populations. At the same time, released in large quantities, from synthetic sources, they can cause disorientation, disruption of communication between the two sexes, by sending false signals, more numerous than those transmitted by females. It is assumed that receptor blockade with pheromone molecules also occurs. Consequently, the likelihood of males and females meeting for breeding is greatly diminished.

In this research it was assumed that the same mechanism can work when using analogues.

In ecological cultures, organic and not only, it is recommended to use sticky traps, either yellow ones, but especially those delta type with attractive pheromone baits. Installing traps with attractive baits in the onion plot, when 2-3 leaves appear, and watching the catches, the level of *Delia antiqua* population can be observed.

If the attack is not very large the traps with attractive baits are sufficient for the reduction of the adult populations of *Delia antiqua*, without using other treatments.

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