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TEST OF NEW DISPENSERS FOR *HELIOTHIS ARMIGERA* SEX PHEROMONE

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INTRODUCTION

Recently, much attention is paid to the development and implementation of integrated systems of plant defense, which is overseeing the change in the number of harmful organisms in specific agro-ecosystems. There are numbers of methods and techniques that are the most acceptable for use in integrated systems of plant defense. Pheromones are chemicals that regulate intraspecific behavior of insects. Pheromones are fundamentally different from conventional insecticides due to their chemical and physical properties. Under natural conditions, pheromones have high volatility whereby the substance evaporate quickly. Hence, their application lead to no residual amounts of chemicals found on the plants.

Insect pheromones and their derived synthetically analogues are an important and promising tool in biological plant protection because of its selective action. Thus, the synthetic analogues corresponds to the natural insect pheromone and their usage can significantly reduce the consumption of plant protection chemicals.

The behavior of insects can be controlled by using the harmful moths synthetic pheromones that influences the dynamics of their development and the population of a particular species. The usage of sex pheromones plays an important role in plant defense by controlling the harmful organisms population in specific agro-ecosystems and leads to the agricultural production greening. Identification and synthesis of biologically active substances allowed their broad use in regulation and suppression of the most important agricultural pests population.

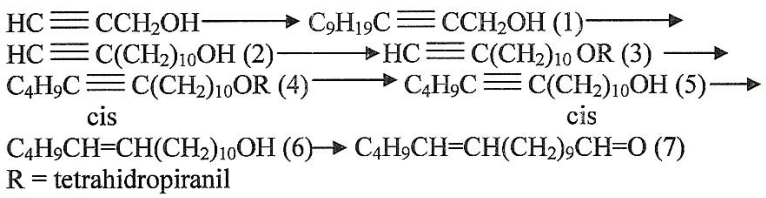
For the last twenty years, on the territory of the Republic of Moldova the cotton moth is the primary pest for tomatoes, sweet peppers, sweet corn and other important agricultural crops. In some areas, the tomatoes are susceptible to 80-90% of damage, which completely eliminates the economic profit of this crop cultivation. Hence, our scientists develop new biological tomatoes and sweet corn pest protection system allowing full defense from all stages of insect development [2] where one of the priority places is given to the pheromone monitoring. The chemical structure of sex pheromone of the cotton bollworm is particularly unstable and has limited duration that complicates work in a field conditions. Thus the dispensers containing the pheromone have undergo weekly change that increases the cost of a crop protection methods [2, 3].

Synthetic sex pheromone production tends to the expenses reduce while maintaining the quality of synthesized pheromones. Therefore the emphasis is aimed to find new substances that will lead to the enhancement or the inhibition activity of already known components [1].

The success of the sex pheromone use depends on many factors such as the sex pheromone composition, the degree of its purity, the main component stability, and the type of the dispenser [3]. Usage of different materials for the dispenser production (rubber, red medical rubber, rubber caps, corks, synthetic and natural twine, lavsan) leads to different evaporation intensity and chemical composition effectiveness of Lepidoptera sex pheromone. However, different dispenser materials as well as the chemical composition of pheromones from different species of Lepidoptera, affect the attractiveness of the traps and the efficiency of the method as a whole. Therefore there is a need for careful selection of materials when used as a dispenser for a specific chemical composition of synthetic sex pheromones. The longer the period of evaporation, the more economically profitable is the use of a particular material as a dispenser. The aim of this work is the search of the possibilities to adjust the process of chemical pheromone synthesis and careful selection of materials for new efficient dispensers.

MATERIALS AND METHODS

During the research we used a synthetic sex pheromone of the cotton bollworm *Heliothis armigera Hb.* (Z)-11-hexadecenol-97 + (Z)-11-hexadecenol-3. The main component of the sex pheromone *Heliothis armigera* (aldehyde (Z)-11-hexadecenol) has been synthesized in Substante Biologic Active Lab under the direction of Dr. Rosca Gh. The diagram below represents the synthesis and reduces the pheromone production cost.



We used a braided household twine (diameter 3,5-4,0 mm and length 2,5 cm) on the basis of synthetic staple fibers of polypropylene as a new dispenser («ICOB» Ukraine), where the active ingredient dose is 2,5mg/2,5cm. Lure to the dispenser was added by impregnation. To increase a timeframe effectiveness of pheromone action, dispenser was covered with polyvinylchlorid (PVC)5 %.

The activity of new synthetized cotton bollworm pheromone have been tested in the field and compared to the pheromone synthetized standardly. For the experiment, we used tomatoes and sweet corn because they are known as the major substrate for cotton bollworm. The area of the experimental plot is 1 hectare for each crop kind.

We used pheromone delta traps with a sticky insert and covered with entomological adhesive. Attractiveness of the pheromone traps were determined in the field. The experiment performed in conditions represented below (Table 1) and was conducted three times.

Table 1. Experimental diagram for males *H. armigera* attarctivness with different dispenser pheromone traps

Variants	Dispensers
I. STANDARD	RUBBER CORK
II. No PVC	SYNTHETIC TWINE
III. PVC covered	5% PVC SYNTHETIC TWINE

Pheromone traps were distributed randomly and capsules exchange have been done depending on the pheromone composition evaporation rate. The data obtained were subjected to statistical analysis using ANOVA method.

RESULTS AND DISCUSSION

Pheromone traps were put up in corn and tomato fields in the same time with the beginning of the development of the second generation of cotton bollworm. During Visual inspections of the plants was confirmed that the period of laying eggs in mass coincides with flying in mass of imago *H. armigera.* That allowed high numbers of the pest monitoring within the experimental plots. Thus, during flying in mass of the pest number of males caught in the traps with new scheme synthesized pheromone is 10.5 male/trap average. However, number of males caught in the traps with standard scheme synthesized pheromone is 9.3 male per trap. Statistical data shows no significant difference of these two options $DME_{0,05}$=2,45. The results prove that the attractiveness of new scheme synthesized pheromone is not inferior to standard scheme synthesized pheromone. The use of new synthetic schemes allowed us to reduce the production costs of the pheromone by 50%.

For our research previously, we used rubber corks dispensers where about 50% of the pheromone original amount remained bound; therefore, in order to increase efficiency of the pheromone we used braided household twine (diameter 3.5-4mm) from synthetic polypropylene fibers. Then we decided to cover the dispensers with a layer of 5% and 8% PVC because of the temperature regime changes during the development of generations of *H. armigera* in the Republic of Moldova. Thus during the development of the first generation of *H. armigera* we used dispensers covered with a layer of 5% PVC and during the second and the third generation we used dispensers covered with 8% PVC. Such differences are due to high temperatures in the testing period (t=35-38^{0}C).

Also we studied the dynamics of the pheromone release both in the laboratory and in the field conditions. We found that in the laboratory conditions after 42 days of exposition the residual of pheromone release from the dispensers with 8% PVC is 2.40 ± 0.43mg, which makes 50% of the initially imposed dose (5.0mg) [1]. There for we assumed that the dispensers tested in the laboratory conditions could be effective in the fields as well and we continued the research in the field.

It is well known that the biological effectiveness of a dispenser can be evaluated by numbers of trapped insects.

The results of pheromone traps attractiveness were gained during the development of the second and the third cotton bollworm generation. Thus, the standard dispenser - rubber cork trap had 16.3 males per trap per 7 days and the synthetic twine without PVC had 13.2 males per trap per 7 days. Statistical data shows no significant difference of these two options ($DME_{0,05}$=1,89). The PVC coated dispenser had only 0.4 males per trap per 7 days (Figure 1). Our results showed that the traps attractivness covered with PVC are very low compared to the results received in the laboratiry conditions, where the pheromon relese was proved even [1]. There for we analyzed the residual quantity of *H. armigera* main pheromone component in the dispensers at regular intervals (Figure 2).

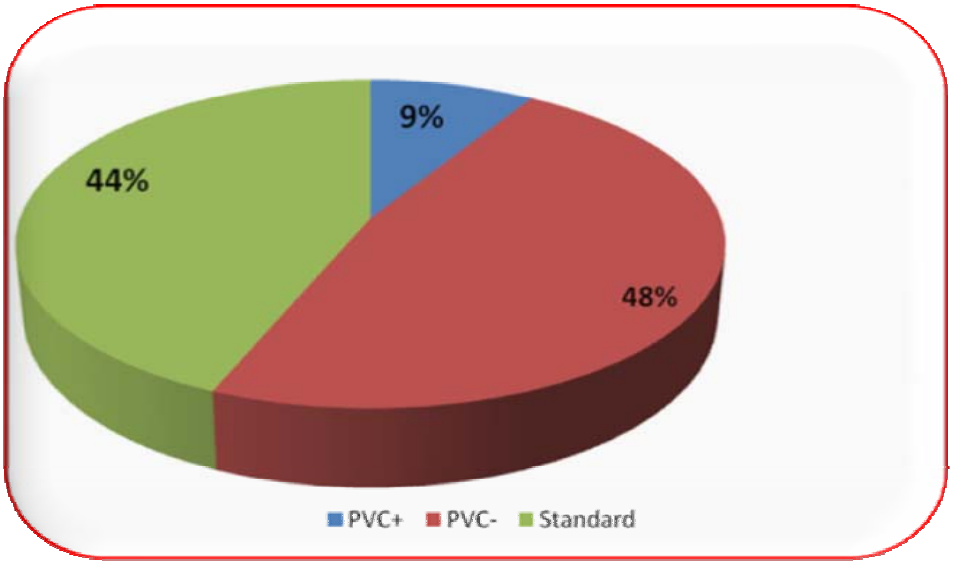


Fig. 1. Percentage of *H. armigera* males trapped depending on the dispenser

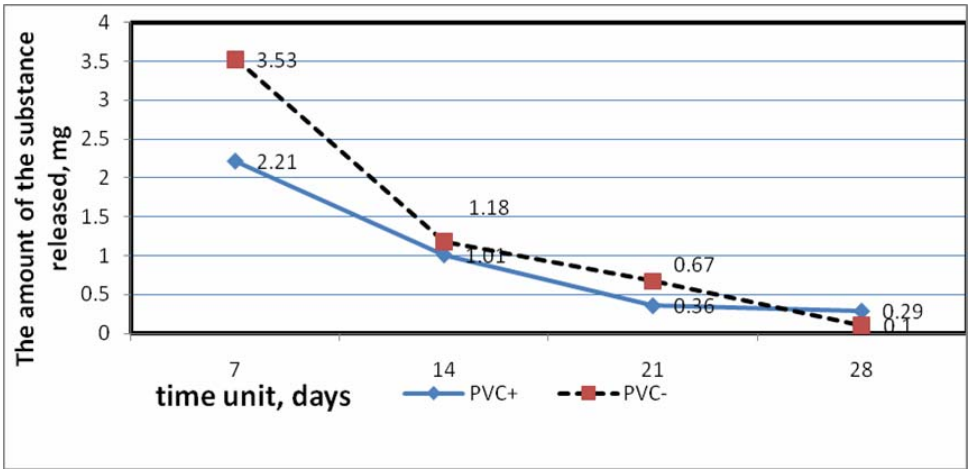


Fig. 2. In field dynamic of *H. armigera* pheromone release from the dispensers with and without PVC cover

The chart represents not even pheromone release. We proved that in the field conditions larger amount of initially administered substance dose was released in the first days. Thus, from day 1 to day 7 the pheromone release from the synthetic twine without PVC was 3.53mg (70.6%) and from the PVC coated dispenser pheromone release was 2.21mg (44.2%). However, in subsequent period of expose (from day 7 to day 21) the level of pheromone release was reduced that can be explained by the decrease amount of active substance in the dispensers.

Data showed that PVC coated dispensers reduced the amount and increased the time of cotton bollworm pheromone release. However, velocity and effectiveness release analysis reveled that the amount of substance released per time unit is 1.5-2 times lower than the amount of substance released from the non-PVC covered dispensers. Thus, for the first seven days of the exposure from non-PVC covered dispensers 3.53mg of pheromone but from PVC covered 2.21mg of pheromone was released. Then from day 14 to day 21, non-PVC dispensers showed 0.67mg of pheromone release and PVC covered 0.36mg of pheromone release. The analysis of residual quantity revealed that non-PVC covered dispensers released 96% of pheromone for 28 days but PVC covered released 87% of pheromone. That data allowed us to extend the activity of PVC covered dispensers but their attractiveness in field conditions was found very low, therefore we removed them from the use.

Our study allowed us to developed new synthetic twine non-PVC covered dispenser (2.5cm/2.5mg of pheromone) for cotton bollworm monitoring. The attractiveness of new dispenser is

similar to the attractiveness of the standard dispenser but the cost is 30% less.

CONCLUSION

To monitor cotton bollworm activity new dispensers were developed. They represent the fragments of synthetic non-PVC twine 2.5cm long with 2.5mg of pheromone. The low price and similar to the standard dispensers attractiveness make them better choice for pest control in the future.

ABSTRACT

This study shows a comparative assessment of a new way synthesized pheromone *Heliothis armigera* activity compared to pheromone activity synthesized by standard scheme. In addition, for this sex pheromone, new dispensers were tested in the field conditions. New dispensers, such as fragments of synthetic twine 2.5cm/2.5mg of pheromone non-PVC coated showed similar to the standard attractiveness of male cotton bollworms. However, the cost of new dispensers is 30% less.

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