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ETHOLOGY AND REPRODUCTION OF IMAGO *AGROTIS SEGETUM* DEN. ET SCHIFF. IN SEASONAL DYNAMICS IN THE REPUBLIC OF MOLDOVA

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Key words: *Agrotis segetum,* eggs, female, male, spermatophore, pheromone trap, light trap.

INTRODUCTION

Pests economic and social damage always attracts attention of farmers. A family of moth one of the most numerous and widespread of various types of lepidoptera. Some types of moths' outbreaks can cause the loss of harvest in a variety of agricultural crops. One such species is a turnip moth *(Agrotis segetum Den. et Schiff)*.

Turnip moth one of wide polyphagia, can cause a severe damage of 15% per a night to the newly planted different crops [2]. In some years of mass reproduction, the high risk of the pest is a reason of reproduction potential and population dynamics in general.

The fertility of moths depends on climatic conditions, showing effects of environmental factors of egg development production. It is well known that female fertility depends on hydrothermal and nutritional factors. The population size is strongly influenced by the conditions of the puberty stage. Temperature, air humidity and especially nutrition are important. Moths, with very few exceptions, required supplementary feeding. Besides nutrition, fertility is influenced by physical factors of the environment during the life of the imago. If the temperature declines at summer night up to 8-10^{0}C, moth's years scoring stopped. The hydrothermal optimum of summer, during which egg products and eggs mature, is 22-28^{0}C for turnip moths. At temperatures below 15^{0}C, the metabolism decreases and, as a result, egg maturation ceases [2]. The fertility knowledge of female turnip moth and the vitality of laid eggs provides us with information of several next pests generation in crop areas and the risk that this population will cause to the crop. Determination of the number of female turnip moth generations, the harmfulness of each of them, the timing of the development stages is of great importance for the forecasting of the phytosanitary situation and the development of zonal plant protection systems.

The purpose of this work was to determine the ethological and reproductive monitoring of imago *A. segetum* in seasonal dynamics.Based on the purpose, the following objectives have been set: to study the reproductive potential of the *A. segetum* in the seasonal dynamics of the population; to determine the potential timing of female's fertilization, depending on the seasonal generations.

MATERIALS AND METHODS

To study the reproductive and copulatory potential of the turnip moth population, light traps were used during the growing season, and pheromone traps were used to monitor the number of generations (Fig. 1). The light trap model was developed at the Institute of Genetics, Physiology and Plant Protection.

The light trap was mounted at a height of 2 meters from the ground near the soybean field preferred by the pest. Population development monitoring was conducted from the first decade of May to the third decade of September 2018. The collector was counted and replaced daily. After each count, all the captured insects were placed in a special vessel and then in a freezer for 15-20 minutes for immobilization. All butterflies belonging to the moth family (*Noctuidae*) were then counted. Of these, the turnip moths (*A. segetum)* were separated and separated by sex (male and female).

The female underwent anatomical dissection to study for mating. The amount of spermatophore in the bursa copulatory which indicates the number of mating has been calculated (fig. 2).

Further, the number of eggs in the egg tubes of females was calculated depending their time period of the generation (fig. 3).

Pheromone traps were placed at a test site with a soybean area of 1 hectare at a rate of 3 traps/ha. The height of the traps was adjusted as the crop grew (1.2-1.5m). Captured males were recorded 3 times a week throughout the growing season. The adhesive liners were replaced as pollution continued. The pheromone capsule was replaced once a month. In our experiment, we used an improved formula of a four-component sex pheromone for *A. segetum* [Cis-5-decenilacetat (8,3%) + Cis-5-tetradecenilacetat (8,3%) + Cis-7-dodecenilacetat (41,7%) + Cis-9-tetradecenilacetat (41,7%)], synthesized in the laboratory of chemistry of the Institute of Genetics, Physiology and Plant Protection. The dose of pheromone used is 2.5 mg / 1 dispenser.

a. b.

Figure 1. Types of traps: a) Light trap; b) pheromone trap

Figure 2. Spermatophores separated from the captured females *Agrotis segetum.*

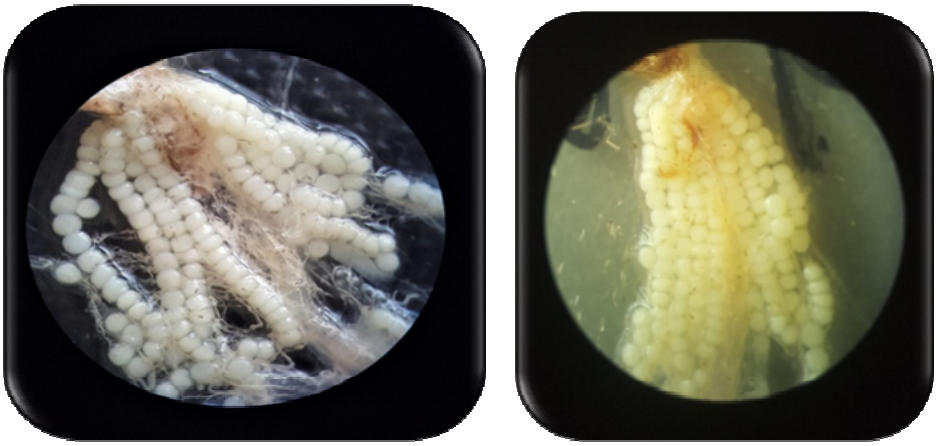

Figure 3. Appearance of egg tubes isolated from females *Agrotis segetum*

RESULTS AND DISCUSSIONS

To determine the reproductive and copulatory potential of the turnip moth population, during the growing season, butterflies caught in light traps were used.

At the same time, the share of this pest in the whole complex of scooters drawn by light traps on the field of soy was determined, as well as their generational sex ratio (table 1).

Table 1. Monitoring of captured butterflies of fam. *Noctuidae* to light traps depending on the generations

Generation	Total captured imago		Male *A. segetum*	Female *A. segetum*
	families *Noctuidae*	of them *A. segetum*		
I	115	25	14	10
II	148	26	14	13
III	215	19	12	7
TOTALY	478	70	40	30

When analyzing the data, we found that both *A. segetum* butterflies and other members of the *Noctuidae* family were caught on light traps. For example, only 478 *Noctuidae* individuals and only 70, represented species *A. segetum*, which was 14.7% of the total. It has been shown that the largest share of the species *A. segetum* in the total number of species *Noctuidae* occurs during the period of development of the first and second generations.

At the same time, it was determined that the proportion of males in the first and second generations was almost the same as that of females, and only in the third generation did the proportion of males exceed the proportion of females by 42%. Overall, the *A. segetum* sex ratio for the entire growing season was 1.3:0.8.

In further studies, we dissected all the females caught. The results showed that the number of spermatophores in copulate bags of female *A. segetum* ranged from one to six. Ten per cent of the females had no spermatophores, meaning they were not fertilized (Fig. 4).

The analysis showed that the most frequent cases (20%, 30% and 23%) were females mating 1-3 times containing 1, 2, 3 spermatophore, therefore, in their copulate bursae. Females mating more than three times accounted for only 17%.

Next, we dissected females to determine the number of eggs in the egg tubes. The number of eggs found in the egg tubes of one female was found to range from 713. The analysis of the obtained data allowed us to determine the reproductive potential of the *A. segetum* population according to the development of generations. It was found that the reproductive potential of *A. segetum* in the first generation is 25%, in the second generation - 24%, and in the third generation - 51%. Thus, proved that reproductive potential of species *A. segetum* depends on the period of development of generations and on phenological phases of development of agricultural crops.

Male excommunication on pheromone traps determined the number of generations of *A. segetum* throughout the growing season and compare them with the fertilised female excreta into light traps, depending on the phenological phase of soybean development.

It was found that the first generation of *A. segetum* begins in the first decade of May, the end of the third-generation summer is in the second decade of September. Based on the analysis of pheromonitoring records, sexually active males were considered. The light trap records the number of fertilized females over time. Based on these data, a schedule of male activity and peak fertilized females was drawn up against the background of phenological soybean development phases (fig. 5).

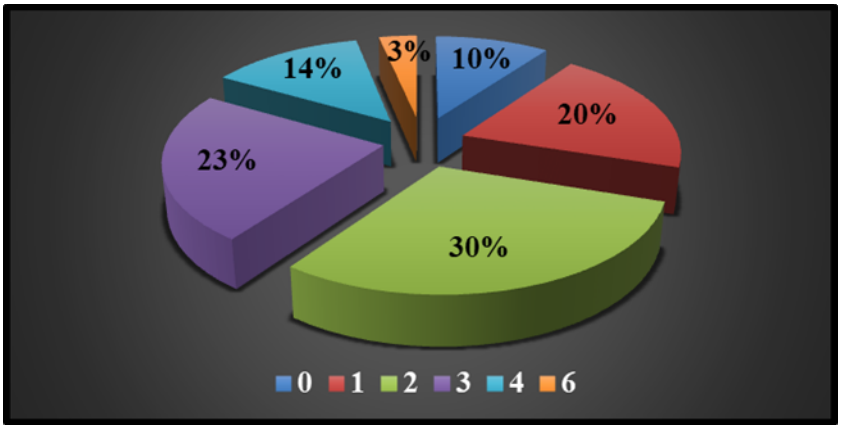

Figure 4. The number of spermatophores in the bursa copulatory of *Agrotis segetum* females

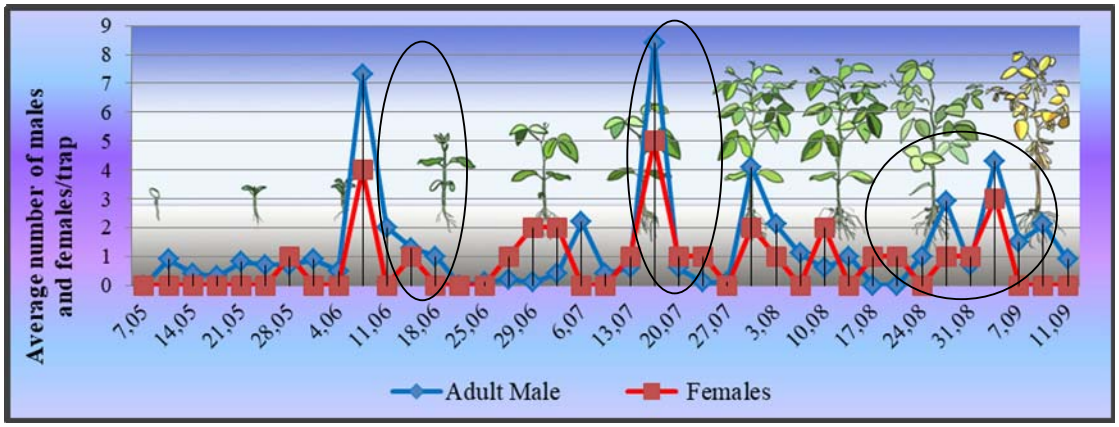

Figure 5. Catching males with pheromone traps and catching females with light traps

Based on the analysis of the pheromonitoring records, which took into account sexually matured active males and the light trap data, which took into account the fertile females, a graph was constructed, reflecting the cycles of potential fertilization times of large numbers of females, which coincide with the main phases of soybean development – start of branching phase (II decade of May - II decade of June), flowering (II-III decades of July), forming and ripening of beans (III decade of August - I decade of September).

CONCLUSIONS

1. The reproductive development potential of *A. segetum* depends to a large extent on the sequence of generations. Thus, the potential for reproduction was 25% for the first generation, 24% for the second generation and 51% for the third generation. The most common females (20%, 30% and 23%) were those who mate - times containing, and spermatophore. Females who mate more than 3 times accounted for only 17%.

2. It was noted that the cycles of potential mass fertilization of females coincide with the main phenological phases of soybean development – start of branching phase, flowering, formation and ripening of beans.

ABSTRACT

During the growing season of one year, the aetological and reproductive monitoring of imago *Agrotis segetum* was carried out using light and pheromone traps. It was noted that, under the climatic conditions of the Republic of Moldova, the first years of butterflies and the laying of winter moths were observed in the third decade of April due to the onset of warm, stable spring temperatures. The pest develops in three full generations. The seasonal sex ratio of the pest was determined - the number of males and females of *A. segetum* was 1,3:0,8. The reproductive capacity of the *A. segetum* population has been found to depend heavily on the sequence of generations. Thus, for the I generation the breeding potential was 25%, for the II generation - 24%, for the III generation - 51%. It was noted that the cycle of potential in-infestation times of large numbers of females coincided with mass numbers of females matching the main phases of soybean development – start of branching phase, flowering, formation and ripening of beans.

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REFERENCES

1. ARN H., DELLEY B., BAGGIOLINI M., et al. 1976, Communication disruption with sex attractant for control of the plum fruit moth, *Grapholitha funebrana*: a two-year field study. In: J. Entomology Exp. Appl., v.19, p. 139-147.
2. RAMAZANOVA Z. M. 2015. Ecological and trophic analysis of the fauna of polyphagous moths on vegetable crops in Dagestan and the development of environmentally friendly methods of protection. Can. agricultural sciences. Makhachkala: DGAUim. M. M. Dzhambulatova.

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