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INFLUENCE OF FECUNDITY OF FEMALE BROWN-MARBLE STINK BUG *HALYOMORPHA HALYS* STAL (1855) ON THE RATE OF DEVELOPMENT OF THE POPULATION IN GENERAL

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INTRODUCTION

Invasive pests pose a significant threat to crop production worldwide. Their range has been expanding particularly rapidly in recent decades, linked to both abrupt climate change and increased international trade and tourism. One of the significant agricultural invasive pests is the brown-marble stink bug *Halyomorpha halys* Stal (1855) (Hemiptera: Pentatomidae). It is a pest of East Asian origin whose natural range covers the territory of China, Myanmar, Vietnam, the DPRK, the Republic of Korea, Japan, Taiwan. From China, the stink bug *H. halys*was accidentally brought to the US in the late 20th century. There, it has become a dangerous pest for a wide range of crops. This pest was first detected in Europe in 2004 (in Liechtenstein) and in 2007 in Switzerland. It was detected in Switzerland. Since then, it has spread rapidly throughout Europe, where it has now been recorded in the territories of more than 25 States [4]. The stink bug *H. halys* is a wide polyphage. From fruit crops, it particularly damages peach, apple, pear, citrus crops and grapes. Larvae and adult stink bugs feed on leaves and fruits, sucking the juice of plants. Therefore, on fruit crops there is a significant decrease in yield [1, 2]. In the invasive *H. halys* range quickly adapts and speeds up population development and development of new territories for it. On the territory of the Republic of Moldova, this pest has been detected since 2019. Since then, its population has been stable at a high level, which in turn requires careful study of its sexual activity and the development of the population as a whole [3].

The aim of this work was to study the effect of the fecundity of the female brown-marble stink bug *H. halys* on the rate of development of the pest population in general.

MATERIALS AND METHODS

Due to the economic importance and high harmfulness of the stink bug *H. halys*, we decided to introduce the phytophage into the laboratory culture to study the sexual activity of the pest and, accordingly, the fertility of females. The imago was kept in boxes measuring 5000 cm3. The average air temperature was 27°C and the relative air humidity was 65%. As a result of the carried out experiments, it was established that in the laboratory conditions it is possible to successfully breed the stink bug *H. halys* when using sweet and tomato peppers, legumes - peas and soy as food, Berries of some ornamental and cultural plants (eg, American Laconosa, Rowan, Sea Buckthorn, Grapes), Mandarin fruits and young ears of Corn, and some other plants (fig. 1).

Figure 1. *Halyomorpha halys* brown-marble stink bug breeding method in laboratory conditions.

Each version of the experiment involved 30 individuals of a two-year laboratory population in a sex ratio of 1:1.

RESULTS AND DISCUSSIONS

Using the developed method of breeding a bug in the laboratory, we found that the first mating cases, after leaving the wintering, have a shorter period of time (from 8 to 20 minutes) than the subsequent ones. So, after 1-2 weeks, adults begin to engage in copulation relationships with a duration of 2,0 to 2,5 hours. Four to seven days after mating, females begin to lay their first eggs.

Visual observations have shown that *H. halys* females on average hatch 3-4 times over 6-13 days. The number of eggs laid in one egg bed varies from 10 to 42 (more often 28 eggs). Analysis of the data showed that the female fertility of the laboratory population varies widely (from 76 to 292 eggs/females), averaging 240 eggs/females. Eggs - pale salad, rounded, from 1,3 to 1,6 mm. The embryonic development period of the larvae at a temperature of 29±2°C lasts from 4 to 7 days. The proportion of hatchlings from the first eggs laid is between 82 and 97%.

Thus, we calculated the number of all laid eggs of 15 females in one generation, as well as the fertility of these eggs (Fig. 3).

Based on the data we have obtained, it can be seen that the total number of laid eggs of 15 female laboratory population in one generation was 3319, or an average of 221,3 eggs/female, of which only 3% were sterile (Fig. 4).

Subsequently, with rare exceptions, the hatching of larvae from the eggs of the laboratory population of the *H. halys* stink bug, reaches 99,6%. It should be noted that due to such a high percentage of hatching of larvae from laid eggs, is a way to quickly increase the population density of this pest.

Thus, we have calculated the total number of eggs and eggs laid during the whole growing period, as well as the number of sterile eggs from the total number (Fig. 5).

Figure 2. Observations of sexual activity and fecundity of *Halyomorphahalys* females in laboratory conditions

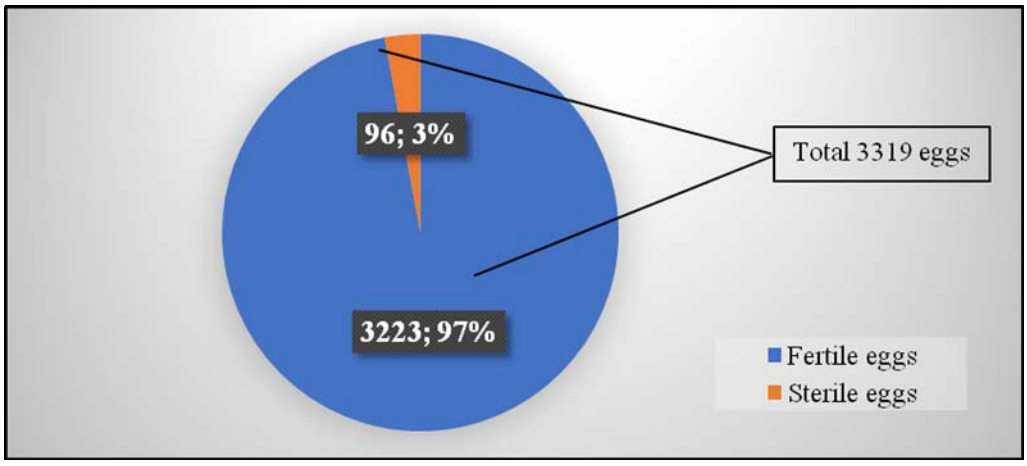

Figure 3. The number of eggs laid by 15 females of the *Halyomorpha halys* stink bug for one generation in the laboratory.

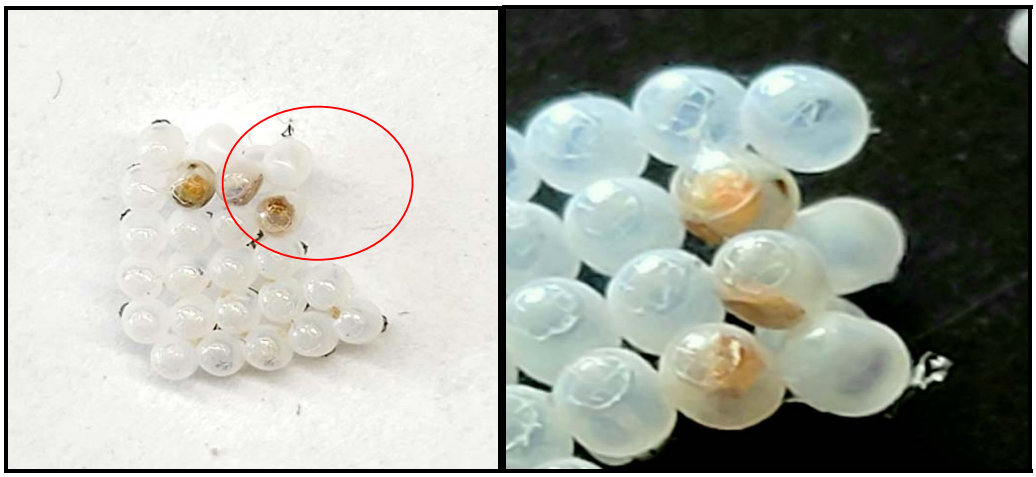

Figure 4. The appearance of the eggs from which the larvae of the *Halyomorpha halys* stink bug did not hatch

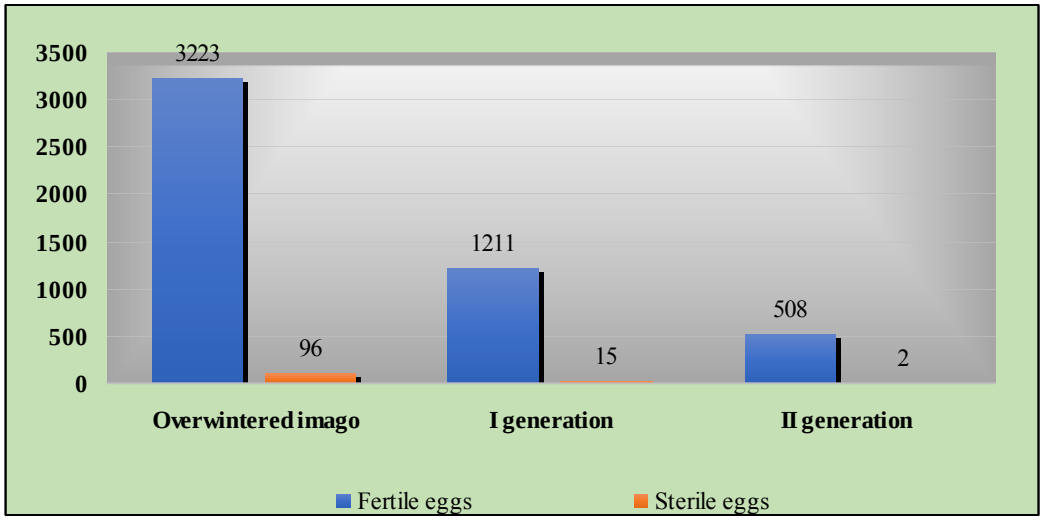

Figure 5. The number of all eggs laid by 15 females of the *Halyomorpha halys* stink bug during the growing period in the laboratory

When analyzing the obtained data, we noted that 15 females of the laboratory population of the stink bug *Halyomorpha halys* during the growing period laid 190 eggs, which contained 5055 eggs. Sterile eggs accounted for only 2,2%.

We have shown that the highest level of sexual activity occurs during the winter season, with 65,7% per cent fertility, 24,3% per cent in the first generation and 10,1% per cent in the second generation.

This phenomenon is explained by the fact that, with the onset of spring, *H. halys* stink bugs begin to actively multiply in order to increase the population in nature. Further, due to the fact that the pest is able to live and multiply over several growing periods, as well as with the long life cycle (35-45 days), *H. halys* does not need to multiply massively before wintering, because the nymphs die before they develop. In this case, during the I-decade of August and the II-decade of September (the maturation period of fruits), imago stink bugs less mate, but more are stocked with nutrients before wintering, thereby causing economically important damage to various crops. Thus, the period of low sexual activity can be a period of mass harmfulness of the pest.

CONCLUSIONS

Determined that fecundity of females in the laboratory population was found to average 240 eggs/female. It was noted that the hatching of larvae from the eggs of the laboratory population of *H. halys* reaches 99.6%, which contributes to the rapid growth of the population density.

It was determined that overwintered adults in the spring-summer period show the maximum sexual

activity, their fertility is 65.7%, in the first generation the fecundity of adults was 24.3%, in the second generation - 10.1%.

It was revealed that the period of weak sexual activity (the period of fruit ripening) is a period of mass harmfulness of the stink bug.

ABSTRACT

Our research has shown that the invasive species *Halyomorpha halys*, found in the conditions of the Republic of Moldova in 2019, has already settled in a new area, inhabits both cultivated and ornamental plants and is able to rapidly increase the population density.

The fertility of one female is 240 eggs, of which the percentage of sterility ranges from 0,4 to 3, depending on the generation. It was noted that overwintered adults in the spring-summer period show the maximum sexual activity, their fecundity is 65,7%, in the first generation the fecundity of adults was 24,3%, in the second generation – 10,1%. It was established that the period of weak sexual activity of the stink bug (the period of fruit ripening) is a period of its mass harmfulness.

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