

## PARASITIC HYMENOPTERA AND THEIR INFLUENCE ON THE NUMBER OF LEPIDOPTERA PESTS FOR *BRASSICA OLERACEA* L. VAR *CAPITATA* FROM THE EXPERIMENTAL FIELD OF THE VEGETABLE RESEARCH AND DEVELOPMENT STATION BACĂU

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### INTRODUCTION

Cabbage (*Brassica oleracea* L. var. *capitata*) is an important vegetable crop grown in many countries in the world, but they are attacked by different species of pests in all phases of vegetation (Călin, 2005b, Ester et al., 2003). They can be severely affected by various lepidopteran pests, such as *Pieris brassicae*; *Plutella xylostella*; *Mamestra brassicae*. The damage produced by this species of *Lepidoptera* affects the value of cabbage.

Cabbage plants can tolerate some leaf-feeding damage before head formation, but as larvae grow, they move to the center of the plant and bore into the cabbage head, which reduces product marketability (Cartea et al., 2010).

The largest group of pests for cabbage plants are species of the owl moth family (*Lepidoptera*: *Noctuidae*), especially *Mamestra brassicae* L., in cases of strong infestation by this insect, the plant area can be reduced to 30%, with the main yield loss of 10-15%. (Mazurkiewicz et al., 2020). In the climatic conditions of our country, this species has two generations in one year (Stancă-Moise, 2017). Adults appear in late May or early June and they have twilight and nocturnal activity. The second generation appears in late July and they deposit the eggs in the first decade of August. After the mating, they lay approximately 10-50 eggs on the underside of the cabbage leaves (Stancă-Moise, 2016, Călin, 2005a).

In the climatic conditions in Romania, *Plutella xylostella* has 2-4 generations per year. In late June or early July, butterflies appear, giving birth to a new generation. It overwinters in the chrysalis stage on various plant remains. This species has the potential to adapt to different climatic conditions. *P. xylostella* can cause severe economic losses when the population is not well managed (Qadeem, 2017, Kahuthia-Gathu and Othim, 2019).

*Discestra/Hadula trifolii* appears sporadically in the cabbage crops without developing economic damages. It is a species commonly found in alfalfa and beet crops (Ippolito, 2016, Călin, 2005a).

The larvae of *Pieris brassicae* feed on plants of the cabbage family and can cause considerable economic damage to Brassica crops (Yildizhan et al., 2009). In the south of our country, it has 3 generations per year and two generations in the north.

The most numerous damages are produced by the larva in the second generation, in the autumn cabbage crops. It winters in the chrysalis stage on the basal leaves from the rosette of cabbage (Zibae, 2012, Atapour, 2016, Feltwell, 2012, Stancă-Moise, 2017).

*Trichogramma* spp. are known to be biocontrol agents (Sigsgaard et al., 2017) of lepidopteran eggs. The family *Trichogrammatidae* includes some of the smallest insects (Polilov, 2016, Fischer et al., 2011) and the majority are egg parasitoids of many lepidopteran pests. They have a long history of use in augmentative biological control in field crops and glasshouses (Nasir et al., 2017).

*Ichneumonidae* is a family of parasitoid wasps in the order *Hymenoptera*. This family includes about 25,000 species (Klopfstein et al., 2019).

The vast majority inject eggs either directly into their host's body or onto its surface, after hatching, the ichneumonid larva consumes its still living host. The most common hosts are larvae or pupae of *Lepidoptera*, *Coleoptera* and *Hymenoptera* (Shaw and Bonsall, 1997, Aubert, 2000, Olson et al., 2005).

The objective of this study was to identify the main lepidopteran pests of cabbage from the experimental field of the Vegetable Research and Development Station Bacău, to obtain basic information regarding the record of *Lepidoptera* parasitism and to determine the main

parasites of these species. The density of pests and

## MATERIALS AND METHODS

The experiments were performed at Vegetable Research and Development Station Bacău in the open field on the autumn cabbage Silviana variety. Starting with the seedling stage, the attack of cabbage pests was monitored. The observations were made decadal. Also, were collected biologic material was represented by the clutch of *M. brassicae*, *D. trifolii*, *P. brassicae* eggs and pupa and larva of *P. xylostella*. The biologic material was collected on August 21, 2019.

The clutches were collected from the field and placed in individual test tubes, the same was done with the pupae and larva of *P. xylostella*. Daily observations were made in the laboratory to see the degree of attack of parasitic *Hymenoptera* species. The density per square meter of both pests and parasites and the percentage of parasites were calculated.

## RESULTS AND DISCUSSIONS

Were collected eggs, pupae and larvae of *Lepidoptera* (figures 6, 7, 8, 9), representing 21% of 209 cabbage plants (*B. oleracea* L. var. capitata) analyzed. As can be seen in figure 1, for species of *Lepidoptera* harmful to cabbage culture were identified. A total of 77% of the clutch collected represented *M. brassicae* eggs, 19% were *P. xylostella* pupae and larvae and *D. trifolii* and *P. brassicae* eggs represented only 2% each.

The potential density of *Lepidoptera* clutches of the family *Noctuidae*, *Pieridae* and the

parasites per square meter (sqm) was also calculated. active stages of the species *P. xylostella* can be seen in figure 2. The highest density was recorded by the species *M. brassicae* (0,71/sqm), followed by *P. xylostella* (0,17/sqm). *D. trifolii* and *P. brassicae* have a very low density, less than 0,1/sqm.

As regards the percentage of viable eggs for the *M. brassicae* species (figure 3), it is found that 19% of the eggs collected were eggs already hatched at the time of collection, on 3% of eggs, mold has formed after they were being transferred into test tubes and 78% were viable eggs.

About the total number of eggs (figure 4) the *M. brassicae* have a number of 1.232 eggs, registering a density of 23,58 sqm. The lowest density and the lowest number of eggs were recorded in the species *D. trifolii* (21 eggs with a density of about 0,40 sqm). *P. brassicae* recorded a density of 1,45 sqm and the clutch counted 76 eggs.

The number of pupae collected for the species *P. xylostella* recorded a density value per square meter of 0,15 and a value of less than 0,1 per square meter of larvae (figure 5).

From the biological material collected, it was found that all the eggs, including *P. xylostella* pupae, were parasitized. The parasites were identified as belonging to the family *Trichogrammatidae* and *Ichneumonidae* (figures 10, 11 and table 1). *Hymenoptera* of the family *Trichogrammatidae* have been determined to be the species *Trichogramma evanescence* and have parasitized the eggs of species of the family *Noctuidae* and *Pieridae* and recorded a density per square meter of 34,85. The *Hymenoptera* of the family *Ichneumonidae* have parasitized pupae of *P. xylostella* and they have a recorded density of about 0,36 sqm.

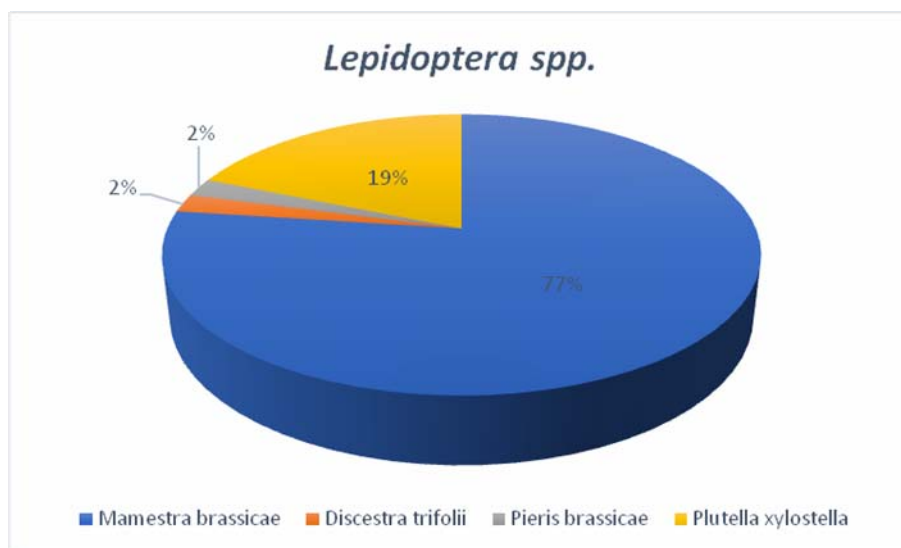


Fig. 1 Identified lepidopteran species in the experimental field of the Vegetable Research and Development Station Bacău

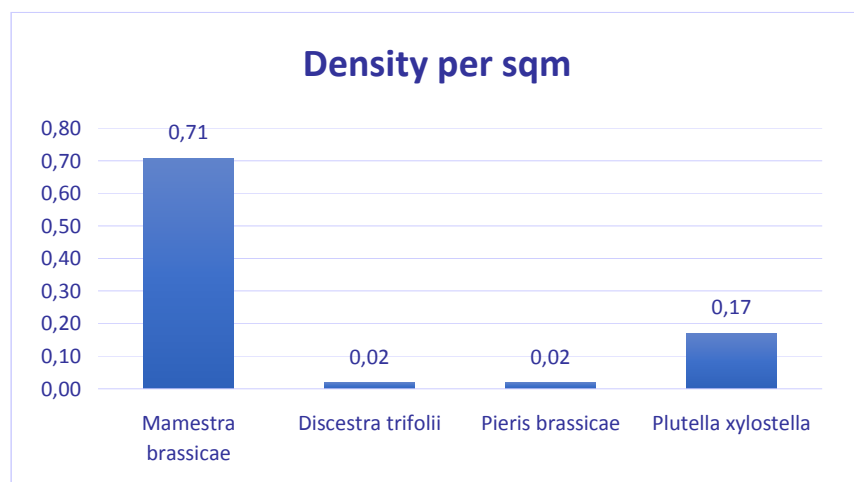


Fig. 2. Density of pests of the order *Lepidoptera* per square meter

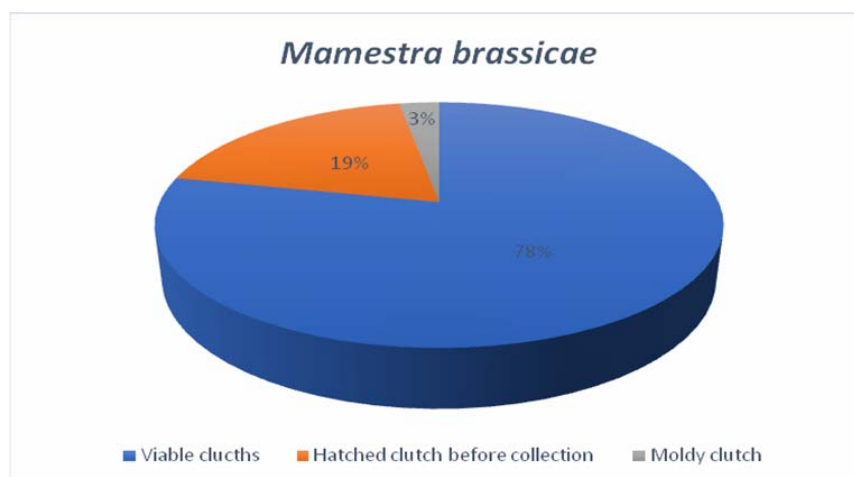


Fig. 3. Percentage of viable eggs for the *M. brassicae*

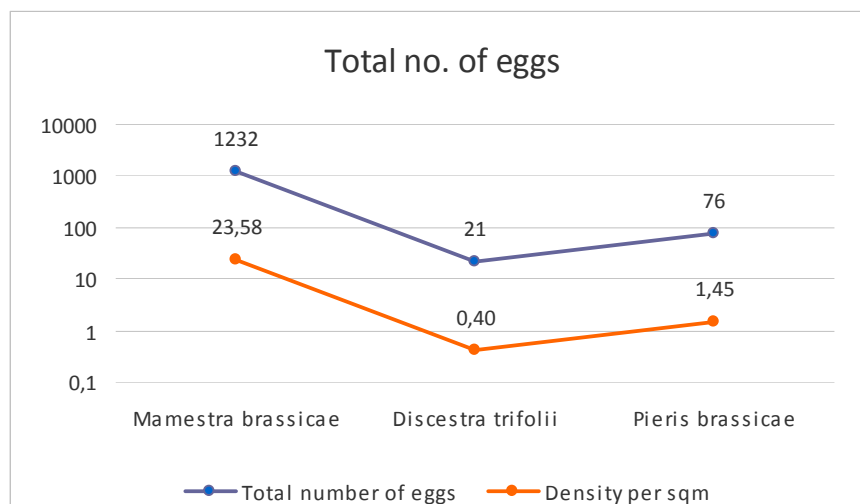


Fig. 4. The total number of eggs from the clutches collected

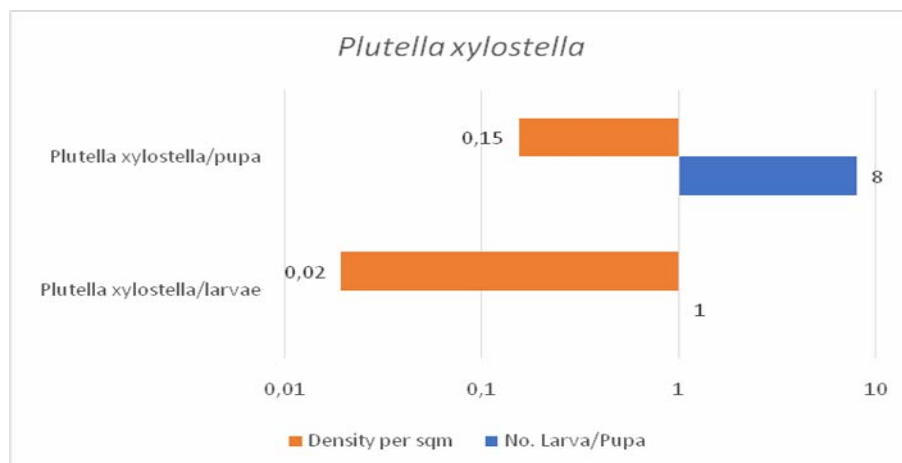


Fig. 5. The total number of pupae and larvae from *P. xylostella*

Table 1. The family of parasitoides from cabbage pests

Parasitoides	Total number of parasites	Nr. paraziți pe ouă de <i>M. brassicae</i>	Nr. paraziți pe ouă de <i>D. trifolii</i>	Nr. paraziți pe ouă de <i>P. brassicae</i>	Nr. paraziți pe pupe de <i>P. xylostella</i>	Density per sqm
<i>Fam. Trichogrammatidae</i>	1.821	1.742	35	44	0	34,85
<i>Fam. Ichneumonidae</i>	19	0	0	0	19	0,36

## CONCLUSIONS

Four species of *Lepidoptera* harmful to cabbage culture (*Brassica oleracea* L. var. capitata, Silvana variety) were identified in the experimental field of SCDL Bacău in 2019. The highest density is recorded in the species *Mamestra brassicae*.

From the biological material collected, it was found that all the eggs, including *P. xylostella* pupae, were parasitized.

*Trichogramma evanescens* prefer one of the three most harmful lepidopteran pest species in cabbage, *Mamestra brassicae*, *Pieris brassicae* and *Discestra trifolii*. But the *Plutella xylostella* larva and pupas was preferred by the himenopterele din familia *Ichneumonidae*.

Studies on pests of cabbage crops and their parasites can provide us with important information about the plant-pest-parasite relationship that can influence the success of a crop. For this purpose, we need more data on biological pest control in cabbage cultures.

## ABSTRACT

In the experimental field on the autumn cabbage, Silvana variety of Vegetable Research and Development Station Bacău, four *Lepidoptera* species have been identified as major pests (*Mamestra brassicae*, *Discestra trifolii*, *Pieris brassicae* and *Plutella xylostella*) in 2019. Were collected biologic material represented by clutches of eggs. In the laboratory, daily observations were made, to see the degree of parasitic attack. The

highest density of parasitic *Hymenoptera* was recorded by *T. evanescens* at all *M. brassicae* eggs.

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Fig. 6. Egg Clutch of *M. brassicae* on a cabbage leaf



Fig. 7. Egg Clutch of *D. trifolii* on a cabbage leaf



Fig. 8. Egg Clutch of *P. brassicae* on a cabbage leaf seen on a stereomicroscope

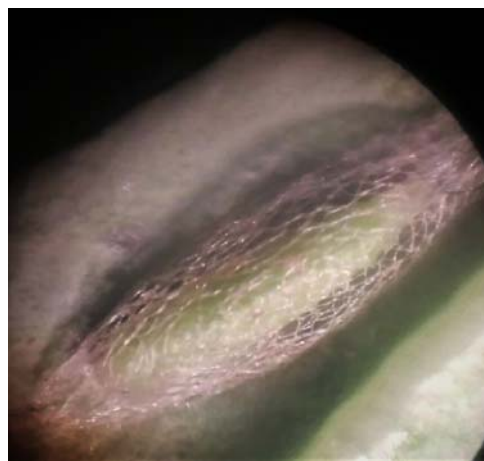


Fig. 9. Pupa of a *P. xylostella* seen on a stereomicroscope



Fig. 10. *Trichogramma evanescence*, ventral view on setereomicroscope



Fig. 11. *Himenoptera* from *Ichneumonidae* Family seen