OBSERVATIONS CONCERNING THE HARMFUL ENTOMOFAUNA FROM WINTER RAPESEED CROPS IN THE CONDITIONS OF CENTRAL OF MOLDAVA, BETWEEN YEARS 2014-2017

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Abstract: During 2014-2017, 22 species were identified in the yellow bowl trap type installed in winter rapeseed crops established at A.R.S.D. Secuieni. Of these, 11 species are specific to winter rapeseed crops and 11 species were accidental identified because of the proximity with different agricultural crops (maize, sunflower, grain cereals). The highest abundance was registered by Epicometis hirta Poda species which accounted 914 specimens collected during the analyzed period. The species were integrated into classes of dominance (D1 - subrecedent species. D2 - recedent species. D3 - subdominant species. D4 - dominant species and D5 - eudominant species). Meligethes aeneus F., Ceuthorrhyncus napi Gyll. and Epicometis hirta Poda. being considered eudominant species belonging to the D5 class. The Ceuthorrhynchus napi Gyll., Meligethes aeneus F., Epicomites hirta Poda., Psylliodes chrysocephala L., Subcoccinella 24 punctata L., Oulema melanaopa L. species were classified in the constancy class - C4 - eucconstant species. Meligethes aeneus F., Epicometis hirta Poda and Ceuthorrhynchus napi Gyll. species recorded the highest values for the index of ecological significance (W %) and were classified in the W5 class - characteristic species. The collected entomofauna belongs to five orders: Coleoptera, Heteroptera, Lepidoptera, Diptera and Hymenoptera. The highest number of species (17 species) and the highest number of collected specimens (3246 specimens) belonged to the Coleoptera order.

Keywords: winter rapeseed crops, harmful entomofauna, ecological indicators, yellow bowl trap type

1. INTRODUCTION

Rapeseed crops involves a careful plant surveillance because it is one of the most susceptible crop to pest attack through the phenological development of plants. Knowing the harmful species, which by attacking the different plant organs (leaves, stem, floral buds, flowers) leads to low productions of poor quality, it is important because theoretical knowledge combined with practical knowledge ensure the establishment of the suitable treatment moment [1-7].

The researches conducted to identify the pest attack correlated with influence of zonal agroecological factors has led to the establishment of the climate changes impact on winter rapeseed crops entomofauna. The drought which appears more frequently in the spring and summer months, the succession of high temperatures and low

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rainfall periods, especially in the winter months, determine the insect hibernation period to shorten causing great problems through the aggressive attacks and high densities of the key species.

In this paper we present data regarding the entomofauna collected from rapeseed crops in the conditions of Central of Moldova.

2. EXPERIMENTAL SETUP

The researches were conducted at the Agricultural Research – Development Station Secuieri – Neamt on the rapeseed crops during 2014-2017 and consisted on collecting the harmful entomofauna from winter rapeseed crops, determining it and establishing of some ecological parameters represented by abundance, species dominance, constancy and index of ecological significance.

In spring, were installed yellow bowl trap type in the winter rapeseed crops, aiming to collect the harmful organisms, between the stem elongation phenophase until the end of seed ripening phenophase. The biological material was collected in Petri dishes, clear of vegetable remains and analyzed in the laboratory at microscope, then grouped on species and orders.

The collected material was subjected to a mathematical analysis, obtaining a number of ecological parameters: abundance (A), dominance (D), constancy (C) and index of ecological significance (W), which highlight the characteristics of the analyzed biocenoses.

The abundance (A %) represents the total number of individuals of a species in the catch from a certain place on a given date. Based on the value of this indicator, the other indicators are calculated.

The dominance (D %) shows the participation percentage of each species in the catch. Explains the relationship of a species herd with the sum of the individuals of the other associated species. This indicator is calculated according to the equation (1):

$$D_A = \frac{N_A \cdot 100}{N_1}$$

where:
- D is dominance;
- A - species abundance;
- $N_A$ - the total number of individuals of A species;
- $N_1$ - the total number of individuals of the collected species.

Dominance classes include species whose spread percentage falls within the following values:
- D1-subrecedent species P<1.0%;
- D2-recedent species P=1.1-2.0%;
- D3-subdominant species P=2.1-5.0%;
- D4-dominant species P=5.1-10.0%;
- D5-eudominant species P>10.1%.

The constancy (C %) expresses the continuity of a species occurrence in the analyzed biotope. This characteristic is a structural indicator because it shows the participation proportion of a species in the biocenosis structure. The higher the value of the indicator, the more the species is better adapted to the conditions offered by the biotope.

The constancy is calculated according to the equation (2):

$$C_A = \frac{n_p \cdot A}{N_p} \cdot 100$$

where:
- $C_A$ represent the constancy of A species;
n<sub>p</sub> A - the number of samples in which the A species occurs;
N<sub>p</sub> - total number of collected samples.

Depending on the value of this indicator, the species are classified as follows:
- C1- accidental species(1-25%);
- C2- accessories species(25.1-50%);
- C3- constant species(50.1-75%);
- C4- euconstant species(75.1-100%).

The index of ecological significance (W %) represents the relationship between the structural indicator (C) and the productive indicator (D) and is calculated using equation (3):

\[
W_A = \frac{C_A \cdot D_A \cdot 100}{10000}
\]

where:
W<sub>A</sub> are the ecological significance index of A species;
C<sub>A</sub> - constancy of A species;
D<sub>A</sub> - dominance of A species.

Depending on the values obtained, the species are divided into the following classes:
- W1- accidental species (W < 0.1%)
- W2- accessories species (W = 0.1 - 1.0%)
- W3- accessories species (W = 1.1% - 5.1%)
- W4- characteristic species (W = 5.1% - 10%)
- W5- characteristic species (W >10.1%)

3. RESULTS AND DISCUSSION

From the observations and determinations carried out on the entomofauna collected from winter rapeseed crops, it was found that it was made up of 22 species that totalized over the entire observation period (2014-2017) 3447 specimens (Table 1).

In 2016 were registered 1502 specimens and it was the year with the highest number of specimens collected, in 2015 were collected 1038 specimens, followed by the year 2014 with 618 specimens, and the lowest number of insects collected was recorded in 2017 - 289 specimens.

During the analyzed period, it was found that the identified species had values ranging from one specimen at *Agriotes* spp. species to 914 specimens at *Epicomites hirta* Poda species. The highest number of collected specimens was recorded in the following species *Meligethes aeneus* F. (621 sp), species of *Phyllotreta* (494 sp), *Ceuthorhynchus napi* Gyll. (406 sp), *Ceuthorhynchus assimilis* Payk.(270 sp), *Psylliodes chrysocephala* L. (179 sp), *Baris chlorizans* Germ. (142 sp) and *Athalia rosea* L.(52 sp) (Table 1).

There were found other species of insects, which have been categorized as accidental species coming from proximity crops (maize. sunflower. grain cereals): *Ostrinia nubilalis* Hbn., *Chlororhynchus bjerki* Tj., *Tanymecus dilaticollis* Gyll., *Crepidotera ferruginea* Scopoli., *Oscinella frit* L., *Oulema melanopa* L., *Eurygaster spp.*, but also entomophagus species (*Subcoccinella 24 punctata* L.).

| No. | Species | Order | Collected entomofauna (2014-2017) | Total specimens 2014-2017 |
|-----|---------|-------|---------------------------------|--------------------------|
| 1   | *Meligethes aeneus* F. | Coleoptera | 204 272 122 23 | 621 |
| 2   | *Phyllotreta atra* Goeze | Coleoptera | 37 158 95 0 | 290 |
| 3   | *Phyllotreta nemorum* L. | Coleoptera | 12 142 29 0 | 183 |
| 4   | *Phyllotreta nigripes* Fabr. | Coleoptera | 1 0 20 0 | 21 |
From Table 2, it can be noted that the collected species were classified in dominance classes as follows:
- nine species belong to D1 class - **subrecedent species** with a spreading percentage below 1.0 %;
- three species were classified to D2 class – **recedent species** with a spreading rate ranging from 1.2 % - 2.0 %;
- two species were classified in D3 class – **subdominant species** whose spreading rates were between 2.1 % - 5.0 %;
- four species belong to D4 class – **dominant species** with spreading rates between 5.1 % - 10 %;
- three species were classified in D5 class – **eudominant species** whose spread percentage was higher than 10.1%.

| No. | D1 - subrecedent species × 1.1 % | D2 – recedent species 1.2 % - 2.0 % | D3 – subdominant 2.1 % - 5.0 % | D4 – dominant species 5.1 % - 10 % | D5 – eudominant species > 10.1 % |
|-----|---------------------------------|-----------------------------------|--------------------------------|-----------------------------------|---------------------------------|
| 1   | Agriotes spp.                   | Athalia rosea L.                  | Baris chlorizans Germ.          | Phyllotreta nemorum L.            | Ceuthorrhynchus napi Gyll.       |
| 2   | Oiscinella frir L.              | Harpalus spp.                     | Chlorops pumilionsis Bjerk.      | Psylliodes chrysocephala L.       | Meligethes aeneus F.             |
| 3   | Tanyuemus dilaticollis Gyll.    | Lygus pratensis L.                | Ceuthorrhynchus assimillis Payk. | Epicomites hirta                  |                                 |
| 4   | Crepidodera ferruginea Scopoli  | Lygus pratensis L.                | Ceuthorrhynchus assimillis Payk. | Epicomites hirta                  |                                 |
| 5   | Ceuthorrhynchus pleurostigma Marsh | Lygus pratensis L.                |                                 |                                   |                                 |
| 6   | Ostrinia nubalis Hbn.           | Lygus pratensis L.                |                                 |                                   |                                 |
| 7   | Phyllotreta nigripes Fabr.      | Lygus pratensis L.                |                                 |                                   |                                 |
| 8   | Eurygaster spp                  | Lygus pratensis L.                |                                 |                                   |                                 |
| 9   | Oulema melanopa L.              | Lygus pratensis L.                |                                 |                                   |                                 |

Calculating the percentage of harmful entomofauna on dominance classes it was found that in D1 class, species with sporadic spreading were recorded 3.46 % of the collected species. From D2 class, species with low spreading, belong 4.84 % from the identified species. In D3 class, species with middle spread, were recorded 7.12 % of the total, 27.34 % belong to D4 class, dominant species, and in D5 class, eudominant species, were recorded 57.34 % from the collected species (Figure 1).
The share of harmful species collected on dominance classes.

The species were distributed by constancy classes according to the obtained values (Table 3):
- six species had the constancy values between 1 and 25% belonging to C1 class - **accidental species** (Crepidodera ferruginea Scopoli, Tanymecus dilaticollis Gyll., Agriotes spp., Ostrinia nubilalis Hbn., Chlorops pumilionis Bjerk., Oscinella frit L);
- in C2 class - **accessories species** (25 % and 50 %), there were three species (Phyllotreta nigripes Fabr., Ceuthorrhyncha plerostigma Marsh., Eurygaster spp.);
- to C3 class - **constant species** (50.1 %-%75 %), belong seven species (Ceuthorrhyncha assimilis Payk., Phyllotreta atra Goeze, Phyllotreta nemorum L., Baris chlorizans Germ., Athalia rosea L., Lygus pratensis L., Harpalus spp);
- six species belong to C4 class - **euconstant species** (75.1 %-%100 %) (Ceuthorrhyncha napi Gyll., Meligethes aeneus F., Epicomites hirta Poda, Psylliodes chrysocephala L., Subcoccinella 24 punctata L., Oulema melanopa L.).

Table 3. The classification of the species collected in the yellow bowl trap type on constancy classes.

| No. | Constancy classes                                                                 |
|-----|-----------------------------------------------------------------------------------|
|     | C1 – accidental species (1-25%)                                                    |
| 1   | Agriotes spp.                                                                      |
| 2   | Oscinella frit L.                                                                  |
| 3   | Tanymecus dilaticollis Gyll.                                                       |
| 4   | Crepidodera ferruginea Scopoli                                                     |
| 5   | Ostrinia nubilalis Hbn                                                              |
| 6   | Chlorops pumilionis Bjerk.                                                         |
| 7   |                                                                                  |
|     | C2 – accessories species (25.1-50%)                                                |
|     | Ceuthorrhyncha plerostigma Marsh                                                    |
|     | Phyllotreta nigripes Fabr.                                                         |
|     | Eurygaster spp.                                                                    |
|     |                                                                                  |
|     | C3 – constant species (50.1-75 %)                                                  |
|     | Ceuthorrhyncha assimilis Payk.                                                      |
|     | Phyllotreta atra Goeze                                                             |
|     | Baris chlorizans Germ.                                                             |
|     |                                                                                  |
|     | C4 – euconstant species (75.1-100 %)                                               |
|     | Ceuthorrhyncha napi Gyll.                                                          |
|     | Meligethes aeneus F.                                                               |
|     | Epicomites hirta Poda                                                              |
|     |                                                                                  |
| Total | 6 species | 3 species | 7 species | 6 species |

Fig. 1. The share of harmful species collected on dominance classes.
Depending on the **index of ecological significance** (W), the species were classified as follow (Table 4):
- six species (Agriotes spp., Oscinella frit L., Tanytarsus dilaticollis Gyll., Crepidodera ferruginea Scopoli., Ostrinia nubilalis Hbn., Ceuthorrhynchus pleurostigma Marsh.) are part of **W1 class** (<0.1%);
- in **W2 class** (0.1-1.0 %) belong four species (Phyllotreta nigripes Fabr., Chlorops pumilionis Bjerk., Eurygaster spp., Oulema melanopa L.);
- six species (Athalia rosea L., Harpalus spp., Lygus pratensis L., Subcoccinella 24 punctata L., Baris chlorizans Germ., Phyllotreta nemorum L.) belong to **W3 class** (1.1-5.0 %);
- three species (Ceuthorrhynchus assimillis Payk., Psylliodes chrysocephala L., Phyllotreta atra Goeze) were recorded to **W4 class** (5.1-10.0 %);
- from **W5 class** (>10.0 %) are three species (Meligethes aeneus F., Epicomites hirta Poda, Ceuthorrhynchus napi Gyll.).

Table 4. The classification of the species collected in the yellow bowl trap type according to the index of ecological significance (W) classes.

| No. | Index of ecological significance (W) classes |
|-----|-----------------------------------------------|
|     | W₁ < 0.1 % | W₂ – 0.1-1.0 % | W₃ – 1.1-5.0 % | W₄ – 5.1-10.0 % | W₅ – > 10.0 % |
| 1   | Agriotes spp. | Phyllotreta nigripes Fabr. | Athalia rosea L. | Psylliodes chrysocephala L. | Ceuthorrhynchus napi Gyll. |
| 2   | Oscinella frit L. | Eurygaster spp | Harpalus spp. | Ceuthorrhynchus assimillis Payk. | Meligethes aeneus F. |
| 3   | Tanytarsus dilaticollis Gyll. | Chlorops pumilionis Bjerk. | Lygus pratensis L. | Phyllotreta atra Goeze | Epicomites hirta Poda |
| 4   | Crepidodera ferruginea Scopoli | Oulema melanopa L. | Subcoccinella 24 punctata L. | Baris chlorizans Germ. | |
| 5   | Ceuthorrhynchus pleurostigma Marsh | | | | |
| 6   | Ostrinia nubilalis Hbn | | | Phyllotreta nemorum L. | |
| Total | 6 specii | 4 specii | 6 specii | 3 specii | 3 specii |

Grouping the collected species on systematic orders showed that the analyzed entomofauna classified in five orders: **Coleoptera**, **Heteroptera**, **Lepidoptera**, **Diptera** and **Hymenoptera** (Figure 2).

From **Coleoptera** order were registered most of the species spread in the rapeseed crops, respectively 17 species, to **Diptera** order belongs tow species and the **Heteroptera**, **Lepidoptera** and **Hymenoptera** orders were represented by one species each (table 5).

Table 5. The distribution of collected species from rapeseed crops on systematic orders.

| No. | Coleoptera | Heteroptera | Lepidoptera | Diptera | Hymenoptera |
|-----|------------|-------------|-------------|---------|-------------|
| 1   | Meligethes aeneus F. | Eurygaster spp | Ostrinia nubilalis Hbn. | Oscinella frit L. | Athalia rosea L. |
| 2   | Phyllotreta atra Goeze | | | Chlorops pumilionis Bjerk. | |
| 3   | Phyllotreta nemorum L. | | | | |
| 4   | Phyllotreta nigripes Fabr. | | | | |
| 5   | Psylliodes chrysocephala L. | | | | |
| 6   | Baris chlorizans Germ. | | | | |
| 7   | Ceuthorrhynchus napi Gyll. | | | | |
| No. | Species                                      |
|-----|---------------------------------------------|
| 8   | *Ceuthorhynchus assimilis* Payk.             |
| 9   | *Ceuthorhynchus pleurostigma* Marsh.        |
| 10  | *Epicomites hirta* Poda                    |
| 11  | *Oulema melanopa* L.                       |
| 12  | *Lygus pratensis* L.                       |
| 13  | *Tanymecus dilaticollis* Gyll.             |
| 14  | *Crepidodera ferruginea* Scopoli           |
| 15  | *Harpalus spp.*                            |
| 16  | *Subcoccinella 24 punctata* L.             |
| 17  | *Agriotes spp.*                            |
|     | **Total**                                   |
|     | 17 species  
1 species  
1 species  
2 species  
1 species |

By calculating the percentage of orders after the number of species it was found that: *Coleoptera* order had the maximum share of 77.4 %, followed by *Diptera* order which had a share of 9.1 % and then by *Hymenoptera*. *Heteroptera* and *Lepidoptera* orders with 4.5 % each (Figure 2).

![Figure 2](image.png)

**Fig. 2.** The orders share depending on the number of species collected from rapeseed crops.

Within the *Coleoptera* order the highest share of 28.07 % belongs to *Epicomites hirta* Poda species, followed by *Meligethes aeneus* F. with 19.02 % and *Ceuthorhynchus napi* Gyll. with 12.4 7%. The lowest shares were recorded by the species: *Agriotes* spp. with 0.03 %, *Tanymecus dilaticollis* Gyll with 0.12 % and *Crepidodera ferruginea* Scopoli with 0.15 % (Figure 3).
4. CONCLUSIONS

During 2014-2017 were identified 22 species using the yellow bowl trap type installed in winter rapeseed crops established at A.R.S.D. Secuieni.

Of these, 11 species are specific to winters rapeseed crops and 11 species were accidental identified due to their proximity to different agricultural crops (maize, sunflower, grain cereals).

The highest abundance was recorded by Epicomites hirta Poda species with 914 specimens collected during the analyzed period.

The species were classified into dominance classes (D1 - subrecedent species, D2 - recedent species, D3 - subdominant species, D4 - dominant species and D5 - eudominant species). Meligethes aeneus F., Ceuthorrhynchus napi Gyll. and Epicomites hirta Poda. being considered as eudominant species belonging to D5 class.

The Ceuthorrhynchus napi Gyll., Meligethes aeneus F., Epicomites hirta Poda, Psylliodes chrysocephala L., Subcoccinella 24 punctata L., Oulema melanopa L., species have been classified into C4 constancy class - euconstant species.

Meligethes aeneus F., Epicomites hirta Poda and Ceuthorrhynchus napi Gyll. species recorded the highest values on the ecological significance index (W%) and were classified in W5 class - characteristic species.

The analyzed entomofauna belongs to five orders: Coleoptera, Heteroptera, Lepidoptera, Diptera and Hymenoptera. The highest number of species (17 species) and the highest number of collected speciemens (3246 specimens) belonged to the Coleoptera order.
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