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# INFLUENCE O THE PEST CONTROL METHODS OVER THE USEFUL ENTOMOFAUNA WITHIN THE VITICULTURAL ECOSYSTEM

**Ioan ENOIU[1], Lidia FÎCIU[2], Sonia DROSU[3]**

[1]Naturevo Ltd, St. Ion Urdareanu, no 34, Sector 5, Bucharest, Romania
[2]Research and Development Institute for Viticulture and Winemaking, St. Mantei, Calugareasca Valley, Romania
[3]Institute of Plant Protection Research and Development, Bd Ion Ionescu de la Brad, no. 8 Dictrict 1, 013813, Bucharest, Romania

Corresponding author email: john.enoiu@naturevo.ro

***Abstract***

*The paper presents the influence of the differential methods to control pests and diseases of vines, respectively chemical control, biological and integrated, over the useful and harmful in a entomofauna vineyard ecosystem. Experimental data obtained showed that the abundance entomofauna (useful and harmful) presented higher values for biological control and integrated methods compared to chemical control method. Integrated control, especially chemical, caused a reduction of 4% and 17% in the number of the useful insects compared to the biological control method. The ratio between useful and harmful entomofauna recorded in May and June had an average of 1.1, with an upward trend in the use of biological control method and decreasing for integrated control, especially the chemical. Useful entomofauna recorded lower values than the harmful for all control methods used, which proves that useful pests are more sensitive than the harmful ones after application.*

***Key words:*** *methods of pest control, viticulture, useful entomofauna.*

## INTRODUCTION

A full management of viticultural ecosystem can not be achieved without a reconsideration of the whole system based on a design that takes into account both ecological pest knowledge and their destructive potential and complex adoption of the most appropriate measures for the natural control of the harmful species (Coulon et Sentenac, 2001; Dejeu et al., 2005; Fregona, 2005). Parasites and predators of the existing natural background in each ecosystem wine is by far one of the most important natural biotic factors limiting the populations of the harmful pests (Perju *et al*., 1988). Some technological sequences used in vineyards, especially treatments of diseases and pests of vines, can influence in an obvious manner the diversity and numerical abundance of natural predators populations, with direct implications in maintaining the natural balance within the wines ecosystem.

Based on these considerations the paper aims to present the influence of differential methods of pests and diseases control in vines over the useful and harmful entomofauna existing in a vineyard ecosystem.

## MATERIALS AND METHODS

Research has been carried out within a vineyard having planting distances: 2.0/1.0 m placed into terraced slope conditions arranged in terraces wide (width 17.2 m, 8 rows of vines). The biological material was represented by Merlot/SO4-4 variety.

They were experienced 3 differentiated method to control pests and diseases of the vines, namely:

-Chemical control based on the use of contact and systemic insecticides;

-Biological control based on the use of of copper, sulfur and bioinsecticides;

-Integrated control based on the use of less harmful insecticides, accepted internationally for the integrated pest management in vineyards to which were added biotechnical means and bioinsecticides.

To collect biological material that represents the useful and harmful entomofauna of the

vineyard, several methods were used depending on the targeted species, namely:
-Barber traps, which is the classical method for collecting mobile arthropods on the ground;
-Shaking technique that allows collecting useful and harmful entomofauna by shaking vegetative organs above an entomological net;
-Method of leaf samples, allowing an estimate of the entomophagous populations from the leaves.
Measurements were made at an interval of two weeks between May and June. After harvesting the samples samples were brought to the laboratory and analyzed the binocular loupe and microscope to identify the present species. Identified species were classified into taxonomic groups: orders, families and genus. The relative abundance and the number of species that encounter the the useful and the harmful entomofauna specific for the vineyard ecosystem was studied, the subject to the type of the treatment.
Based on the data we have got calculated the ratio between the two components of vine pests and predators respectively.

## RESULTS AND DISCUSSIONS

Based on the role and the importance of predators into two vineyard ecosystem, a mapping of the vine pest for the three methods differentiated, on diseases and pest control in vineyards was concluded.
Arthropod fauna collected by means, during May-June in the experimental plots, amounted a total of 810 insects. out of these, 430 were harmful insects, representing 53.1% and 380 formed entomophagous population, representing 46.9% of the total. The reletio between the two populations was 1.13.
Function to the pest in the species vineyard, arthropods were divided into two groups: (i) harmful fauna (phytophagous pest that feed on different parts of plants and (ii) useful fauna (parasitoids and predators, whose regime is carnivorous diet).
Harmful species were included into 7 orders: Orthoptera, Thysanoptera, Heteroptera, Homoptera, Coleoptera, Lepidoptera and Diptera and 13 families: Catantopidae, Gryllidae, Thripidae, Miridae, Pentatomidae, Cicadellidae, Aphididae, Elateridae, Halticidae, Bruchidae, Curculionidae and Geometridae (for Diptera, suborder Brachycera).
Beneficials were separated into predators and parasites. Predators were included in 7 order: Aranea, Dermaptera, Heteroptera, Neuroptera, Hymenoptera, Coleoptera, and Diptera in 6 families. Parasites Hymenoptera belonge to two superfamilies, Chalcidoidea and Ichneumonoidea. Ants present in a large numbers were included into Formicoideal subfamily.
The taxonomic classification of the fauna collected specific to the vineyard ecosystem studied is presented in Table 1.

Table 1. Taxonomic classification of the fauna collected from the viticultural ecosystem studied

| Harmful fauna | Useful fauna |
|---|---|
| 1. Ord. ORTHOPTERA<br>Fam. Catantopidae<br>*Caliptamus italicus* L.<br>Fam. Gryllidae<br>*Grilus campestris* L.<br>*Melanogryllus desertus* Pallas<br>2Ord. THYSANOPTERA<br>Fam. Thripidae<br>3. Ord. HETEROPTERA<br>Fam. Miridae<br>*Lygus sp*.<br>Fam. Pentatomidae<br>4. Ord. HOMOPTERA<br>Fam. Cicadellidae<br>Fam. Aphididae<br>5. Ord. COLEOPTERA<br>Fam. Elateridae<br>Fam. Halticidae<br>Fam. Bruchidae<br>Fam. Curculionidae<br>6. Ord. LEPIDOPTERA<br>Fam. Geometridae<br>7. Ord. Diptera<br>Subord. Brachycera | 1. O. ARANEAE<br>2. O. DERMAPTERA<br>Fam. Forficulidae<br>*Forficula auricularia* L<br>3. HETEROPTERA<br>Fam. Anthocoridae<br>*Orius sp.*<br>4. NEUROPTERA<br>Fam. Chrysopidae<br>*Chrysoperla carnea Steph.*<br>5. O. HYMENOPTERA<br>Suprafam. Chalcidoidea<br>Suprafam. Ichneumonoidea<br>Suprafam. Formicoidea<br>6. Ord. COLEOPTERA<br>Fam. Coccinellidae<br>*Coccinella 7-punctata* L.<br>*Propylea 14-punctata* L.<br>*Stethorus punctillum* Weise<br>Fam. Staphilinidae<br>7. Ord. DIPTERA<br>Fam. Tachinidae |

The structure and relative abundance and number of species that form the harmful fauna population specific for the vineyard ecosystem studied, function of the types of management regarding the control of the agents on the entire collection period (May-June), is presented in Table 2.
The experimental data obtained, indicate a difference in the number of species collected of functions of the three types of pest management. Thus, it may be noted that the version where we used the biological control of

pest agents, that have been used substances based on Cu and S + bioinsecticides was collected the largest number of copies of harmful artopode (174 insects), followed by the version where were used the integrated control (less harmful chemicals + biotechnical means + bioinsecticides) (152 insects) and variant who underwent chemical control (104 insects).
This is the result of the less toxic effect of the products used for the biological control, and effect of more toxic chemicals used for chemical control. Integrated control place, the abundance of pests on an intermediate position.
In terms of the structure of pests, the situation is different on the three pest control methods.
In the version with chemical control, the highest level was occupied by the insects of the order Coleoptera (51.0%), followed by Homoptera (30.8%) and Orthoptera (11.5%). The remaining 6.73% counted Thisanoptera, Heteroptera, Lepidoptera and Diptera.
Whole, pests collected from the chemically treated, is below the threshold harmful to the vines. Noticeable is that Ciccadellidae family, wich require careful follow-up for future, given that in Europe there are several species of mycoplasmas carried by these vectors in vineyards (eg Scaphoideus titanus, Metcalfa pruinosa). Fortunately,these micoplasmas have not been identified so far in our country.
In the variant of biological control, there are two groups close to each other: Homoptera and Coleoptera occupy 44.3% and 30.5% in the structure of the pest, followed by Heteroptera and Orthoptera 12.1% and 9.2%.
In the version with integrated control, four groups of insects occupy close structural levels, as follows: Homoptera (38.8%), Coleoptera (22.4%), Orthoptera (20.4%) and Heteroptera (14.5%).

Table 2. Structure and relative and numeric abundance of the harmful insects subjects to the controlling method.

| Toxonomy classification | Chemical control | | Biological control | | Integrated control | |
|---|---|---|---|---|---|---|
| | Nr ex. | % | Nr ex. | % | Nr ex. | % |
| 1. Ord. ORTHOPTERA | 12 | 11.5 | 16 | 9.2 | 31 | 20.4 |
| 2. Ord. THYSANOPTERA | 1 | 1.0 | 3 | 1.7 | 0 | 0.00 |
| 3. Ord. HETEROPTERA | 0 | 0.0 | 21 | 12.1 | 22 | 14.5 |
| 4. Ord. HOMOPTERA | 32 | 30.8 | 77 | 44.3 | 59 | 38.8 |
| 5. Ord. COLEOPTERA | 53 | 51.0 | 53 | 30.4 | 34 | 22.3 |
| 6. Ord. LEPIDOPTERA | 2 | 1.9 | 1 | 0.6 | 3 | 2.0 |
| 7. Ord. DIPTERA | 4 | 3.8 | 3 | 1.7 | 3 | 2.0 |
| **TOTAL** | **104** | **100** | **174** | **100** | **152** | **100** |

To be noted that all versions include Orthoptera group, represented by crickets and grasshoppers, whose presence is justified by the variety of spontaneous vegetation surrounding the vineyard ecosystem (Table 3).
Useful entomofauna specific for a vineyard ecosystem, where three types of pest were applied is presented both as structure and as number and relative abundance into the Table 4.
Analyzing the useful entomofauna collected from the vineyard ecosystem under the three methods of pest control, as in the case of the harmful fauna, we found the same trend: the largest number of beneficial being collected from biological control version (214 insects), followed by integrated control variant (102 insects), while fewer individuals were recorded in chemical control version (64 insects).

Table 3. Numerical distribution of the harmful entomofauna differentiated by the methods applied for pest control in vineyard

| **Toxonomy classification** | **Chemical control** | **Biological control** | **Integrated control** |
|---|---|---|---|
| Ord. ORTHOPTERA | 4 | 7 | 12 |
| Ord. THYSANOPTERA | 1 | 1 | 0 |
| Ord. HETEROPTERA | 0 | 10 | 9 |
| Ord. HOMOPTERA | 14 | 25 | 11 |
| Ord. COLEOPTERA | 17 | 20 | 15 |
| Ord. LEPIDOPTERA | 0 | 0 | 2 |
| Ord. DIPTERA | 0 | 2 | 0 |
| **TOTAL** | **36** | **65** | **49** |

Table 4. Structure and number and relative abundance of entomophagous population under different type of pest control

| **Toxonomy classification** | **Chemical control** | | **Biological control** | | **Integrated control** | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| 1. Ord. ARANEA | 18 | 28.1 | 34 | 15.9 | 33 | 32.3 |
| 2. Ord. DERMAPTERA | 15 | 23.4 | 41 | 19.2 | 12 | 11.8 |
| 3. Ord. HETEROPTERA | 0 | 0.0 | 6 | 2.8 | 2 | 2.0 |
| 4. Ord. NEUROPTERA | 1 | 1.6 | 7 | 3.3 | 5 | 4.9 |
| 5. Ord. COLEOPTERA | 7 | 10.9 | 37 | 17.3 | 16 | 15.7 |
| 6. Ord. DIPTERA | 1 | 1.6 | 9 | 4.2 | 3 | 2.9 |
| 7. Ord. HYMENOPTERA | 22 | 34.4 | 80 | 37.4 | 31 | 30.4 |
| **TOTAL** | **64** | **100** | **214** | **100** | **102** | **100** |

The beneficial insects were lower as number, but the number of species was higher. As a structure, the highest percentages were occupied by ants Hymenoptera group, 37.4% (biological control), 34.4% (chemical control) and 30.4% (integrated control). Ants, although they are not recognized as major predators in the agroecosystems, are big consumers of fresh dejections secreted by some insects, mainly aphids, and insect remains under decomposition.

A group of predators of a great importance in limiting the multiplication of pests are beetles of the family Coccinellidae, Coccinella and Stetorus genres. They have occupied the highest percentage in the alternative of biological control structure (17.3%), followed by integrated control option (15.7%) and then chemical variant (10.9%).

Noteworthy are the groups of Aranea (spiders predators) and Dermaptera (earwig), which achieved levels between 15.9-32.4% and 11.8-23.4%. Both groups of predators feed on small insects (aphids, mites) present on various vegetable substrates vines, respectively spontaneous vegetation. Earwig might produce damages in grapes at harvest time, but without the grapes ripened, they are regarded as predators of insects.

The structure and abundance of entomophagous in the experimental plots of the stationary were three types of pest management were applied, are shown in Table 5.

Table 5. Structure and abundance of the entomophagous into the stationary , subject to different pest control methods in vineyard

| Toxonomy classification | Chemical control | Biological control | Integrated control |
|---|---|---|---|
| Ord. ARANEA | 7 | 6 | 18 |
| Ord. DERMAPTERA | 6 | 8 | 2 |
| Ord. COLEOPTERA | 1 | 19 | 3 |
| Ord. DIPTERA | 0 | 1 | 0 |
| Ord. HYMENOPTERA | 4 | 31 | 18 |
| **TOTAL** | **18** | **65** | **41** |

Table 6. The ratio between the useful and harmful entomofauna (U / D) for the three methods of pest control in vineyard

| Collection (no) | Date of collection | Chemical control | Biological control | Integrated control |
|---|---|---|---|---|
| | | (U/D) | | |
| 1 | 25.05. | 0.96 | 1.08 | 1.10 |
| 2 | 5.06. | 0.84 | 1.48 | 1.03 |
| 3 | 19.06 | 0.46 | 1.55 | 0.95 |
| 4 | 29.06. | 0.31 | 1.03 | 0.78 |

Based on the harmful and useful entomofauna collected from the wine ecosystems, a rotation between useful and harmful fauna was achieved for each collection date. The results are presented in the Table 6.

From Table 6 we can see that the ratio between the two components harmful pests and beneficial, followed an upward trend under the biological control and a decreasing if the variants of integrated and chemical particularly. As a general pole during spring and early summer this ratio has a value of 1.1, changes to one or other of the components occurring after the intervention with the control treatments: biological, chemical or integrated.

## CONCLUSIONS

Entomofauna abundance of the useful and harmful insects presented higher values for the biological and integrated control methods, compared to the chemical control method.

Compared to the biological control, the most protective for the useful entomofauna, integrated control and especially chemical, caused a reduction of 4% and 17% in the number of useful insects.

The ratio between useful and harmful entomofauna recorded an average of 1.1, with

increasing trend for variants where was practiced the biological control going downward in the variant where chemical control was practiced.

Useful entomofauna was lower than the harmful for all 3 methods of control, which proves that beneficial insects are more sensible than the harmful insects, under phytosanitary treatments.

## REFERENCES


Coulon T., Sentenac G., 2001. Un référentiel national ‚Production intégrée des raisins" pour les vignobles français. Bulletin de l'O.I.V., vol. 74, nr. 845-846, p. 445-462.

Dejeu et al., 1997. Hortiviticultura si protectia mediului. Ed. Didactica si Pedagogica, Bucharest

Fregoni M., 2005. Viticoltura di qualita. Informatore Agrario Publishing House

Perju T. et all., 1988. Entomofagii si utilizarea lor în protectia integrata a ecosistemelor viticole. Ceres Publishing House, Bucharest


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