Scientific Papers. Series B, Horticulture. Vol. LXV, No. 1, 2021
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

OBSERVATIONS ON THE STRUCTURE, DYNAMICS AND ABUNDANCE OF EXISTING ARTHROPODS IN WALNUT ORCHARDS

Ionel PERJU, Mihai TĂLMACIU, Nela TĂLMACIU, Monica HEREA

University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad",
3 Mihail Sadoveanu Alley, Iași, Romania

Corresponding author email: monica28is@yahoo.com

Abstract

The research was carried out within SCDP Iași, in two lots with a different crop technology. The observations concerned the entire entomofauna of arthropods from a walnut orchard where a conventional cultivation technology was applied and in a walnut orchard where ecological methods of protection against diseases and pests were applied. The research was carried out during 2018-2019, when the method of soil traps Barber type was used, while the flight curve of the pest Cydia pomonella was followed with help of synthetic pheromones traps, AtraPom type. The observations were made throughout the vegetation period, from May to September, having as research material 4 walnut genotypes, in the seventh year after planting, being grafted on Juglans regia. In the case of the conventional variant, phytosanitary treatments with fungicides and insecticides were performed, and in the ecological walnut variant, no phytosanitary treatments were performed, pest control being performed using biotechnical means, using only traps with synthetic sex pheromones AtraPom. During this period, climatic factors were also analyzed, which influence the biology of useful and harmful species. Following the monitoring and determination of all species collected, data were recorded on the abundance and dynamics of existing fauna.

Key words*: soil traps, AtraPom, Cydia pomonella, dinamics.*

INTRODUCTION

Through a specific strategy adopted at the location of the orchards, for the selection of rootstocks and the appropriate assortment, fertilization works, soil works, formation and fruiting cuttings, etc. the aim is to ensure a certain production potential.

This production potential can be reduced by 20-30% or sometimes totally compromised due to the attack of diseases and pests. Therefore, the protection of these orchards is seriously and permanently required, in order to highlight their production potential at the highest level.

The permanence of walnut orchards on the same land, for several decades, make the fight against diseases and pests quite difficult, compared to annual agricultural plants, where crop rotation is a very effective means of control.

The large number of pests that attack the walnut plantations make the organization of their control occupy an important volume of the concerns of the fruit grower. Protecting the plantations at the level of current requirements, must not only save the harvest, but by combating this need to increase the percentage of perfectly healthy quality fruit.

Damages caused by pests are on the rise and this requires increased attention by specialists. By using classical control measures, especially chemical ones, it is not possible to prevent the occurrence of damage caused by these arthropods.

The application of pesticides that have increased toxicity on a large scale, produces a harmful effect on the environment, which causes pollution of ecosystems.

A serious consequence of the use of these classical methods of control is the loss of the biosphere's ability to self-regulate.

As a result, regarding the disadvantages of using classical control methods, the use of modern control methods should not be ignored, as they are based on natural control methods, but also ecological methods.

It is necessary that all control actions be applied in accordance with the new ecological concept, of integrated control, which consists in a system of regulation of pest populations, taking into account the specific flight and dynamics of pest and zoophagous species, using in harmoniously all control methods (agrophytotechnical, physical-mechanical, biological and chemical), in order to maintain

the density of pests or their attack, at a level that does not cause crop losses.

The aim of our research is based on the identification and centralization of the arthropod fauna existing in walnut plantations in order to establish as accurately as possible the useful and harmful fauna and following these determinations we will be able to establish the control method that can be used efficiently in these experimental lots.

MATERIALS AND METHODS

For the study of the arthropod fauna from the walnut orchard both in conventional system and in ecological system from Sîrca, Iași county, the specific collection method was practiced with the help of soil traps type Barber, and the obtained material serving for the study of the determination and centralization of the epigean fauna from the respective plantation, and the data referring to the frequency and abundance of the number of identified species, it gives us an appreciation of the degree of population in the ecosystems.

The method of collecting insects with Barber cups gives good results especially in areas where otherwise we cannot collect insects, and here we refer to the collection of insect species that move mainly at ground level or cannot be collected by the method of threading.

Petrous or epigean species that move on the ground (arachnids, beetles, gastropods or isopods) can also be collected. The trap consists of a container buried in the ground with an opening at its surface. As a collection liquid it is recommended to use a saturated salt solution, this solution thus allowing the visit of the trap once every 15-20 days. Collected specimens should be washed in clean water before being transferred to alcohol. The advantage of using the solution is that the specimens do not usually collapse when dry and are obviously not toxic to humans and other animals. (Tălmaciu, 2010; Tălmaciu, 2016)

The tracking of the flight curve of the species was performed with the help of pheromone traps, which was based on the principle of intensive attraction of males and their capture on the sticky support of the trap on which the pheromone bait was placed, plugs made of rubber or plastic, porous material which allowed the gradual diffusion of the pheromone. The supports are hung with clips or wires in the crown. This method is also used in biological control by mass capture and even disorientation of males by synthetic sex pheromones.

RESULTS AND DISCUSSIONS

From our observations following the experiments carried out by applying the Barber trap method to the walnut orchard in the ecological stationary (Table 1), 4274 specimens belonging to a number of 9 orders were captured at the 6 collections, namely: *Coleoptera*, *Orthoptera*, *Diptera*, *Hymenoptera, Homoptera, Heteroptera, Colembola* and *Isopoda*, all belonging to the class *Insecta*, and the order *Aranea* belonging to the class *Arachnida*. The best represented were the orders *Orthoptera* with 437 specimens; *Hymenopera* with 395 samples; Isoptera with 278 specimens; *Coleoptera*, with 263 specimens, Spider with 123 specimens, and *Heteroptera* with 117 specimens. The orders *Diptera* and *Homoptera* recorded less than one hundred specimens each. For the species of the order *Colembola*, it was not possible to calculate a total number of specimens because the biological material collected that belonged to this order in three of the six collections was represented by numerous colonies (Panin, 1951; Reitter, 1908)

Following the centralization of catches on each collection, we could see that the largest number of specimens was recorded at the first collection, the one on 22.05 where a total of 2218 specimens belonging to 21 species or taxa. The next two samplings recorded a number of specimens of 724 and 680, respectively, belonging to 208 and 34 species and taxa, respectively. The lowest number of collected specimens was registered at the fourth collection on 27.07.2019 and was 146. Following the collections on 07.08.2019, and on 27.08.2019 278 were collected respectively 228 specimens that belonged to 23 and 25 species and taxa, respectively.

The collection of biological material with the help of these two methods was done in the following data: 22.05.2019; 18.06.2019; 06.07.2019; 27.07.2019; 07.08.2019, 27.08.2019;

Table 1. The entomofauna from the ecological walnut orchard collected with the soil traps Barber method in the Sârca stationary in 2019

No.	Order	Specie/Taxa	No of harvesting						Total samples
			I	II	III	IV	V	VI	
1	Coleoptera	*Harpalus pubescens* Müll.	10	3	9	17			39
		Harpalus calceatus Duft.	11	1	5	10	2	9	38
		Harpalus distinguendus Duft.	11	1	12	2	3	3	32
		Harpalus tenebrosus Dej	3	16	9	2	8	1	38
		Harpalus aeneus F.		1	2	1	1	1	6
		Pterostichus cupreus L.	1		8	1			9
		Opatrum sabulosum L.	2		1		1		4
		Hister quadrimaculatus L.	4	1	4			2	11
		Dermestes laniarius Illig.	1	2			2	3	8
		Otiorhynchus kollari Gyll.	1		2			2	5
		Rhizophagus politus Hel.	1		1			1	3
		Pteryngium crenatum Gyll.	1		1				2
		Ceuthorynchus obsoletus Germ.		2					2
		Aphthona euphorbiae Sch.	-	2	4		1	1	8
		Agriotes ustulatus Schall.		1	3		1	1	6
		Otiorhynchus fuscipes O.		2	2		1		5
		Apion apricans Herbst		2					2
		Apion virens Herbst		1	1				2
		Quedius cinctus Payk		1					1
		Coccinella 7 punctata L.		2				3	5
		Amara aenea Deeg		1			1	1	3
		Metabletus truncatelus L.		1	4		1		6
		Cyaniris cianea F.		1			2		3
		Anthicus humeralis Geb.		2				1	3
		Anthicus floralis L.	1		1			1	3
		Chrysomela marginata L.		1					1
		Anisodactylus binotatus F.			1		1	4	6
		Nebria brevicollis F.			1		1		2
		Psylliodes affinis Payk			1			2	3
		Tachyusa constricta Erich			2				2
		Oxypora vittata Mär			1			1	
		Tachyporus abdominalis F.			2				2
		Longitarsus gracilis Kuts.			1`				1
		Pentodon idiota Herbst			1		1		2
2	Orthoptera	*Gryllus campestris* L.	306		40		69	22	437
3	Isoptera	*Armadillidium vulgare* L.	1605	511	450	-	121	101	2788
4	Diptera		17	25	11	6	2	18	79
5	Aranea		44	30	19	12	14	4	123
6	Hymenoptera	*Formicidae*	131	54	56	38	40	35	354
		Viespidae	3	31	4	2	-	1	41
7	Heteroptera		39	16	21	14	4	9	117
8	Colembola		22	colony	colony	40	colony	-	colony
9	Homoptera	*Cicadidae*	4	13	1	1	1	1	21
Total order and samples			2218	724	680	146	278	228	4223

In order to establish the structure and dynamics of the arthropod entomofauna as a result of applying the soil trap type Barber method to the walnut orchards in the conventional lot (Table 2), 1211 specimens belonging to a number of 10 orders were captured at the 6 collections, namely: *Coleoptera*, *Orthoptera*, *Diptera*, *Hymenoptera*, *Homoptera*, *Heteroptera*,

Lepidoptera, *Colembola* and *Isopoda*, all belonging to the class *Insecta*, and the order *Aranea* belonging to the class *Arachnida*. The best represented were the orders of *Hymenopera* with 382 copies; Isoptera with 323 specimens*;* *Homoptera* with 126 specimens; *Coleoptera*, with 118 specimens, *Aranea* with 97 specimens, *Colembolla* with 70 specimens; *Diptera* with 43 specimens and *Heteroptera* with 30 specimens. The orders *Orthoptera* and *Lepidoptera* registered 9 and 3 specimens, respectively.

Table 2. The entomofauna from the conventional walnut orchard, collected with the soil traps Barber method in the Sârca stationary in 2019

No.	Order	Name of species	No of harvesting						Total samples
			I	II	III	IV	V	VI	
1	Coleoptera	*Amara crenata* Deeg		1		4		1	6
		Anthicus floralis L.			1	1		2	4
		Aphthona euphorbiae Sch.			4		1	1	6
		Apion virens Herbst			1				1
		Chrysomela marginata L.			1			2	3
		Coccinella 7 punctata L.			8			4	12
		Dermestes laniarius Illig.			1		2		3
		Harpalus aeneus F.			3	6		8	17
		Harpalus azureus F.		2	2		1		5
		Harpalus calceatus Duft.		4	1				5
		Harpalus pubescens Müll.		3	7	2			12
		Microlestes maurus Sturm				1		2	3
		Nebria brevicollis F.			1		1		2
		Opatrum sabulosum L.	1	1	21		1	3	27
		Ophonus sabulicola Panz				1	2		3
		Otiorhynchus ovatus L.	1						1
		Oxypora vittata Mär.	1	1					2
		Pterostichus nigrita L.	1						1
		Pentodom idiota Herbst			1		1		2
		Pteryngium crenatum Gyll.			2			1	3
2	Aranea		4	28	44	17	2	2	97
3	Colembola		23		47	-			70
4	Diptera		6	2	18	2	12	3	43
5	Orthoptera	*Gryllus campestris* L.		1	1	2		5	9
6	Heteroptera		7	10		11	2		30
7	Hymenoptera	*Formicidae*	195	43	39	40	32	16	365
		Viespidae	6	5	3	2	1		17
8	Homoptera	*Cicadelidae*	8		3				11
		Aphididae	22	73		19	11		125
9	Isoptera	*Armadillidium vulgare* L.	15	42	83	80	62	41	323
10	Lepidoptera			1	1	1			3
Total order and samples			290	217	293	189	131	91	1211

As a result of the collection of arthropod species from the conventional walnut orchard in 2019, we can see that the number of catches per harvest varied within fairly wide limits, so the largest number of specimens was recorded at the first collection, that of dated 22.05 where a total of 290 specimens belonging to 13 species or taxa were collected. The next two collections recorded a number of over 200 specimens belonging to over 20 species and taxa. At harvest no. 4, the total number of specimens was 189 and for this a number of 15 species and taxa were identified. Following the collections from 07.08.2019, 131 specimens were collected that belonged to 14 species and taxa. The lowest number of specimens collected was also recorded at the sixth collection on 27.08.2019 and was 91.

The tracking of the flight curve of the species *Cydia pomonella*, the main pest found in the walnut orchard was made using the method of capturing adults by using traps with synthetic

pheromones of AtraPom type (Beşleagă, 2008) in the two experimental lots in the walnut orchard and then the cycle scheme was made evolution of the pest.
In the period 2018-2019 in Iasi, the average and maximum daily temperatures, but also the monthly temperatures were very favorable for the evolution of the pest. For example, in 2018 the temperature was very high, registering in May 32.4°C, and in 2019, in July 40.0°C.
Based on the research undertaken, it was concluded that the codling moth has two generations per year in the area where the studies were conducted (Table 3).

Table 3. Synthesis table of *Cydia pomonella* L. species in 2019

No.	Biological stage	*Date of first appearance*	Sum temp. effective (tn-to)	*Date of last appearance*	Sum temp. effective (tn-to)
1	Pupae	15.04	46.3	04.05	98.4
2	Adult	05.05	105.8	15.05	196.9
3	Egg	12.05	158.9	26.05	349.5
4	Larvae	22.05	285.1	07.06	514.3
5	Pupae	07.06	514.3	12.06	584.1
6	Adult	16.06	649.5	22.06	735.3
7	Egg	04.07	911.4	15.07	1053.8
8	Larvae	10.07	993.2	overwinter	

Regarding the evolutionary cycle, from the data obtained, it results that in 2019 the first adult appeared in the first decade of May at an effective temperature of 105.8°C. Butterflies generally take place on warm, windless evenings. Temperature has the greatest influence on flight. All these observations highlight the influence of climatic conditions, temperature and humidity factors, on the appearance and evolution of each stage of development of the codling moth.

CONCLUSIONS

Following the collection and determination of the collected insect species, it could be observed that both the number of collected specimens and the number of species or taxa determined by the soil traps method was significantly higher in the lot of organic walnuts than in the lot of conventional walnut orchards.
The collected entomofauna was represented by a very wide range of insects that can present as food both phytophagous and zoophagous, or even mixed, which belonged to 10 systematic orders.
Based on the research undertaken, it was concluded that the species *Cydia pomonella*, has two generations per year in the area where the studies were conducted.

REFERENCES

Baicu T., Săvescu A. (1978). *Combaterea integrată în protecţia plantelor*, Bucharest, Ceres Publishing House.

Beşleagă Ramona, Georgescu T., Cârdei E., Diaconu A., (2008*).* The evolution of the attack level of apple tortricides in ecological conditions at SCDP Iaşi , The Journal "*Scientific Articles*", Horticulture Series, 51:118-126.

Panin S. (1951). Identification manual of harmful and useful beetles in R. P. R. *Publisher of State for scientific and didactic literature*, Bucharest.

Reitter E. (1908-1916) Fauna Germanica. Die Kafer des Deutschland Reichs Lutz., *Publishing House, Stuttgardt*, 5:246, 392, 436, 236, 342.

Tălmaciu M., Mocanu Ionela, Herea Monica, Talmaciu Nela, Manole Liliana (2016). Observations on Invertebrates Fauna Encountered in Some Agricultural Crops, *Full Paper Proceeding NDMRP*, Istanbul, 2:119-129.

Tălmaciu Nela, Tălmaciu M., Herea Monica (2010) Comparative research on the structure and abundance of beetles in some orchards, *Bulletin of University of Agricultural Sciences and veterinary medicine Cluj-Napoca,* 67 (1):156-164.