Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 13, Issue 4, 2013
PRINT ISSN 2284-7995, E-ISSN 2285-3952

THE ECONOMIC IMPORTANCE OF THE EPIGEAL FAUNA IN THE CORN AGRICULTURAL ECOSYSTEM IN OCNA SIBIU (SIBIU COUNTY) IN 2012

Iuliana ANTONIE

"Lucian Blaga" University, The Faculty of Agricultural Sciences, Food Industry and the Protection of the Environment, Sibiu, 7-9 Dr. Ion Raţiu, 550012, Sibiu, Romania, Phone: +40 269 211338, Fax: + 40 269 213381, E-mail: iuliana_antonie@yahoo.com

Corresponding author: iuliana_antonie@yahoo.com

Abstract

The arthropods have the role of biologic indicators, of diagnosis instruments regarding the negative effects of the human intervention in the structure and functioning of the agricultural ecosystems. Their presence or absence, the growth or lowering of their populations in the agricultural ecosystems can indicate the state of health of these systems and their good functioning. The aim of our researches is establishing the fauna structure of the community of arthropods at the soil level in the corn agricultural ecosystem in Ocna Sibiu, (Sibiu County); the characterization of the communities of invertebrates under the aspect of numerical abundance and of that of relative one; framing the entomologic fauna into a beneficial or pest one, the identification of the culture technology for the researched area. Regarding the applied researched methods, they were as follows: the using of pitfall traps (Barber traps) that were at the level of the soil as well as the method of direct collecting of the fauna from the plants. As a result of our researches there was established the taxonomic and quantitative structure of the collected fauna through the methods of pitfall traps (Barber traps) in Ocna Sibiu during 2012; there were identified 13 taxonomic groups. From the total of the collected agricultural fauna gathered by the help of pitfall traps in Ocna Sibiu locality there were identified 51 species of insects from which 30 were beneficial ones and 21 pest ones, the dominating order being Coleopteron with 35 species. The establishment of the group of arthropods, especially of the entomologic fauna, beneficial or pest indicates the equilibrium or the disequilibrium state from the researched corn three field systems. The ratio between the two types of fauna permits choosing the optimum method of maintaining the equilibrium between the species of the system and applying those measures of management in order to affect less the system in its assembly and to determine the growth of the production.

Key words**:** *biodiversity, corn, fauna*

INTRODUCTION

The arthropods belong to the group of organisms best represented on the entire planet that could be met in each and every terrestrial habitat playing a major role in the evolution and maintaining of the biocoenosis [13]. The arthropods have the role of biological indicators, of diagnosis instruments regarding the negative effects of the human interventions in the structure or functioning of the agricultural ecosystems. Their presence or their absence, the growth or lowering of their populations in the agricultural ecosystems indicates the state of health of the system and good functioning [3]. Among all the arthropods the insects represent the base in the majority of the trophic chains. These pollinate more than a quarter of a million of flower species; without these pollinators it could be lost a third of the entire food. These insects recycle the nutrients enriching the soils and decomposing the animal rests and dejections. The pest species are to be blamed for the enormous annual economic losses but the losses are less than the benefits bring by the beneficial species. [13].

Our researches studied the corn because this represents the main field culture in Romania, with surfaces in all the areas of the country. Researches regarding the invertebrates from corn, mainly the entomologic fauna were concretized in our country in a serial of studies from which some regarded the invasive species *Diabrotica virgifera virgifera* (the western worm of the ground roots), [1, 2, 5, 7, 8, 9, 17, and 23]. The other studies reflect the interest for *Tanymecus dilaticollis*,

[12, and 22]. Few researches in our country were interested on knowing the fauna structure composing of a group of insects in the corn agricultural ecosystem [4, 6, 10, 14, 18, 19, 20, 24, and 25].
The aim of our researches was in sampling and identifying the biodiversity of the epigeal fauna that was present in the corn culture in Ocna Sibiu locality, Sibiu County. Our option for this agricultural ecosystem was determinate by the fact that this raised two major problems: the mono culture that is practiced in the area and the apparition of the of the invasive species *Diabrotica virgifera virgifera* L. (the western worm of the corn roots). In this way as a result of this study there were identified a series of pest insects but also beneficial ones for the corn culture.

MATERIALS AND METHODS

The interval when the researches took place was April – October 2012;
The locality where the researches took place was Ocna Sibiu (Sibiu County). The shape of the plot taken into study was a rectangular one having a surface of 2 hectares;
The main sampling method in the researched area was that of pitfall traps at the level of the soil, in which as an attractant and a preserver was used a solution of formaldehyde 4% (Photo 1). There were put 10 pitfall traps (Photo 2). The sampling time for such a trap was 48 hours from the moment of installing. The biologic material was collected in special little bottles, in alcohol, one for each and every sample; then followed the study in the lab.


Photo 1. Barber trap (original photo)

Photo 2. Ocna Sibiu locality – Example of Barber traps arrangement

There was also applied the method of direct collecting. This was a qualitative one that allowed us a more thorough analysis regarding the interrelations hostess plant – phyitophaguos insect or between the latter one and other beneficial species in the bioecenosis;
The technology used was of an intensive type (Photo 3);


Photo 3. Ocna Sibiului- agricultural technology of intensive type (original photo)

The determination of the collected material: the phase in the lab had some operations such as unpacking the samples, labeling and numbering them and then followed by their determination. For this last operation there were used a number of determiners [15, 16, 21 and 26]. For the raw sorting of the biologic material was used a magnifying glass IOR 1983 and for determination and getting photos the binocular magnifying glass Olympus SZ 61;
There were done two categories of analysis: quantitative analysis of the collected fauna

through the method of pitfall traps and quantitative analysis with the identification of the beneficial and pest species in the researched corn area.

RESULTS AND DISCUSSIONS

Nowadays in Romania there are cultivated with corn an area of approximate 3 million hectares every year, illustrating the importance of this culture for the Romanian farmers [11].

Regarding the surface cultivated with corn in Ocna Sibiu locality, where the researches took place, it came out that it grew from 209 till 2012 from 962 hectares to 1,720 hectares. The technology of applied culture in the area is one of intensive kind. The technologic elements were as follows:

-Preparing of the field was done by: ploughing, disking, crushing and sowing;
-The previous plant was wheat;
-The sort used was Pioneer P9025;
-The sowing took place on 18th April 2012;
-The density at sowing was of 66,000 plants/hectare;
-The fertilizing process was done with N P K 15/15/15 (300kg/hectare);
-The chemical treatments were applied at the seed (Semnal 500 FS, Nuprid AL 600 FS, for the soil pests – 10l/hectare);
-The agricultural system was not irrigated.

Taking into consideration its tropical and subtropical origin, for the corn the humidity represents one of the command factors of first importance for the growing as, especially for accomplishing the values of optimum productivity.

The area that was chosen for experiment was affected during the last years but especially during the year of the experiment (2012) by a systematic, profound drought that influenced negatively, in the highest degree the cereal production in the entire Sibiu County. The structure of the biodiversity of the epigeal fauna was strongly and directly influenced by this command factor.

In table 1 there is presented the taxonomic structure as well as the quantitative one of the collected fauna through the pitfall traps (Barber traps) method, in the Ocna Sibiu agricultural ecosystem during 2012.

Table 1. The taxonomic and quantitative structure of the collected fauna through the pitfall traps in Ocna Sibiu locality, Sibiu County during 2012

Order/subclass	Numerical Abundance	Relative Abundance
Isopoda	1	0,12
Scutigeromorpha	1	0,12
Scolopendromorpha	1	0,12
Acari	144	17,33
Araneae	49	5,89
Collembola	301	36,23
Orthoptera	4	0,48
Thysanoptera	12	1,45
Heteroptera	33	3,97
Homoptera	8	0,97
Hymenoptera	102	12,27
Coleoptera	128	15,40
Diptera	47	5,65
Total	**831**	**100,00**

The samplings collected from the corn field (applying an agricultural technology of intensive type) comprised invertebrates from 13 taxonomic groups: *Isopoda, Scutigeromorpha, Scolopendromorpha, Acari, Araneae, Collembola, Orthoptera, Thysanoptera, Heteroptera, Homoptera, Hymenoptera, Coleoptera*, *Diptera* (Table 2).

The taxonomic groups with the highest numerical abundance were: Collembola with 301 samples (36.23%), Acari with 144 samples (17.33%), Coleopteron with 128 samples (15.40%), Hymenoptera with 102 samples (12.27%). The taxonomic group with the lowest numerical abundance was: Orthoptera with 4 samples (0.48%) and Homoptera with 8 samples (0.97%).

The structure of the great groups on the experimental fields in Ocna Sibiu emphasized the dominant position of class Insecta with 634 samples (76.42%) comparing to other groups of Arthropod with only 196 samples (23.58%).

From the total of collected agricultural fauna with the help of pitfall traps there were identified 52 species of insects from which 31 beneficial ones (Table 2) and 21 pest ones (Table 3). The dominant order of insects was Coleopteron with 35 species.

Table 2. Species of beneficial collected insects in the agricultural ecosystem in Ocna Sibiu with the help of pitfall traps in 2012

Nr	Species	Order	Family
1	*Sminthurus viridis* L.	Collembola	Sminthuridae
2	*Entomobryia arborea* Tullb.	Collembola	Entomobryidae
3	*Bourletiella pruinosa* Tullb.	Collembola	Sminthuridae
4	*Ceratophysella bengtssoni* Agren	Collembola	Hypogastruridae
5	*Formica rufa* L.	Hymenoptera	Formicidae
6	*Lasius flavus* L.	Hymenoptera	Formicidae
7	*Myrmica rubra* L.	Hymenoptera	Formicidae
8	*Oxytelus nitidulus* Grav.	Coleoptera	Staphylinidae
9	*Mycetoporus Mulsanti* Gangb.	Coleoptera	Staphylinidae
10	*Mycetoporus clavicornis* Steph.	Coleoptera	Staphylinidae
11	*Trogophloeus rivularis* Strm.	Coleoptera	Staphylinidae
12	*Cantharis fusca* L.	Coleoptera	Cantharidae
13	*Anthrenus verbasci* L.	Coleoptera	Dermestidae
14	*Amara eurynota* Panz	Coleoptera	Carabidae
15	*Idiochroma dorsalis* Pontopp.	Coleoptera	Carabidae
16	*Anchus obscurus* Herbst.	Coleoptera	Carabidae
17	*Nebria Gyllenhali* Schönch.	Coleoptera	Carabidae
18	*Microlestes maurus* Strm.	Coleoptera	Carabidae
19	*Poecilus cupreus* L.	Coleoptera	Carabidae
20	*Harpalus distinguendus* Duft.	Coleoptera	Carabidae
21	*Harpalus pubescens* Müll.	Coleoptera	Carabidae
22	*Brachynus explodens* Duft.	Coleoptera	Carabidae
23	*Brachynus psophia* Serv.	Coleoptera	Carabidae
24	*Brachynus crepitans* L.	Coleoptera	Carabidae
25	*Malachius bipustulatus* L.	Coleoptera	Melyridae
26	*Dasytes niger* L.	Coleoptera	Melyridae
27	*Dasytes obscurus* Gyll.	Coleoptera	Melyridae
28	*Cryptocephalus fulvus* Goeze	Coleoptera	Chrysomelidae
29	*Cicindela campestris* L.	Coleoptera	Cicindelidae
30	*Calliphora vicina* Rob.& Desv.	Diptera	Calliphoridae
31	*Sarcophaga carnaria* L.	Diptera	Sarcophagidae

Table 3. Species of pest collected insects in the agricultural ecosystem in Ocna Sibiu with the help of pitfall traps during 2012

Nr	Species	Order	Family
1	*Cacophsylla melanoneura* Först.	Homoptera	Psyllidae
2	*Melanogryllus desertus* Pall.,	Orthoptera	Gryllidae
3	*Adelphocoris lineolatus* Goeze	Heteroptera	Miridae
4	*Adelphocoris seticornis* F.,	Heteroptera	Miridae
5	*Opatrum sabulosum* L.	Coleoptera	Tenebrionidae
6	*Agriotes segetum Den.& Schiff .*	Coleoptera	Elateridae
7	*Melanotus crassicollis* Er.	Coleoptera	Elateridae
8	*Tanymecus dilaticollis* Gyll.	Coleoptera	Curculionidae
9	*Meligethes coracinus* Strm.	Coleoptera	Nitidulidae
10	*Diabrotica virgifera virgifera* Le Conte	Coleoptera	Chrysomelidae
11	*Chaetocnema tibialis* Illig.	Coleoptera	Chrysomelidae
12	*Phyllotreta vittula* Redtb.	Coleoptera	Chrysomelidae
13	*Phyllotreta nemorum* L.	Coleoptera	Chrysomelidae
14	*Aphthona herbigrada* Crt.	Coleoptera	Chrysomelidae
15	*Podagrica malvae* Illig.	Coleoptera	Chrysomelidae
16	*Haltica palustris* Weise	Coleoptera	Chrysomelidae
17	*Anoxia villosa* L.	Coleoptera	Scarabaeidae
18	*Oxythyrea funesta* Poda	Coleoptera	Scarabaeidae
19	*Meromyza nigriventris* Macq.	Diptera	Agromyzidae
20	*Agrotis segetum* Den. & Schiff	Lepidoptera	Noctuidae
21	*Pyrrochoris apterus L.*	Heteroptera	Pyrrochoridae

An indicator of great importance for the state of the structural and functional parameters of a biocoenosis belonging to the inhabited eco systems, with often enters modifications in the system (input) is represented by the ratio beneficial fauna -pest fauna. The ratio between these two types of fauna allows choosing the optimum method of keeping the equilibrium between the species of the system and applying those methods of management which would affect as little as possible the system in its assembly and to determine the growth of the production. In the case of our researches the ratio is favorable to the beneficial species of insects (Table 2, Table 3).

CONCLUSIONS

The identifies species in the researched agricultural ecosystem were grouped in beneficial species (30) and pest species (21) as a result of emphasizing the way of live and the ecologic functions in the trophic chains that are fulfilled by each and every species.

The ratio beneficial fauna/pest fauna indicates the equilibrium or non equilibrium state in the researched corn field and imposes applying the measures of amelioration that are adequate for a lasting economic development in the benefit and for the welfare of the entire community.

The ratio beneficial fauna/pest fauna (BF/PF) was positive at the field in Ocna Sibiu, this being in the favor of the beneficial fauna. This indicates the maintaining of the structural and functional parameters of the agricultural ecosystem at values above the level of resilience.

In the agricultural ecosystem Ocna Sibiu the impact of the technology of intensive applied type upon the biodiversity of the epigeal fauna was amplified by the maintaining at high values of pressure of the natural command factor and namely the excessive and persisting drought during the last 3 years, correlated with the not irrigate system in which was cultivated the corn in the experimental plot.

The samplings collected with the pitfall traps method comprised organisms from 13

taxonomic groups: *Araneae, Collembola, Orthoptera, Thysanoptera, Heteroptera, Homoptera, Hymenoptera, Coleoptera, and Diptera*. The taxonomic groups with the highest numerical abundance were: Collembola, Acari, Coleopteron and Hymenoptera. The taxonomic groups with the lowest numerical abundance were: Isopoda, Scutigeromorpga, and Scolopendromorpha each with a sample, followed by Orthoptera and Homoptera.

From the arthropods the highest number of 634 belongs to the insects, their dominant order being Coleopteron with 35 species.

REFERENCES

[1]Aldea, Livia, 2005, Diseminarea populaţiilor de Diabrotica virgifera Le Conte în România în perioada 1997-1999, Lucrările celei de-a 7-a Conferinţe Naţionale pentru Protecţia Mediului prin Biotehnologii şi a celei de-a 4-a Conferinţă Naţională de Ecosanogeneză cu participre Internaţională, Fascicola 2, Ecosanogeneză şi Biologie, Univ. Transilvania, Braşov, 748-749.

[2]Antonie Iuliana, 2009, Specii invazive, în: Biodiversitatea Arpăşelului o bogăţie a tuturor, Editura Alma Mater, Sibiu.

[3]Antonie Iuliana, 2013, Cercetări asupra entomofaunei din solul culturii de porumb, Ed. Universităţii „Lucian Blaga" din Sibiu, 106-108.

[4] Antonie Iuliana, Iuliana, Manole T., Stanciu Mirela, 2012, The Impact of the Agricultural Technology upon the Biodiversity of the Arthropods Present in the Corn Culture in Sibiu County, Journal of Horticulture, Forest and Biotechnology, 16(3): 2-12.

[5] Antonie Iuliana, Neagu Maria, 2009, The check on of the species Diabrotica virgifera virgifera Le Cont in the Mureş Contry, Reserarch people and actual tassks on multidisciplinary sciences, Lorenz, Bulgaria, 1: 164-169.

[6]Antonie Iuliana, Pavel Petronela, Tănase Maria, Sand Camelia, 2012, The Indicators of the Soils and Their Importance upon the Entomologic Fauna in the Corn Culture in Copşa Mică – Axente Sever (Sibiu County), Buletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Agriculture, vol. 69 (20):177-181.

[7] Antonie, Iuliana, Spânu, Simona, 2010, Researches regarding the influence of temperature and humidity on the efectives of Diabrotica virgifera virgifela Le Conte in Sibiu county between 2001-2009, Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Agriculture, 67 (1): 310.

[8] Antonie, Iuliana, Spânu, Simona, 2010, Researches regarding the species Diabrotica virgifera virgifela Le Conte in Sibiu county, Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Agriculture, 67 (1): 12-19.

[9]Antonie, Iuliana, Stanciu, Mirela-Aurora, Sand, Camelia, Blaj, R., 2012, Proposals of technological sequences in the integrated management of the species *Diabrotica virgifera virgifera* Le Conte In Sibiu County, Lucrări Ştiinţifice, Seria I, 14 (2): 313-322,Timişoara.

[10]Antonie, Iuliana, Teodorescu, Irina, 2005, Industrial emission and pesticides impact on agrobiocenosis biodiversity, Entomologische Nachrichten und Berichte, 81-90.

[11]Berca, M., 2006, Planificarea de mediu si gestiunea resurselor naturale, Ed. Ceres, Bucuresti.

[12]Caragea, Ioana, 2007, Consideraţii ecologice asupra ariei de dăunare a speciei *Tanymecus dilaticollis* Gzll. în judeţul Ilfov, An. ICCP Bucureşti, 34: 29-37.

[13] Ciolpan O., 2011, Practicum de entomologie, Ed. Ars Docendi, Bucuresti, 279 pag.

[14]Costea, Georgeta, Ciochia, V., Mărgărit, Gr., 2007, Structura faunei utile şi fitofage din cultura de porumb, zona Bucureşti şi imprejurimi, anul 2005, Lucrările celei de-a 8–a Conferinţe Naţionale pentru Protecţia Mediului prin Biotehnologii şi a celei de-a 5-a Conferinţă Naţională de Ecosanogeneză cu participre Internaţională, Fascicola I, Agricultura şi Silvicultura, Univ. Transilvania, Braşov, 230-235.

[15] Freude, H., Harde, K. W., Lohse, G. A., 1983, Die Käfer Mitteleuropas, Band 1-11, Goecke & Evers (eds) Verlag, Krefeld, Germany.

[16] Ganglbauer, L., 1892, Die Käfer von Mitteleuropa, Band I – Familienreihe Caraboidea, Druck und Verlag von Carl Gerold's Sohn, Wien, 556 pag.

[17] Groza, Ioana, 2000, Cercetări privind cresterea si dezvoltarea speciei Diabrotica virgifera virgifera Le Conte, în conditii de laborator si câmp, în partea de vest a tării, USAMV Timisoara, 32:613-619.

[18] Iamandei, Maria, Manole, T., Gogoaşă, C., 1996, Contribuţii la studiul structurii faunistice a artropodelor în cadrul sistemelor naturale şi agricole din Delta Dunării, în: Lucrările celei de-a treia Conf. Naţ. Pt. Prot. Mediului prin Metode şi Mijloace Biologice şi Biotehnice, Braşov, 123-126.

[19]Manole, T., Iamandei, Maria, Margarit, Gr., Teleman, Mariana, 1999, Fauna spectrum and spreading of insects from Elateridae (Coleoptera), A biannual publication of the Research Institute for cereals and Industrial Crops Fundulea-Romania, nr. 11-12: 59-64.

[20]Mărgărit Gr., Hondru., Trotuş Elena, Siriţianu Carmen, 1998, Cercetări asupra structurii şi abundenţei viermilor sârmă (Coleopter: Elateridae) în diferite culturi agricole din zona Secuieni-Neamţ, Probleme de Protecţia Plantelor, I.C.C.P.T Fundulea, 26(1): 33-37.

[21]Panin, S., 1951, Determinatorul coleopterelor dăunătoare şi folositoare din România, Ed. Ştiin. Did., 209 pag.

[22]Paulian, F., 1973, Contribuţii la cunoaşterea dezvoltării, ecologiei şi combaterii speciei Tanymecus

dilaticillis Gyll., Rezumatul tezei de doctorat, Institutul Agronomic "N.Bălcescu" Bucureşti.
[23]Popov C., Ciobanu Cornelia, Balint Adriana, Muresan Felicia, 2008, Cercetări privind combaterea larvelor speciei Diabrotica virgifera virgifera Le Conte prin tratamentul seminţelor de porumb, Protecţia Plantelor, AN. I.N.C.D.A. Fundulea, 76: 155-165, Bucureşti.
[24] Rosca, I., 2008, Cercetări privind managementul protectiei plantelor impotriva dăunătorilor si protejarea biodiversitatii, Teza de doctorat, USAMV Bucuresti, Facultatea de Management Inginerie Economica in Agricultura si dezvoltare Rurala. Cond. St. prof. univ. dr. Mihai Berca.
[25] Teodorescu, Irina, Vădineanu, A., Simionescu, A., 2001, Managementul capitalului natural. Studii de caz. Ed. Ars Docendi, Bucureşti, 11-95.
[26]Teodorescu, Irina, Vlad Antonie, Iuliana, 2009, Entomologie, Ed. Geea, Bucuresti, 114-127.