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PRELIMINARY STUDY ON EPIGEAL INVERTEBRATES FAUNA IN EXPERIMENTAL PEPPER CROPS AT SCDL BUZĂU, ROMANIA

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Abstract: This paper presents the species composition and abundance of epigeal invertebrate fauna collected from experimental pepper crops at the Vegetable Research and Development Station Buzău, Romania during 219-2020. The open field bell pepper Buzau 10 (2019) and Cantemir (2020) varieties were used in the experiment in five variants with two factors, diatomite (three doses) and bioinoculant Trichoderma asperellum Td85 strain. Diatomite was local from the Pătârlagele deposit (Buzău County) and antagonistic fungus was from the collection of microorganisms of Research and Development Institute for Plant Protection Bucharest. The fauna on the soil surface was collected using Barber traps, replaced every two weeks from June to October. The ecological parameters of abundance, dominance, constancy and ecological significance have been calculated using specific formulas. Specific attributes of the two products, diatomite and bioinoculant Trichoderma, reflected on the ecological and structural characteristics of invertebrate communities.

Key words: *pepper crops, invertebrates fauna, ecological parameters, diatomite, bioinoculant Trichoderma*

INTRODUCTION

Epigeal organisms are considered to be micro- and macroinvertebrates that live on the surface and upper layers of the soil, on litter layer and O horizon (Coyle et. al, 2017). Invertebrates contribute to soil formation through the conversion of organic matter on the soil surface into soil, thus supporting functions of the ecosystems (Karuppaiah et al., 2012; Sangle et al., 2015). Soil invertebrate and microorganism communities are influenced by vegetation through the abundance, quality and distribution of organic resources that it produces in both space and time (Giller et al., 1996). According to Bardgett & Cook (1998), fauna is usually larger on the surface of the soil than in lower horizons. Larger invertebrates are adapted to an open and dry habitat and generally predominate the surface soil and litter layer (Bardgett & Cook, 1998).

In the last years, studies on epigeal fauna in agriculture crops represented an important concern for many specialists in Romania. Data on various parameters that characterize epigeal fauna in different agricultural crops were published by Manole et al. (2009), Bucur & Roșca (2011), Bușmachiu & Bacal (2012) and Rotari (2012) for pepper, eggplant and tomato crops, Mocanu et al. (2017) for wheat crops, Varvara (2007, 2016) for sugar beet, sunflower, maize, potato crops, apple orchards and vineyards and Moise (2019) for meadow.

The aim of this study was to assess the epigeal invertebrates, harmful and useful, in experimental pepper crops under influence of treatments with diatomite and bioinoculant *Trichoderma asperellum* Td85.

MATERIALS AND METHODS

The study was carried out in the experimental field of the Vegetable Research and Development Station Buzău (VRDS Buzău), Romania (45.160611 N/26.826609 E/91m) in 2019 and 2020. The open field bell pepper (*Capsicum annuum* L.), Buzau 10 (2019) and Cantemir (2020) varieties were used in the experiment, in five variants with four repetitions each (7mp per repetition), completed randomized block method: untreated V1, three doses of diatomite V2 (52.5 g), V3 (105 g), V4 (210 g) and V5 (bioinoculant *Trichoderma asperellum* Td85 strain, 3 grams at the root of the seedling at planting in early June). The diatomite was from the Pătârlagele deposit (Buzău County) and the antagonistic fungus *Trichoderma* from the collection of microorganisms belonging to the Research and Development Institute for Plant Protection Bucharest. The diatomite was mechanically processed to obtain particles that reach sub-micron dimensions creating amorphous powders with specific properties of nanomaterials. This was used in vegetation season, as powder in the three doses set out above, on rows of plants in June, followed by treating the plants and soil with a dispersion containing diatomite particles in July. The dispersion was achieved by dissolving 83 g of carboxymethylcellulose in 10 L of water, followed by the addition of 10 g of diatomite. After homogenization, the dispersion was transformed into a gel of liquid consistency, but able to keep the diatomite particles in suspension.

To capture the epigeal arthropods fauna on the soil surface, one Barber trap per repetition was used from June to October each year. A 4% dish soap solution was used into the traps. The biological material collected at 2 weeks interval and conserved in 70% ethanol was analysed in the Entomology Laboratory of the Research and Development Institute for Plant Protection Bucharest.

The ecological parameters consisting of abundance (A), dominance (D%), constancy (C%) and ecological significance (W%) were calculated according to Baban (2006), as follows:

D% = $\frac{A \times 100}{n}$, where: A - number of individuals for a species; n - total number of individuals for all species. According to the values of this parameter, species were classified as subreceding species (D1 <1%), receding species (D2= 1-2%), subdominant species (D3= 2-5%), dominant species (D4= 5-10%) and eudominant species (D5 >10%).

C% = $\frac{ns \times 100}{n}$, where: ns - number of samples with one species; n - total number of samples. Depending on the values achieved, species were grouped as accidental (C1= 1-25%), accessory (C2= 25-50%), constant (C3= 50-75%) and euconstant (C4= 75-100%).

W% = $\frac{D \times C}{100}$, According to ecological significance, species were ranked as accidental (W1 <1%), accessory (W2= 1-5%) and characteristic (W3 >5%).

RESULTS AND DISCUSSIONS

A total of 3089 specimens were collected, of which 1455 specimens in 2019 belonging to 3 phyla and 7 classes of invertebrates and 1634 specimens in 2020 belonging to 3 phyla and 8 classes of invertebrates: Phylum: Annelida (Class: Clitellata), Mollusca (Class: Gastropoda), Arthropoda (Class: Malacostraca, Chilopoda, Arachnida, Diplopoda, Entognatha, Insecta) (Table 1). The highest values of numerical abundance had Insecta (63.5% in 2019 and 65.39% in 2020) followed by Arachnida (20.72% in 2019 and 27.82 % in 2020). Among the insects, the order Coleoptera (24.3%) followed by Diptera (23.95%) and Hemiptera (7.92%) reached the highest value in 2019, while in 2020, the orders with the

highest number of individuals were Diptera (20.25%), Coleoptera (19.03%) and Hymenoptera (15.85%).

Table 1. Taxonomic structure of invertebrates collected in pepper experiment in 2019 and 2020

	Phylum	Class	Order	Family	Genus	Species
2019	3	7	17	55	93	117
2020	3	8	16	58	104	124

From species analysis, the highest five abundances in 2019 were of *Agromyza nana* (110 specimens), *Harpalus pubescens* (76 specimens), *Poecilus cupreus* (72 specimens), *Entomobryia arborea* (70 specimens) and *Chlorops pumilionis* (67 specimens). In 2020, the most abundant species were *Formica rufa* (124 specimens), *Agromyza nana* (105 specimens), *Ceratophysella bengtssoni* (87 specimens), *Psammotettix striatus* (79 specimens), *Pseudoophonus rufipes (*76 specimens).

Results on total epigeal invertebrate fauna, pest and useful, captured in 2019 and 2020 are presented in Figures 1 and 2, and also in Tables 2 and 3. Data from each year of collection showed differences between variants, both in term of the number of specimens and in terms of the number of taxa (species, genus, family, subfamily) that form the epigean fauna.

The distribution of the fauna in 2019, on functional components harmful and useful, is presented in Figure 1 and Table 2.

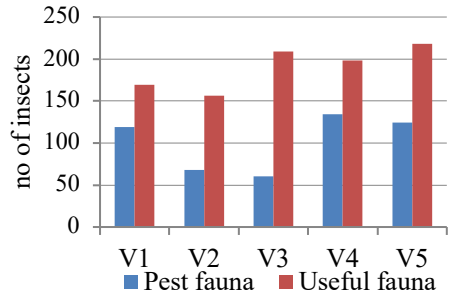

Figure 1. Graphic representation of epigean fauna in pepper field in 2019

Table 2. Total fauna and number of taxa in pepper variants in 2019

Variant		V1	V2	V3	V4	V5
Total fauna		288	224	269	332	342
Pest Fauna (%)		41. 4	30.35	22.30	40.36	36.25
Useful Fauna (%)		58.6	69.64	77.69	59.63	63.74
No of taxa (species, genera)	PF	30	19	13	28	23
	UF	47	40	35	38	39

Compared to the control variant V1, the total number of fauna (harmful and useful) was lower in variants V2 and V3 in which diatomite was applied at a doses of 52.5g and 105g respectively, and higher in V4 in which 210g diatomite was applied and in V5 in which *T. asperellum* Td85 was used at planting (Figure 1).

At the level of variants with increasing doses of diatomite, the pest fauna (PF), compared to control V1, was 1.75 times lower in V2 and 1.98 times lower in V3, and 1.12 times higher in V4. The known insecticidal action of diatomite was observed only in two of the three variants.

In variant V5 in which *T. asperellum* Td85 was used, both categories of fauna, harmful and useful, were numerically superior to the control V1. This situation can be attributed to the fact that the fungus after application created conditions with favourable effects for the activity of the fauna at ground level.

In all variants of the experiment, the useful fauna (UF) was superior to the pest one, the biggest differences being in V3, V2 and V5 (Table 2). Both PF and UF were represented by a different number of taxa in variants. The number of UF taxa was higher than PF in all variants, the biggest differences being in V3 and V5.

The distribution of the fauna in 2020, on functional components harmful and useful, is presented in Figure 2 and Table 3.

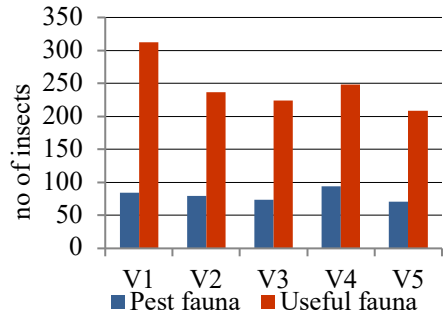

Figure 2. Graphic representation of epigean fauna in pepper field in 2020

Table 3. Total fauna and number of taxa in pepper variants in 2020

Variant		V1	V2	V3	V4	V5
Total fauna, dc:		396	318	298	342	280
Pest Fauna (%)		21.21	25.47	24.83	27.49	25.36
Useful Fauna (%)		78.79	74.53	75.17	72.51	74.64
No of taxa (species, genera)	P F	16	21	21	18	16
	UF	34	36	44	50	41

In contrast to the untreated variant V1, the total fauna (pest and useful) was lower in all other variants. Among the variants with treatments, the total fauna was lower in V5 in which Td85 was used, 3 grams/plant at root during planting, in V3 and V2 in which 105g and 52.5 g of diatomite was applied respectively (Figure 2).

The useful fauna had a situation similar with the total fauna, this being 1.32 times lower in V2, 1.39 times lower in V3, 1.26 times lower in V4 and 1.5 times lower in V5 compared to the control variant. The reduction effect in variants with diatomite could be attributed to the known insecticidal action of the administered diatomite. The reduction in fauna in V5 was unpredictable.

The pest fauna (phytophagous) had lower values in variants V5 (Td85), V3 (diatomite 105 g/variant) and V2 (diatomite 52.5 g/variant) compared to the untreated control variant. In V4 (diatomite 210 g/variant), the pest fauna exceeded that of the control variant 1.2 times (Figure 2).

At the level of variants with diatomite, most specimens (total, pest, useful) were in variant with the highest dose of diatomite. In all variants, the useful fauna was superior to the pest fauna, the UF/PF ratio being approximately 3:1 (Table 3). Both PF and UF were represented by a different number of taxa in variants. The number of UF taxa was higher than the PF taxa in all variants (Table 3) confirming a greater richness of zoophagous species than phytophagous pest species.

The ecological parameters represented by abundance (A), dominance (D%), constancy (C%) and ecological significance (W%) calculated for pest and useful faunistic components for the two years study are presented in Tables 4, 5, 6 and 7.

Table 4. List of the identified taxa and ecological parameters for pest fauna in 2019

Taxa of pest fauna 2019	V1				V2				V3				V4				V5			
	A	D(%)	C(%)	W(%)	A	D(%)	C(%)	W(%)	A	D(%)	C(%)	W(%)	A	D(%)	C(%)	W (%)	A	D(%)	C(%)	W(%)
Acari	4	3,37	33,34	1,12	0	0	0	0	0	0	0	0	3	2,24	16,67	0,37	2	1,62	16,67	0,27
Acyrtosiphon pisum Har.	0	0	0	0	0	0	0	0	0	0	0	0	2	1,50	16,67	0,25	1	0,81	16,67	0,13
Gastropoda	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	1	0,75	16,67	0,12	0	0	0	0
Aphis fabae Scop.	3	2,53	33,34	0,84	3	4,42	33,34	1,47	2	3,34	16,67	0,55	1	0,75	16,67	0,12	2	1,62	33,34	0,54
Agromyza flaviceps Fall.	8	6,73	83,34	5,60	6	8,83	33,34	2,94	1	1,67	16,67	0,27	8	5,97	33,34	1,99	12	9,68	50,00	4,84
Agromyza nana Meig.	30	25,21	50,00	12,60	15	22,06	100	22,06	17	28,34	50,00	14,17	30	22,39	83,34	18,65	18	14,52	66,67	9,68
Aphtona pygmaea Kutsch.	0	0	0	0	0	0	0	0	0	0	0	0	2	1,50	16,67	0,25	0	0	0	0
Attagenus pellio L.	0	0	0	0	0	0	0	0	0	0	0	0	1	0,75	16,67	0,12	1	0,81	16,67	0,13
Austroagallia sinuata Muls. et Rey	1	0,84	16,67	0,14	2	2,95	16,67	0,49	1	1,67	16,67	0,27	3	2,24	33,34	0,74	3	2,42	16,67	0,40
Chaetocnema tibialis Illig.	2	1,68	16,67	0,28	0	0	0	0	0	0	0	0	1	0,75	16,67	0,12	0	0	0	0
Chlorops pumilionis Bjerk.	10	8,41	16,67	1,40	2	2,95	16,67	0,49	0	0	0	0	22	16,42	16,67	2,73	33	26,62	50,00	13,31
Cicadella viridis L.	3	2,53	16,67	0,42	2	2,95	33,34	0,98	0	0	0	0	0	0	0	0	2	1,62	16,67	0,27
Delia antiqua Meig.	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diptera – Chloropidae	3	2,53	33,34	0,84	4	5,89	33,34	1,96	0	0	0	0	4	2,99	16,67	0,49	1	0,81	16,67	0,13
Diptera – Muscidae	26	21,85	66,67	14,56	21	30,89	50,00	15,44	27	45,00	66,67	30,00	10	7,47	83,34	6,22	14	11,29	50,00	5,64
Diptera - Sciaridae	5	4,21	50,00	2,10	3	4,42	33,34	1,47	2	3,34	33,34	1,11	11	8,21	66,67	5,47	9	7,26	50,00	3,63
Diptera – Simuliidae- Simulium sp.	1	0,84	16,67	0,14	0	0	0	0	2	3,34	16,67	0,55	3	2,24	16,67	0,37	0	0	0	0
Diptera - Trypetidae	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dolycoris baccarum L.	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elachiptera cornuta Fall.	2	1,68	33,34	0,56	1	1,47	16,67	0,24	0	0	0	0	2	1,50	16,67	0,25	6	4,84	33,34	1,61
Empoasca solani Curt.	0	0	0	0	0	0	0	0	0	0	0	0	6	4,48	33,34	1,49	0	0	0	0
Halticus apterus L.	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haltica oleracea L.	2	1,68	16,67	0,28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicella candicans Pfeiff.	2	1,68	16,67	0,28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemitarsonemus latus Banks.	1	0,84	16,67	0,14	1	1,47	16,67	0,24	0	0	0	0	4	2,99	33,34	0,99	0	0	0	0
Hippelates plebejus Loew.	0	0	0	0	0	0	0	0	0	0	0	0	1	0,75	16,67	0,12	0	0	0	0
Kakothrips robustus Uzel	1	0,84	16,67	0,14	1	1,47	16,67	0,24	0	0	0	0	0	0	0	0	0	0	0	0
Lepidoptera	0	0	0	0	0	0	0	0	1	1,67	16,67	0,27	0	0	0	0	0	0	0	0
Limotettix striola Fall.	2	1,68	33,34	0,56	0	0	0	0	2	3,34	16,67	0,55	1	0,75	16,67	0,12	5	4,04	16,67	0,67
Lygus pratensis	0	0	0	0	1	1,47	16,67	0,24	0	0	0	0	1	0,75	16,67	0,12	1	0,81	16,67	0,13
Longitarsus luridus Scop.	0	0	0	0	1	1,47	16,67	0,24	0	0	0	0	0	0	0	0	0	0	0	0
Longitarsus pratensis Panz.	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lucilia sericata Meig.	0	0	0	0	0	0	0	0	1	1,67	16,67	0,27	2	1,50	16,67	0,25	1	0,81	16,67	0,13
Macrosiphum gei Koch.	0	0	0	0	1	1,47	16,67	0,24	0	0	0	0	4	2,99	16,67	0,49	2	1,62	16,67	0,27
Meromyza nigriventris Macq.	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	2	1,50	16,67	0,25	2	1,62	16,67	0,27
Mythimna l-album L.	0	0	0	0	0	0	0	0	0	0	0	0	1	0,75	16,67	0,25	0	0	0	0
Orthocephalus coriaceus F.	0	0	0	0	0	0	0	0	1	1,67	16,67	0,27	1	0,75	16,67	0,25	1	0,81	16,67	0,13
Phyllotreta atra F.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1,62	16,67	0,27
Phyllotreta vittula Redtb.	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	2	1,50	33,34	0,50	0	0	0	0
Phytomyza lonicerae Rob.-Desv.	1	0,84	16,67	0,14	1	1,47	16,67	0,24	0	0	0	0	0	0	0	0	0	0	0	0
Psammotettix striatus L.	1	0,84	16,67	0,14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psylloides chrysocephala L.	1	0,84	16,67	0,14	1	1,47	16,67	0,24	2	3,34	33,34	1,11	4	2,99	50,00	1,49	0	0	0	0
Rhinoncus pericarpius L.	2	1,68	16,67	0,28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scatophaga stercoraria L.	0	0	0	0	0	0	0	0	1	1,67	16,67	0,27	1	0,75	16,67	0,25	0	0	0	0
Tingis reticulata Herr-Scaff.	0	0	0	0	1	1,47	16,67	0,24	0	0	0	0	0	0	0	0	0	0	0	0

Tipula oleracea L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2,42	16,67	0,40
Tipula paludosa	0	0	0	0	1	1,47	16,67	0,24	0	0	0	0	0	0	0	0	1	0,81	16,67	0,13
Xanthocrambus saxonellus Zinck.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1,62	16,67	0,27

Table 5. List of the identified taxa and ecological parameters for useful fauna in 2019

Taxa of useful fauna	**V1**				**V2**				**V3**				**V4**				**V5**			
2019	**A**	**D(%)**	**C(%)**	**W(%)**	**A**	**D(%)**	**C(%)**	**W(%)**	**A**	**D(%)**	**C(%)**	**W(%)**	**A**	**D(%)**	**C(%)**	**W(%)**	**A**	**D(%)**	**C(%)**	**W(%)**
Acupalpus elegans Dej.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	2	1,01	33,34	0,33	0	0	0	0
Aleochara moerens Gyll.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	1	0,46	16,67	0,07
Aleochara ruficornis Grav.	0	0	0	0	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Aleochara laevigata Gyll.	1	0,60	16,67	0,10	1	0,65	16,67	0,10	0	0	0	0	1	0,51	16,67	0,08	0	0	0	0
Allolobophora caliginosa Sav.	0	0	0	0	0	0	0	0	0	0	0	0	2	1,01	16,67	0,16	0	0	0	0
Araneae	40	23,67	83,34	19,72	37	23,72	83,34	19,76	57	27,28	83,34	22,73	66	33,34	100,0	33,34	56	25,69	83,34	21,41
Apis melifera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,46	16,67	0,07
Anthelephila cyanea Hope	0	0	0	0	1	0,65	16,67	0,10	1	0,48	16,67	0,08	3	1,52	33,34	0,50	0	0	0	0
Anthicus floralis L.	5	2,96	50,00	1,48	1	0,65	16,67	0,10	0	0	0	0	1	0,51	16,67	0,08	0	0	0	0
Anthicus (Endomia)melanocephalus Con.	1	0,60	16,67	0,10	1	0,65	16,67	0,10	0	0	0	0	1	0,51	16,67	0,08	1	0,46	16,67	0,07
Amalorrhynchus melanarius Steph.	2	1,19	16,67	0,19	0	0	0	0	0	0	0	0	0	0	0	0	1	0,46	16,67	0,07
Amara crenata Dej.	0	0	0	0	0	0	0	0	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0
Amara apricaria Payk.	3	1,78	16,67	0,29	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Anthocoris nemorumL.	8	4,74	33,34	1,58	1	0,65	16,67	0,10	3	1,44	33,34	0,48	12	6,06	50,00	3,03	9	4,13	33,34	1,37
Aporrrectodea caliginosa Sav.	0	0	0	0	0	0	0	0	2	0,96	16,67	0,16	3	1,52	16,67	0,25	1	0,46	16,67	0,07
Bembidion assimile Gyll.	1	0,60	16,67	0,10	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Bembidion properans Steph.	0	0	0	0	0	0	0	0	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0
Blaniulus guttulatus Bosc.	1	0,60	16,67	0,10	4	2,57	16,67	0,42	2	0,96	16,67	0,16	2	1,01	16,67	0,16	4	1,84	16,67	0,30
Cartodere ruficollis Marsh.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Charopus pallipes Oliv.	0	0	0	0	0	0	0	0	0	0	0	0	1	0,51	16,67	0,08	0	0	0	0
Chilopora rubicunda Er.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,46	16,67	0,07
Chromatoiulus unilineatus Koch.	0	0	0	0	0	0	0	0	3	1,44	33,34	0,48	4	2,02	16,67	0,33	3	1,38	16,67	0,23
Chrysoperla carnea L.	0	0	0	0	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Coccinella 5-punctata L.	1	0,60	16,67	0,10	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	2	0,92	16,67	0,15
Coccinella 7-punctata L.	0	0	0	0	0	0	0	0	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0
Corticaria longicollis Herbst.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corticarina fulvipes Com.	0	0	0	0	0	0	0	0	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0
Corticarina gibbosa Herbst.	1	0,60	16,67	0,10	0	0	0	0	1	0,48	16,67	0,08	1	0,51	16,67	0,08	0	0	0	0
Corticarina truncatella Mnnh.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	2	1,01	16,67	0,16	0	0	0	0
Diptera – Dolichopodidae	0	0	0	0	0	0	0	0	4	1,92	16,67	0,32	5	2,53	16,67	0,42	3	1,38	33,34	0,46
Dolichovespula saxonica F.	2	1,19	16,67	0,19	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Drasterius bimaculatus Rossi	1	0,60	16,67	0,10	1	0,65	16,67	0,10	3	1,44	33,34	0,48	0	0	0	0	3	1,38	16,67	0,23
Empis livada L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0,92	16,67	0,15
Entomobryia arborea Tullb.	1	0,60	16,67	0,10	0	0	0	0	24	11,49	16,67	1,91	23	11,62	16,67	1,93	22	10,10	33,34	3,36
Entomobrya multifasciata Tullb.	0	0	0	0	10	6,41	16,67	1,06	0	0	0	0	0	0	0	0	0	0	0	0
Formica rufa L.	2	1,19	16,67	0,19	3	1,93	50,00	0,96	3	1,44	50,00	0,72	1	0,51	16,67	0,08	6	2,76	33,34	0,92
Geocoris grylloides L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,46	16,67	0,07
Halictus maculatus Smith.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harpalus aeneus F.	1	0,60	16,67	0,10	1	0,65	16,67	0,10	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0
Harpalus calceatus Duft.	0	0	0	0	0	0	0	0	0	0	0	0	1	0,51	16,67	0,08	2	0,92	16,67	0,15
Harpalus distinguendus Duft.	4	2,37	50,00	1,18	2	1,29	33,34	0,43	11	5,27	50,00	2,63	3	1,52	33,34	0,50	6	2,76	33,34	0,92
Harpalus griseus Panz.	4	2,37	16,67	0,39	4	2,57	16,67	0,42	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0

Hemerobius humulinus L.	1	0,60	16,67	0,10	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Hymenoptera - Braconidae	1	0,60	16,67	0,10	0	0	0	0	1	0,48	16,67	0,08	3	1,52	50,00	0,76	1	0,46	16,67	0,07
Hymenoptera-Ichneumonidae	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenoptera-Scelionidae	1	0,60	16,67	0,10	1	0,65	16,67	0,10	0	0	0	0	5	2,53	33,34	0,84	4	1,84	50,00	0,92
Ichneumon sp.	0	0	0	0	2	1,29	16,67	0,21	0	0	0	0	1	0,51	16,67	0,08	0	0	0	0
Ischnopoda atra Grav.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lasius flavus F.	0	0	0	0	2	1,29	16,67	0,21	0	0	0	0	0	0	0	0	0	0	0	0
Lasius fuliginosus Latr.	0	0	0	0	0	0	0	0	0	0	0	0	5	2,53	33,34	0,84	3	1,38	33,34	0,46
Lasius niger L.	0	0	0	0	0	0	0	0	0	0	0	0	1	0,51	16,67	0,08	1	0,46	16,67	0,07
Lathrobium elongatum L.	0	0	0	0	2	1,29	16,67	0,21	0	0	0	0	0	0	0	0	0	0	0	0
Lepidocyrtus cyaneus Tullb.	0	0	0	0	0	0	0	0	1	0,48	16,67	0,08	1	0,51	16,67	0,08	2	0,92	16,67	0,15
Lithobius forficatus L.	0	0	0	0	1	0,65	16,67	0,10	2	0,96	16,67	0,16	0	0	0	0	0	0	0	0
Myrmica rubra L.	6	3,55	33,34	1,18	5	3,21	66,67	2,14	3	1,44	33,34	0,48	2	1,01	16,67	0,16	26	11,93	66,67	7,95
Malachius bipustulatus L.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nabis ferus L.	2	1,19	33,34	0,39	0	0	0	0	0	0	0	0	0	0	0	0	1	0,46	16,67	0,07
Nabis pseudoferus Remane.	1	0,60	16,67	0,10	2	1,29	16,67	0,21	2	0,96	33,34	0,32	1	0,51	16,67	0,08	1	0,46	16,67	0,07
Ocalea rivularis Mill.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,46	16,67	0,07
Ocys quinquestriatus Gyll.	0	0	0	0	0	0	0	0	2	0,96	16,67	0,16	0	0	0	0	0	0	0	0
Orius niger Wolff.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oxytelus inustus Grav.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,46	16,67	0,07
Phalangium opilio L.	12	7,10	33,34	2,36	12	7,70	33,34	2,56	4	1,92	16,67	0,32	14	7,07	50,00	3,53	4	1,84	33,34	0,61
Philonthus aerosus Kiesw.	2	1,19	16,67	0,19	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Philonthus albipes Grav.	0	0	0	0	0	0	0	0	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0
Phloeonomus monilicornis Gyll.	0	0	0	0	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Poecilus cupreus L.	10	5,92	50,00	2,96	17	10,90	50,00	5,45	29	13,88	33,34	4,62	4	2,02	50,00	1,01	12	5,51	50,00	2,75
Polydesmus complanatus L.	1	0,60	16,67	0,10	2	1,29	33,34	0,43	6	2,87	33,34	0,95	4	2,02	33,34	0,67	5	2,30	33,34	0,76
Pseudoophonus rufipes De Geer	23	13,61	83,34	11,34	11	7,06	66,67	4,70	21	10,05	83,34	8,37	7	3,54	50,0	1,77	14	6,43	83,34	5,35
Pterostichus macer Marsh.	3	1,78	16,67	0,29	4	2,57	16,67	0,42	0	0	0	0	2	1,01	16,67	0,16	1	0,46	16,67	0,07
Pterostichus niger Schall.	1	0,60	16,67	0,10	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Pterostichus nigrita F.	2	1,19	33,34	0,39	6	3,85	66,67	2,56	4	1,92	50,00	0,96	5	2,53	33,34	0,84	0	0	0	0
Pterostichus vulgaris L.	8	4,74	83,34	3,95	7	4,49	66,67	2,99	8	3,83	66,67	2,55	4	2,02	66,67	1,34	5	2,30	50,00	1,15
Sarcophaga carnaria L.	1	0,60	16,67	0,10	0	0	0	0	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0
Scelio inermis Zett.	0	0	0	0	0	0	0	0	0	0	0	0	1	0,51	16,67	0,08	0	0	0	0
Scymnus suturalis Thunbg.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1,38	16,67	0,23
Sphaerius acaroides Waltl.	0	0	0	0	1	0,65	16,67	0,10	1	0,48	16,67	0,08	1	0,51	16,67	0,08	1	0,46	16,67	0,07
Sphaerophoria fatarum Goel.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphaerophoria scripta L.	1	0,60	16,67	0,10	0	0	0	0	1	0,48	16,67	0,08	0	0	0	0	0	0	0	0
Telenomus tetratomus Thoms.	2	1,19	16,67	0,19	3	1,93	33,34	0,64	0	0	0	0	1	0,51	16,67	0,08	2	0,92	33,34	0,30
Trimorus angustipennis Kieff.	0	0	0	0	1	0,65	16,67	0,10	0	0	0	0	0	0	0	0	5	2,30	66,67	1,53
Vespula germanica	0	0	0	0	0	0	0	0	2	0,96	33,34	0,32	2	1,01	16,67	0,16	0	0	0	0
Xantholinus punctulatus Payk.	1	0,60	16,67	0,10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6. List of the identified taxa and ecological parameters for pest fauna in 2020

Taxa of pest fauna 2020	V1				V2				V3				V4				V5			
	A	D (%)	C (%)	W (%)	A	D (%)	C (%)	W (%)	A	D (%)	C (%)	W (%)	A	D (%)	C (%)	W(%)	A	D (%)	C (%)	W (%)
Adelphocoris seticornis F.	3	0.84	45.45	0.38	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	1	0.35	9.09	0.03
Agriotes lineatus L.	0	0	0	0	1	0.31	9.09	0.02	1	0.33	9.09	0.03	0	0	0	0	1	0.35	9.09	0.03
Agromyza flaviceps Foel.	6	1.68	45.45	0.76	1	0.31	9.09	0.02	1	0.33	9.09	0.03	1	0.29	9.09	0.02	0	0	0	0
Agromyza nana Meig.	7	1.96	36.36	0.71	24	7.54	63.63	4.79	18	6.04	54.54	3.29	25	7.31	72.72	5.31	24	8.57	45.45	3.89
Aphis fabae Scop.	0	0	0	0	2	0.62	18.18	0.11	2	0.67	18.18	0.12	0	0	0	0	0	0	0	0
Aphrodes bicinctus Schrank	0	0	0	0	0	0	0	0	1	0.33	9.09	0.30	0	0	0	0	0	0	0	0
Austroagallia sinuata Muls. et Rey	1	0.28	9.09	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bruchidius varius Oliv.	0	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Bryobia rubrioculus Scheut.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Cacopsylla melanoneura F.	0	0	0	0	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Chlorops pumilionis Bjerk.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Crambus perlella Scop.	0	0	0	0	1	0.31	9.09	0.02	4	1.34	36.36	0.48	0	0	0	0	0	0	0	0
Culex pipiens L.	0	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Cydnus aterrimus Forst.	0	0	0	0	2	0.62	18.18	0.11	0	0	0	0	0	0	0	0	0	0	0	0
Delia antiqua Meig.	0	0	0	0	1	0.31	9.09	0.02	0	0	0	0	0	0	0	0	0	0	0	0
Delia platura Meig.	0	0	0	0	0	0	0	0	1	0.33	9.09	0.30	0	0	0	0	0	0	0	0
Diptera-Chloropidae	0	0	0	0	1	0.31	9.09	0.02	1	0.33	9.09	0.30	4	1.17	9.09	0.10	0	0	0	0
Diptera- *Culicidae*	3	0.84	18.18	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diptera – *Muscidae*	0	0	0	0	2	0.62	18.18	0.11	0	0	0	0	2	0.58	18.18	0.10	6	2.14	9.09	0.19
Dyspessa ulula Bkh.	0	0	0	0	1	0.31	9.09	0.02	0	0	0	0	0	0	0	0	0	0	0	0
Elachiptera cornuta Fall.	0	0	0	0	5	1.57	27.27	0.42	2	0.67	18.18	0.12	6	1.75	18.18	0.31	0	0	0	0
Gryllus campestris L.	0	0	0	0	0	0	0	0	0	0	0	0	3	0.87	18.18	0.15	1	0.35	9.09	0.03
Haltica oleracea L.	2	0.56	18.18	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicella itala Linea.	0	0	0	0	0	0	0	0	0	0	0	0	2	0.58	18.18	0.10	1	0.35	9.09	0.03
Heliothrips haemorrhoidalis Bche.	0	0	0	0	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Liriomyza solani Macq.	1	0.28	9.09	0.02	10	3.14	27.27	0.85	3	1.00	27.27	0.27	13	3.80	45.45	1.72	13	4.64	36.36	1.68
Lygus pratensis L.	0	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Mamestra oleracea L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Melanogryllus desertus Pall.	0	0	0	0	1	0.31	9.09	0.02	0	0	0	0	0	0	0	0	0	0	0	0
Melanotus crassicollis Erich.	0	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Melighethes aeneus L.	1	0.28	9.09	0.02	3	0.94	18.18	0.17	2	0.67	18.18	0.12	0	0	0	0	0	0	0	0
Meromyza nigriventris Macq.	2	0.56	18.18	0.10	1	0.31	9.09	0.02	2	0.67	18.18	0.12	7	2.04	45.45	0.92	3	1.07	27.27	0.29
Musca domestica L.	0	0	0	0	3	0.94	18.18	0.17	0	0	0	0	1	0.29	9.09	0.02	1	0.35	9.09	0.03
Myzus ornatus Laing.	1	0.28	9.09	0.02	0	0	0	0	4	1.34	18.18	0.24	3	0.87	9.09	0.07	1	0.35	9.09	0.03
Phyllotreta vittula Redtb.	0	0	0	0	1	0.31	9.09	0.02	2	0.67	9.09	0.06	0	0	0	0	0	0	0	0
Phytobia cepae Hend.	0	0	0	0	2	0.62	9.09	0.05	1	0.33	9.09	0.03	5	1.46	9.09	0.13	0	0	0	0
Psammotettix alienus Dahl.	3	0.84	36.36	0.30	4	1.25	9.09	0.11	3	1.00	18.18	0.18	3	0.87	9.09	0.07	5	1.78	36.36	0.64
Psammotettix striatus L.	12	3.37	54.54	1.83	13	4.08	45.45	1.85	22	7.38	54.54	4.02	15	4.38	45.45	1.99	11	3.92	36.36	1.42
Rhinoncus pericarpius L.	1	0.28	9.09	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sitophilus granarius L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Tetranychus urticae Koch	1	0.28	9.09	0.02	2	0.62	9.09	0.05	0	0	0	0	0	0	0	0	0	0	0	0
Thrips tabaci Lind.	0	0	0	0	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0

Table 7. List of the identified taxa and and ecological parameters for useful fauna in 2020

Taxa of useful fauna 2020	V1				V2				V3				V4				V5			
	A	D (%)	C (%)	W (%)	A	D (%)	C (%)	W(%)	A	D (%)	C (%)	W(%)	A	D(%)	C(%)	W(%)	A	D(%)	C(%)	W(%)
Acupalpus dorsalis F.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Acupalpus elegans Panz.	*0*	0	0	0	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	1	0.35	9.09	0.03
Acupalpus meridianus L.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Aleochara pubenula Klug.	*2*	0.56	18.18	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anchomenus dorsalis Pontopp	*0*	0	0	0	5	1.57	9.09	0.14	0	0	0	0	0	0	0	0	0	0	0	0
Andrena cineraria Linea.	*1*	0.28	9.09	0.02	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Anthicus antherinus L.	*0*	0	0	0	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Anthicus floralis L.	*8*	2.24	54.54	1.22	5	1.57	36.36	0.57	9	3.02	45.45	1.37	10	2.92	63.63	1.85	12	4.28	36.36	1.55
Anthicus quadriguttatus Rossi	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Anthocoris nemorum L.	*0*	0	0	0	0	0	0	0	7	2.34	45.45	1.06	1	0.29	9.09	0.02	1	0.35	9.09	0.03
Apidae	*0*	0	0	0	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Aphelinus flaviventris Kurtj.	*1*	0.28	9.09	0.02	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Aphidius colemani Ver.	*0*	0	0	0	0	0	0	0	3	1.00	18.18	0.18	1	0.29	9.09	0.02	1	0.35	9.09	0.03
Aranea	*109*	30.61	100.0	30.61	81	25.47	90.91	23.15	78	26.17	100.0	26.17	69	20.17	90.90	18.33	93	33.21	81.81	27.17
Bembidion bipunctatum L.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	1	0.35	9.09	0.03
Bembidion minimum F.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.71	9.09	0.06
Bembidion properans Steph.	*0*	0	0	0	1	0.31	9.09	0.02	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Bolitobius pygmaeus F.	*1*	0.28	9.09	0.02	1	0.31	9.09	0.02	0	0	0	0	2	0.58	9.09	0.05	1	0.35	9.09	0.03
Bradycellus similis Dej.	*0*	0	0	0	1	0.31	9.09	0.02	1	0.33	9.09	0.03	2	0.58	9.09	0.05	1	0.35	9.09	0.03
Bradysia bicolor *Meig.*	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Calliphora vicina Rob. Desv.	*0*	0	0	0	1	0.31	9.09	0.02	0	0	0	0	0	0	0	0	2	0.71	9.09	0.06
Cantharis obscura L.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Carpophilus sexpustulatus F.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.71	9.09	0.06
Ceratophysella bengtssoni Agren	*16*	4.49	90.90	4.08	26	8.17	18.18	1.48	12	4.02	36.36	1.46	30	8.77	45.45	3.98	3	1.07	9.09	0.09
Cerceris arenaria L.	*0*	0	0	0	0	0	0	0	2	0.67	9.09	0.06	0	0	0	0	0	0	0	0
Conosoma littoreum L.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Corticaria crenulata Gyll.	*2*	0.56	18.18	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corticaria longicollis Zett.	*2*	0.56	18.18	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corticarina gibbosa Herbst.	*3*	0.84	18.18	0.15	1	0.31	9.09	0.02	1	0.33	9.09	0.03	1	0.29	9.09	0.02	0	0	0	0
Corticarina truncatella Mnnh.	*2*	0.56	18.18	0.10	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Cryptobium fracticorne Payk.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Dermestes mustelinus Er.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Diadromus pinplarius Wesm.	*2*	0.56	9.09	0.05	1	0.31	9.09	0.02	0	0	0	0	0	0	0	0	0	0	0	0
Diptera-Bombyliidae	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Diptera - Conopidae	*0*	0	0	0	1	0.31	9.09	0.02	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Diptera - Sciaridae	*0*	0	0	0	1	0.31	9.09	0.02	2	0.67	18.18	0.12	0	0	0	0	0	0	0	0
Diptera-Tachinidae	*3*	0.84	27.27	0.22	3	0.94	9.09	0.08	2	0.67	18.18	0.12	0	0	0	0	0	0	0	0
Drasterius bimaculatus Rossi	*0*	0	0	0	3	0.94	27.27	0.25	4	1.34	36.36	0.48	1	0.29	9.09	0.02	5	1.78	36.36	0.64
Dromius melanocephalus Dej	*2*	0.56	9.09	0.05	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Ephisternus globulus Payk.	*0*	0	0	0	1	0.31	9.09	0.02	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Entomobrya multifasciata Tullb.	*2*	0.56	18.18	0.10	1	0.31	9.09	0.02	0	0	0	0	1	0.29	9.09	0.02	1	0.35	9.09	0.03
Eugnoriste occidentalis Coq.	*5*	1.40	27.27	0.38	7	2.20	45.45	1.0	8	2.68	54.54	1.46	9	2.63	54.54	1.43	5	1.78	36.36	0.64
Exorista larvarum L.	*0*	0	0	0	0	0	0	0	0	0	0	0	4	1.17	9.09	0.10	0	0	0	0
Formica rufa L.	*25*	7.02	63.63	4.46	18	5.66	54.54	3.08	24	8.05	72.72	5.85	34	9.94	63.63	6.32	23	8.21	54.54	4.47
Gauropterus fulgidus Fr.	*0*	0	0	0	0	0	0	0	1	0.33	9.09	0.03	1	0.29	9.09	0.02	1	0.35	9.09	0.03
Geocolis grylloides L.	*0*	0	0	0	2	0.62	18.18	0.11	0	0	0	0	2	0.58	18.18	0.10	1	0.35	9.09	0.03

Halictus parallelus Say.	*0*	0	0	0	1	0.31	9.09	0.02	0	0	0	0	0	0	0	0	0	0	0	0
*Halyzia 22-punctata*L.	*0*	0	0	0	0	0	0	0	3	1.00	18.18	0.18	0	0	0	0	0	0	0	0
Harpalus distinguendus Duft.	*7*	1.96	45.45	0.89	1	0.31	9.09	0.02	3	1.00	18.18	0.18	7	2.04	27.27	0.55	0	0	0	0
Harpalus griseus Panz	*3*	0.84	9.09	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypoaspis aculeifer Canest.	*0*	0	0	0	3	0.94	18.18	0.17	3	1.00	18.18	0.18	1	0.29	9.09	0.02	0	0	0	0
Halictus maculatus Smith.	*0*	0	0	0	0	0	0	0	2	0.67	9.09	0.06	1	0.29	9.09	0.02	0	0	0	0
*Hormius moniliatus*Nees	*0*	0	0	0	0	0	0	0	1	0.33	9.09	0.03	1	0.29	9.09	0.02	0	0	0	0
Hybos culiciformis F.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Hymenoptera - *Braconidae*	*1*	0.28	9.09	0.02	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	2	0.71	18.18	0.12
Hymenoptera-*Ichneumonidae*	*0*	0	0	0	1	0.31	9.09	0.02	0	0	0	0	0	0	0	0	0	0	0	0
Hymenoptera-Scelionidae	*3*	0.84	18.18	0.15	0	0	0	0	2	0.67	9.09	0.06	0	0	0	0	2	0.71	9.09	0.06
Hymenoptera-Sphecidae	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.71	9.09	0.06
Hypoaspis spp.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Itoplectis maculatus F.	*2*	0.56	18.18	0.10	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Kleidotoma brunnea Ion.	*3*	0.84	18.18	0.15	2	0.62	18.18	0.11	4	1.34	18.18	0.24	4	1.17	18.18	0.21	1	0.35	9.09	0.03
Lasius flavus F.	*11*	3.09	27.27	0.84	8	2.51	54.54	1.36	11	3.69	45.45	1.67	10	2.92	63.63	1.85	12	4.28	54.54	2.33
Lasius niger L.	*0*	0	0	0	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Lithobius forficatus L.	*0*	0	0	0	0	0	0	0	0	0	0	0	3	0.87	18.18	0.15	1	0.35	9.09	0.03
Longitarsus gracilis Kutsch.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Longitarsus nasturtii F.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Medetera tristis Zett.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Microlestes maurus Strm.	*0*	0	0	0	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
*Microlestes plagiatus*Duft.	*0*	0	0	0	0	0	0	0	1	0.33	9.09	0.03	1	0.29	9.09	0.02	1	0.35	9.09	0.03
Myrmica rubra L.	*12*	3.37	54.54	1.83	2	0.62	18.18	0.11	5	1.67	18.18	0.30	2	0.58	18.18	0.10	0	0	0	0
Nabis ferus L.	*4*	1.12	27.27	0.30	1	0.31	9.09	0.02	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Ocyusa incrasata Rey.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Ophonus sabulicola Panz.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Orius niger Wolff.	*2*	0.56	18.18	0.10	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Oxypoda togata Er.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Phalangium opilio L.	*12*	3.37	45.45	1.53	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Phygadeuon fumator Grav.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Picromerus bidens L.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0
Pleurophorus caesus Panz.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	2	0.71	18.18	0.12
Poecilus cupreus L.	*6*	1.68	36.36	0.61	2	0.62	18.18	0.11	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Polydesmus complanatus L.	*0*	0	0	0	2	0.62	9.09	0.05	1	0.33	9.09	0.03	1	0.29	9.09	0.02	1	0.35	9.09	0.03
Porcellio scaber L.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Pterostichus niger Schall.	*0*	0	0	0	5	1.57	27.27	0.42	3	1.00	27.27	0.27	4	1.17	27.27	0.31	6	2.14	18.18	0.38
Pterostichus vulgaris L.	*8*	2.24	45.45	1.01	1	0.31	9.09	0.02	1	1.00	9.09	0.09	0	0	0	0	0	0	0	0
Pseudoophonus rufipes De Geer	*49*	13.77	100	13.77	26	8.17	72.72	5.94	7	2.34	36.36	0.85	13	3.80	72.72	2.76	10	3.57	27.27	0.97
Sarcophaga carnaria L.	*0*	0	0	0	16	5.03	36.36	1.82	0	0	0	0	6	1.75	36.36	0.63	0	0	0	0
Sceliphron spirifex Line.	*1*	0.28	9.09	0.02	0	0	0	0	1	0.33	9.09	0.03	0	0	0	0	0	0	0	0
Sciara analis Schin.	*2*	0.56	18.18	0.10	2	0.62	9.09	0.05	2	0.67	9.09	0.06	1	0.29	9.09	0.02	0	0	0	0
Scopeus cognatus Rey.	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.35	9.09	0.03
Stenichneumon culpator Schrank	*0*	0	0	0	1	0.31	9.09	0.02	2	0.67	9.09	0.06	2	0.58	9.09	0.05	1	0.35	9.09	0.03
Tachina fallax Meig.	*0*	0	0	0	3	0.94	18.18	0.17	6	2.01	27.27	0.54	4	1.17	27.27	0.31	0	0	0	0
Trissolcus semistriatus Ness.	*0*	0	0	0	0	0	0	0	0	0	0	0	1	0.29	9.09	0.02	0	0	0	0

The species and group of species that reached the maximum values of the total fauna both useful and harmful in the 2 years of survey are presented in Table 8.

Table 8. Values of ecological parameters for the most abundant fauna

Ecological indices	Harmful Fauna	Variant					Useful Fauna	Variant				
		1	2	3	4	5		1	2	3	4	5
2019												
D_5 - eudominant >10%	*Agromyza nana*	*	*	*	*	*	*Araneae*	*	*	*	*	*
	Chlorops pumilionis				*	*	*Pseudoophonus rufipes*	*		*		
	Diptera – Muscidae	*	*	*		*	*Entomobryia arborea*			*	*	*
							Poecilus cupreus		*	*		
							Myrmica rubra					*
C_4 - euconstant 75.1-100%	*Agromyza flaviceps*	*					*Araneae*	*	*	*	*	*
	Agromyza nana		*		*		*Pseudoophonus rufipes*	*		*		*
	Diptera – Muscidae				*		*Pterostichus vulgaris*	*				
W5 - characteristic >10%	*Agromyza nana*	*	*	*	*		*Araneae*	*	*	*	*	*
	Diptera – Muscidae	*	*	*			*Pseudoophonus rufipes*	*				
2020												
D_5 - eudominant >10%							*Araneae*	*	*	*	*	*
C_4 - euconstant 75.1-100%	*Agromyza nana*				*		*Araneae*	*	*	*	*	*
							Ceratophysella bengtssoni Agren	*				
							Pseudoophonus rufipes	*				
W5 - characteristic >10%							*Araneae*	*	*	*	*	*
							Pseudoophonus rufipes	*				

Among useful fauna, different species from the Araneae order have been found. The great majority of them feed on insects and they can be found with a high species diversity in almost all habitats and microhabitats, from subterranean environments to mountain tops but also in agricultural areas (Marc et al., 1999).

Another important group of useful arthropods with a high abundance was Collembola, represented by two species *Entomobryia arborea* and *Ceratophysella bengtssoni*. Collembola species indirectly contribute in the process of decomposition through the fragmentation of organic matter and the control of soil microbial communities (Brady & Weil, 2009). They are common in both natural and anthropogenic habitats (Babenko et al., 1994).

Concerning insects in Table 8, the Coleoptera order consisted of three useful species from the Carabidae family: *Pseudoophonus rufipes*, *Poecilus cupreus* and *Pterostichus vulgaris*. They are very common polyphagous predatory species found in agroecosystems and are considered to play an important role in the natural control of pests (Cavaliere, 2019). Another order containing useful species was Hymenoptera, with the most numerous specimens in our study belonging to the ant *Myrmica rubra*. This species is a generalist omnivore with a wide food spectrum that includes other insects, pollen as well as honeydew and nectar (Reznikova & Panteleeva, 2001; Ness et al., 2013). The preferred habitat of *M. rubra* are gardens and agroecosystems (Michlewicz & Tryjanowski, 2017).

The harmful fauna with the most abundant specimens was represented by Diptera order, the main representatives being the species *Agromyza nana*, *A. flaviceps* and *Chlorops pumilionis* to which was added the Muscidae family. Larvae of Agromyzidae and Chloropidae are pest of agricultural plants and weeds (Kaniuczak, 2011; Pap, 1984). Members of Muscidae family are hematophagous parasites, vectors of different diseases and pests to humans and domesticated animals and they exploit foods and various habitats such as agroecosystems (Moon, 2019).

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CONCLUSION

Data from the present study indicated that applications of diatomite from Pătârlagele deposit (Buzău County) quantitatively reduced epigeal fauna in pepper crops while the applications of bioinoculant based on *Trichoderma asperellum* Td85 favored it. Further new field studies are necessary to be developed in the near future to evaluate the effects of the two products.

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