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RECENT RESULTS REGARDING THE ENTOMOFAUNA EXISTING IN SOME BOXWOOD PLANTATIONS FROM IAȘI AREA

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Abstract

Boxwood (Buxus spp.) is one of the most popular ornamental plants grown in landscaping due to its green foliage and low maintenance requirements. Commercial varieties of boxwood are propagated by cuttings, and the life cycle of the plant in the nursery can vary depending on the culture technology. The experience took place in the period 2022-2023 within a subunit of the ROMSILVA National Forest Management, in the Iași area. The aim of this study was to evaluate the existing entomofauna within the three variants established in the breeding grounds. The material was collected using the Barber-type soil traps every year from the beginning of May to the end of September, with a difference of 10-14 days. The obtained results revealed a different structure of the taxonomic groups during the study period, the weights being directly influenced by the climatic conditions. From the analysis of the collected entomofauna, species belonging to 12 orders were identified. The most representative was the order Hymenoptera 27.35%, followed by the order Isopoda (19.72%) and the order Coleoptera with a value of 17.49%

Key words*: Boxwood, entomofauna, Barber traps, Coleoptera, climatic conditions.*

INTRODUCTION

Buxus has been used in landscape designs since ancient times and valued for its diverse forms and evergreen foliage (Batdorf, 2005; Dhakal et al., 2022). The ecological plasticity and adaptability of this species to a wide range of environmental factors offer the possibility of growing boxwood in hedges or as solitary examples of topiary art or bonsai (Palmer, 2014; Rashidova et al., 2022).

The maintenance of landscape plant compositions in which Buxus species also participate have become a challenge in recent decades as it is frequently threatened by several pests and pathogenic agents. The most reported arthropods that caused damage both in the appearance of the landscape, but also constrain the production of boxwood in ornamental plant nurseries are *Cydalima perspectalis* Walker., *Psylla buxi* L., *Monarthropalpus buxi* Rubst., but they can also be affected by others quarantine pests (Wan et al., 2014, Soporan et al., 2015; Eickermann et al., 2020).

The management of pests in boxwood requires the integrated use of cultural practices, preventive and curative treatments, but also interspecific strategies (Burjanadze et al., 2019) There are also pathogenic agents that hinder the production of boxwood, with significant economic losses: *Phytophthora* sp. (Weiland, 2021), *Calonectria* sp. (Iriarte, 2016), *Pseudonectria* sp. (Spetik et al., 2019).

The propagation of boxwood varieties by cuttings through different production systems complicates the management of diseases and pests. Propagation usually begins in closed propagation beds and greenhouses, and then they are transferred to the field for several years until the final planting. The transfer of plants from indoor to outdoor production maximizes the risk of spreading diseases and pests from one production area to another (Dhakal et al., 2022). However, there is insufficient research regarding the minimization of the risk of expansion both through biological and chemical control.

The susceptibility of this species to some harmful arthropods causes significant economic losses in boxwood production as well, with new plants being extremely vulnerable regardless of the nursery's cultural

technologies. The purpose of this study is to identify the existing arthropods in the three experimental variants in order to establish the structure of the useful and harmful entomofauna. The results obtained will constitute a resource for the development of plans for the management of harmful arthropods within boxwood crops or landscaping.

MATERIALS AND METHODS

The research was carried out in the production fields of the Galata-Iași nursery, a subunit of ROMSILVA National Forest Management. During 2022-2023, observations and determinations were made in order to identify the existing epigaeic fauna from the boxwood plantations, within three experimental variants: V1 - untreated; V2 - organic treatments was applied; V3 - conventional treatments was applied. The variants were established in fields with boxwood saplings of the *Buxus sempervirens* L. variety from the 3rd, respectively 4th year of planting. Collection of arthropods was done with the help of Barber-type soil traps, with 3 traps placed on each established variant. The traps were installed at the beginning of May every year, and the captured entomological material was collected every 14 days, until the end of September. These were made up of boxes placed at ground level in which 0.6 ml of NaCl fixation fluid, 30% concentration, was added (Stašiov et al., 2023). For the collection of arthropods, this type of trap was chosen because due to its efficiency and continuous capture, thus overcoming interspecific differences in the rhythms of circadian activity of arthropods (Koivula et al., 2003).

The collected biological material was separated from plant remains, transferred to containers with 30% alcohol to avoid its degradation. Further, the entomological material was analyzed, determined and taxonomically structured. Also, the biological material was subjected to indicators that highlight the characteristics of the analyzed biocenosis: abundance (A), dominance (D), constant (C) and ecological significance index (W).

During 2022-2023, the climate of the field was also monitored by AgroExpert System.

RESULTS AND DISCUSSIONS

The research undertaken during the plant growth period of 2022-2023 on the existing arthropods in the boxwood fields generated a number of 10 harvest data annually. In 2022 was collected 5196 specimens with Barber soil-traps. In 2023 arthropods abundance was higher, with a total of 5622 specimens collected. 20.05.2022/23; 06.06.2022/23; 20.06.2022/23; 01.07.2022/23; 15.07.2022/23; 29.07.2022/23; 12.08.2022/23; 26.08.2022/23; 15.09.2022/23. 29.09.2022/23. Table 1 highlights and sums up the totality of the epigean entomofauna collected on the dates mentioned above. The structure and density of the arthropods collected varies throughout the observation period between 476 specimens and 1816 specimens. The largest number of specimens was obtained at the Vth harvest, and the fewest were recorded in the last sample (Xth).

Table 1. The structure of arthropods collected in the period 2022-2023 in the boxwood fields (ROMSILVA Nursery, Iași)

Order	No of harvesting										Total	%
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Acari	2	3	6	11	17	9	0	8	7	2	65	0.60
Araneae	47	38	31	62	41	46	35	40	25	21	386	3.57
Coleoptera	112	121	223	279	356	272	195	98	132	102	1890	17.47
Collembola	73	87	108	124	172	106	65	58	53	57	903	8.35
Dermaptera	1	1	5	0	8	12	7	0	3	1	38	0.35
Diptera	18	30	35	32	21	25	20	15	23	8	227	2.10
Heteroptera	73	107	202	251	292	174	91	76	63	37	1366	12.63
Homoptera	35	48	59	54	41	65	44	27	36	22	431	3.98
Hymenoptera	198	345	376	501	480	352	269	173	132	124	2950	27.27
Isopoda	137	164	273	312	322	401	222	103	114	85	2133	19.72
Lepidoptera	1	3	6	0	3	8	0	0	3	0	24	0.22
Orthoptera	45	32	49	56	63	25	34	46	38	17	405	3.74
Total	742	979	1373	1682	1816	1495	982	644	629	476	10818	100

The research carried out over time highlights that climatic factors have a significant influence on these populations (Kardol et al., 2011; Meehan et al., 2020). Thus, during the studied period average annual temperatures of 11.4°C (2022) and 12.2°C (2023) were recorded. In both years, a positive deviation of +1.2°C (2022) and +2.0°C in 2023 was found, respectively from the multi-year average (10.2°C). Figure 1 shows the dynamics of average monthly temperatures in the study years.

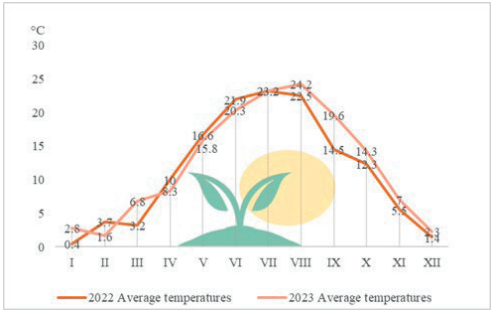

Figure 1. Average monthly temperatures from 2022-2023, Galata Nursery-ROMSILVA Iași

Accumulated precipitation in 2022 amounts 379.0 mm, registering a deficit of 183.6 compared to the multiannual average (562.6 mm). In 2023, the amount of precipitation approached the multi-year average, registering 409.2 mm, the deficit being only 153.4 mm (Figure 2).

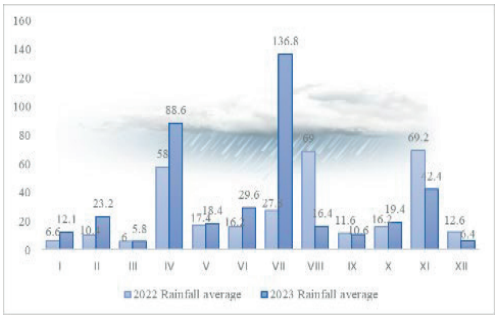

Figure 2. Average monthly rainfall from 2022-2023, Galata Nursery-ROMSILVA Iași

The correlation of the data from the table with the climatic situation presented in Figures 1 and 2 shows that the increasing temperatures have influenced the increase in the abundance of arthropods from most orders. Similarly, periods with precipitation positively influenced the presence of certain orders (ex: Isopoda ord. and Hymenoptera ord.) and negatively influenced others (ex: Araneae ord.). This is also confirmed by other previous studies (Lindberg & Bengtsson, 2005; Kardol et al., 2011; Meehan et al., 2020). From another perspective, the response of soil fauna to climate factors may vary temporally or be specific to the plant growing season or habitat. Thus, the arthropod community increased in 2023, in the conditions of a warmer summer and with more abundant precipitation, compared to the previous year.

Figure 3. The placement of Barber traps in the field

In Table 2 are listed the species of Coleoptera order encountered in V1, untreated variant, considered in the experimental protocol as the control variant. In the V1 samples, 755 specimens were collected. Following the analysis, 47 species of Coleoptera were identified. The most common species were: *Harpalus distinguendus* Duft (161 specimens), *Opatrum sabulosum* L. (116 specimens), *Dermestes laniarius* Illi. (103 specimens). The accidentally encountered species within the sample were: *Acupalpus dorsalis* Fabricius (1), *Ablattaria laevigata* Fabricius (1), *Anthicus gracilis* Panzer (1), *Coccinella septempunctata* L. (1), *Cantharis pulicaria* Fabricius (1), *Formicomus pedestris* Rossi (1), *Tachyporus hypnorum* Fabricius (1), *Trox hispidus* P. (1).

Table 2. Coleopters collected in the V1 during 2022-2023

Species	No	2022	2023
Acupalpus dorsalis Fabricius	1	x	
Acupalpus meridianus L.	2		x
Acupalpus saturalis Dejean	7	x	x
Agriotes ustulatus Schaller	5	x	x
Ablattaria laevigata Fabricius	1		x
Amara aenea De Geer	41	x	x
Amara crenata Dejean	2	x	
Anisodactylus binotatus Fabricius	5	x	x
Anthicus floralis L.	3	x	x
Anthicus gracilis Panzer	1		x
Anthicus humeralis Gebler	6	x	x
Badister sodalis Duft.	2		x
Baris lepidii Germar	2	x	
Brachinus crepidans L.	7	x	x
Brachynus explodens Duft. Duft.	6	x	x
Cantharis pulicaria Fabricius	1	x	
Ceutorhynchus atomus Nilsson	4	x	
Ceutorhynchus rapae Gill.	3	x	
Chilopora rubicunda Erichson	2		x
Coccinella septempunctata L.	1		x
Cryptophagus bimaculatus Panzer	2		x
Dermestes laniarius Illi.	103	x	x
Diabrotica virgifera virgifera LeConte	5		x
Formicomus pedestris Rossi	1		x
Harpalus aeneus Fabricius	34	x	x
Harpalus distinguendus Duft	161	x	x
Harpalus griseus Panzer	25	x	x
Harpalus pubescens Müller	88	x	x
Harpalus punctipes Dejean	5	x	
Hister neglectus Germar	28	x	x
Hister ventralis Marseul	13	x	x
Longitarsus quadriguttatus P.	2	x	
Opatrum sabulosum L.	116	x	x
Orchestes stigma Germar	3		x
Otiorhynchus morio Fabricius	12	x	x
Otiorhynchus niger Fabricius	4	x	x
Otiorrhynchus sensitivus Scopoli	2		x
Phyllotreta euforbiae Thomas	2		x
Phyllotreta vittula R.	5	x	
Podonta nigrita Fabricius	2	x	
Pterostichus cupreus L.	10	x	x
Quedius pedestris Olivier	3	x	
Sipalia circellaris Gravenhorst	2		x
Staphylinus stercorarius Olivier	2		x
Stephanitis rhododendri Horvath	21	x	x
Tachyporus hypnorum Fabricius	1		x
Trox hispidus P.	1	x	
TOTAL:	**755**		

Variant 2 (V2) of this study was treated with biological products, administered during the vegetation period, namely Laser 240 SC (fermentation product of a soil bacterium: *Saccharopolyspora spinosae*) and BactoSpeine DF (product with natural microorganisms, *Bacillus thuringiensis* subsp. kurstaki). In this variant, 704 specimens of coleopters are collected (Table 3). The species with largest number of specimens collected were: *Harpalus distinguendus* Duft (109 sp.), *Opatrum sabulosum* L. (103 sp.), *Dermestes laniarius* Illi. (83 sp.), *Amara aenea* De Geer (42 sp.), *Harpalus pubescens* Müller (37 sp.), *Stephanitis pyri* Fabricius (38 sp.), *Amara crenata* De Geer (34 sp.), *Harpalus griseus* Panzer (31 sp.), *Hister ventralis* Marseul (29 sp.), *Stephanitis rhododendri* Horvath (22 sp.) *Hister neglectus* Marseul (20 sp.). The rest of the species recorded less than 20 specimens within the sample.

Table 3. Coleopters collected in the V2 during 2022-2023

Species	No	2022	2023
Agriotes ustulatus Schaller	3		x
Ablattaria laevigata Fabricius	1		x
Amara aenea De Geer	42	x	x
Amara crenata Dejean	34	x	x
Amara eurynota Panzer	18	x	x
Amara familiaris Duft.	7	x	x
Anisodactylus binotatus Fabricius	12	x	x
Anisodactylus signatus Panzer	4	x	
Apion violaceum Gyll.	9	x	x
Bagous cylindrus Paykull	1		x
Brachinus crepitans L.	5		x
Brachinus explodens Duft.	7	x	x
Bradycellus harpalinus Serville	1		x
Ceutorhynchus atomus Nilsson	2	x	
Dermestes laniarius Illi.	83	x	x
Dromius melanocephalus Dejean	2	x	
Formicomus pedestris Rossi	4	x	x
Harpalus aeneus Fabricius	4	x	
Harpalus calceatus Duft.	18	x	x
Harpalus distinguendus Duft.	109	x	x
Harpalus griseus Panzer	31	x	x
Harpalus pubescens Müller	37	x	x
Heterothops quadripunctula G.	2	x	
Hister cadaverinus Hoffmann	6	x	
Hister neglectus Germar	20	x	x
Hister ventralis Marseul	29	x	x
Longitarsus luridus Scopoli	2		x
Longitarsus pratensis Panzer	4	x	x
Micraspis sedecimpunctata L.	2		x
Olisthopus rotundatus Paykull	1		x
Opatrum sabulosum L.	103	x	x
Otiorhynchus morio Fabricius	5	x	x
Pleurophorus caesus Panzer	9	x	x
Podonta nigrita Fabricius	2	x	
Pterostichus cupreus L.	15	x	x
Pterostichus melas Creutzer	1		x
Stephanitis pyri Fabricius	38	x	x
Stephanitis rhododendri Horvath	22	x	x
Tachinus elongatus Gyllenhal	8	x	x
Tachyporus ruficollis Graven.	1	x	
TOTAL:	**704**		

Variant 3 (V3) was treated with chemical products used in conventional technology. Here, treatments were carried out during the vegetation period with systemic and contact insecticides. The systemic insecticides used were Mospilan 20 SC and Coragen and for contact action were used Faster 10 CE and Karate Zeon.

The influence of these treatments was significant on the arthropods in the boxwood field. The number of beetles collected in this variant was 433 specimens. In table 4, a smaller influence on the following species is observed:

Harpalus distinguendus Duft (96 sp.), *Opatrum sabulosum* L. (94 sp.), *Dermestes laniarius* Illi. (76). Also, a significant reduction in the number of specimens of the genus *Amara* sp. *Harpalus* sp., *Hister* sp. was observed.

Table 4. Coleopters collected in the V3 during 2022-2023

Species	No	2022	2023
Acupalpus flavicollis Sturm	1		x
Amara aenea De Geer	10	x	x
Amara crenata Dejean	15	x	x
Amara eurynota Panzer	17	x	x
Amara familiaris Duft.	8	x	x
Anisodactylus binotatus Fabricius	6	x	x
Anthicus floralis L.	3	x	x
Anthicus humeralis Gebler	2	x	
Baris lepidii Germar	1		x
Brachinus crepitans L.	3	x	x
Brachinus psophia Serville	1		x
Calodera aethiops Grave.	1		x
Ceutorhynchus atomus Nilsson	1		x
Ceutorhynchus maculaalba R.	1		x
Coccinella 11 punctata L.	1		x
Cymindis vaporariorum L.	2	x	
Dermestes laniarius Illi.	76	x	x
Formicomus pedestris Rossi	4	x	x
Harpalus autumnalis Duft.	3	x	
Harpalus azureus Fabricius	11	x	x
Harpalus calceatus Duft.	4	x	x
Harpalus distinguendus Duft	96	x	x
Harpalus griseus Panzer	19	x	x
Hister funestus E.	1		x
Hister neglectus Germar	15	x	x
Hister terricola Ger.	2	x	
Hister ventralis Marseul	12	x	x
Leptusa angusa K.	1	x	
Micraspis sedecimpunctata L.	1	x	
Opatrum sabulosum L.	94	x	x
Orchestes pratensis Ger.	2	x	
Otiorrhynchus morio Fabricius	1		x
Oxyporus rufus L.	2		x
Pleurophorus caesus Panzer	1		x
Pseudocleonus cinereus Schrank	1		x
Pterostichus cupreus L.	4	x	x
Staphylinus predator Müller	2	x	x
Stephanitis pyri Fabricius	5	x	x
Tachyporus hypnorum Fabricius	1		x
Thiasophila inquilina Märkel	1	x	
Valgus hemipterus L.	1	x	
TOTAL:	**433**		

Table 5 shows the structure of the useful fauna composed with the species from the orders: Araneae, Coleoptera, Collembola, Dermaptera, Hymenoptera and Heteroptera. The most abundant arthropods belong the Hymenoptera order (852 specimens), following Colleoptera (634 specimens) and Collembola (567 specimens). The mentioned orders are characterized in the categories of constant and euconstant (C4) species depending on the indicator (C) which expresses the continuity and appearance of the species in the analyzed biotope. The accidental species (C1) encountered in this variant was represented by *Forficula auricularia* L. (Dermaptera ord.), which is considered also recedent species (D2), by dominance. According to the classification of ecological index W, the values were between 0.2% (Dermaptera ord.) and 33.2 (Hymenoptera ord.).

Table 5. Ecological parameters analysis of the useful species collected in the boxwood fields during 2022-2023

Order	(A)	(C)		(D)		(W)	
		%	Class	%	Class	%	Class
Araneae	310	71.1	C3	12.1	D5	8.6	W4
Coleoptera	634	100	C4	24.7	D5	24.7	W5
Collembola	567	94.4	C4	22.1	D5	20.8	W5
Dermaptera	38	14.4	C1	1.4	D2	0.2	W2
Hymonoptera	852	100.	C4	33.2	D5	33.2	W5
Heteroptera	163	46.6	C2	6.4	D4	2.9	W3

CONCLUSIONS

In the last years boxwood species (*Buxus* sp.) began to have pests that massively affect the landscape, but also produce economically important damages in the production of boxwood in the nursery. The management of pests in boxwood requires the integrated use of cultural practices, preventive and curative treatments, but also interspecific strategies.

The results obtained in the study showed that the structure and density of arthropods is influenced by abiotic factors. Within the 3 variants studied, the soil fauna was collected in a number of 10818 specimens.

The abundance of arthropods was 755 specimens in the V1 control variant, 704 specimens were collected in the ecologically treated variant (V2), and 433 specimens were collected in the conventional variant (V3).

Useful entomofauna collected during 2022-2023 showed the structure composed with the species from the orders: Araneae, Coleoptera, Collembola, Dermaptera, Hymenoptera and Heteroptera. The most abundant arthropods belong the Hymenoptera order (852 specimens), following Coleoptera (634 specimens) and Collembola (567 specimens).

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