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AUCHENORRHYNCHA STRUCTURE IN AN EXPERIMENTAL TOMATO CROP AT VRDS BUZĂU, ROMANIA

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Abstract: A study of Auchenorrhyncha fauna was conducted in 2024 and 2025 in an experimental field of tomatoes at the Vegetables Research and Development Station Buzău, Buzau County, southern Romania. A total of 6555 specimens distributed in 21 species were collected, 1179 (17.99%) in 2024 and 5376 (82.01%) in 2025. Cicadellidae family was the most numerous and diverse, 1177 specimens classified in 11 species in 2024 and 5357 specimens classified in 14 species in 2025, represented mainly by two subfamilies, Typhlocybinae (1094 specimens, 7 species in 2024 and 4398 specimens, 5 species in 2025) and Deltocephalinae (83 specimens and 4 species in 2024 and 924 specimens, 6 species in 2025). The collected species were classified as species producing direct damage (*Megophthalmus scanicus*, *Eupteryx aurata*, *Zygina flammigera*, *Zyginidia pullula*, *Zyginella pulchra*, *Erasmoneura vulnerata*, *Edwardsiana rosae*, *Phlepsius ornatus*, *Platymetopius rostratus* and *Platymetopius major*) and as species confirmed or potential reported vectors to spread pathogens to plants such as phytoplasmas and viruses, mainly to vegetables (*Hyalesthes obsoletus*, *Reptalus quinquecostatus*, *Laodelphax striatellus, Austroagallia sinuata*, *Anaceratagallia ribauti*, *Eupteryx atropunctata*, *Empoasca decipiens*, *Psammotettix alienus, Neoaliturus fenestratus*, *Fieberiella florii* and *Phlogotettix cyclops*). The most abundant four species were *E. decipiens*, *E. rosae*, *Z. pullula* and *E. atropunctata* in 2024, and *Z. pullula*, *E. decipiens*, *E. atropunctata*, and *P. alienus* in 2025.

Key words: *Auchenorrhyncha fauna, structure, tomatoes crop*

INTRODUCTION

Tomato (*Lycopersicon esculentum*) is one of the most valuable vegetables crops from an agronomic and economic point of view, widely grown throughout in our country. However, the tomato production showed a significant decrease in recent years (Ilie et al., 2025), a trend attributed to reduction in cultivated area, abiotic and biotic factors such as climate changes and pests and diseases as well. According to INS data published for the year 2024, the total tomato production in Romania was 444056 tons, with an average production of 12979 kg/ha, decreasing compared to 2023 by 30126 tons and 1024 kg/ha, respectively.

Insects of the Auchenorrhyncha suborder (Hemiptera) which include leafhoppers, planthoppers, treehoppers, froghoppers and cicadas are among important phytosanitary risks affecting tomato crops. They are phytophagous species with specialized piercing-sucking mouthparts that puncture plant tissues to extract the sap. By feeding on elaborated sap from phloem and raw sap from xylem (Bartlett et al., 2018), they cause direct damage, but also indirect damage acting as vectors due to ability to transmit some phytopathogenic agents such as phytoplasmas, bacteria and viruses. Weintraub & Beanland (2006) identified over 200

Auchenorrhyncha species that transmit phytoplasma microorganisms, and over 70 species that transmit viruses. Preventive measures such as sanitary selection and the use of uninfected seedlings, associated with control of vectors are main effective means to reduce the diseases incidence and maintain stable production (Ustun et al., 2023).

Information of the Auchenorrhyncha fauna in various solanaceous crops is contained in a lot of studies in the world (Osmelak & Fletcher, 1988; Ahmed et al., 2016; Kiliç & Sertkaya, 2019; Mutlu et al., 2023; Ata, 2024), referring to composition, species richness and population dynamics, phytoplasma and virus vectors (Choueiri et al., 2007; Girsova et al., 2017; Siampour et al., 2020; Therhaag et al., 2024).

The purpose of this work was to evaluate the Auchenorrhyncha fauna in a tomato crop placed in the experimental field of the Vegetables Research and Development Station Buzău (VRDSB), Buzău County, Romania, in 2024 and 2025.

MATERIAL AND METHODS

This study was performed in 2024 and 2025 in a tomato lot of approximately 700 m² in rectangular form, cultivated with Florina 44 and Buzău 47 varieties, as part of the experimental vegetables field (45°9'38.06"N/26°49'36.19"E) situated at the VRDSB, in the southeast of Romania. The tomato plants, grown in double rows of approximately 75 m, were protected by two maize rows on the long edges. The vegetable plots adjacent to the tomatoes included eggplants and peppers, were also protected by double maize rows. Drip irrigation provided the plants' water needs. Five pesticide treatments against the tomato fruit borer, aphids and mites were applied between June and August each year. The space between the rows was worked by manual hoes, so that weeding was insignificant inside the plot, and low at the ends of the plot where two species of weed were observed, bindweed (*Convolvulus arvensis*) and red-root amaranth (*Amaranthus retroflexus*).

Adult insects of Auchenorrhyncha were collected on yellow adhesive laminated traps, (21x29.7cm) produced in Romania. For both years, a number of four traps were placed inside the tomato crop at plant level and replaced every two weeks between mid-July and late October. In total, a number of 32 traps corresponding with eight collection dates were used for each year.

The identification of insect species was carried out in the laboratory at the Research-Development Institute for Plant Protection Bucharest using a Zeiss Stemi 2000-C stereomicroscope, and was based on the external morphological characters of adult insects and the determination keys from the literature (Biedermann & Niedringhaus, 2009; Mozaffarian, 2018).

The ecological parameters of abundance (A), dominance (D%), constancy (C%) and ecological significance index (W%) of species communities in the Auchenorrhyncha suborder were calculated using formulas in the literature (Stan, 1994; Baban, 2006). The flight dynamics of adult catches were conducted for the most abundant species in each year.

RESULTS AND DISCUSSIONS

The Auchenorrhyncha fauna monitored in the experimental tomato field at the VRDSB in 2024 and 2025 using yellow sticky traps is presented in table 1 that includes the number of species and specimens taxonomically classified by family and subfamily. In the monitoring period, a total of 6555 specimens was captured, 1179 (17.99%) in 2024 and 5376 (82.01%) in 2025, which have been included into 21 species, 12 in 2024 and 17 in 2025, classified within

three families (Cixiidae, Delphacidae and Cicadellidae) and six subfamilies (Cixinae, Criomorphinae, Megophthalminae, Agalliinae, Typhlocybinae and Deltocephalinae).

The largest family, in terms of number of specimens recorded every year, was Cicadellidae, which included 1177 specimens (99.83%) in 2024 and 5357 specimens (99.65%) in 2025. Moreover, the highest number of species was also recorded within the Cicadellidae family, 11 species in 2024 and 14 species in 2025. As reported by the Catalogue of Life, a complete authoritative list of the entire world's species and maintained by hundreds of taxonomists globally, of all 48056 species described in the Auchenorrhyncha suborder, 23548 (49%) belong to the Cicadellidae family (Figure 1, https://www.catalogueoflife.org/data/taxon/BXWCS). The other families identified were Cixiidae and Delphacidae which summed only 21 specimens, 2 in 2024 and 19 in 2025, representing 0.17 and 0.35% respectively.

Within the Cicadellidae family, collectively known as leafhoppers, the most numerous and diverse subfamily was Typhlocybinae that counted 1094 specimens (92.94%) distributed in 7 species in 2024, and 4398 specimens (82.10%) distributed in 5 species in 2025. The Deltocephalinae was the next representative subfamily, with 83 specimens (7.05%) and 4 species in 2024 and 924 specimens (17.25%) and 6 species in 2025. The high abundance of these two subfamilies in vegetable crops is very relevant because most of the species included here are notable pests of plants, reported either for the direct damage or as vectors of viruses or of phytoplasmas. A significant number of species can be vectors of viruses, bacteria and phytoplasmas, which increase their economic importance. According to Wilson & Weintraub (2007), the majority of phytoplasma vectors fall into the Cicadellidae family, with most of them being within the Deltocephalinae subfamily (over 75%). Species in the subfamily Typhlocybinae mainly cause direct damage to host plants during feeding activity, manifested by white chlorotic spots on the leaf surface (Backus, 1993), but also include members described as potential vectors of phytoplasmas (Weintraub et al., 2019).

The highest abundance was recorded on the species *E. decipiens* (593 specimens in 2024 and 1509 in 2025), followed by *Z. pullula* (75 specimens in 2024 and 1651 in 2025), *E. atropunctata* (71 specimens in 2024 and 1164 in 2025), *P. alienus* (33 specimens in 2024 and 865 in 2025) and *E. rosae* (301 specimens in 2024 and 73 in 2025).

Table 1. Auchenorrhyncha species and abundance on yellow sticky traps in experimental tomato crop at VRDS Buzău

	Family/Subfamily/Species	2024		2025	
		Number	(%)	Number	(%)
Cixiidae/Cixinae					
1	*Hyalesthes obsoletus* Signoret 1865	-	-	5	0.09
2	*Reptalus quinquecostatus* Dufour 1833	-	-	1	0.02
Delphacidae/Criomorphinae					
3	*Laodelphax striatellus* Fallén 1826	2	0.17	13	0.24
Cicadellidae/Megophthalminae					
4	*Megophthalmus scanicus* Fallén 1806			2	0.04
5	*Austroagallia sinuata* Mulsant & Rey 1855			9	0.17
Cicadellidae/Agalliinae					
6	*Anaceratagallia ribauti* Ossiannilsson 1938			24	0.45
Cicadellidae/Typhlocybinae					
7	*Eupteryx atropunctata* Goeze 1778	71	6.02	1164	21.65
8	*Eupteryx aurata* Linnaeus 1758			1	0.02
9	*Zyginidia pullula* Boheman 1845	75	6.36	1651	30.71
10	*Zyginella pulchra* Löw 1885	6	0.51		

11	*Zygina flammigera* Fourcroy 1785	43	3.65		
12	*Empoasca decipiens* Paoli 1930	593	50.30	1509	28.07
13	*Edwardsiana rosae* Linnaeus 1758	301	25.53	73	1.36
14	*Erasmoneura vulnerata* Fitch 1851	5	0.42		
Cicadellidae/Deltocephalinae					
15	*Psammotettix alienus* Dahlbom 1850	33	2.8	865	16.09
16	*Neoaliturus fenestratus* Herrich-Schäffer 1834	14	1.19	47	0.87
17	*Fieberiella florii* Stål 1864			1	0.02
18	*Phlepsius ornatus* Perris 1857			2	0.04
19	*Phlogotettix cyclops* Mulsant & Rey 1855			1	0.02
20	*Platymetopius rostratus* Herrich-Schäffer 1834	34	2.88	8	0.15
21	*Platymetopius major* Kirschbaum 1868	2	0.17		
Total number of specimens		1179	100	5376	100

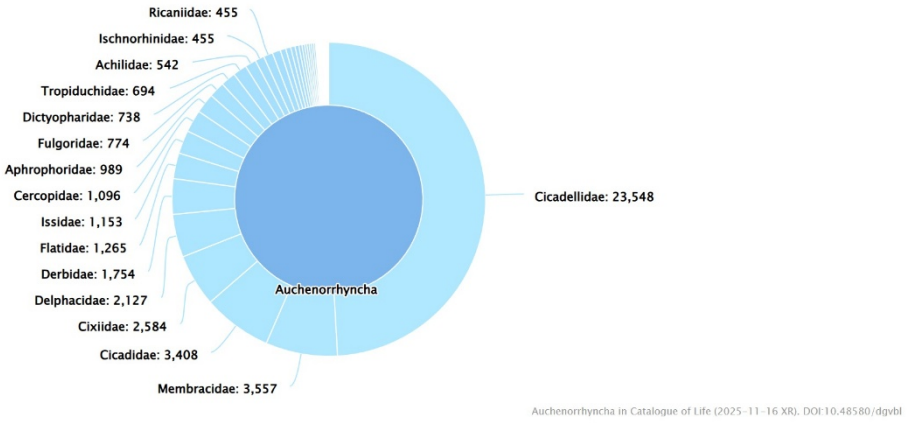

Figure 1. Number of species/family in the Auchenorrhyncha suborder according to Catalogue of Life (https://www.catalogueoflife.org/data/taxon/BXWCS)

Out of the total Auchenorrhyncha species collected for both years on yellow sticky traps in tomato plot in this study, 11 species (52.38%) were included in the group of known or potential vectors that spread pathogens to plants, mainly to vegetables, such as viruses and phytoplasmas, following reports in literature. In terms of contribution to annual abundance, these species predominated every year, totaling 713 specimens (60.47%) in 2024 and 3639 specimens (67.69%) in 2025. The species commonly reported as vectors in vegetable crops and which we found in this study, were *Hyalesthes obsoletus*, *Reptalus quinquecostatus*, *Laodelphax striatellus*, *Austroagallia sinuata*, *Anaceratagallia ribauti*, *Eupteryx atropunctata*, *Empoasca decipiens*, *Psammotettix alienus*, *Neoaliturus fenestratus*, *Fieberiella florii* and *Phlogotettix cyclops*.

The identification of insects that act as vectors of plant pathogens is essential for their management, especially since there is little knowledge regarding this topic in our country. Vegetable crops are often infected by phytoplasmas, of which the most widespread are Aster Yellow (16SrI) and Peanut Witch's Broom (16SrII) and Stolbur phytoplasma (16SrXII) (Kumari et al., 2019). The Auchenorrhyncha as phloem-feeding species associated with stolbur phytoplasma includes mainly the planthoppers of the Cixiidae family. The cixid planthoppers *H. obsoletus* and *R. quinquecostatus* are the most known species to vector the stolbur phytoplasma from natural foci consisting of weeds to a wide range of plants of economic interest such as potato, tomatoes, pepper, eggplant, celery (Carraro et al., 2008; Chuche et al.,

2016; Mitrović et al., 2016). The small number of individuals of the two species observed in present survey was as a result of lack of weeds inside surveyed tomato plot.

The Cicadellidae leafhoppers are among the most common and abundant insect vectors of phytoplasmas (Weintraub & Beanland, 2006). *A. sinuata,* a leafhopper commonly found in vegetable crops, was molecular tested positive for aster yellow in carrots (Weintraub & Orenstein, 2004) and stolbur in celery (Carraro et al., 2008), and recently this was reported as vector of parsley yellow leaf curl virus in Iran (Nichkerdar et al., 2024). Presence of stolbur in the cicadellid leafhopper *A. ribauti* collected in diseased carrot fields in Croatia was reported by Drobnjakovic et al. (2010).

The typhlocybin leafhopper *E. atropunctata* is mentioned on potato crops affected by stolbur phytoplasma in Serbian by Mitrović et al. (2015), and insects collected from potatoes in Russia (Girsova et al., 2015) as well as from grapevine in Austria (Riedle-Bauer et al., 2006) were found infected with stolbur phytoplasma. Another important typhlocybin species collected in high number this study and reported to be vector is the leafhopper *E. decipiens*. This is an extremely polyphagous species, major pest of agricultural crops in fields and greenhouses, including vegetables (Raupacha et al., 2002); vegetable varieties with glabrous leaves, such as sweet peppers, are among the preferred host plants. Specimens of this species collected from carrot plants in Türkiye showing phytoplasma symptoms were tested positive for the presence of yellow diseases phytoplasma (Zelyüt et al., 2022).

The deltocephalin leafhopper *P. alienus*, a common species in wheat fields and decisive vector for viruses to cereals (Nahdi et al., 2020), develop abundant populations on solanaceous (Mitrovic et al. 2015). This was reported as potential vectors for phytoplasma, being found infected with stolbur phytoplasmas in carrot (Drobnjakovic et al., 2010) and aster yellows in wheat fields (Zwolińska et al., 2025).

Other notable reported phytoplasma vector is the leafhopper *N. fenestratus.* This spreads various phytoplasmas in vegetable crops, as for example: aster yellows carrots (Weintraub & Orenstein, 2004), lettuce phyllody (Salehi et al. 2007), stolbur in lettuce and carrot (Mitrovic et al. 2019).

Other vector leafhoppers collected in our study, *F. florii* and *P. cyclops*, are reported to play an important role to transmit phytoplasmas to woody plants, peach X-disease (Krczal et al., 1988), apple proliferation (Tedeschi & Alma, 2006) and European stone fruit yellows (Landi et al., 2007) and grapevine flavescence doree (Strauss & Reisenzein, 2018). Presence of stolbur phytoplasma was fond in the delphacid planthopper *L. striatellus* in grapevine in Jordan (Abu Alloush et al., 2023).

Based on annual captures on yellow sticky traps between July and October 2024 and 2025, the captures curves of the most abundant four species can be observed in figures 2 and 3. In 2024, *Empoasca decipiens* predominated with a peak activity of 189 specimens between 10 and 20 August, followed by *Edwardsiana rosae*, with a peak activity of 81 adults between 5 and 20 September. *Zyginidia pullula* and *Eupteryx atropunctata* had smaller populations throughout the year. In 2025, *Z. pullula*, *E. decipiens* and *Psammotettix alienus* all had high abundances between 15 and 30 July (527, 288 and 265 specimens respectively). *Z. pullula* had another peak during 20 August and 5 September (412 specimens) and *E. decipiens* during 20 September and 5 October (283 specimens). *E. atropunctata* had a peak flight activity during 10 and 20 August (295 specimens).

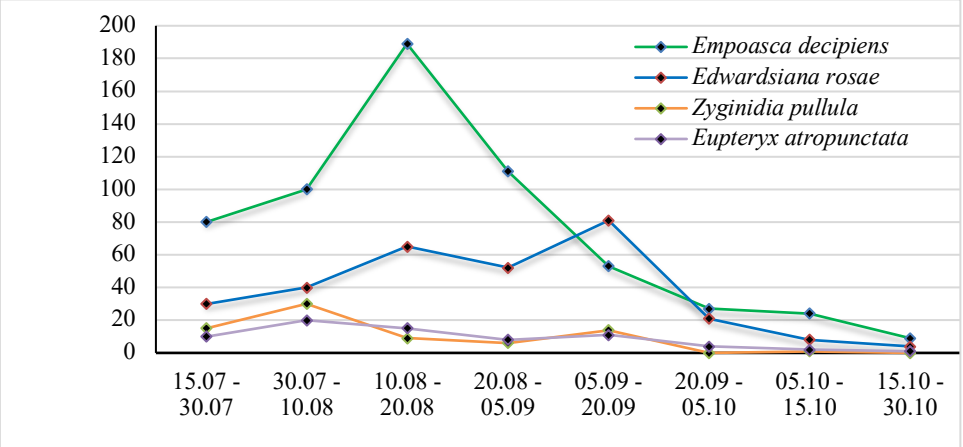

Figure 3. Dynamics of YSTs captures for the four most abundant Auchenorrhyncha species in 2024

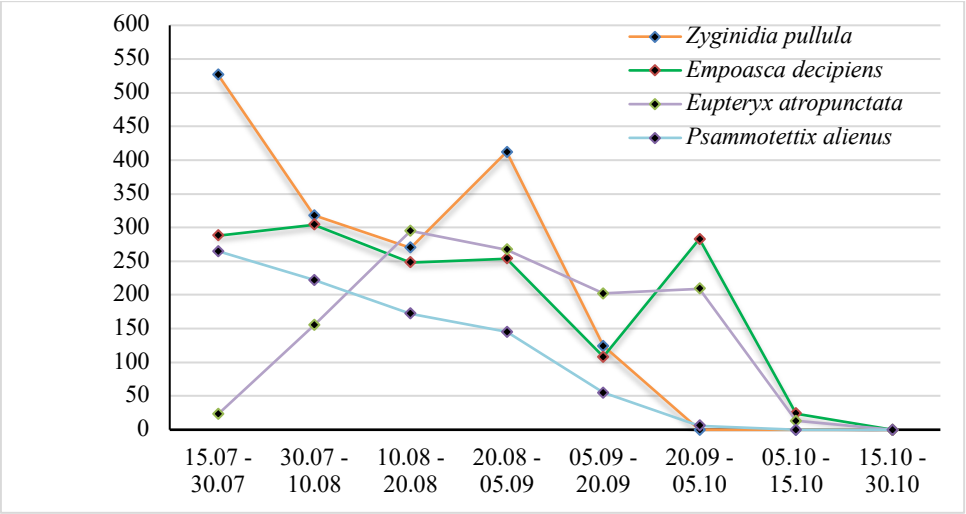

Figure 4. Dynamics of YSTs captures for the four most abundant Auchenorrhyncha species in 2025

The values of the ecological parameters, dominance, constancy and ecological significance index, calculated for Auchenorrhyncha identified in 2024 and 2025 in this study are included in the table 2.

Table 2. Ecological parameters calculated for Auchenorrhyncha species captured in tomato crop

Family/Subfamily/Species	2024						2025					
	D		C		W		D		C		W	
	%	Cls	%	Cls	%	Cls	%	Cls	%	Cls	%	Cls
Cixiidae/Cixinae												
Hyalesthes obsoletus	-	-	-	-	-	-	0.09	D1	25	C1	0.022	W1
Reptalus quinquecostatus	-	-	-	-	-	-	0.01	D1	12.5	C1	0.001	W1
Delphacidae/Criomorphinae												
Laodelphax striatellus	0.17	D1	25	C1	0.042	W1	0.24	D1	62.5	C3	0.15	W1
Cicadellidae/Megophthalminae												
Megophthalmus scanicus	-	-	-	-	-	-	0.03	D1	12.5	C1	0.003	W1
Austroagallia sinuata	-	-	-	-	-	-	0.16	D1	50	C2	0.008	W1
Cicadellidae/Agalliinae												
Anaceratagallia ribauti	-	-	-	-	-	-	0.44	D1	12.5	C1	0.055	W1
Cicadellidae/Typhlocybinae												
Eupteryx atropunctata	6.02	D4	100	C4	6.02	W3	21.65	D5	87.5	C4	18.94	W3
Eupteryx aurata	-	-	-	-	-	-	0.01	D1	12.5	C1	0.001	W1
Zyginidia pullula	6.36	D4	75	C3	4.77	W2	30.71	D5	62.5	C3	19.19	W3

Zyginella pulchra	0.5	D1	25	C1	0.125	W1	-	-	-	-	-	-
Zygina flammigera	3.64	D3	75	C3	2.73	W2	-	-	-	-	-	-
Empoasca decipiens	50.29	D5	100	C4	50.29	W3	28.06	D5	87.5	C4	24.55	W3
Edwardsiana rosae	25.53	D5	100	C4	25.53	W3	1.35	D2	12.5	C1	0.168	W1
Erasmoneura vulnerata	0.42	D1	25	C1	0.105	W1	-	-	-	-	-	-
Cicadellidae/Deltocephalinae												
Psammotettix alienus	2.79	D3	62.5	C3	1.74	W2	16.09	D5	75	C3	12.06	W3
Neoaliturus fenestratus	1.18	D2	50	C2	0.59	W1	0.87	D1	75	C3	0.65	W1
Fieberiella florii	-	-	-	-	-	-	0.01	D1	12.5	C1	0.001	W1
Phlepsius ornatus	-	-	-	-	-	-	0.03	D1	12.5	C1	0.003	W1
Phlogotettix cyclops	-	-	-	-	-	-	0.01	D1	12.5	C1	0.001	W1
Platymetopius rostratus	2.88	D3	100	C4	2.88	W2	0.14	D1	50	C2	0.007	W1
Platymetopius major	0.17	D1	25	C1	0.042	W1	-	-	-	-	-	-

D1 - D5 = Dominance; C1 - C3 = Constancy in samples (traps); W1 - W3 = Ecological significance index
D1 < 1% - subreceding species, D2 = 1-2% - receding species, D3 = 2-5% - subdominant species, D4 = 5-10% - dominant species, D5 > 10% - eudominant species; C1 = 1-25% - accidental species, C2 = 25-50% - accessory species, C3 = 50-75% - constant species, C4 = 75-100% - euconstant species; W1 < 1% = accidental species, W2 = 1-5% - accessory species, W3 > 5% - characteristic species

The leafhopper *E. decipiens* (Cicadellidae:Typhlocybinae) was the only eudominant species in both study years; this had the highest contribution in Auchenorrhyncha community each year. Other eudominant species were four cicadellids, three typhlocybins leafhoppers *E. rosae* in 2024, and *Z. pullula* and *E. atropunctata*, and one deltocephalin leafhopper, *P. alienus* in 2025. Dominant species were two typhlocybins *Z. pullula* and *E. atropunctata* in 2024. Subdominant species were one typhlocybin, *Zygina flammigera* and two deltocephalins *P. alienus* and *Platymetopius rostratus* also in 2024. Rest of species, four in 2024 and twelve in 2025, were classified as receding species or subreceding species.

The best presence in samples and classified as euconstant species were *E. atropunctata* and *E. decipiens* both in 2024 and 2025, and *E. rosae* and *E. atropunctata* in 2024. Constant species were *Z. pullula* and *P. alienus* in both collecting years, *Z. flammigera* in 2024 and *L. striatellus* and *N. fenestratus* in 2025. The other species were present in fewer samples and were distributed into classes of accidental species or accessory species.

The ecological significance index was the highest in two species both years *(E. atropunctata* and *E. decipiens)*, one species in 2024 (*E. rosae)* and two species in 2025 (*Z. pullula* and *P. alienus*), giving them the status of characteristic species. Four species in 2024, *Z. pullula, Z, flammigera, P. alienus* and *P. rostratus* were grouped as accessory species; the other species were grouped as accidental species in the surveyed tomato plot.

CONCLUSIONS

The study took place in 2024 and 2025 in an experimental tomato field situated in the Vegetable Research and Development Station Buzău, southeast of Romania. In total, 6555 specimens of Auchenorrhyncha distributed in 21 species were collected, 1179 (17.99%) in 2024 and 5376 (82.01%) in 2025.

Cicadellidae family was the most numerous and diverse with 1177 specimens classified in 11 species in 2024 and 5357 specimens classified in 14 species in 2025. Within this family, two subfamilies, Typhlocybinae (1094 specimens, 7 species in 2024 and 4398 specimens, 5 species in 2025) and Deltocephalinae (83 specimens and 4 species in 2024 and 924 specimens, 6 species in 2025) were the most representative.

The species identified in this study were classified as species that produce direct damage (*Megophthalmus scanicus*, *Eupteryx aurata*, *Zygina flammigera*, *Zyginidia pullula*, *Zyginella pulchra*, *Erasmoneura vulnerata*, *Edwardsiana rosae*, *Phlepsius ornatus*, *Platymetopius rostratus* and *Platymetopius major*) and confirmed and potential reported vectors of pathogens to vegetal crops (*Hyalesthes obsoletus*, *Reptalus quinquecostatus*, *Austroagallia sinuata*,

Anaceratagallia ribauti, *Eupteryx atropunctata*, *Empoasca decipiens*, *Psammotettix alienus, Neoaliturus fenestratus*, *Fieberiella florii* and *Phlogotettix cyclops*).

The most abundant four species were *E. decipiens*, *E. rosae*, *Z. pullula* and *E. atropunctata* in 2024, and *Z. pullula*, *E. decipiens*, *E. atropunctata*, and *P. alienus* in 2025.

Further investigation should be performed in tomato crops in Romania to obtain more accurately knowledge about the abundance of Auchenorrhyncha with emphasis on species that vector phytoplasma microorganisms, major diseases of plants including solanaceous.

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