

## THE DIVERSITY OF LADYBUG SPECIES (COLEOPTERA: COCCINELLIDAE) IN ALFALFA CROPS, REPUBLIC OF MOLDOVA

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**Abstract.** The purpose of this work was to identify the species of ladybugs in the multiannual alfalfa fields in the Republic of Moldova. The main role of the overwhelming majority of ladybug species in the wild is the consumption of aphids, whiteflies, phytophagous mites, woolly lice and a wide range of other soft-bodied pests. In alfalfa fields, too, ladybirds consume plant lice, which damage the leaves and tender stalks of alfalfa by puncturing them and consume the sap, infecting the plant with viruses. According to updated data, 48 species of ladybugs have been identified in the Republic of Moldova (BUȘMACHIU et al., 2022). The most common species native for the Republic of Moldova include *Hippodamia variegata*, *Coccinella septempunctata*, *Subcoccinella 24-punctata*, *Propylea quatuordecimpunctata*, *P. quatuordecimpunctata*, *Scymnus frontalis* and *S. nigrinus*. Less common in alfalfa fields are the species *Hippodamia tredecimpunctata*, *Tythaspis sedecimpunctata*, *Psyllobora vigintiduopunctata* and *Vibidia duodecimguttata*. The last one was collected in one field and in a single specimen. One species of Coccinellidae - *Platynaspis luteorubra* is cited for the first time for the Republic of Moldova.

**Keywords:** alfalfa, Coccinellidae, new species, Republic of Moldova.

**Rezumat. Diversitatea speciilor de buburuze (Coleoptera: Coccinellidae) din culturile de lucernă, Republica Moldova.** Scopul acestei lucrări a fost de a identifica speciile de buburuze din lanurile multianuale de lucernă din Republica Moldova. Rolul principal al majorității covârșitoare a speciilor de coccineline din mediul sălbatic este consumul de afide, muște albe, acarieni fitofagi, păduchi lănoși și o gamă largă de alți dăunători cu corp moale. De asemenea, în câmpurile de lucernă, coccinelinele consumă păduchii de plante, care deteriorează frunzele și tulpinile fragede ale lucernei prin perforarea acestora și consumarea sevei, infectând planta cu virusi. Conform datelor actualizate, în Republica Moldova au fost identificate 48 de specii de coccineline (BUȘMACHIU et al., 2022). Printre cele mai comune specii autohtone pentru Republica Moldova se numără *Hippodamia variegata*, *Coccinella septempunctata*, *Subcoccinella 24-punctata*, *Propylea quatuordecimpunctata*, *P. quatuordecimpunctata*, *Scymnus frontalis* și *S. nigrinus*. Mai puțin frecvente în lanurile de lucernă sunt speciile *Hippodamia tredecimpunctata*, *Tythaspis sedecimpunctata*, *Psyllobora vigintiduopunctata* și *Vibidia duodecimguttata*. Ultima a fost colectată într-un singur câmp și într-un singur exemplar. Specia *Platynaspis luteorubra* este citată pentru prima dată în Republica Moldova.

**Cuvinte cheie:** lucernă, Coccineline, specie nouă, Republica Moldova.

### INTRODUCTION

For most people, the ladybug is known as a useful garden insect, which in both its adult and larval stages, spares crops from aphids, mites, grubs and other insects. But it turns out that there are exceptions, some species can destroy crop plants and also contribute to the decline of beneficial native insect species. Ladybugs, although well known to all entomologists and others, present in both natural and agricultural ecosystems remain to this day a poorly studied group in Republic of Moldova. Systematically, they belong to the *Coccinellidae* family, *Cucujoidea* superfamily, *Coleoptera* order, and *Insecta* class.

The research of ladybugs on the current territory of the Republic of Moldova started at the beginning of the 20<sup>th</sup> century. The first species of this group were cited for Bessarabia in 1917 by MILLER & ZUBOWSKY, in 1933 by RUSCINSKY, and in 1957 by MEDVEDEV & SHAPRO. In 1983 in the *Animal World of Moldavia, Invertebrates*, OSTAFICHIUC (1990) lists 32 species of ladybugs, without indicating the species.

In ZUBOWSKY's Entomological Collection Catalogue, published by DERJANSCHI et al. (2016), 25 species of ladybird are cited. In 2021, BACAL et al. publish the first part of the list of species in the collection of the Museum of Entomology of the Institute of Zoology. According to the updated data, 48 species of ladybugs have been identified and published in the Republic of Moldova (BUȘMACHIU et al., 2022). In Ukraine, since 1954, DYADECHKO described 72 species of ladybugs, while in the updated lists of ladybug species in Turkey the number is 105 (OĞUZOĞLU et al, 2017), and in Portugal 101 (SOARES et al., 2021).

The aim of this work was to inventory and identify ladybug species in multiannual alfalfa agrocenoses in the Republic of Moldova. As a result of this research, possibly these insects will be more widely used in the future in agricultural fields against pests and will allow a reduction of pesticide use.

### MATERIAL AND METHODS

Faunistic material of ladybug species were carried out in April-August and October 2020-2023 in alfalfa fields in the Anenii Noi (Telita), Cahul (Rosu, Vadul lui Isac), Calarasi (Bahmut, Bularda, Nishcani, Oniscani, Răciula, Sipoteni), Causeni (Leuntea), Dubăsari (Holercani, Malovata), Fălești (Albinețul Vechi) districts, Cuzmenii Vechi, Fălești, Răciula, Vrănești), Ialoveni (Băcioi, Horăști), Leova (Romanovca), Nisporeni (Bursuc, Nisporeni, Vărzărești,

Vulcănești), Orhei (Jora de Jos), Rezina (Trifești), Sângerei (Iezăreni), Strășeni (Pânășești), ATU Găgăuzia (Comrat, Svetlii, Congaz), Plaiul Fagului Reserve, including the Chișinău municipality (Fig. 1).

A total of 2,552 ladybug specimens were collected from alfalfa fields located in 34 localities, belonging to 7 districts in the central region of the country, including Plaiul Fagului Reserve, 3 districts in the northern region, 3 districts and ATU Găgăuzia in the southern region.

Ladybugs were collected using entomological net with a diameter of 30 cm. For a sample 100 threads were made, carried out in parallel 2-3 times to obtain complex and truthful data. Some specimens were also collected by hand.

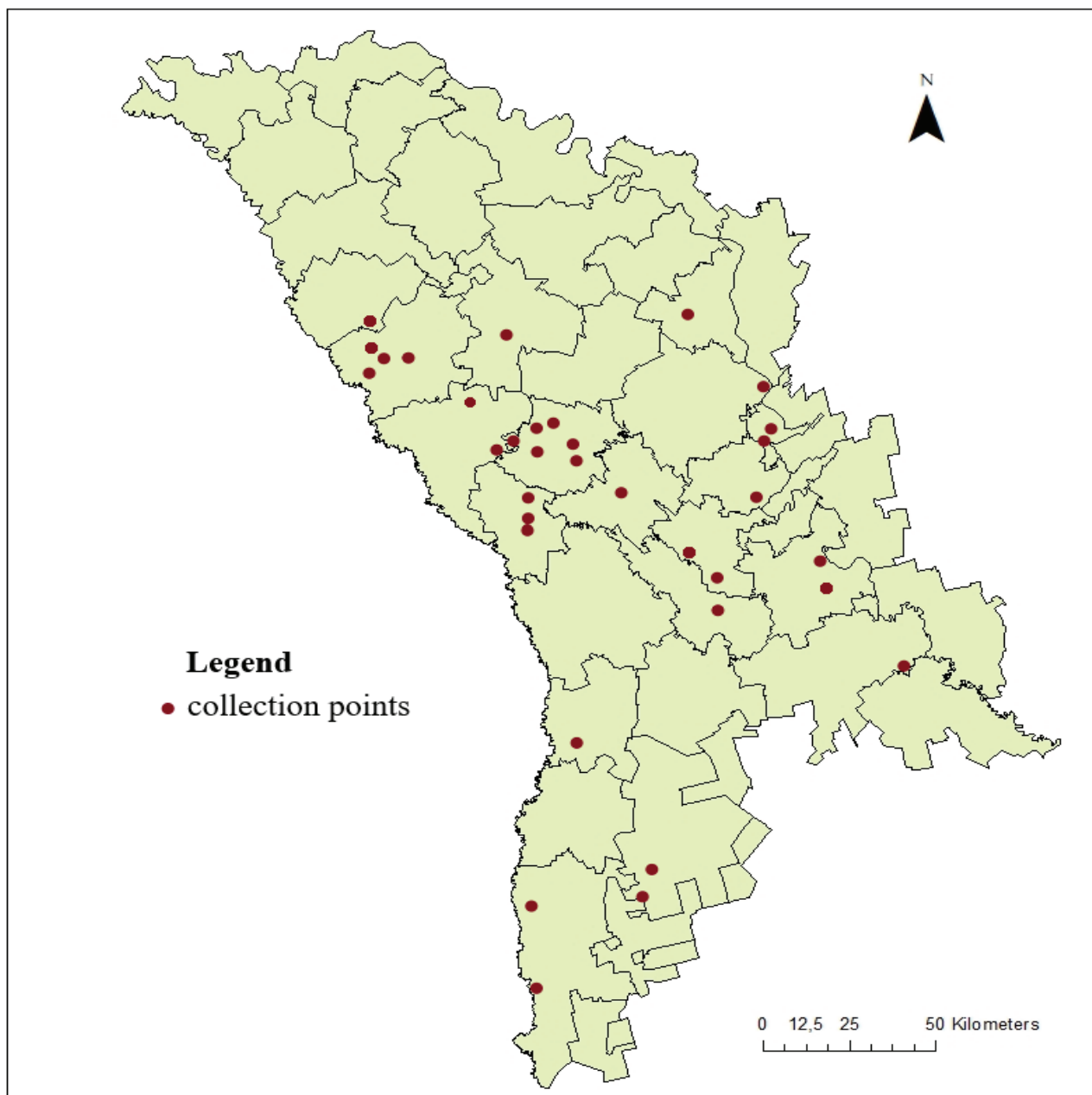


Figure 1. Map of the location of ladybugs collection points.

## RESULTS AND DISCUSSIONS

As a result of the study carried out on the species diversity of ladybugs in alfalfa fields, a total of 14 species of insects were identified, belonging to 11 genera and 3 tribes (Tab.1). Throughout the study, only 3 species of ladybugs dominated numerically. About 40% of the total number of insects collected in the alfalfa fields is accounted for by the dominant species *Hippodamia variegata*, followed by *Coccinella septempunctata* with 20%, both feeding mainly on aphids (Fig. 2). One species of Coccinellidae - *Platynaspis luteorubra* is cited for the first time for the country and is marked with an asterisk (\*) in Table 1.

The third most common ladybug in alfalfa fields was *Subcoccinella 24-punctata* with a 13% share. This is the only species among the ladybugs considered a pest. Alfalfa is eaten by both adults of species and its larvae, which consume plant parts by gnawing the lower skin and leaf parenchyma, thus leaving the upper skin intact.

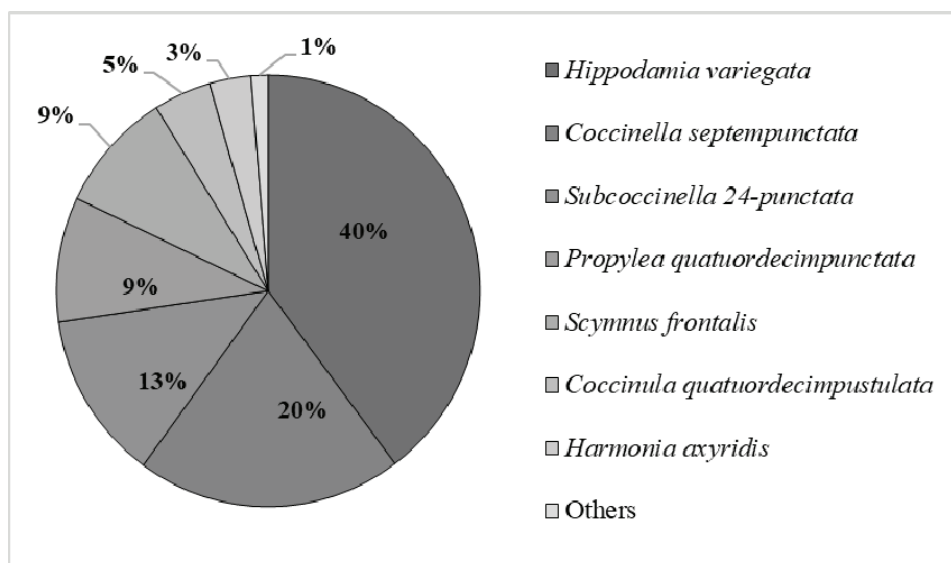


Figure 2. The species of ladybugs identified in alfalfa.

Table 1. The species of ladybugs collected from alfalfa crop.

Species	Locality	Number of specimens	Date of collection
<i>Coccinella septempunctata</i> (Linnaeus, 1758)	Horăști	7	25.05.2021
		35	05.05.2022
	Băcioi	5	05.05.2022
		10	27.04.2022
	Bahmut	3	13.04.2021
		102	06.05.2021
		2	08.06.2021
		4	17.05.2023
	Vărzărești	7	04.08.2020
	Molovata	8	10.06.2021
	Jora de Jos	10	12.05.2021
	Holercani	8	10.06.2021
	Leuntea	2	04.06.2021
	Plaiul Fagului	18	26.07.2022
	Teița	21	12.06.2021
		2	12.05.2022
	Nisporeni	9	23.07.2021
	Bursuc	32	23.07.2021
	Vulcănești	20	13.05.2022
	Răciula	29	06.05.2022
Vrănești	1	19.08.2022	
Cuzmenii Vechi	4	21.07.2022	
Albinețul Vechi	2	21.07.2022	
Trifești	7	03.06.2022	

	Vadul lui Isac	40	13.05.2022
	Svetlii	20	13.05.2022
	Bularda	6	06.05.2022
	Nișcani	12	06.05.2022
	Congaz	21	13.05.2022
	Roșu	23	13.05.2022
	Bulboaca	2	17.05.2023
	Bușila	17	17.05.2023
	Făgădău	27	17.05.2023
	Chișinău	1	28.05.2023
<i>Coccinella magnifica</i> (Redtenbacher, 1843)	Vărzărești	9	04.08.2020
	Cuzmenii Vechi	1	21.07.2022
<i>Coccinula quatuordecimpustulata</i> (Linnaeus, 1758)	Horăști	1	25.05.2021
		5	05.05.2022
	Băcioi	4	05.05.2022
		2	27.04.2022
	Bahmut	2	06.05.2021
	Plaiul Fagului	1	26.07.2022
	Telița	2	12.06.2021
	Nisporeni	1	23.07.2021
	Vulcănești	1	13.05.2022
	Răciula	2	06.05.2022
		3	27.07.2022
	Onișcani	1	24.08.2022
	Fălești	2	27.07.2022
	Sipoteni	1	26.07.2022
	Romanovca	4	21.07.2022
	Cuzmenii Vechi	1	21.07.2022
	Trifești	10	03.06.2022
	Vadul lui Isac	39	13.05.2022
	Svetlii	13	13.05.2022
	Congaz	2	13.05.2022
	Roșu	8	13.05.2022
	Bușila	5	17.05.2023
	Făgădău	2	17.05.2023
<i>Harmonia axyridis</i> (Pallas, 1773)	Băcioi	6	18.08.2022
	Vărzărești	28	04.08.2020
	Molovata	1	10.06.2021
	Holercani	1	10.06.2021
	Plaiul Fagului	1	26.07.2022
	Telița	1	12.05.2022
	Iezăreni	1	19.08.2022
	Fălești	3	27.07.2022
	Vrănești	19	19.08.2022
	Cuzmenii Vechi	7	21.07.2022
	Albinețul Vechi	2	21.07.2022
	Pănășești	2	26.07.2022
	Trifești	7	03.06.2022
	Svetlii	1	13.05.2022
	Roșu	1	13.05.2022
<i>Hippodamia variegata</i> (Goeze, 1777)	Horăști	3	05.05.2022
	Băcioi	1	05.05.2022
		3	27.04.2022
		5	18.08.2022
	Bahmut	4	06.05.2021
	Vărzărești	17	04.08.2020
	Jora de Jos	5	12.05.2021
	Plaiul Fagului	134	26.07.2022
	Telița	2	12.06.2021
	Bursuc	1	23.07.2021
	Vulcănești	3	13.05.2022

	Răciula	21	27.07.2022	
	Onișcani	18	24.08.2022	
	Iezăreni	6	19.08.2022	
	Fălești	16	27.07.2022	
	Vrănești	42	19.08.2022	
	Sipoteni	208	26.07.2022	
	Romanovca	49	21.07.2022	
	Cuzmenii Vechi	42	21.07.2022	
	Albinețul Vechi	7	21.07.2022	
	Pănăsești	361	26.07.2022	
	Svetlii	1	13.05.2022	
	Congaz	2	13.05.2022	
	Bulboaca	3	18.05.2023	
	Bușila	33	17.05.2023	
	Făgădău	28	17.05.2023	
<i>Hippodamia tredecimpunctata</i> (Linnaeus, 1758)	Telița	1	12.05.2022	
	Răciula	3	27.07.2022	
	Vrănești	1	19.08.2022	
	Congaz	1	13.05.2022	
<i>*Platynaspis luteorubra</i> (Goeze, 1777)	Chișinău	1	28.05.2023	
<i>Propylea quatuordecimpunctata</i> (Linnaeus, 1758)	Horăști	1	25.05.2021	
		26	05.05.2022	
	Băcioi	13	05.05.2022	
		3	27.04.2022	
		1	02.05.2023	
	Bahmut	4	06.05.2021	
		8	21.05.2021	
		2	17.05.2023	
	Plaiul Fagului	27	26.07.2022	
	Telița	5	12.06.2021	
		1	12.05.2022	
	Nisporeni	1	23.07.2021	
	Bursuc	2	23.07.2021	
	Vulcănești	7	13.05.2022	
	Răciula	13	06.05.2022	
		14	27.07.2022	
	Onișcani	1	24.08.2022	
	Iezăreni	2	19.08.2022	
	Fălești	8	27.07.2022	
	Vrănești	14	19.08.2022	
	Sipoteni	1	26.07.2022	
	Romanovca	2	21.07.2022	
	Cuzmenii Vechi	11	21.07.2022	
	Albinețul Vechi	2	21.07.2022	
	Pănăsești	1	26.07.2022	
	Trifești	6	03.06.2022	
	Vadul lui Isac	19	13.05.2022	
	Bularda	1	06.05.2022	
	Nișcani	5	06.05.2022	
	Onițcani	2	06.05.2022	
	Congaz	9	13.05.2022	
	Roșu	13	13.05.2022	
	Bulboaca	2	18.05.2023	
	Bușila	7	17.05.2023	
	Făgădău	2	17.05.2023	
	Chișinău	2	28.05.2023	
	<i>Psyllobora vigintiduopunctata</i> (Linnaeus, 1758)	Băcioi	1	27.04.2022
		Răciula	1	06.05.2022
		Svetlii	1	13.05.2022
		Bularda	1	06.05.2022
Bahmut		1	17.05.2023	
Făgădău		1	17.05.2023	

<i>Scymnus frontalis</i> (Fabricius, 1787)	Plaiul Fagului	4	26.07.2022
	Vulcănești	1	13.05.2022
	Răciula	4	27.07.2022
	Onișcani	4	24.08.2022
	Iezăreni	1	19.08.2022
	Fălești	1	27.07.2022
	Vrănești	13	19.08.2022
	Sipoteni	21	26.07.2022
	Romanovca	16	21.07.2022
	Albinețul Vechi	18	21.07.2022
	Pănășești	14	26.07.2022
	Trifești	8	03.06.2022
	Congaz	1	13.05.2022
	Roșu	2	13.05.2022
	Bușila	3	17.05.2023
Făgădău	4	17.05.2023	
Chișinău	117	28.05.2023	
<i>Scymnus nigrinus</i> (Kugelann, 1794)	Pănășești	1	26.07.2022
<i>Subcoccinella 24-punctata</i> (Linnaeus, 1758)	Bahmut	8	06.05.2021
		8	21.05.2021
		15	17.05.2023
	Leuntea	1	04.06.2021
	Plaiul Fagului	15	26.07.2022
	Telița	2	12.05.2022
	Nisporeni	60	23.07.2021
	Bursuc	27	23.07.2021
	Răciula	6	06.05.2022
		111	27.07.2022
	Sipoteni	2	26.07.2022
	Romanovca	24	21.07.2022
	Bularda	34	06.05.2022
	Nișcani	6	06.05.2022
	Roșu	1	13.05.2022
	Băcioi	1	02.05.2023
	Bublboaca	1	18.05.2023
Chișinău	1	28.05.2023	
<i>Tytthaspis sedecimpunctata</i> (Linnaeus, 1758)	Băcioi	1	27.04.2022
		2	02.05.2023
	Plaiul Fagului	1	26.07.2022
	Telița	1	12.05.2022
	Răciula	1	27.07.2022
	Vrănești	1	19.08.2022
Svetlii	1	13.05.2022	
<i>Vibidia duodecimguttata</i> (Poda, 1761)	Răciula	1	27.07.2022

In addition to the three dominant species, an impressive number of *Propylea quatuordecimpunctata* (239) were collected, most of them found in the alfalfa field near Plaiul Fagului Reserve.

Also, 233 specimens of the genus *Scymnus* were collected; of which 232 were *Scymnus frontalis* and one specimen of *Scymnus nigrinus*. About 50% of the total numbers of *S. frontalis* were collected from Chisinau municipality in 2023, being the only alfalfa field in which this species predominated. It should be mentioned that, compared to other alfalfa fields, this one was less affected by aphids.

Of the genus *Coccinella*, in addition to the numerous specimens of *Coccinella septempunctata*, 10 specimens of *Coccinella magnifica* were also observed, 9 of which were present in the alfalfa field of Vărzărești.

Less common in the alfalfa fields are specimens of *Hippodamia tredecimpunctata* (6), *Tytthaspis sedecimpunctata* (6) and *Psyllobora vigintiduopunctata* (4). *Vibidia duodecimguttata* was collected in only one specimen in Răciula.

The total number of collected ladybugs specimens varied depending on the location of the investigated agrocenoses, most of them being collected from the localities of Pănășești (379), Sipoteni (233), Răciula (209) and Plaiul Fagului (201). The dominant species varied from one field to another, in Pănășești, Sipoteni and Plaiul Fagului

*Hippodamia variegata* predominated, in Bahmut and Vadul lui Isac - *Coccinella septempunctata*, and in Răciula and Nisporeni - *Subcoccinella 24-punctata*.

The predominance of a harmful species *Subcoccinella 24-punctata* can lead to partial loss of plants attacked by alfalfa, with the leaves twisting and drying out and significant damage being recorded in the early part of the growing season. The species has two generations per year and overwinters as an adult at the base of dry alfalfa plants (BOINCEAN, 2020).

During the last field collections and investigations (28 May 2023), in the Chisinau municipality, Schinoasa sector, a specimen of *Platynaspis luteorubra* was detected (Photo 1). This species has not been mentioned in the Republic of Moldova so far, being considered myrmecophilous (VANTAUX et al, 2012). The larvae of *Platynaspis luteorubra* develop on the nests of ants, in particular of *Lasius niger* and *Tramorium caespitum*, very common species that grow aphid colonies. However, in appearance, this ladybird can be considered an aphid eater.

We note that the main role of the overwhelming majority of ladybugs species in the wild is the consumption of aphids, whiteflies, phytophagous mites, woolly lice, and a wide range of other soft-bodied pests. Similarly, in alfalfa fields, cockchafers consume plant lice, which damage the tender alfalfa leaves and stems by puncturing them and consume the sap infecting the plant with viruses.

By eating plant pests, the ladybirds regulate their numbers and prevent the spread of the alfalfa virus called *Medicago virus* or alfalfa mosaic virus which is transmitted by aphids (Fig. 3) (YAHYA et al., 2019).

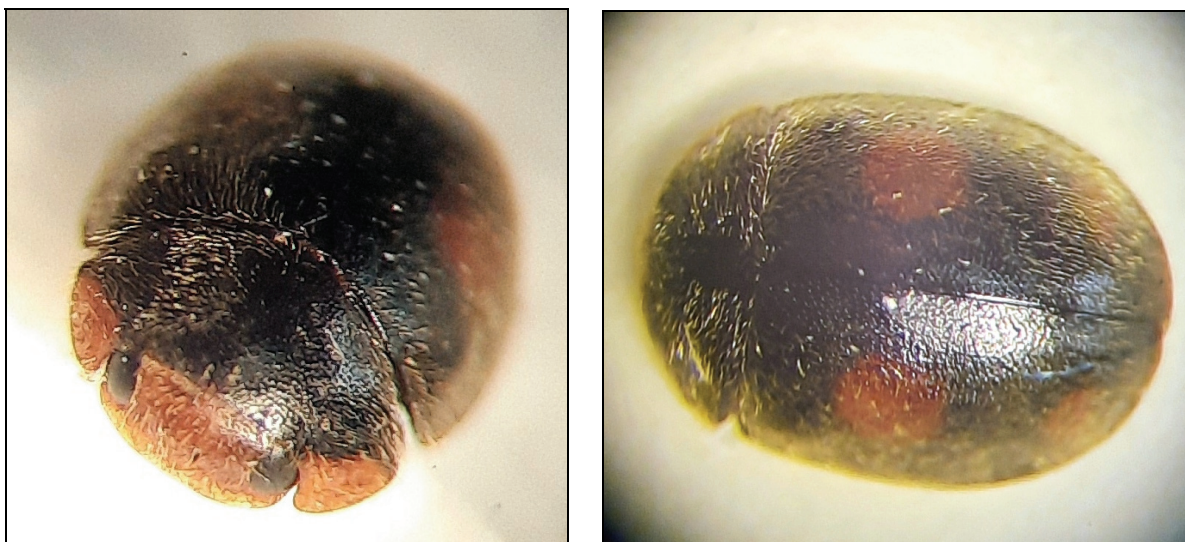


Photo 1. *Platynaspis luteorubra* (original).

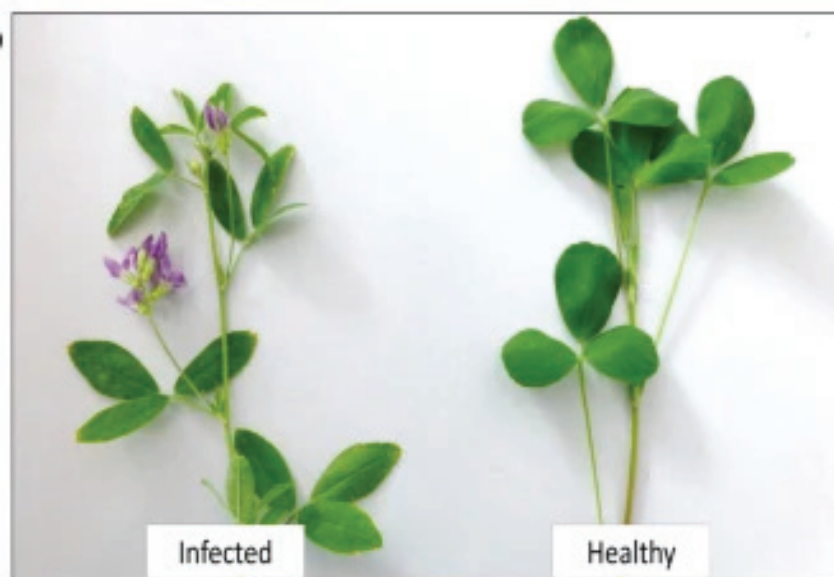


Figure 3. Alfalfa plant infected with *Medicago virus*.

In the Republic of Moldova, the diversity of ladybugs in alfalfa fields has not been studied yet, but such research exists internationally. POUR & SHAKARAMI (2012) analysed the diversity of coccinellids in KHORRAMABAD (Iran), highlighting their importance and the general characteristics of each species, and WERF et al. (2000) characterized the dispersal of *Coccinella septempunctata* in alfalfa fields (USA), which was also frequently found in alfalfa fields in the Republic of Moldova. Also GREZ et al. (2005) from the University of Chile Research Station, Santiago created an experimental fragmented alfalfa landscape to analyse the influence of these conditions on ladybugs dispersal.

#### ACKNOWLEDGEMENTS

Thanks to Mrs Grozdeva Svetlana for her help in collecting ladybugs. The work was developed within the framework of the project No. 20.80009.7007.02 State Program (2020-2023).

#### CONCLUSIONS

As a result of the research carried out during 2020 -2023 years, a total of 2,552 specimens of ladybugs belonging to 14 species were collected from alfalfa fields, mainly from the central region of the Republic of Moldova.

One rather rare species *Platynaspis luteorubra* - was firstly identified in the Republic of Moldova. About 40% of the total number of collected specimens in the alfalfa fields is accounted for by the dominant species *Hippodamia variegata*, followed by *Coccinella septempunctata* with 20%, both feeding mainly on aphids.

Coccinellids are a group of insects extremely useful for all types of habitats, they regulate the number of some phytophagous pests and contribute to the national economy, except for phytophagous species affecting alfalfa, such as *Subcoccinella 24-punctata* which has been detected in quite large numbers.

#### REFERENCES

- BACAL SVETLANA, BUȘMACHIU GALINA, BURDUJA DANIELA. 2021. Contribuții la cunoașterea buburuzelor (Coleoptera: Coccinellidae) din fauna Republicii Moldova. *Akademios*. Chișinău. **1**(60): 20-27.
- BOINCEAN B. 2020. *Cultivarea lucernei în sistem ecologic*. Available online at: <https://moldova.peopleinneed.net/media/publications/1551/file/cultivarea-lucernei-in-sistem-ecologic.pdf>. (accessed: March 23, 2023).
- BUȘMACHIU GALINA, BACAL SVETLANA, BURDUJA DANIELA, CALESTRU LIVIA, BELOVA V. 2022. *Buburuzele (Insecta: Coccinellidae) din Republica Moldova*. Institutul de Zoologie. Capatina Print. Chișinău. 68 pp.
- DERJANSCHI V., BABAN ELENA, CALESTRU LIVIA, STAHI NADEJDA, ȚUGULEA CRISTINA. 2016. *Catalogue of the "N. Zubowsky entomological collection"*. *Academy of Sciences of Moldova, National Museum of Ethnography and Natural History*, Institute of Zoology, Edit. "Bons Offices" Chișinău, 296 pp.
- DYADECHKO N. P. 1954. *Coccinellidae of the Ukrainian SSR*. Kiev. Academy of Sciences of USSR. 156 pp. (in Russian).
- GAAFAR Y. Z. A., RICHERT-PÖGGELER K. R., SIEG-MÜLLER A., LÜDDECKE P., HERZ K., HARTRICK J., SEIDE Y, VETTEN H.-J. 2019. A divergent strain of melon chlorotic spot virus isolated from black medic (*Medicago lupulina*) in Austria. In: *Virology Journal*. **16**(89). Available online at: <https://virology.biomedcentral.com/articles/10.1186/s12985-019-1195-8> (accessed: 13 november, 2022).
- GREZ A. A., ZAVIEZO T., RIOS M. 2005. Ladybird (Coleoptera: Coccinellidae) dispersal in experimental fragmented alfalfa landscapes. *European Journal of Entomology*. London. **10**: 209-216. Available online at: <https://www.eje.cz/pdfs/eje/2000/04/08.pdf> (accessed: 24 december, 2022).
- OSTAFICHUC V. G. 1990. Nasekomye – vrediteli sel'skoho zjajstvennyh kul'tur. In: *Fauna biocenoticheskikh oazisov i ejo prakticheskoe znachenie*. Shtiinca. Kishinev: 70-124.
- OĞUZOĞLU Ş., AVCI M., ŞENAL D., KARACA I. 2017. First record of *Anatis ocellata* (Linnaeus, 1758) (Coleoptera: Coccinellidae) in Turkey. *Türkiye Entomoloji Bülteni*. Istanbul. **7**(2): 197-202. Available online at: <https://dergipark.org.tr/tr/download/article-file/398093>. (accessed: 15 march, 2023).
- MEDVEDEV S. & SHAPIRO D. 1957. To the knowledge of beetles fauna (Coleoptera) of the Moldavian Soviet Socialist Republic and the neighboring regions of Ukraine. In: *Scientific works of the IBF*. Ukraine. **30**: 173-206.
- MILLER E. & ZUBOVSKY N. 1917. Materials on the entomological fauna of Bessarabia. In: *Proceedings of the Bessarabian Society Naturalists and Life Science Amateurs*. Typography Bessarabian Provincial Board. Chișinău. **2**(1): 32-150.
- POUR A. & SHAKARAMI J. 2012. Recognition of ladybird fauna (col.: Coccinellidae) in the alfalfafields of khorramabad. *The Journal of Animal & Plant Sciences*. London. **22**(4): 939-943. Available online at: <http://www.thejaps.org.pk/docs/V-22-4/19.pdf>. (accessed: 09 march, 2023).
- RUSCINSKII A. 1933. Beitrag zur Coleopterenfauna Bessarabiens. In: *Bulletin du Musee National de Sciences naturelles de Chisinau-Roumanie*. Chișinău. **5**: 131-143.
- SOARES A. O., CALADO H. R., FRANCO J. C., AGUIAR A. F., ANDRADE M. M., ZINA V., AMEIXA O. M. C. C., BORGES I., MAGRO A. 2021. An annotated checklist of ladybeetle species (Coleoptera, Coccinellidae) of



- Portugal, including the Azores and Madeira Archipelagos. In: *ZooKeys*. Pensoft Publisher. London. **1053**: 107-144. Available online at: <https://zookeys.pensoft.net/article/64268/>. (accessed: 18 february, 2023).
- WERF W., EVANS E., POWELL J. (2000) Measuring and modelling the dispersal of *Coccinela septem punctata* (Coleoptera: Coccinellidae) in alfalfa fields. In: *European Journal of Entomology*. Czech Academy of Sciences. Praga. **97**: 487-493. Available online at: <https://www.eje.cz/pdfs/eje/2000/04/08.pdf>. (accessed: 13 november, 2022).
- VANTAUX A., ROUX O., MARGO A., ORIVEL J. 2012. *Evolutionary Perspectives on Myrmecophily in Ladybirds*. Available online at: <https://hal.science/hal-02062391/document>. (accessed: 30 march, 2023).

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Received: April 12, 2023

Accepted: July 28, 2023