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Diversity of avifauna in the orchards of the Republic of Moldova

Tudor Țibuleac, Teodor Glăvan-Caranghel, and Victoria Nistreanu

Abstract. The study was conducted in the period 1991-2018 in 86 different types of orchards from the central part of the Republic of Moldova, in all phenological periods. The bird fauna in the orchards is well represented, with a rich diversity of 95 species from 13 orders, which represents 35% of the avifauna of the republic. The dominant species were the passerine birds that are widespread and have high density in various arboreal biotopes. There were recorded 5 protected species: *Ciconia ciconia*, *Circus pygargus*, *Milvus migrans*, *Falco vespertinus* and *Dendrocopos medius*. In terms of phenology, the predominance of migratory species was found, followed by sedentary ones, winter guests, occasional and passage species. Further research is needed on orchard avifauna, which provide a range of economically valuable ecosystem services.

Keywords: avifauna, orchard, diversity, dominant species, rare species, phenology, importance.

Diversitatea avifaunei în livezile din Republica Moldova

Rezumat. Studiul a fost realizat în perioada 1991-2018 în 86 de livezi de diferite tipuri din zona centrală a Republicii Moldova, în toate perioadele fenologice. Fauna de păsări din livezi este bine reprezentată, cu o bogată diversitate de 95 de specii din 13 ordine, ceea ce reprezintă 35% din avifauna republicii. Speciile dominante au fost paseriformele care sunt larg răspândite și au densități mari în diverse biotopuri arboricole. Au fost înregistrate 5 specii protejate: *Ciconia ciconia, Circus pygargus, Milvus migrans, Falco vespertinus* și *Dendrocopos medius*. Din punct de vedere fenologic, s-a constatat predominanța speciilor migratoare, urmate de cele sedentare, oaspeți de iarnă, specii ocazionale și de pasaj. Sunt necesare cercetări suplimentare asupra avifaunei din livezi, care oferă o serie de servicii ecosistemice valoroase din punct de vedere economic.

Cuvinte-cheie: avifauna, livadă, diversitate, specii dominante, specii rare, fenologie, importanță.

1. Introduction

Due to the favorable pedological and climatic conditions, the Republic of Moldova represents a viticulture and fruit growing region par excellence. That is why ornithological studies in the area often have connections with the anthropic landscape and fruit growing

in particular. Among the first studies, which address aspects of avifauna in the Republic of Moldova, there can be mentioned several books dedicated to the biocenotic distribution of bird communities, the influence of anthropogenic factors on avifauna, as well as their role in orchard pest control [1, 2, 13]. Further research addresses the distribution and other ecological aspects of birds in natural and anthropogenic ecosystems, as well as the specific composition and density of bird populations in intensive orchards [3, 4, 5]. Similar studies also extend to the avifauna of protective forest belts, both from agricultural fields and from orchards [8, 12, 19]. The studies on the avifauna of orchards have been focused on the adaptation of birds to the conditions of anthropogenic ecosystems [14], the particularities of the ecology of bird nesting in intensive orchards [6, 7], the importance of birds in the fight against agricultural pests and the importance of biocenotic oases in enriching the avifauna of agrocenoses [10, 12, 14] and spatial distribution of birds in orchards [11, 20]. In the last 20 years, the studies on the avifauna of orchards are very few and sporadic [18].

After the year 2000, new forms of private property began to appear – farmers and orchard collectives. The planting of new orchards, which are almost exclusively of intensive and super-intensive form, has started and the structure of their tree species composition has also changed. Thus, the share of seed orchards, such as apple and pear, decreased in favor of stone fruit ones, such as plum, peach, apricot, cherry, sour cherry, as well as nut trees, such as walnut, almond, rarely hazelnut. In this context, there have been changes in the quantitative and qualitative structure of bird communities in various types of orchards. Hence the need for an updated study on orchard avifauna has arisen.

The aim of the paper is to analyze the diversity of the avifauna in the orchards of the republic in the last decades, highlighting the dominant species and the importance of birds in the functioning of anthropogenic ecosystems.

2. Materials and Methods

The study was conducted in the period 1991-2018. There were selected 86 different orchards, in terms of tree essence, age, structure and location, with an area between 0.02 and 60 ha each, in total – 615 ha. The studied orchards were mixed, of different species and varieties, from apple and pear to cherry, peach and apricot, located in the Central Codri forest area, in the suburbs of Chisinau and in the Criuleni district.

In order to highlight the seasonal dynamics of the avifauna distribution, the annual life cycle of the birds was divided, according to established principles, into 5 phenological aspects. They are the following: hiemal, prevernal, vernal, serotinal and autumnal. The estimation of bird density was carried out using the method of plots and the method of

transects [15, 16, 17]. The evaluation of the diversity and bird number was carried out by the mapping method, recording on the sketch of the territory all the individuals identified visually and after sound. The research was systematically carried out twice for each phenological aspect in the period 1991-2001 and in the vernal, serotinal and autumnal aspects in the period 2002-2018.

3. Results and Discussions

Obtained results and discussions As result of the studies carried out in different types of orchards, a diversity of 95 bird species from 13 orders was established (Tab. 1). The classification was made according to the World Bird Database - Avibase; the Bird World and Bird Life International databases.

Table 1. Avifauna diversity in the orchards from the central part of the Republic of Moldova

No.	Order, Species	H	P	V	S	A
Order Galliformes						
1.	Phasianus colchicus	-	+	+	+	-
2.	Perdix perdix	+	+	+	+	+
3.	Coturnix coturnix	-	-	+	-	-
Order Ciconiiformes						
4.	Ciconia ciconia	-	-	+	+	+
Order Accipitriformes						
5.	Circus aeruginosus	-	+	-	-	-
6.	Circus pygargus	-	+	-	-	-
7.	Buteo buteo	-	+	+	+	+
8.	Buteo lagopus	+	-	-	-	-
9.	Milvus migrans					
10.	Accipiter nisus	+	+	-	+	+
11.	Accipiter gentilis	-	+	-	+	-
Order Falconiformes						
12.	Falco tinnunculus	-	+	+	+	+

13.	Falco vespertinus	-	-	-	+	+
Order Columbiformes						
14.	Columba livia	+	+	+	+	+
15.	Columba palumbus	-	-	-	+	-
16.	Streptopelia turtur	-	+	+	+	-
17.	Streptopelia decaocto	-	-	-	+	-
Order Cuculiformes						
18.	Cuculus canorus	-	+	+	+	-
Order Apodiformes						
19.	Apus apus	-	-	+	+	-
Order Caprimulgifomes						
20.	Caprimulgus europaeus	-	-	-	+	-
Order Strigiformes						
21.	Asio otus	+	+	+	-	-
22.	Athene noctua	+	+	-	-	-
Order Coraciiformes						
23.	Merops apiaster	-	-	+	+	-
Order Bucerotiformes						
24.	Upupa epops	-	-	+	-	-
Order Piciformes						
25.	Dendrocopos syriacus	+	+	+	+	+
26.	Dendrocopos medius	+	-	-	-	-
27.	Dendrocopos major	+	+	+	+	+
28.	Dendrocopos minor	+	-	-	-	-
29.	Picus canus	-	+	-	-	-
Order Passeriformes						
30.	Regulus regulus	+	+	-	-	-
31.	Coccothraustes coccothraustes	+	+	+	+	-

32.	Carduelis cannabina	-	+	+	-	-
33.	Jynx torquilla	-	-	+	+	-
34.	Serinus serinus	-	-	+	-	-
35.	Fringilla coelebs	+	+	+	+	+
36.	Fringilla montifringilla	+	-	-	-	-
37.	Corvus frugilegus	+	+	+	-	+
38.	Corvus corone	+	+	+	-	+
39.	Galerida cristata					
40.	Melanocorypha calandra	-	+	-	-	-
41.	Alauda arvensis	-	+	+	+	-
42.	Lullula arborea	-	+	+	+	+
43.	Turdus pilaris	+	+	-	-	-
44.	Motacilla alba	-	+	+	+	+
45.	Phoenicurus phoenicurus	-	-	-	+	-
46.	Phoenicurus ochruros	-	-	+	+	+
47.	Certhia familiaris	+	+	+	+	+
48.	Corvus corax	+	+	+	+	+
49.	Pica pica	+	+	+	+	+
50.	Anthus campestris	-	-	-	+	+
51.	Anthus trivialis	-	+	+	+	+
52.	Carduelis chloris	+	+	+	+	-
53.	Hippolais icterina	-	-	+	-	-
54.	Garrulus glandarius	+	+	+	+	+
55.	Oriolus oriolus	-	+	+	+	-
56.	Sturnus vulgaris	-	+	+	-	-
57.	Delichon urbica	-	-	-	+	-
58.	Erithacus rubecula	-	+	-	+	+
59.	Saxicola rubetra	-	-	+	+	-

60.	Saxicola torquata	-	+	+	+	+
61.	Bombycilla garrulus	+	-	-	-	-
62.	Turdus merula	+	+	+	+	+
63.	Pyrrhula pyrrhula	+	+	-	-	+
64.	Ficedula albicollis	-	+	-	-	-
65.	Ficedula hypoleuca	-	+	-	-	-
66.	Muscicapa striata	-	+	+	+	-
67.	Oenanthe oenanthe	-	+	-	-	-
68.	Phylloscopus trochilus	-	-	-	+	-
69	Phylloscopus collybita	-	+	+	+	+
70.	Parus caeruleus	+	+	-	+	+
71.	Aegithalos caudatus	-	+	-	-	+
72.	Parus major	+	+	+	+	+
73.	Parus palustris	+	+	-	-	+
74.	Emberiza hortulana	-	-	+	+	-
75.	Emberiza schoeniclus	+	+	-	-	-
76.	Emberiza citrinella	+	+	+	+	+
77.	Emberiza calandra	-	-	+	-	-
78.	Luscinia luscinia	-	-	+	+	-
79.	Hirundo rustica	-	+	+	+	-
80.	Carduelis spinus	+	-	-	-	+
81.	Lanius minor	-	-	+	+	-
82.	Lanius excubitor					
83.	Lanius collurio	-	-	+	+	-
84.	Sylvia atricapilla	-	-	+	+	-
85.	Sylvia communis	-	-	+	+	-
86.	Sylvia borin	-	-	+	-	-
87.	Sylvia curruca	-	-	+	-	-

88.	Sylvia nisoria	-	-	+	+	-
89.	Corvus monedula	-	+	+	-	+
90.	Carduelis carduelis	+	+	+	+	+
91.	Turdus philomelos	-	+	+	+	+
92.	Turdus viscivorus	-	+	-	-	-
93.	Sitta europaea	-	-	-	+	+
94.	Passer montanus	+	+	+	+	+
95.	Passer domesticus	-	-	+	+	+
Total species	95	32	56	58	58	38

Note: phenological period: H – hiemal, P – prevernal, V – vernal, S – serotinal, A - autumnal.

The avifauna of any habitat is formed on the basis of biotic and abiotic factors, specific to a certain area, settling as a component of the regional avifauna. Thus, the regional avifauna of the Republic of Moldova includes about 280 species of birds [3], 95 species of birds were identified in orchards, which constitutes approximately 34% of the avifauna of the republic. It is quite a large diversity, taking into account the fact that orchards are anthropogenic ecosystems and not natural ones. The dominant species in orchards were *Fringilla coelebs*, *Passer montanus*, *Emberiza citrinella*, *Cardueliscarduelis*, *Parus major*. Also, 5 rare species listed in the Red Book of the Republic of Moldova [9, p. 266-230], were registered, namely *Ciconia ciconia*, *Circuspygargus*, *Milvus migrans*, *Falco vespertinus*and *Dendrocopos medius*.

Following the analysis of the avifauna in terms of phenological aspect, it was found that migratory species predominate with over 44% of the total number of species, followed by sedentary ones, winter guests, occasional and species of passage (fig. 1). The increased share of nesting species (migratory and sedentary), found in orchards, does not necessarily mean breeding, but only their presence in this habitat. The phenological category of each species was assessed in relation to the regional avifauna in general [3] and not in relation to the specific orchard habitat. If we take it strictly, there are almost no sedentary birds in the orchards. Even tits and woodpeckers retire for the night in certain periods of the year, especially in winter, to the neighbouring arboreal biotopes. Synanthropic species, such as corvids, retreat to the localities during the cold period of the year. According to the given study, the nesting of 48 species (about 50% of the total number) was established in the orchards, both by finding the nests and by their nuptial song or dance. However,

even in cases of direct registration of birds with nuptial behaviour, difficulties may arise. For example, the common buzzard and the raven often include orchards in their breeding territories, but their nests are located in adjacent biotopes.

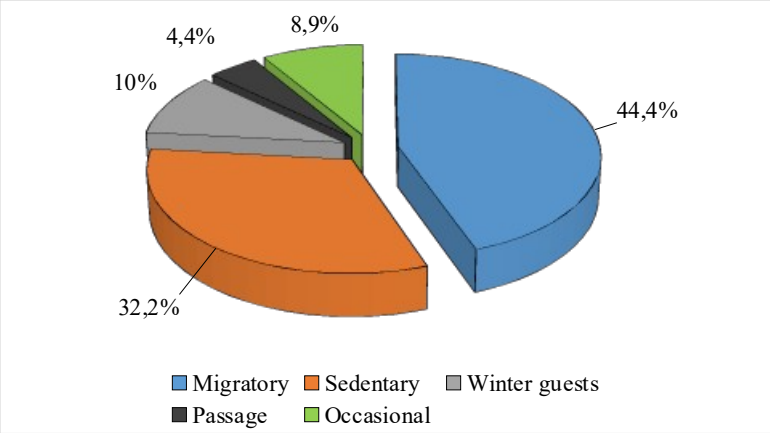

Figure 1. Phenological groups of birds in orchards.

As species of passage were considered the birds, which are assigned to this category in relation to the regional avifauna. But many migratory birds, as well as the winter guests observed on the territory of the republic, can be met in orchards only during migrations. Thus, a part of chaffinches, like other migratory birds are birds of passage in orchards. That is why their real share, being difficult to assess accurately, is much higher. The share of occasional species is relatively small, they meet sporadically in certain periods of the year in search of food, and some species, such as *Ciconia ciconia*. *Milvus migrans*, *Falco vespertinus*, were reported only a few times.

The study of the avifauna of orchards is of particular importance, because in such biotopes stable communities of birds are formed, which contribute to the biological regulation of pests in all phenological periods. Also, the orchards, especially the old ones, provide favourable conditions for rare species as well, being biocenotic oases for the protection and preservation of the avifauna diversity in the agricultural landscape.

4. Conclusions

The bird fauna in the orchards from the central part of the Republic of Moldova is well represented, constituting 95 species from 13 orders, which represents 35% of the avifauna of the republic. The dominant species are the widespread Passeriformes, which have large numbers in various arboreal biotopes. 5 protected species *Ciconia ciconia*, *Circus pygargus*, *Milvus migrans*, *Falco vespertinus* and *Dendrocopos medius* were reported.

In terms of phenology, the predominance of migratory species was found, followed by sedentary ones, winter guests, occasional and species of passage. Further research is needed on orchard avifauna, which contribute to the stable functioning of ecosystems and provide a range of economically valuable ecosystem services.

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(Tudor Ţibuleac) "ORGNAT" Society
E-mail address: ttibuleac@yahoo.es

(Teodor Glăvan-Caranghel, Victoria Nistreanu) MSU, Institute of Zoology
E-mail address: theodor_glavan@yahoo.com, victoria.nistreanu@sti.usm.md