

Breeding species in urban avifauna of Chisinau city

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Abstract. The research was conducted between 2015 and 2024 in various ecosystems of Chisinau city: "Râșcani" Forest-Park, "Valea Trandafirilor" Park, "Valea Morilor" Park, "La Izvor" Park, "Dendrariu" Park, "Grădina Botanică" Park, and the Bâc River meadow. In Chisinau, 68 species of breeding birds were recorded, belonging to 12 orders. The largest share was held by species from the order Passeriformes (41 species), followed by Piciformes (4), Columbiformes (4), Strigiformes (4), Ciconiiformes (3), Gruiformes (3), Charadriiformes (2), Coraciiformes (1), Anseriformes (1), Apodiformes (1), and Podicipediformes (1). According to nesting site preferences, bird species were distributed into 7 ecological groups: arboreal nesters – 17 species, cavity nesters – 15 species, ground nesters – 4 species, and species nesting in anthropogenic cavities – 4 species. Based on trophic preferences, the 68 bird species were classified into 5 ecological groups: the most numerous was the entomophagous group (46 species), followed by carnivores (8), omnivores (6), granivores (4), and ichthyophagous species (3). Urban ecosystems play a significant role in maintaining the diversity of avifauna during the nesting period by providing suitable nesting sites and trophic resources similar to those found in natural environments, thus significantly contributing to the conservation of bird diversity in the central area of the republic.

Keywords: breeding avifauna, anthropogenic biotopes, bird diversity, ecological groups, urban environment.

Speciile clocitoare din avifauna urbană a orașului Chișinău

Rezumat. Cercetările au fost efectuate în perioada 2015-2024 în ecosistemele or. Chișinău: Pădurea-parc „Râșcani”, Parcul „Valea Trandafirilor”, Parcul „Valea Morilor”, Parcul „La Izvor”, Parcul „Dendrariu”, Parcul „Grădina Botanică” și lunca râului Bâc. În orașul Chișinău au fost înregistrate 68 specii de păsări clocitoare, care fac parte din 12 ordine, ponderea cea mai mare o dețin speciile din ordinul Passeriformes – 41 specii, urmată de Piciformes – 4, Columbiformes – 4, Strigiformes – 4, Ciconiiformes – 3, Gruiformes – 3, Charadriiformes – 2, Coraciiformes – 1, Anseriformes – 1, Apodiformes – 1 și Podicipediformes – 1. După preferințele locului de cuibărit speciile de păsări semnalate în ecosistemele din oraș au fost repartizate în 7 grupe ecologice: ponderea cea mai mare a fost înregistrată la grupa arboricolă – 17 specii, urmată de grupul ce preferă să se cuibărească în scorburi 15 specii, iar cel mai mic număr fiind înregistrat la speciile ce se cuibăresc pe sol și în cavități de natură antropogenă, fiecărui grup aparținând câte 4 specii. După preferințele trofice cele 68 de specii de păsări au fost împărțite în 5 grupe

ecologice. Cele mai numeroase aparțin grupului entomofage – 46 specii, urmată de carnivore – 8, omnivore – 6, granivore – 4 și ihtiofage – 3 specii. Ecosistemele urbane joacă un rol semnificativ pentru menținerea diversității avifaunei în perioada nădicolă. Oferindu-le speciilor de păsări loc de cuibărit și hrană necesară pentru hrănirea progeturilor asemănătoare cu cele din mediul natural. Astfel contribuind semnificativ la conservarea diversității avifaunei în zona centrală a republicii.

Cuvinte-cheie: avifauna clocitoare, biotopuri antropizate, diversitatea păsărilor, grupe ecologice, mediul urban.

1. INTRODUCTION

Urban areas occupy a large and ever-growing portion of the globe. To date, anthropization has had disastrous effects on native species. However, some areas are more favorable for wildlife, suggesting that humans do not destroy nature simply by their presence. Urban green spaces are important both ecologically and socially. Thus, anthropized ecosystems have substantial importance in biodiversity conservation, being an essential component in creating the environment in areas with modified biotopes (buildings, parks, squares, orchards, vineyards, forest strips). The emergence of anthropized ecosystems creates favorable living conditions for only a small number of species with greater adaptive potential. These consequences have increased the vulnerability of each species and biodiversity in general, changing the specific composition and the population of avifauna [3, 10].

Research on the biotopic distribution of bird species in Chișinău began in the 1990s [5]. More detailed studies on the structure and diversity of the urban avifauna were conducted in the 2000s [9, 10]. During this period, some works also appeared, in which the reproductive activity of bird species in the ecosystems of Chișinău was elucidated [15, 16, 17]. Successfully carrying out the reproductive process of bird species is crucial for the perpetuation of the species, while also contributing to the conservation of biodiversity. This process is determined by environmental conditions such as temperature, daylight duration, vegetation structure, food, disturbance factors, etc. [2, 6, 18, 14].

In recent decades, it has been observed that as humans increasingly modify natural landscapes, disturbing the normal life processes of living organisms, more and more bird species find refuge in urban environments, which remain hospitable to many of them, offering optimal conditions for reproduction.

The aim of this study was to elucidate the diversity of breeding bird species in the avifauna of Chișinău. Additionally, the study highlights the importance of the green

spaces in the city, which, through their landscape diversity, provide favorable conditions for the nesting of many bird species.

2. MATERIALS AND METHODS

The study was conducted based on personal observations made in various biotopes within the city of Chişinău. The selection of observation points was made considering several factors. First, attention was directed towards the green areas within the city, which are of particular interest to bird species during the breeding period, covering multiple points across the city of Chişinău, including: Râşcani Forest Park, Valea Trandafirilor Park, Valea Morilor Park, La Izvor Park, Dendrariu Park, Botanical Garden Park, and the floodplain of the Bâc River.

Estimates of bird populations were carried out during the breeding period over the years 2015-2024 using standard methods, including photo and video recording. The following research methods were used in the bird population investigations:

Cartographic Method: This is one of the most effective methods used to find nests and determine the number of breeding pairs. Within a square, at least four estimates are made, and the location of each individual is marked on a sketch. By overlapping the four sketches and marking the points where the birds were observed, the final map is obtained, outlining the territory within which the bird nests can be found [7, 11].

Transect Method: This method involves establishing routes that are followed during each field outing. Along these routes, all birds observed on the ground were recorded. This method is used for assessing bird fauna [1, 6, 11].

Observations from Fixed Points: This method involves selecting fixed points at specific locations where observations were made systematically. These locations were visited periodically over a span of 9 years. The network of points remained constant, and the duration of observations was always 10 minutes. The observed bird species, the number of individuals of each species, the type of bird activity, flight height, and biotope type were recorded [4, 8, 11].

3. RESULTS AND DISCUSSIONS

As a result of the research conducted in various biotopes within the urban ecosystems of Chişinău, 68 species of breeding birds from 12 orders were recorded (Fig. 1). The highest proportion of species belongs to the order Passeriformes, with 41 species, followed by Piciformes – 4 species, Columbiformes – 4 species, Strigiformes – 4 species, Ciconiiformes – 3 species, Falconiformes – 3 species, Gruiformes – 3 species, and Charadriiformes – 2

species. The lowest number of species is found in the orders Coraciiformes – 1 species, Anseriformes – 1 species, Apodiformes – 1 species, and Podicipediformes – 1 species.

The anthropized biotopes in the urban area, such as parks, squares, alleys, which contain a large diversity of trees, shrubs, grass layers, and not least reed areas near water bodies, as well as various types of buildings, provide favorable conditions for a relatively large number of bird species from different orders.

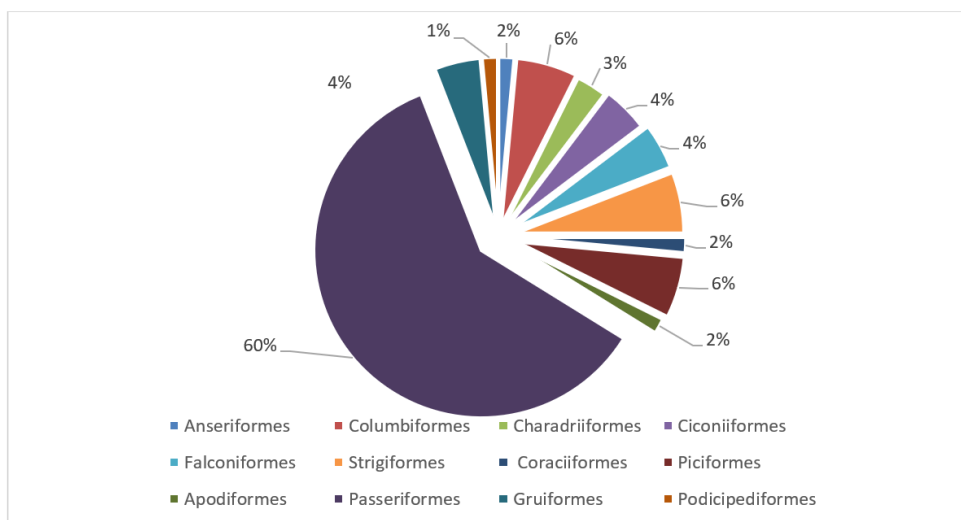


Figure 1. Proportion of breeding bird orders from urban ecosystems of Chisinau

Within the study, attention was focused on the main stages of the reproductive cycle in birds, namely: territory establishment, pair formation, nest building, egg laying, incubation, hatching, chick growth and development, and care. Territory selection and pair formation involve two prominent activities: song and mating displays. At the beginning of the breeding season, the main activities of the birds are directed towards occupying a territory and finding a mate for reproduction.

Territoriality plays a significant role in the reproductive process, combining two key factors: preferences related to the nesting site, which is always marked by certain landmarks such as tall trees, bushes, light poles, buildings, etc., and directly related to food availability. Depending on these preferences, the bird species registered in various biotopes of the city were classified into the following ecological groups: according to preferences related to the nesting site (arboreal, shrub-dwelling, ground-dwelling, cavity-nesting, building-nesting, and those related to aquatic biotopes in reed beds), and by trophic needs (insectivores, granivores, carnivores, ichthyophagous, and omnivores).

The species distribution in various nesting sites was noted and the highest share belonged to those nesting in trees (Tab. 1, Fig. 2). The majority of the breeding bird species

belong to the group that nests in trees – 17 species, followed by the group that prefers to nest in tree hollows – 15 species, in reed thicket – 11 species, in buildings – 10 species, and in shrubs – 7 species. The smallest number of species prefer to nest on the ground and in anthropogenic cavities – 4 species each. This is mainly due to the significant disturbance caused by cats, dogs, and humans. Anthropogenic factors directly influence the success of the reproductive process, particularly during hatching and chick growth stages [13, 19, 20].

Table 1. Diversity and preferences of bird species related to the nesting sites

Species	Trees	Shrubs	Ground	Cavities	Tree hollows	Buildings	Reed
<i>Anas platyrhynchos</i>							+
<i>Tachybaptus ruficollis</i>							+
<i>Ixobrychus minutus</i>							+
<i>Ardea cinerea</i>							+
<i>Nycticorax nycticorax</i>	+						
<i>Gallinula chloropus</i>							+
<i>Fulica atra</i>							+
<i>Chroicocephalus ridibundus</i>							+
<i>Larus cachinnans</i>							+
<i>Acrocephalus palustris</i>							+
<i>Acrocephalus arundinaceus</i>							+
<i>Acrocephalus scirpaceus</i>							+
<i>Accipiter gentilis</i>	+						
<i>Accipiter nisus</i>	+						
<i>Falco subbuteo</i>	+						
<i>Columba livia domestica</i>						+	
<i>Streptopelia decapcto</i>	+						
<i>Columba palumbus</i>	+						
<i>Streptopelia turtur</i>	+						
<i>Athene noctua</i>						+	
<i>Strix aluco</i>						+	
<i>Asio otus</i>						+	
<i>Tyto alba</i>						+	

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<i>Apus apus</i>						+	
<i>Alcedo atthis</i>				+			
<i>Upupa epops</i>					+		
<i>Dendrocopos syriacus</i>					+		
<i>Dendrocopos major</i>					+		
<i>Picus canus</i>					+		
<i>Jynx torquilla</i>					+		
<i>Hirundo rustica</i>						+	
<i>Delichon urbica</i>						+	
<i>Motacilla alba</i>						+	
<i>Motacilla flava</i>			+				
<i>Lanius collurio</i>			+				
<i>Oriolus oriolus</i>	+						
<i>Sturnus vulgaris</i>					+		
<i>Garrulus glandarius</i>	+						
<i>Pica pica</i>	+						
<i>Corvus frugilegus</i>	+						
<i>Corvus corone cornix</i>	+						
<i>Corvus corax</i>	+						
<i>Troglodytes troglodytes</i>				+			
<i>Sylvia atricapilla</i>		+					
<i>Sylvia curruca</i>		+					
<i>Sylvia borin</i>		+					
<i>Sylvia communis</i>		+					
<i>Phylloscopus collybita</i>			+				
<i>Phylloscopus trochilus</i>			+				
<i>Ficedula albicollis</i>					+		
<i>Ficedula parva</i>					+		
<i>Muscicapa striata</i>					+		
<i>Erithacus rubecula</i>					+		
<i>Phoenicurus phoenicurus</i>					+		
<i>Phoenicurus ochruros</i>						+	
<i>Luscinia luscinia</i>		+					
<i>Turdus merula</i>	+						

<i>Turdus philomelos</i>	+						
<i>Parus major</i>					+		
<i>Cyanistes caeruleus</i>					+		
<i>Poecile palustris</i>					+		
<i>Sitta europea</i>					+		
<i>Cerhtia familiaris</i>	+						
<i>Passer domesticus</i>				+			
<i>Passer montanus</i>				+			
<i>Carduelis chloris</i>		+					
<i>Carduelis carduelis</i>		+					
<i>Fringilla coelebs</i>	+						
Total species (68)	17	7	4	4	15	10	11

The number of species nesting in cavities is fluctuating, since species that prefer tree hollows in natural biocenoses, in anthropized environments, due to the lack of hollows, may also nest in various cavities of anthropogenic origin. For example, the species with greater adaptive plasticity such as *Parus major*, *Poecile palustris*, *Passer domesticus*, *Phoenicurus ochruros*, and *Phoenicurus phoenicurus* can occupy various cavities, such as pipes, light poles, and cracks in buildings [5, 19].

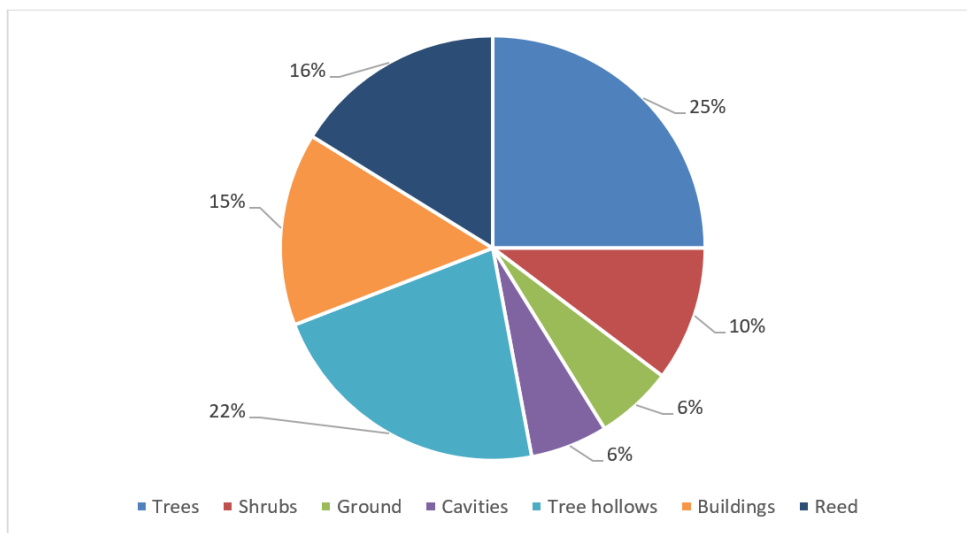


Figure 2. Proportion of breeding bird species according to nesting places

Food, like reproduction, is a vital and essential element for the life of birds and plays a significant role in the formation of urban avifauna. In urban ecosystems, food scarcity

can lead to lower productivity during the breeding season, as mentioned in other studies [3, 12].

Depending on their trophic preferences, the bird species observed in various biotopes in the city were classified into the following ecological groups: entomophagous, granivorous, carnivorous, ichthyophagous, and omnivorous (Fig. 3). The most numerous species belong to the entomophagous group – 46 species (69%), followed by carnivorous – 8 species (12%), omnivorous – 6 species (9%), granivorous – 4 species (6%), and ichthyophagous – 3 species (4%). The diversity of avifauna in urban biotopes is influenced by the structure

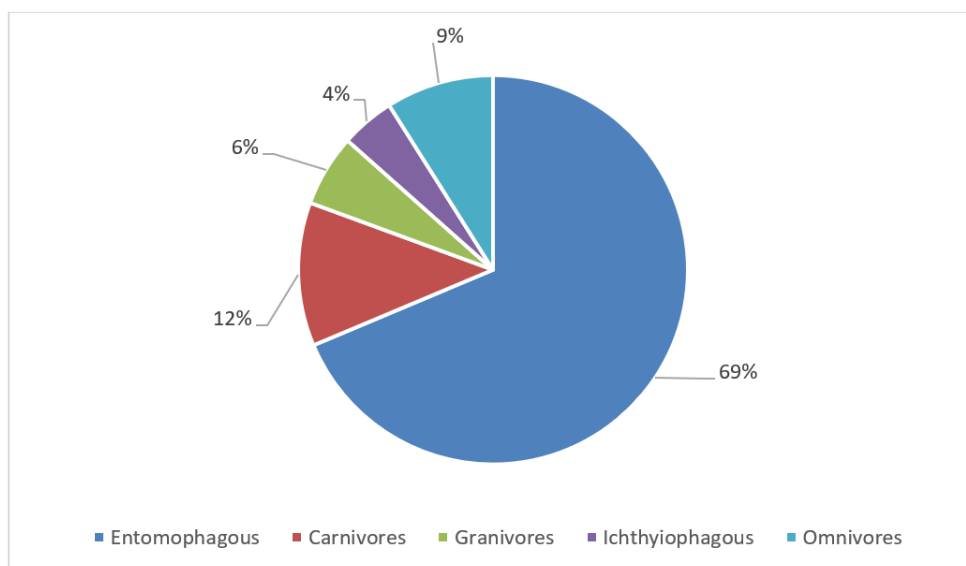


Figure 3. Ecological groups of breeding birds according to trophic preferences

of vegetation and the interactions between adjacent biotopes. This fact is also reflected in the values of the Shannon diversity index. During the migration (passage) period, this index is lower, with values between 2.30 and 2.80, compared to the nesting period, when the index is higher, ranging from 2.80 to 3.35. These values suggest that urban biotopes, such as parks, squares, aquatic areas, and urban alleys, are essential for supporting a high diversity of species, especially during the breeding period, when they play a crucial role in trophic connections.

The diverse structure of urban ecosystems thus contributes not only to the reproductive success of species that nest in this environments, but also to providing a temporary habitat for other migratory species, which find in these spaces the food and shelter they need during the different seasons of the year. Thus, these urban areas become a vital refuge for wild birds and play an important role in conserving urban avifauna diversity.

4. CONCLUSIONS

In Chisinau city, 68 species of breeding birds were recorded, belonging to 12 orders, the largest share being held by species from the order *Passeriformes* – 41 species, followed by *Piciformes* – 4, *Columbiformes* – 4, *Strigiformes* – 4, *Ciconiiformes* – 3, *Gruiformes* – 3, *Charadriiformes* – 2, *Coraciiformes* – 1, *Anseriformes* – 1, *Apodiformes* – 1 and *Podicipediformes* – 1.

According to nesting site preferences, the bird species from the city's ecosystems were divided into 7 ecological groups: the largest share was recorded in the arboreal group – 17 species, followed by the group that prefers to nest in hollows – 15 species, and the smallest number was recorded in the species that nest on the ground and in anthropogenic cavities, each group having 4 species.

According to trophic preferences, the bird species belong to 5 ecological groups. The most numerous were the entomophagous group – 46 species, followed by carnivores – 8 species, omnivores – 6 species, granivores – 4 species, and ichthyophagous – 3 species.

Urban ecosystems play a significant role in maintaining bird diversity during the breeding season, providing bird species with nesting sites and food necessary to feed their offspring, similar to those found in the natural environment. Thus, the urban environment contributes significantly to the conservation of bird diversity in the central part of the republic.

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