ECOSYSTEM ANTHROPIZATION – NEW NESTING SITES FOR BIRDS

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Abstract. The research conducted on some anthropized environment, especially on the urbanized one, creates preconditions for the assessing of the rhythm of the process of urbanization of bird species. The adaptive behavioural changes in some bird species as regarding the nesting in urban areas are manifested by changes in nest location on trees, shrubs and buildings, the composition of building material for nests compared to that used in the natural environment, the sites of food collection, etc. High buildings have attracted to cities other species such as the Black Redstart (*Phoenicurus ochruros*), the Common Swift (*Apus apus*), the Northern House-Martin (*Delichon urbica*), the Barn Swallow (*Hirundo rustica*), etc. which prefer to build their nests on tall buildings. These species built their nests in the cracks between the slabs of blocks of flats and under the eaves of buildings. In recent decades, the species Common Raven (*Corvus corax*), Eurasian Jackdaw (*C. monedula*), Carrion Crow (*C. corone*) and Rook (*C. frugilegus*) have changed the support for their nests.

Keywords: birds, anthropized ecosystems, modified biotypes, ecological plasticity, adaptation.

Rezumat. Antropizarea ecosistemelor - noi locuri de cuibărit pentru păsări. Cercetările realizate în mediul antropizat şi, în special, în cel urbanizat crează premize de apreciere a tempoului procesului de urbanizare a speciilor de păsări. Modificările adaptive comportamentale ale unor specii de păsări la cuibărit în mediul urban se manifestă prin modificarea amplasării cuiburilor pe arbori, arbuşti, clădiri, componenţa materialului de construcţie a cuiburilor, comparativ cu ceea ce sunt înregistrate în mediul natural, locului de colectare a hranei etc. Prezenţa clădirilor înalte au atras în teritoriul oraşului specii, precum, codroşul de munte (*Phoenicurus ochruros*), dreapneua neagră (*Apus apus*), lăstunul de casă (*Delichon urbica*), rândunica (*Hirundo rustica*) etc. Aceste specii îşi construiesc cuiburile în fisurile dintre plăcile blocurilor de locuit, sub streşina clădirilor. În ultimele decenii sunt înregistrate modificări ale suportului de amplasare a cuiburilor şi anume la speciile: corb (*Corvus corax*), stăncuţă (*C. monedula*), cioara grivă (*C. corone*) şi cioară de semănătură (*C. frugilegus*).

Cuvinte cheie: păsări, ecosisteme antropizate, biotopuri modificate, plasticitate ecologică, adaptare.

INTRODUCTION

Anthropized ecosystems have a substantial importance in biodiversity conservation. They are also an essential component in the ambiance creation in the territories occupied by modified biotopes (buildings, squares, gardens, vineyards, forest strips, etc.). The emergence of anthropized ecosystems creates favourable conditions only for a limited number of species with a higher adaptive potential. The research conducted on some anthropized environments, especially on the urbanized one, creates preconditions for the assessing of the rhythm of the process of urbanization of bird species. Urban areas occupy a large and increasing portion of the globe. So far, anthropization produced a disastrous effect on native species of birds. However, some regions are better for wild species of birds, suggesting that people do not destroy nature by their mere presence. Urban green spaces are important both ecologically and socially. Gardens and parks are often the only places where the urban population gets in contact with the natural fauna and it seems that this contact is very beneficial. For example, in Great Britain about 75 % of the people who possess a household provide food for birds in their gardens (CHAMBERLAIN et al., 2003).

MATERIALS AND METHODS

Quarterly observations were made from February to August in ecosystems with a different level and nature of anthropogenic influence. The following research methods of investigations were used:

a) transect method (BIBBY et al., 1997);
b) method of point estimation (BIBBY et al., 1997);
c) mapping method (BIBBY et al., 1997);
d) method of photographic recording;
e) method of video recording.

RESULTS

The investigations were carried out in different regions of the Republic of Moldova. Territories-samples were selected in different types of ecosystems with different levels of anthropogenic influence and heterogeneity. Stationary research was carried in the following study locations: the Scientific Reserve "Plaiul Fagului", forests - "Străşeni", "Chetrosu", the forest strip "Ghidighici", and the reed strips and town parks "La Izvor", "Valea Morilor" and the Botanical Garden.

Each type of biotope was studied every two weeks during the spring and breeding periods, and the composition and the number of species, the spatial structure of the communities and the functionality of this structure were recorded.

The basic parameters that influence the ecological ability of ecosystems in terms of birds, namely specific diversity, density and organic structure, were also studied.

The urbanized landscape is a specific technogenic environment. Some elements of this landscape may be comparable with the natural habitat. During the urbanization process new biotopes (habitats) are created, which create favourable conditions for some species, and less favourable conditions for those that previously inhabited them. Quite many researches have been conducted regarding the composition and the tendencies of avifauna formation in the urbanized habitat. This process occurs continuously depending on the degree of adaptability and the anthropogenic pressing on avifauna, and is manifested by the phenomenon of bird species sinantropization. Ecological, demographic and behavioural plasticity are among the general requirements that must be met by urbanization. The particular conditions which must be met are the spectrum of food, which has to be as wide as possible, and the preferred habitats.

Depending on the trends of the urbanization of the natural landscape, bird species develop a range of adaptive features to facilitate the colonization of urban (anthropized) environment. In addition, the process of urbanization of some species of birds is influenced by their wide ecological plasticity towards various changes of the anthropized environment, reflected by an increased density of certain species, changes in the terms of the breeding period and other seasonal features.

In this context, we can speak about the adaptability recorded in some species of passeriformes in the conditions created by the urban ecosystem. The adaptive behavioural changes in some bird species as regarding the nesting in urban areas are manifested by changes in nests location on trees, shrubs and buildings, the composition of building material for nests compared to that used in the natural environment, the sites of food collection, etc.

For example, a few decades ago, the Black Redstart (*Phoenicurus ochruros* Gmelin 1774), a species which has a rapid adaptation to urban conditions, could be found only on the rocky banks of the river Dniester, in the north of the country (GANEA, 1978). Nowadays this species can be found on construction sites, tall buildings, in city parks, etc. The nests of the Black Redstart birds were found in various places. The most original nest (which has been found up to now by us) was located at a height of 1.30 m inside an old electricity pole lined with cables in the courtyard of the children's hospital V. Coţaga. Another pair of Black Redstart as smart as the previous ones built its nest at a height of about 1.70 m in the crack of a brick wall of the kindergarten No. 26 in the district of Old Post in Chişinau.

High buildings have attracted to cities other species such as the Common Swift (*Apus apus* Linnaeus 1758), the Northern House-Martin (*Delichon urbica* Linaeus 1758), the Barn Swallow (*Hirundo rustica* Linnaeus 1758), etc. which prefer to build their nests on tall buildings. These species built their nests in the cracks between the slabs of blocks of flats and under the eaves of buildings. Similar nonspecific nesting places were also recorded in Iasi (CROITORU, 2009). Until recently, the Barn Swallow has not practically been observed in city areas. Nowadays, it is seen quite often. Nests of this species are usually located on the windows of the blocks of flats, inside closed balconies, but they can also be found on the beams which support the roofs of commercial halls in downtown area, namely at the Central Commercial Market. Their nests have been also found in abandoned buildings in parks where there are aquatic biotopes.

In urban areas, depending on nest sites, differences were found in some species of birds regarding the nest appearance, the building material used and their dimensions. For example, the Great Tit (*Parus major* Linnaeus 1758), the Blue tit (*P. caeruleus* Linnaeus 1758) and the Black Redstart build their nests inside pipes used as supports for vines surrounding apartment buildings and inside the legs of benches in parks and squares.

Another peculiar case is the Eurasian Collared-Dove (*Streptopelia decaocto* Friv.1838) that built its nest in the pot of a house plant that hang from a balcony of a flat on the 3rd floor. Some other peculiarities that reveal the adaptability of some species of Passeriformes to the anthropized environment are changes in their innate behaviour regarding the choice of nest sites and their building. In recent decades, the species Common Raven (*Corvus corax* Linnaeus 1758), Eurasian Jackdaw (*C. monedula* Linnaeus 1758), Carrion Crow (*C. corone* Linnaeus 1758) and Rook (*C. frugilegus* Linnaeus 1758) have changed the support for their nests. In some cases these species form associations; for example, a daw and a raven have built their nests on a high voltage power line pillar, and a Rook, Common Raven and Eurasian Jackdaw on another pillar (Fig. 1). Such nesting associations are not random; carrion crows, hooded crow and daws benefit from a higher protection because a raven has an imposing figure and is visually larger that potential predators. It has been observed that usually the nests of these species are placed at the same level with a raven nest, nearby it. When such microcolonies are invaded by potential predators the nests of associated species are affected, thus ensuring a higher rate of ravens' reproduction.

During the 1960s and 1970s of the 20th century, a Common Raven usually nestled in woods; it placed its nest in tree canopies or at the base of high tree trunks (20-30 m). In recent decades, there has been a gradual increase of birds' pairs that build their nests on high voltage power line pillars, its number varying from year to year between 30-50 % of the whole species population.

Table 1. The abundance of the *Corvus corax* species as regard the nest sites in various habitats

Period	**Average no. of pairs in Moldova**	**Pairs that nest, %**		
		Forest	**Rocks**	**Electric pillars**
1960 -1970	350	80	20	—
1990	1000	84-90	10-15	1
2013	750	60-65	10	25-32

During the 1960s and 1970s of the last century, the raven abundance was between 1/2 pairs per 5 km in forest ecosystems of Lozova, 2 pairs per 6 km in Trebujeni, and 1 pair per 2 km in the forest of Vertujeni along the bank of the Dniester river. According to the results obtained and the analysis of data, during the 1970s, the nesting sites of most pairs of ravens (80 %) were the trees in forests (Table 1). During the 1980s and 1990s of the 20th century, 84-90 % of the Common Raven population in the Republic of Moldova built their nests in forests, and some of them on power line pillars. There were also observed a reduction in the number of pairs that build their nests in rocks.

During the last decade, the number of pairs nesting on the power line pillars has significantly increased. For example, in the sector Ghiliceni – Chişcareni on a stretch of 20 km, there were observed nine nests, in the sector Scoreni – Străşeni on the same stretch there were six nests, in Anenii Noi – 4 nests, and on the route Pîrlița – Pervomaisc there were 8 nests. The power line pillars are beside forest sectors or at a small distance from woods.

DISCUSSIONS

This adaptive feature of nesting behaviour of the species, i.e. its nesting in anthropogenic sectors instead of forests, ensures the perpetuation of the species and its evolution over time.

One of the causes ravens change their nesting sites are the changes occurring in the forest ecosystems of the republic, i.e. the irrational forest exploitation that causes a significant reduction of forest habitats.

A key priority is the trophic basis. During the 1980s and the 1990s of the last century, in the Republic of Moldova, there were large cattle farms, which had special pits for carrions. They served as a source of food for ravens. In the recent transitional period, there has been a significant reduction in the number of these farms, thus the trophic basis for ravens has decreased.

The anthropogenic disturbance and the predators, for example mustelids (stone marten, pine marten), squirrels etc., are other reasons for nesting on electric pillars. Consequently, the destruction of eggs and chicks by predators has decreased significantly. All this has helped to increase overall the species density by increasing their reproduction. At the same time, the location of nests on pillars offers to the adult birds a better visibility both of the vital space and of the feeding territory. It also ensures a maximum protection of the eggs laid by a female, since it reduces the access of natural predators to the nests.

It has been observed that the number of raven nests on the electric pillars that are near forests or woodland is greater than the nests on electric pillars that are situated in open areas. Nevertheless, the number of nests in the region of the town of Bălți has increased, as on the outskirts of this town there are unauthorized dumps that serve as a trophic source for ravens.

Saker Falcon (*Falco cherug* Gray 1834) - one of the rare species of birds of fauna of Europe. In Moldova, the number and distribution of the Saker Falcon have strongly changed in the last years. The results of the inspection of the territory of Moldova in search of nesting places of the Saker Falcon have shown that the behaviour of a kind during the nested period has strongly changed. In 2005, on electric pillars, there were registered nesting sectors of Saker Falcon (10-12 nesting pairs). Routing accounts have revealed only one compact settlement in the south of the country (MUNTEANU et al., 2010).

The species Eurasian Jay (*Garrulus glandarius* Linnaeus 1758) shows a tendency of nesting in anthropogenic areas of parks and public gardens. Thus, during the 1980s, this species visited sporadically urbanized areas during nesting period and very often during post reproductive and hiemal periods. This was explained by bad conditions of cold seasons because of which they were forced to search for food in concealed places. In recent years, the percentage of the species Eurasian Jay has ranged from 0.7 to 2.9 % in forests, and 0.4% to 1.0 % in anthropogenic areas (the Botanical Garden, urban parks, public gardens) in the reproduction period. This year, their number in anthropogenic areas is 2-3 times greater during post reproduction period: in the Rose Valley – 0.9% to 2%, in the park in spring – 1.2% to 2.1%, and in the Botanical Garden – 3.0 to 3.5 %.

A similar situation has been observed in the Eurasian Jackdaw, which until the 1980s, nestled mostly in rural areas, placing their nest in unfinished buildings, churches bell towers, chimneys and in empty electric pillars (GANEA, 1978). After the 1980s, this species has shown a phenomenal adaptability to cavity nesting in hollow pillars. This has happened because the number of rural settlements with chimneys has significantly decreased, and the abandoned buildings have been destroyed. The comparative results of the studies on the Eurasian Jackdaw species during 1984-1986 and 2011-2012 on the same route, namely the forest strips Chetrosu on a stretch of 800 m, showed a growing trend of nesting in empty cavity of electric pillars: in 1984 – 3 pairs, in 1986 – 4 pairs, in 2011 – 8 pairs, and in 2012 – 6 pairs.

CONCLUSIONS

- In urban biotopes significant changes in some Passeriformes species (Black Redstrat, Common Swift, Northern House-Martin, Barn Swallow and Eurasian Collared-Dove) have been recorded regarding the nest-site selection, which differs essentially from the nest-sites selection in natural environments.
- The adaptive behaviour of bird species with a solitary lifestyle – the Common Raven and a colonial lifestyle – the Eurasian Jackdaw and Rook in poor nesting conditions is manifested by joint nesting (microcolonies) on power line pillars that provides an advanced protection against natural predators and the anthropogenic disturbance factor.

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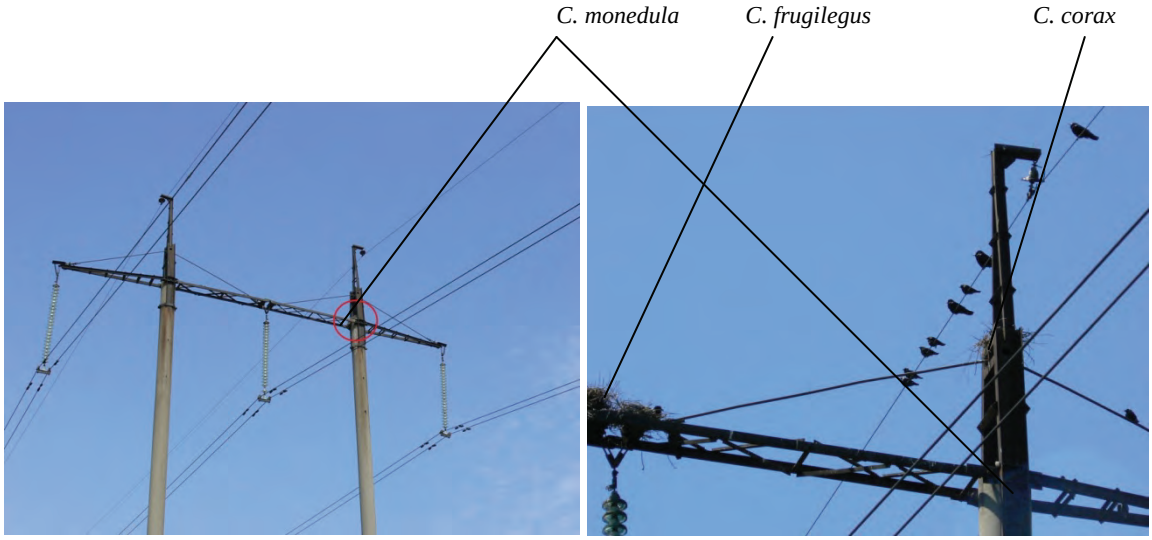

Figure 1. The sites of location of nests of *Corvus monedula, C. frugilegus* şi *C. corax* on the electric pillars (original photo).

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