

Influence of Vegetation on the Avifauna in Two Urban Parks in Plovdiv, Bulgaria

Yanitsa Petrova, Atanas Irikov*

University of Plovdiv, Faculty of Biology, Department of Ecology and Environmental Conservation, 24 Tzar Assen Str., Plovdiv 4000, Bulgaria

* Corresponding author: yanitsapetrova@gmail.com

Abstract. This study is related to the investigation of the impact that vegetation caused on the avifauna of the parks "Lauta" and "Tsar Simeon Garden" located in the city of Plovdiv, Bulgaria. As a result of the study, we found that the biodiversity of the vegetation in park "Tsar Simeon Garden" is highly significant in comparison with the same in park "Lauta". In the park "Tsar Simeon Garden" introduced plant species dominate over indigenous species, as compared with the park "Lauta". The differences in the vegetation are caused by different management approaches carried out in the both parks. The degree of similarity between trees and bushes in both parks is low. The vegetation also had a significant influence on the avifauna living within the parks. The avian biodiversity in park "Lauta" is two times higher in comparison with the avian biodiversity in park "Tsar Simeon Garden". The degree of similarity in the avifauna between both parks is significant, due the fact that all of the species, except one documented in "Tsar Simeon Garden" being documented in park "Lauta" as well. Eighteen new species of birds were recorded and described for the first time in the city of Plovdiv. The conservation status of the avifauna in park "Lauta" is quite significant in comparison with the same in park "Tsar Simeon Garden".

Key words: avifauna; birds; vegetation; native; introduced; indigenous; urban parks

Introduction

Most forecasts indicate that after four decades two thirds of the Earth's population will live in big cities. The concentration of the population and the compression of the infrastructure will increase the need of green areas. The urban parks are of great importance not only for human population, but also for many animals which find appropriate living conditions within the parks. So far, most of the bird species which live in cities are observed namely in the urban parks.

At this moment, there is no published systematic data about the vegetation in the parks "Lauta" and "Tsar Simeon Garden" in the city of Plovdiv, Bulgaria. There is a lack

of information about the complex of avifauna in the both parks. Until this moment the influence of the vegetation on the avifauna in urban parks has not been studied in Bulgaria.

The aim of this study was to determine the impact of the vegetation on the avifauna in the both urban parks - "Lauta" and "Tsar Simeon Garden", located in the city of Plovdiv, Bulgaria.

Materials and Methods

Study area. The study was conducted within the park "Lauta" and park "Tsar Simeon Garden" in the city of Plovdiv (42° 9' N, 24° 45' E), one of the most populated

cities in Bulgaria (over 365 000 inhabitants on 102 km²) (PETROVA, 2011).

Data collection and analyses. The fieldwork was carried out in the years 2010 and 2011. The plant species were determined according to the Qualifier of the plants in Bulgaria (DELIPAVLOV *et al.*, 1992), Botanical Atlas (CHESHMEDZHIEV & STOYCHEV, 2005), Decorative dendrology (VAKARELOV & GENCHEVA, 2005), Qualifier of the bushes and trees in Bulgaria (GRAMATIKOV, 1992), Flora of Bulgaria (STOYANOV & STEFANOV, 1948), and Dendrology (STEFANOV & GANCHEV, 1953). Unpublished data concerning the species composition and distribution of plants in park "Tsar Simeon Garden" also was used (HADZHISKI, 2003). Latin and Bulgarian names are written according to the Qualifier of the plants in Bulgaria (DELIPAVLOV *et al.*, 1992). The data concerning the general characteristics of the plant species in the essay are according VAKARELOV & GENCHEVA (2005). Herbaceous species are presented in the floristic characteristic of species composition because in city parks they are of minor importance for species richness and abundance of the avifauna.

The classification of the plant species in terms of extent of occurrence was performed following BRAUN-BLANQUET *et al.* (1939). For the purposes of this study the species were arranged in three larger groups in terms of percentage of occurrence:

➤ *Rare (fewest) species*, representing 20% of the vegetation in the park, corresponding to I degree of abundance according to BRAUN-BLANQUET *et al.* (1939);

➤ *Common species* that represent 21% to 60% of the vegetation in the park, corresponding to II degree of abundance according to BRAUN-BLANQUET *et al.* (1939);

➤ *Very frequently common species* that represent 61% to 100% of the vegetation in the park, corresponding to IV and V degree of abundance according to BRAUN-BLANQUET *et al.* (1939).

The vertical structure of the vegetation was estimated according to the model of DAJO (1975).

The similarity in the vegetation and the avifauna of both parks were estimated by the Index of Similarity (S) of Sørensen by the next formula (DAJO, 1975):

$$S = \frac{2C}{A + B} \times 100$$

where: *A* - number of species that occur only in park "Tsar Simeon Garden"

B - number of species that occur only in park "Lauta"

C - number of species that are found within the both parks

The studies concerning avifauna characteristics were performed and the data was provided for usage from Atanas Irikov, Ph.D at University of Plovdiv, Faculty of Biology, department of Ecology. They include the observations of the bird species in park "Lauta" from 2000 to 2010 in all seasons and in park "Tsar Simeon Garden" from 2008 to 2011. Different bird species were recorded using transects and absolute statement by visual and acoustic observations and registrations. Binoculars with a magnification of 30x50 were used for observations.

The field qualifier of MICHEV & SIMEONOV (1991) was used to determine bird species and the Latin and Bulgarian names of the birds were given according it.

The conservation status reflects the basic legal measure provided for the Protection of Birds in Bulgaria - Biodiversity Act (State Gazette, 2002). The conservation status of the birds has been prepared according to the Atlas of Breeding Birds in Bulgaria (BSPB, 2007). The categories of threats are based on the criteria of IUCN (BirdLife International 2000; 2004).

Results and Discussion

Estimation of the vegetation in the parks "Lauta" and "Tsar Simeon Garden" situated in city of Plovdiv.

In park "Tsar Simeon Garden," 70 species of trees and bushes were identified.

In the park "Lauta" were identified 41 species of trees and bushes. The trees and bushes were described in the following order: family; genus; species; short characteristic (from ecological point of view) of the species; form of the crown; height in meters and under what type of form were recorded in the park area.

Origin of the vegetation.

In park "Tsar Simeon Garden" introduced plant species dominate (62%) over native (38%) in comparison with park "Lauta" where more native plant species were observed (59%) in comparison to the introduced plant species (41%) (Fig.1).

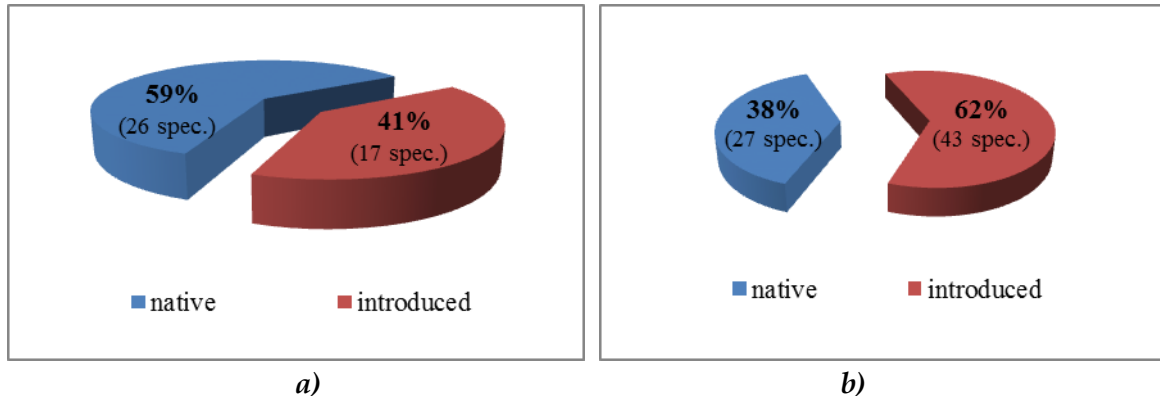


Fig.1. Percentage of native to introduced plant species in park "Lauta" (a) and park "Tsar Simeon Garden" (b)

Frequency of occurrence of the plant species

The frequency of occurrence of the vegetation showed the typical appearance of the park systems, namely the existence of many rare species with low numbers. In both parks the species with an average frequency of occurrence were approximately

equally represented. There was a serious difference in the common species, which was reflected by the fact that in park "Lauta" there were few plants with a much higher frequency in comparison to the park "Tsar Simeon Garden" (Fig.2).

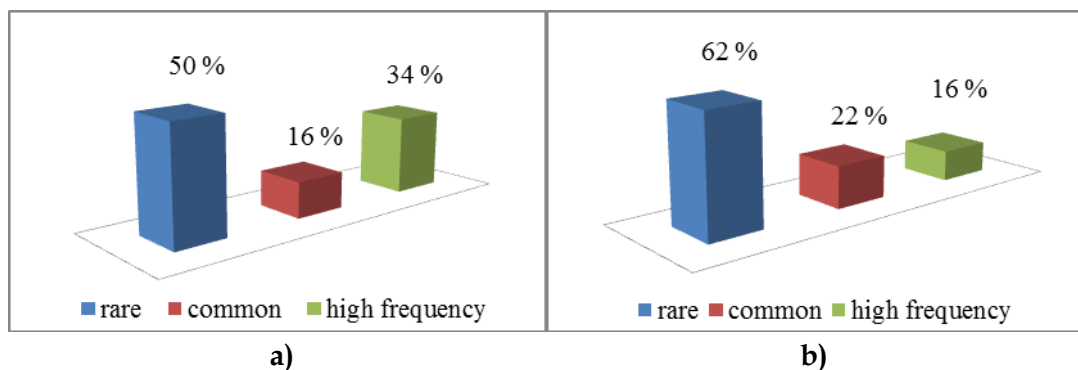


Fig. 2. Frequency of occurrence of the plant species in park "Lauta" (a) and in park "Tsar Simeon Garden" (b)

Spatial structure - vertical and horizontal (level) structure and types of the crowns

Vegetation in park "Lauta" was characterized by a complex spatial structure and the presence of five clear distinct levels in the vertical direction, while in park "Tsar

Simeon Garden" there was no clear distinct level of bushes and low wood.

The horizontal spatial distribution of the vegetation in park "Lauta" was observed to be much more homogeneous in comparison to the mosaic character of the

vegetation in park "Tsar Simeon Garden", probably as a result of the presence of many paths and roads within.

In park "Lauta" there was a wide variety of types of tree crowns in comparison to park "Tsar Simeon Garden", suggesting that "Lauta" is more preferable for avifauna.

Comparison of the vegetation in parks "Lauta" and "Tsar Simeon Garden"

The species diversity of the vegetation in park "Tsar Simeon Garden" was significantly greater (70 species) in comparison with the species diversity of the vegetation in park "Lauta" (43 species). The differences in the vegetation between the two examined parks may be explained by the fact that "Tsar Simeon Garden" was managed and in all seasons recreational activities were maintained, directed and regulated, whereas natural regeneration and succession processes dominated in "Lauta" due to the almost complete absence of such events. The similarities between the both parks were mostly in the species biodiversity (Fig.3).

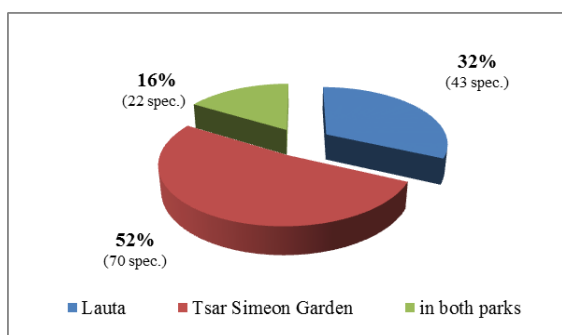


Fig. 3. Degree of similarity between the plant species from trees and bushes-levels in park "Lauta" and park "Tsar Simeon Garden".

Estimation of the avifauna in the parks "Lauta" and "Tsar Simeon Garden" in Plovdiv

The species diversity of the avifauna in park "Lauta" was twice as high (42 species) than the avifauna in park "Tsar Simeon Garden" (22 species). Twenty-one species occurred only in "Lauta", twenty one species were found in both parks and one

species was recorded only for park "Tsar Simeon Garden".

The bird species in both parks were described in the following order: Order; Family; Genus; Species; under what type of form the species were recorded within the parks; category of threat and conservation status.

The complex of avifauna in park "Lauta" was determined to be two times higher in comparison with the complex of avifauna in park "Tsar Simeon Garden". Most of the species in both parks occurred in the high tree level, then the average, low and at last, in the level of the bushes.

Fewer bird species were observed in park "Tsar Simeon Garden" (Fig. 4), probably due to the under-developed level of the bushes and low trees; the predominance of the introduced plant species; and because of the management practices in the park. Hence the living conditions were significantly different from the conditions in the natural forest ecosystems.

In park "Lauta" the opposite tendency was observed: there were more bird species and better developed vertical structure of the vegetation; predominantly native plant species; the park is unmanaged, and hence closer to natural conditions.

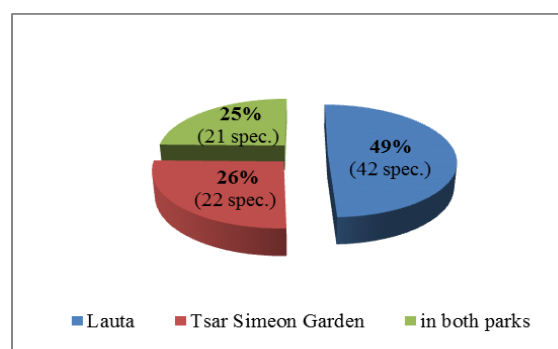


Fig. 4. Percentage of bird species in park "Lauta" and park "Tsar Simeon Garden"

Purpose and way of usage of the parks area from the bird species.

The results are presented in Table 1.

Conservation status of the avifauna in the examined urban parks

In park "Lauta" were observed 28 species strictly protected throughout the cou-

Table 1. Purpose and way of usage of the parks area by the bird species

Species in "Lauta"	Species in "Tsar Simeon Garden"	Usage:
26	26	propagation
16	9	wintering
13	6	feeding
3	2	night
5	3	assylum
3	0	temporary shelter and or shelter
3	2	other purposes (hunting and finding food, temporary wandering, searching for wintering)
0	2	trend to synantropization and adoption to managed park areas

ntry and in park "Tsar Simeon Garden" - 14 species.

The conservation status of the avifauna in park "Lauta" is more significant in comparison to the conservation status of the avifauna in park "Tsar Simeon Garden". In "Lauta" there is a higher number of species in threatened categories.

The conservation status of the avifauna in park "Tsar Simeon Garden" includes: 14 species protected throughout the country; 6 species under the protection of regulated use; 1 species under protection and control (BA, Appendix 4); 1 species with high priority for protection (BA, Appendix 2), protected throughout the country (BA, Appendix 3).

Bird species which fell into categories of endangerment are as follows: 18 species without falling into category of endangered; 1 species Spec exhausted in Europe; 1 species Spec 2 exhausted in Europe; 2 species Spec 3 decreasing in Europe.

The conservation status of bird species in park "Lauta" includes: 28 species protected throughout the country; 9 species under the protection of regulated use BDA application 4;

1 species under the protection and control of art 45 BA; 4 species priority for protection and endangered species (BA, Appendix 2) protected throughout the country (BA, Appendix 3).

Bird species which fell into endangered categories were as follows: 27 species without falling into category of endangerment; 1

undetermined species; 1 species endangered in Bulgaria; 2 species Spec declining in Europe; 2 species Spec 2 exhausted in Europe; 3 species Spec 3 decreasing in Europe; 1 species Spec 3 vulnerable in Europe; 2 species vulnerable in Bulgaria, SPEC 3 exhausted in Europe; 3 species Spec 3 exhausted in Europe.

Bird species, recorded for the first time in the city of Plovdiv

18 species of birds were recorded for the first in Plovdiv: 15 species in park "Lauta" and 3 species in park "Tsar Simeon Garden" (Table 2).

Conclusions

The frequency of occurrence of plant species in both parks met the typical appearance of the park systems, namely the existence of many rare species with low numbers. In both parks, where the study was conducted, the species with an average frequency of occurrence were approximately equally represented. Park "Tsar Simeon Garden" had a higher diversity of species but most species had a low frequency of occurrence. In park "Lauta" the species diversity was lower but most of the species, were with high frequency of occurrence.

Park "Lauta" was characterized by a more complicated vertical structure of the vegetation. There were five very well developed levels in the vertical direction, while in park "Tsar Simeon Garden" was a distinct lack of low bush and low wood

levels. In the horizontal distribution of the vegetation, park "Lauta" was much more homogeneous in comparison with the mosaic character of park "Tsar Simeon

Garden". A wide variety of tree crowns were observed in park "Lauta" in comparison with park "Tsar Simeon Garden".

Table 2. Bird species recorded for the first time in Plovdiv

Park	Latin name	Common name
"Tsar Simeon Garden"	<i>Erithacus rubecula</i> (L.)	European robin
	<i>Sitta europaea</i> (L.)	Wood Nuthatch
	<i>Carduelis chloris</i> (L.)	European Greenfinch
Number of new species 3		
"Lauta"	<i>Accipiter nisus</i> (L.)	Eurasian Sparrowhawk
	<i>Accipiter brevipes</i> (Sev.)	Levant Sparrowhawk
	<i>Falco tinnunculus</i> (L.)	Common Kestrel
	<i>Picus canus</i> (Gmel)	Grey-faced Woodpecker
	<i>Dendrocopos minor</i> (L.)	Lesser Spotted Woodpecker
	<i>Lanius colurio</i> (L.)	Shrike
	<i>Troglodytes troglodytes</i> (L.)	Winter wren
	<i>Erithacus rubecula</i> (L.)	Wood Nuthatch
	<i>Turdus pilaris</i> (L.)	Fieldfare
	<i>Hippolais pallida</i> (Hemp., Ehronb.)	Eastern Olivaceous Warbler
	<i>Aegithalos caudatus</i> (L.)	Long-tailed Tit
	<i>Sitta europaea</i> (L.)	Wood Nuthatch
	<i>Certhia familiaris</i> (L.)	Eurasian Treecreeper
<i>Coccothraustes coccothraustes</i> (L.)	Hawfinch	
<i>Montifringilla nivalis</i> (L.)	White-winget Snowfinch	
Number of new species 15		
Total number of new species 18		

The similarity between trees and bushes in both parks was low (39%). More than half of the plants (52%) appeared only in park "Tsar Simeon Garden", another part (32%) were typical only for park "Lauta" and a few plant species (16%) occurred within both parks.

According to the results of the conducted study the vegetation in the parks "Lauta" and "Tsar Simeon Garden" has a significant influence on the complex of birds living within the parks.

In both parks most of the bird species were nesting in the high wood level, then at the average level, low level and at the least level of the bushes. Less birds were observed in park "Tsar Simeon Garden" due

to under-developed low level, which includes bushes and low trees.

The degree of similarity of the complex of birds in both parks was essential (66%). Half of the species (49%) of birds were found only in park "Lauta", while only 26% of species were specific to "Tsar Simeon Garden". Twenty-five percent of registered bird species occurred within the two parks.

The conservation status of the avifauna in park "Lauta" is much more significant than the same in park "Tsar Simeon Garden".

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