BIOMETRICAL ANALYSIS OF AN URBAN POPULATION OF THE BLACKBIRD (*Turdus merula*) IN SZCZECIN IN POLAND

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ABSTRACT

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In years 1996-2001, a biometrical investigation of an urban population of the Blackbird was conducted in two parks of Szczecin. Altogether, 388 birds were measured, including 191 females and 197 males. Adult females were bigger than young females (in all analysed parameters). Among males there were differences in wing, tail and total head lengths. In both sexes the strongest correlation occurred between wing and tail measurements and between bill and total head lengths. The body mass of females did not depend on their age and was not changing significantly in the course of year. However, in the case of males the young birds were lighter than the adults. Moreover, the males caught in winter were heavier than those caught in spring.

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INTRODUCTION

The intra-species morphological variability range is one of the basic parameters used for describing of different populations. The intra-populational morphometric variability is usually smaller than in the case of the species. Thus, after a statistical analysis of morphological parameters, it is possible to define populational differentiation of a species (*e.g.* Busse and Maksalon 1986). So far, detailed data concerning basic morphological parameters of Blackbird urban populations has not been published in Poland, or existing data (*e.g.* Graczyk 1961) have been based on too small sample.

The aim of this paper is to analyse the variability of the Blackbirds' biometrical parameters in relation to age and sex, and additionally (in the case of body mass) also to season.

STUDY AREA

The study was conducted in years 1996-2001 in two town parks of Szczecin (north-western Poland): Żeromski Park (21.9 ha) and Kownas Park (16 ha).

Żeromski Park, as situated in the centre of town, is characterised by continuous intensive human penetration. Maximal density of Blackbirds in this area in 1997 was 9.5, in 1998 – 11.9, in 1999 – 14.0, in 2000 – 21.5 and in 2001 – 22.4 pairs / 10 ha (Wysocki unpubl.).

Kownas Park is a part of larger complex of green areas, gradually changing into suburban forests. The place is characterised by much lower intensity of human penetration. Maximal density of Blackbirds in 1997 was 10.6, in 1998 – 11.9, in 1999 – 11.3, in 2000 – 13.1 and in 2001 – 13.1 pairs / 10 ha (Wysocki unpubl.).

Most of Blackbirds breeding in both parks winter close to the place of nesting, however single birds can migrate in long distances (*e.g.* a female breeding in 1999 in Kownas Park was found dead in 2000 in Latvia). Breeding site fidelity is pronounced: in Żeromski Park 75% of the breeding birds (of both sexes) return to breeding sites in following seasons, in Kownas Park – 65% of the males and 55% of the females (Wysocki unpubl.).

METHODS

Birds were caught in mist-nets all year round, however most of them were caught in their breeding territories from January to July. Each bird was aged according to Busse (1990).

In total, 388 birds were measured, including 191 females and 197 males. In some birds it was not possible to take all the measurements (because of worn feathers, escape or getting moist by a bird), thus the number of separate measurements can be different.

Following measurements were taken:

(1) Wing length – maximum length of flattened and straightened wing (Svensson 1992) taken with a ruler to the nearest 1 mm.

(2) Tail length – tail was measured in two ways. First 110 individuals (62 males and 48 females) were measured using a ruler (to the nearest 1 mm) according to “to back” method proposed by Busse (1974, 1983), next 190 individuals (93 males and 97 females) were measured using a calliper (to the nearest 1 mm) according to “T[C]” technique (Svensson 1992). Because of different tail position, the length taken with a ruler was on average 17% higher than that measured with a calliper. In Table 1 standardised results for “to back” method are presented.

(3) Bill length – distance from the tip of the bill to the scull (Svensson 1992) measured with a calliper to the nearest 0.05 mm.

(4) Total head length – distance from the tip of the bill to the extreme point of the occipital bone measured with a calliper to the nearest 0.05 mm.

(5) Tarsus length – distance from the notch on the back of the intertarsal joint to the lower edge of the last complete scale before the toes diverge (Svensson 1992) measured with a calliper to the nearest 0.05 mm.
(6) Body mass – weighed with a PESOLA spring-balance to the nearest 1 g.

In order to find differences in size and weight between young and adult birds, both males and females were classified into two age groups. By "young" birds I mean individuals at least 36-days-old (as the wing and tail feathers are full-grown only after about 35 days – Wysocki unpubl.) in plumage of juvenile or immature type (in first year of life), by "adult" birds I mean individuals in plumage of adult type (in second year of life or older).

The significance of differences between mean values was tested using *t*-test. In order to find a correspondence between different measurements, the coefficient of Pearson's linear correlation was calculated.

RESULTS

Adult females were bigger than young females in all analysed parameters. Adult males had significantly higher values of wing, tail and total head lengths than young males ($p < 0.05$, Table 1).

In females, the strongest correlation occurred between bill and total head lengths, between wing and tail lengths, and between wing and total head lengths (Table 2). Moreover, in most cases correlation coefficients for adult females were higher than those for young females. In males, the strongest correlation occurred between bill and total head lengths, between wing and tail lengths, and between tarsus and total head lengths.

The body mass of both young and adult females was the highest in winter and the lowest in summer, however differences both between seasons and between age groups were statistically non-significant (Table 3). Males were the heaviest in autumn and winter, and the lightest – in spring. The difference in body mass between winter and spring was statistically significant ($p < 0.001$). The only season for which statistically significant difference between young and adult birds was found was summer.

DISCUSSION

The obtained lengths of different parts of body of the Blackbird are consistent with the values given by Glutz von Blotzheim (1982). Also other authors (*e.g.* Graczyk 1959, Havlin 1962) cite biometric parameters close to those found in Szczecin.

The highly significant differences in tarsus length between young and adult birds are caused probably by the eliminating impact of winter conditions on the smallest and the weakest individuals. Such elimination can also result in differences in bill and total head lengths. In birds, the bill grows (and wears away) lifelong, so its length can depend on growth speed and on wearing rate. The growth is supposed to be

Table 1
Values of different biometric parameters in females and males by age classes. Significant differences between age groups are given in bold.

	Age	*N*	Mean ± *SD* [mm]	*p*
Females				
Wing	Young Adult	64 101	124.7 ± 3.2 126.2 ± 3.1	***0.01***
Tail	Young Adult	56 89	105.7 ± 4.9 107.4 ± 5.0	***0.04***
Bill	Young Adult	70 104	21.7 ± 1.1 22.1 ± 1.1	***0.03***
Head	Young Adult	70 104	51.8 ± 1.3 52.3 ± 1.1	***0.01***
Tarsus	Young Adult	74 107	33.1 ± 1.0 33.5 ± 1.0	***0.02***
Males				
Wing	Young Adult	98 75	129.0 ± 3.2 132.2 ± 2.6	***< 0.001***
Tail	Young Adult	87 68	108.8 ± 4.8 113.3 ± 5.4	***< 0.001***
Bill	Young Adult	104 79	22.1 ± 1.4 22.4 ± 1.2	*0.09*
Head	Young Adult	103 79	52.3 ± 1.2 52.7 ± 1.1	***0.03***
Tarsus	Young Adult	109 80	33.6 ± 1.1 33.8 ± 1.0	*0.13*

Table 2
Values of correlation coefficients (*r,* upper part) and their significance (*p,* lower part) between different biometric parameters in females. Values of *r* significant ($p < 0.05$) are given in bold.

	Age	Wing	Tail	Bill	Head	Tarsus
Females						
Wing	Young Adult	X	**0.32** **0.44**	0.03 **0.12**	**0.46** **0.25**	**0.29** **0.21**
Tail	Young Adult	*0.02* *< 0.001*	X	0.14 **0.31**	0.14 **0.29**	0.08 0.14
Bill	Young Adult	*0.19* *0.04*	*0.30* *0.003*	X	**0.43** **0.59**	0.16 **0.20**
Head	Young Adult	*< 0.001* *< 0.001*	*0.30* *0.006*	*< 0.001* *< 0.001*	X	0.21 **0.33**
Tarsus	Young Adult	*0.02* *0.03*	*0.58* *0.19*	*0.19* *0.04*	*0.09* *< 0.001*	x

Males

Wing	Young Adult	X	**0.40** **0.48**	0.05 0.06	0.00 0.12	0.12 **0.30**
Tail	Young Adults	*< 0.001* *< 0.001*	X	0.19 0.09	0.02 0.06	0.01 0.03
Bill	Young Adult	*0.66* *0.62*	*0.09* *0.44*	X	**0.72** **0.57**	**0.21** **0.45**
Head	Young Adult	*0.68* *0.27*	*0.85* *0.61*	*< 0.001* *< 0.001*	X	**0.37** **0.45**
Tarsus	Young Adult	*0.23* *0.007*	*0.91* *0.15*	*0.03* *< 0.001*	*< 0.001* *< 0.001*	X

Table 3
Body mass in different seasons. Spring – March-May, Summer – June-August, Autumn – September-November, Winter – December-February.

	Age	*n*	Range	Mean	*p*
Females					
Spring	Young	36	82-112	94.7	*0.98*
	Adult	57	78-110	94.7	
Summer	Young	15	82-108	93.9	*0.61*
	Adult	13	80-100	92.6	
Autumn	Young	11	82-106	91.6	*0.16*
	Adult	10	88-124	97.6	
Winter	Young	8	87-120	100.9	*0.13*
	Adult	27	84-109	96.1	
Males					
Spring	Young	46	77-100	89.2	*0.70*
	Adult	53	81-107	89.6	
Summer	Young	27	83-100	90.6	***0.05***
	Adult	33	84-120	93.4	
Autumn	Young	18	85-120	95.6	–
	Adult	2	106-109	–	
Winter	Young	21	85-108	94.9	*0.13*
	Adult	13	90-128	99.1	

dependent on the feeding conditions, and the wearing rate is connected, among others, with intensity and time of scratching the forest litter. Adult – more experienced – individuals are more efficient in foraging (Cresswell 1997, 1998; Desrochers 1992a), thus they are in better condition and spend less time on scratching. Both these factors may result in longer bill of adults. The bill length as a part of the total head length directly influences this value. The next analysed parameter for

which statistical difference was found is the wing length. There are three hypotheses explaining this fact. Some authors (van Balen 1967, Slagsvold 1982) point at the role of feeding conditions. Young individuals, whose flight feathers grow in the parental feeding period, can be nourished worse than older birds, that in the moulting time were foraging by themselves. The second theory emphasises the benefits of having shorter wings for the young birds (Alatalo *et al.* 1984, Hendenstrom and Alerstam 1998). Increased ability to quick changes of the flight direction can play a role for inexperienced individuals (to escape predator), whereas older and more experienced birds may gain greater benefits from faster flight resulting from longer wings. The third possibility is the larger mortality of the young birds with short wings than of the long-winged ones (Figuerola and Gutierrez 2000). The data collected up to now do not allow to qualify which of these hypotheses is true for the studied population of the Blackbird. Also the tail length was significantly different between young and adult birds. Similar to the wing length, the longer tail may be a result of better feeding conditions (Van Balen 1967, Slagsvold 1982) or of the larger mortality of the young birds with short tails than of the long-tailed ones (Figuerola and Gutierrez 2000).

The highest values of correlation coefficient, both for females and males, were recorded between head and bill (which results from the fact that the bill length is a part of the total head length), and between wing and tail. The latter correlation could have been expected, as the length of rectrices and remiges depends much on the feeding conditions during moult (van Balen 1967, Slagsvold 1982). A series of differences in values of correlation coefficients were noticed between young and adult birds' measurements. Clear differences were shown for correlation of bill and tarsus lengths, head and tarsus lengths, tail and bill lengths, tail and total head lengths in females, whereas in males the greatest differences were found for correlation of wing and tarsus lengths, bill and tarsus lengths, tail and bill lengths. The reason for differences in coefficient of correlation between tail and bill lengths (in females and males) and between tail and total head lengths (in females) could be a different efficiency of foraging for young and for older birds. During the growth of young individuals' feathers, their final length is dependent not only on the genetic load, but also to great extent on the amount of food delivered by parents, whereas the length of head and bill is genetically encoded and less dependent on the feeding conditions. Moreover, the young Blackbirds have to spend much more time on foraging, so their bills may wear away to greater extent. Thus, the bill length may depend to greater extent on the individual efficiency of foraging, which in turn is experience-dependent. The individuals that fledged in April and May are much more experienced and probably also more efficient than those from the last broods. In older birds, the experience, hence the efficiency of foraging, is similar, thus the bill length is to greater extent correlated with the general size of birds.

The recorded body masses during spring and summer in general are consistent with the data by Havlin (1962), however in winter the studied Blackbirds were clearly lighter. According to this author the mean body mass of young males was 107 g (n = 57), adult males – 108.5 g (n = 55), and females (without distinguishing

of age groups) – 106.5 g (n = 74). This difference probably does not result from smaller chances of gaining food, as most of the Blackbirds in Szczecin winters in houses estates, rich supplied in feed by people living there. One cannot excluded that in the 1950s, predation risk (first of all from the Sparrowhawk – *Accipiter nisus*) was smaller, thus the birds could maintain higher fat reserves without increasing the risk of becoming a prey (Metcalfe and Ure 1995, Witter *et al.* 1994).

Comparing the body masses of females, differences neither between seasons nor between young and adult individuals in any season were found. Females, as well as males, were the heaviest in winter. However, as a consequence of weight increase of reproductive system in spring, the difference in weight of females between those seasons did not differ statistically. Young females did not show expected lower body mass in summer (the end of breeding season). Probable reason for this was their lower reproductive effort (lower number of clutches, eggs and chicks fledged – Desrochers 1992b, Desrochers and Magrath 1993, Wysocki unpubl.). In males, the loss of weight in spring (probably connected with occupying and defending territories and later on with guarding of females), and differences in body mass of young and adult Blackbirds in winter season was noticed. A distinct body mass increase in males during autumn-winter season was found in this study, similarly to Biebach (1977). The increase of body mass in winter was proven for many passerines *e.g.* in the Willow Tit – *Parus montanus* (Koivula *et al.* 1995). In winter-time, most of energy is used for survival of the longer night, during which birds do not forage, and of the period of feed shortage on day. This kind of adaptation decreases starvation risk. Nevertheless, there are some factors limiting such reserves (Lima 1986, Witter and Cuthill 1993). Besides, large fat reserves increase predation risk (Metcalfe and Ure 1995, Witter *et al.* 1994). The found differences in winter body mass of young (submitted) and adult (dominated) males fully confirm the earlier data obtained from the Willow Tit (Koivula *et al.* 1995). The fat accumulation, hence increased body mass, is connected with longer intervals between feeding. The dominating (older) males have better access to feed and are to smaller extent subjected to predator attack. Thus, they can use less energy for foraging, and consequently they attain higher body mass.

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