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## Nest site selection in the urban population of Blackbirds *Turdus merula* of Szczecin (NW Poland)

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**Abstract.** Nest site selection in the Blackbird was investigated in two urban parks in Szczecin from 1997 to 2003. The age structure of the tree stands, the area of shrub coverage and the number of predators (apart from squirrels) were similar in both parks. 95% of the nests discovered at the beginning of the breeding season were found again in June and July. Any increase in the heights of the nest sites in successive periods of the breeding season and any changes in the type of vegetation selected for nest construction were recorded. In April, Blackbirds most often used coniferous trees. At the start of the season, when deciduous plants began sprouting leaves, Blackbirds preferred those whose leaves appeared earlier. But later in the season, no difference was found between the numbers of nests in trees developing their crowns earlier or later. The shorter period of nest use in conifers is probably due to their selective penetration by corvids. The selective penetration of such trees by predators probably reduces the frequency of nest building in them between the first (pentads 1–3) and second (pentads 4–6) period of the breeding season, despite the fact that they provide better concealment for nests. The selection of nest sites by the Blackbirds in this study confirms both the predator-pressure and the nest-concealment hypotheses.

**Key words:** Blackbird, *Turdus merula*, nest site selection, urban population, predation

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### INTRODUCTION

The selection of a nest site is one of the most important decisions affecting breeding success in birds. Nest site selection is particularly important for birds constructing open nests, where predation is the basic cause of losses in progeny (Lack 1954, Ricklefs 1969, Martin 1992). As shown by Sonerud & Field (1987), Corvidae, responsible for most nest losses in birds building open nests, are able to remember the location of nests (even to the next breeding season) and to search those areas where nests have occurred previously. Individuals affected by nest predation can change their choice of nest site as a result of a pressure by nest predators (e.g. Best 1978, Brown & Goertz 1978). The presence of predators may cause changes in nest site selection not only in long-lived species, which can accumulate experience (a review by Newton 1998) but also in short-lived birds (Fortmeister & Weiss 2004). Another impor-

tant factor in the decision making process of selecting a nest site is the structure of the vegetation in the colonized territory (Vogrin 2000). Numerous investigations show that the height at which nests are built increases in the course of the breeding season (Dyrzc 1969, Ludvig et al. 1995, Kosiński 2001). According to Dyrzc (1969), the shortage of suitable nest sites in urban parks forces Blackbirds to build nests higher and higher as the leaf canopy develops.

Since the Blackbird is a species characterised by high plasticity in selecting nest sites (Glutz von Blockheim et al. 1982), this paper aims at presenting changes that occur in selecting nest sites during the breeding season, and at determining the effect of predation and development of leaf canopy on the selection of nest sites by Blackbirds living in urban parks.

If the changes observed in nest site selection (Dyrzc 1969, Ludvig et al. 1995) are caused by concern for security of the nest (the nest hiding

hypothesis), the prevalence of nests in coniferous trees and shrubs, which ensure good shelter, should be expected in the early part of the breeding season. Moreover, up to the time of full canopy development in deciduous trees, the proportion of nests built in coniferous trees and shrubs should be similar. Nests also should be more frequently constructed near the tree trunk (in trunk bifurcations and at the trunk) during this period. With the development of leaves, nests should be built at increasing heights and on the branches of trees with greater frequency. However, because Corvidae selectively penetrate conifers (and are capable of remembering nest sites usually found in coniferous plants early in the breeding season), a gradual decrease in the frequency of nest building in coniferous plants should be observed from the very beginning of the breeding season despite either the absence or initial stage of leaf development in deciduous trees and shrubs.

## STUDY AREA

The investigation was conducted in two urban parks of Szczecin (420 000 inhabitants, NW Poland) in the years 1996–2003. Żeromski Park (Park Z, 21.9 ha), located in the city centre, is constantly visited by people and surrounded by streets and housing estates. The tree stand consists mostly of deciduous trees 100–200 years old. Coniferous trees make up only 2% ( $n = 1214$ ) of trees with a diameter exceeding 20 cm. Undergrowth is rare, with the shrub layer covering about 7% of the park area (3% coniferous shrubs and 4% deciduous). In 1997–2003 the density of Blackbirds varied from 1.0 to 2.5 pairs/ha.

Park Kownas (Park K, 16 ha), bordering on small gardens, is a fragment of a large park gradually merging with suburban forests. The number of pedestrians is much smaller than in Park Z. The tree stand consists of 100–200 year-old deciduous and coniferous trees (conifers making up 17% of the trees,  $n = 873$ ). The undergrowth is also very scant and the shrub layer (consisting of Yew *Taxus baccata*, above all) covers about 9% of the park area (8% coniferous and 1% deciduous bushes). In successive years, the density of Blackbirds varied between 1.0–1.4 pairs/ha. The numbers of predators in the two parks are listed in Table 1. Wysocki (2004a) provides a detailed description of the study area.

Table 1. Number of predators in the study parks (breeding species — number of pairs, non-breeding species — average number of individuals encountered daily during the breeding season). + — observed several times in the park, <sup>1</sup> — one intensively fed squirrel was observed throughout the entire breeding season in 2002. <sup>2</sup> — numbers of breeding pairs gradually increasing since 1997.

Predators	Park Z	Park K
Cat <i>Felis catus</i>	3	0.5
House Marten <i>Martes foina</i>	+	+
Red Squirrel <i>Sciurus vulgaris</i>	0 <sup>1</sup>	2–3
Hooded Crow <i>Corvus corone</i>	2–5 <sup>2</sup>	4–5
Magpie <i>Pica pica</i>	4–9 <sup>2</sup>	1–2
Jay <i>Garrulus glandarius</i>	1	2–3
Jackdaw <i>Corvus monedula</i>	1–2	0
Tawny Owl <i>Strix aluco</i>	0	1

## METHODS

During the entire breeding season (March 1–August 1), one to three persons observed the behaviour of birds for 6–8 hours (from dawn to afternoon) every other day in both parks. Almost all nests were discovered. From 70% (in 1997) to over 90% (1999–2003) of birds were individually marked with colored rings. The beginning of breeding was recorded as the moment when the first egg was laid in the nest. Since most nests were located at a height exceeding 7 m, the date the first egg was laid was assessed from the date when the female began incubating (it was assumed that a Blackbird female began incubation after the third egg was laid according to Snow 1958 and pers. observ.).

A statistical analysis of the effect of the onset of breeding on nest site selection was carried out on the basis of pentads (pentad 1 always began on the day when the first egg was found in one of the two parks). The entire breeding season was divided into six periods. The first (pentads 1–3) and the second (pentads 4–6) periods were characterised by a lack of good shelter for Blackbird nests in deciduous plants (the earliest developing Horse Chestnuts *Aesculus* sp. ensured as good a hiding place for nests as yews in the seventh or eighth pentad of the breeding season in the study parks). In the third (pentads 7–9) and fourth (pentads 10–12) periods, the tree species which leafed out earlier offered much better shelter for nests than trees with later foliage development. All the tree species had fully developed canopies in the fifth (pentads 13–15) and sixth periods (after the 15<sup>th</sup> pentad). In analyzing changes in the preference of birds, it was

assumed that the tree species which leafed out earlier included Horse Chestnut, Hawthorn *Crataegus* sp., Linden *Tilia* sp., Maple *Acer* sp., Elm *Ulmus* sp. and Hornbeam *Carpinus* sp., while species with later leaf development included Oaks *Quercus* sp. and Ash trees *Fraxinus* sp.

The following parameters were established for all the nests:

- 1) the height of the nest site measured exactly to within 10 cm up to 6 m of height. Greater heights were estimated. Since no significant differences were found between different years in the two parks (ANOVA, Park Z:  $F_{6,703} = 0.80$ ,  $p = 0.57$ ; Park K:  $F_{6,332} = 1.65$ ,  $p = 0.13$ ), data were combined from both the parks for analysis;
- 2) the plant on which a nest was built (a coniferous or deciduous shrub; a coniferous or deciduous tree);
- 3) the site of the nest (on a branch, at the trunk, in a trunk bifurcation or a hole);
- 4) the degree of nest hiding (to the nearest 10%). Since most nests were located at heights that prevented an exact determination of their hiding, no detailed description (such as given by Cresswell 1997 or Gregoire et al. 2003) was attempted. In the case of nests located up to 4 m, the visibility of a nest and of the incubating female was assessed from four sides, beginning from the direction where the nest was best visible at a distance of 4 m; the hiding of nests located at greater heights was estimated by the development of vegetation within a 4 m radius of the nest. Two observers evaluated hiding each time (the result was averaged and rounded to 10%). Since the basic element that impeded the evaluation of the degree of nest hiding was the development of the canopy, the hiding of all the nests was evaluated in the same way irrespective of the height early in the breeding season (pentads 1–6). In the second part of the season, however, a larger error could occur in estimating nest hiding at greater heights.

The number of predators was determined on the basis of used nests in the case of birds and by a count of the number of individuals encountered during the breeding season, in the case of mammals.

The length of the period of nest use was determined in each case to establish the impact of predators (from 1 – when the loss occurred on the day the first egg was laid, to 30 – when fledglings abandoned the nest; it was assumed that a female began incubating after the second egg was laid. Incubation and feeding in the nest last 14

days). Since both the day the first egg was laid and the day of the loss were precisely known in most cases, the Mayfield method (Mayfield 1975) was not used. Besides, this method is limited by the assumption that, contrary to what was observed in the study population (D. Wysocki unpubl.), the probability of loss is the same in the entire period of hatching and feeding.

To compare female age differences in the parameters of the nest site, I only considered the first nest used by a given female in each of the periods. Because sporadic cases of same nest re-use occurred in successive breeding seasons (Wysocki 2004c), data from different seasons were treated as independent data. The age of birds was determined on the basis of a contrast within the wing (Svensson 1992).

To test for differences in the height, extent of hiding and period of nest functioning, the t test or analysis of variance was used (compliance to the normal distribution was tested using Kolomogorov-Smirnov test). Differences in the frequency of selecting a given nest site were tested using  $\chi^2$ -test. The statistical analyses were performed using STATISTICA software package.

## RESULTS

### Height of the nest site

In Park Z, the average height of the nest site was  $8.7 \pm 5.7$  m during the entire breeding season, while in Park K it was  $8.4 \pm 6.1$  m. In both parks, increases in the height of nest sites were observed in successive stages of the breeding season; Park Z:  $F_{5,705} = 17.87$ ,  $p < 0.001$ ; Park K:  $F_{5,333} = 14.65$ ,  $p < 0.0001$  (Fig. 1). In Park Z, differences between successive periods were close to statistical significance (the post hoc Turkey test) only early in the breeding season (period I vs II,  $p = 0.09$ ; period II vs III,  $p = 0.09$ ; period III vs IV,  $p = 0.11$ ). In Park K, a statistically significant increase in the height of the nest site was found only between periods II and III,  $p = 0.005$ . Later, the mean height of the nest site was similar (in both parks all  $p > 0.9$ ) (Fig. 1). In the first period of the breeding season (pentads 1–3) the nests were built higher in Park Z than in Park K ( $5.5 \text{ m} \pm 4.8$ ,  $n = 108$  and  $3.6 \text{ m} \pm 2.9$ ,  $n = 44$ , respectively;  $t = 2.28$ ,  $p = 0.02$ ). However, if only nests built in conifers are tested, there are also non-significant differences for the first period (Park Z:  $3.4 \pm 3.8$ ,  $n = 48$ ; Park K:  $3.3 \pm 2.6$ ,  $n = 35$ ;  $t = 0.00$ ,  $p = 0.85$ ).

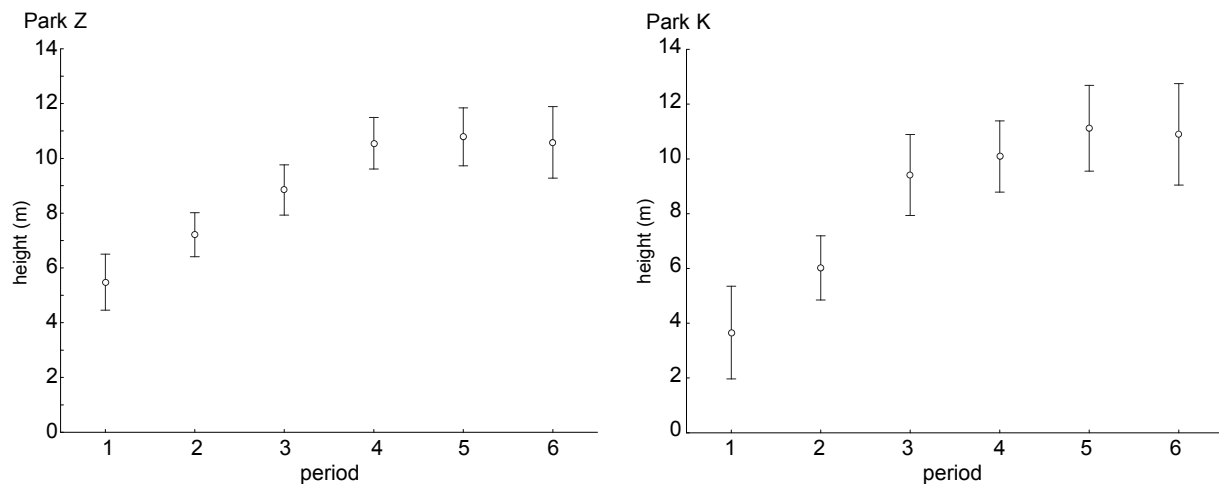


Fig. 1. Mean height and standard deviation of Blackbird nests in different periods of the breeding season.

### Vegetation at the nest building site

Changes were also observed in the type of vegetation surrounding the selected nest site. In the early part of the season, 37% of nests in Park Z and 66% in Park K were built in coniferous trees and shrubs, while towards the end of the breed-

ing season, nests built in these locations constituted only 4% and 10% respectively (Table 2). At the same time, the proportion of nests built in deciduous trees increased from 59% to 91% in Park Z and from 32% to 89% in Park K. In Park Z, the percentage of nests on branches increased

Table 2. Characteristics of Blackbird nest locations during different period of the breeding season. Location: CB — coniferous shrub, DB — deciduous shrub, CT — coniferous tree, DT — deciduous tree, BU — building, site of the nest: SB — on the branch, TR — at the trunk, FT — at the bifurcate of a trunk, HO — tree holes inaccessible to Corvidae. Statistics:  $\chi^2$  test ( $df = 5$ ) for location and site, and ANOVA for nest hiding. \* — data calculated with arc-sin transformed data.

	Pentad 1–6 (N = 284)	Pentad 7–12 (N = 261)	Pentad after 12 (N = 165)	p
<b>Park Z</b>				
Location (%)				
CB	26	3	1	< 0.001
DB	3	4	4	0.97
CT	11	5	3	0.027
DT	59	88	91	< 0.001
Site (%)				
SB	37	42	57	0.006
TR	26	23	13	0.052
FT	30	29	25	0.96
HO	7	6	5	0.98
Hiding*	76 ± 19	77 ± 19	79 ± 16	0.82
<b>Park K</b>				
Location (%)				
CB	44	4	2	< 0.001
DB	2	1	1	0.99
CT	22	9	8	0.032
DT	32	86	89	< 0.001
Site (%)				
SB	49	41	52	0.72
TR	33	23	12	0.025
FT	12	33	33	0.002
HO	5	2	4	0.89
Hiding*	84 ± 16	77 ± 18	80 ± 15	0.01

during the breeding season. In Park K, a significant increase was recorded in the case of nests placed on bifurcated trunks, while in both parks, the frequency of the occurrence of nests placed near the trunk decreased (Table 2). In Park K, nests built in the early part of the season were better hidden than those built later. No such differences were observed in Park Z (Table 2).

If we consider only the pairs that managed to breed twice before the canopy of deciduous trees and shrubs developed (pentads 1–6) and which also had conifers in their territory, coniferous trees and shrubs were significantly more frequently selected for the first brood in both parks (Park Z: first brood – 76%, second brood – 37%,  $n = 38$ ,  $\chi^2 = 12.05$ ,  $df = 1$ ,  $p < 0.001$ ; Park K: 80% and 48%, respectively,  $n = 25$ ,  $\chi^2 = 5.56$ ,  $df = 1$ ,  $p = 0.018$ ). Since nests were better protected in coniferous plants than in deciduous ones, the nests of the first brood were better hidden than the second clutch nests (Park Z:  $86 \pm 15$  and  $75 \pm 21$ , respectively, the t-test for pairs  $n = 38$ ,  $t = 2.57$ ,  $p = 0.012$ ; Park K:  $89 \pm 13$  and  $76 \pm 15$ , the t-test for pairs,  $n = 25$ ,  $t = 3.16$ ,  $p = 0.003$ ). Differences were also found in preferences during the period of canopy development in deciduous trees. In the first half of May, species characterized by early development of leaves were preferred, while in the second half, Blackbirds more often built their nests in trees that developed leaves later in the season – Park Z: period 3 ( $n = 134$ ), period 4 ( $n = 127$ ),  $\chi^2 = 7.40$ ,  $df = 1$ ,  $p = 0.006$ ; Park K: period 3 ( $n = 55$ ), period 4 ( $n = 71$ ),  $\chi^2 = 3.98$ ,  $df = 1$ ,  $p = 0.045$ . (Fig. 2). In June and July (pentads 12–15 and after pentad 15), when all the tree species had fully developed canopies, no such differences were observed (park Z:  $\chi^2 = 0.15$ ,  $df = 1$ ,  $p = 0.7$ , pentads 12–15:  $n = 101$ , pentads after 15:  $n = 62$ ; Park K:  $\chi^2 = 2.67$ ,  $df = 1$ ,  $p = 0.10$ , respectively  $n = 50$  and  $n = 35$ ).

The greatest pressure of predators on nests occurred in the early period of the breeding season in Park Z ( $F_{5,704} = 5.89$ ,  $p < 0.001$  all the differences between the first period, pentads 1–3, and

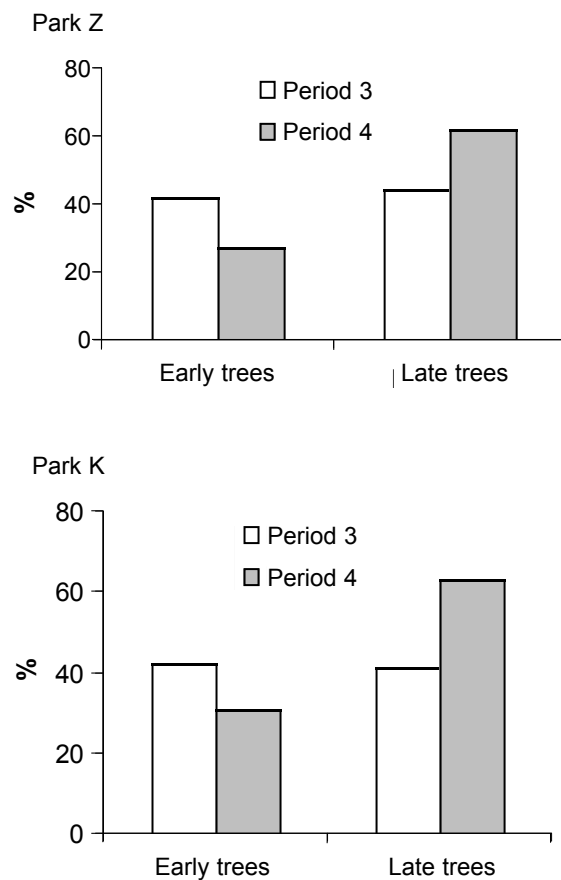


Fig. 2. Frequency of nest building (%) in deciduous trees with the early or late leaf development in different periods of the breeding season.

the later ones were statistically significant, the post hoc Turkey test, all  $p < 0.05$ ; however, no differences were established between later periods). No such differences could be ascertained in Park K ( $F_{5,332} = 0.19$ ,  $p = 0.97$ ) (Table 3). If only the period before the development of leaves is considered (pentads 1–6), nests in coniferous trees and shrubs were more strongly impacted by predation despite their being better hidden than those in deciduous trees and shrubs in Park Z (the losses occurring on  $11.1 \pm 9.9$  day,

Table 3. Mean time of nest use (days) in different periods of the breeding season in the study parks (Park Z:  $F_{5,704} = 5.89$ ,  $p < 0.0001$ , Park K:  $F_{5,332} = 0.19$ ,  $p = 0.97$ ).

Pentads	Park Z	Park K	F	p
1-3	$12.9 \pm 10.8$ (N = 109)	$11.9 \pm 9.3$ (N = 42)	0.27	0.60
4-6	$18.2 \pm 11.1$ (N = 174)	$11.9 \pm 9.4$ (N = 87)	20.43	< 0.001
7-9	$16.9 \pm 10.8$ (N = 134)	$12.5 \pm 8.8$ (N = 55)	7.07	0.008
10-12	$18.0 \pm 9.9$ (N = 127)	$12.4 \pm 9.4$ (N = 71)	15.35	< 0.001
13-15	$20.3 \pm 10.0$ (N = 101)	$11.7 \pm 9.4$ (N = 49)	25.28	< 0.001
after 15	$18.2 \pm 11.0$ (N = 65)	$13.4 \pm 10.1$ (N = 34)	4.47	0.037

$n = 104$  and  $19.1 \pm 11.0$  day,  $n = 178$ , respectively;  $t = 6.06$ ,  $p < 0.0001$ ). In Park K, differences were insignificant ( $10.9 \pm 9.9$  day,  $n = 84$  and  $12.9 \pm 9.0$  day,  $n = 44$ , respectively;  $t = 1.18$ ,  $p = 0.24$ ).

In Park Z, nests built by older females were better hidden, however the differences were statistically significant only in the period between pentads 7 and 12 of the breeding season (Table 4). Nests built by older females were placed lower than those of younger females at the beginning (pentads 1–6) and towards the end (after pentad 12) of the breeding season in this park. Moreover, if the entire breeding season is considered, older females built their nests more frequently in coniferous plants compared with younger birds (20% of 496 and 11% of 149, respectively;  $\chi^2 = 6.17$ ;  $df = 1$ ,  $p = 0.013$ ). In terms of plants characterised by an early or late development of canopies, no differences were found in the frequency of their colonization by females of different ages. No statistically significant differences were found in Park K (Table 4).

Table 4. Differences in several parameters between nests built by young and old females for different periods of the breeding season. MTNU – mean ( $\pm$  SD) time of nest use. t-test \* –  $p < 0.05$ , \*\* –  $p < 0.01$ , \*\*\* –  $p < 0.001$ .

	Females	
	Young	Old
<b>Park Z</b>		
Pentads 1-6	(N = 48)	(N = 216)
Hiding (%)	$73 \pm 18$	$77 \pm 19$
Height (m)	$8.3 \pm 5.6$	$6.2 \pm 4.6^{**}$
MTNU (days)	$14.8 \pm 11.2$	$16.2 \pm 11.3$
Pentads 7-12	(N = 61)	(N = 174)
Hiding (%)	$72 \pm 19$	$78 \pm 19^*$
Height (m)	$9.8 \pm 5.3$	$9.6 \pm 6.1$
MTNU (days)	$18.3 \pm 11.3$	$17.3 \pm 9.9$
Pentads after 12	(N = 40)	(N = 106)
Hiding (%)	$77 \pm 19$	$81 \pm 15$
Height (m)	$12.9 \pm 6.0$	$9.3 \pm 5.2^{***}$
MTNU (days)	$18.3 \pm 10.7$	$20.0 \pm 10.4$
<b>Park K</b>		
Pentads 1-6	(N = 25)	(N = 75)
Hiding (%)	$88 \pm 16$	$83 \pm 16$
Height (m)	$5.7 \pm 5.5$	$5.0 \pm 4.4$
MTNU (days)	$9.9 \pm 8.3$	$13.2 \pm 9.7$
Pentads 7-12	(N = 25)	(N = 83)
Hiding (%)	$76 \pm 17$	$78 \pm 18$
Height (m)	$10.9 \pm 5.9$	$10.2 \pm 6.6$
MTNU (days)	$12.6 \pm 9.5$	$12.9 \pm 9.0$
Pentads after 12	(N = 19)	(N = 47)
Hiding (%)	$87 \pm 13$	$79 \pm 16$
Height (m)	$12.1 \pm 6.2$	$10.4 \pm 5.6$
MTNU (days)	$13.3 \pm 8.3$	$12.6 \pm 9.9$

## DISCUSSION

### Height of the nest sites

In the study population, Blackbirds place their nests at the greatest heights among all the populations so far investigated in urban environments (Glutz von Blotzheim et al. 1982, Pikula & Beklova 1983, Wesolowski & Czapulak 1986, Kentish et al. 1995, Ludvig et al. 1995, Cresswell 1997, Gregoire et al. 2003). Similar heights were observed in the primeval forest of Białowieża National Park (Tomiałojć 1993). According to Tomiałojć (1993), building nests at greater heights in urban conditions is caused by the absence of a well-developed understorey of bushes and also by the impact of strollers, dogs and cats. Other authors, Dyrzc (1969) and Ludwig et al. (1995), observed a gradual increase in the height at which Blackbirds built their nests over the course of the breeding season. According to Dyrzc (1969), nests are built at increasingly greater heights together with the development of leaf canopy because there is a shortage of proper nest sites in urban parks. Vogrin (2000) reported a positive correlation between the height of the nest site and the height of trees and shrubs in a given area. Because of insufficient data, we cannot be sure that the main reason for nests being built at very great heights in the study population was the lack of suitable lower sites, when, at the same time, many nests were found in the fairly numerous 150 year-old oaks. Once the leaf canopies developed, nests situated high in trees were very abundant, impeding any systematic penetration by Corvidae. Differences in the height of nest sites observed between the parks during the first period of the breeding season depended above all on the more regular distribution of coniferous trees and bushes in Park K. Here, most pairs decided to build their first nest in the conifers. This was not an option for a greater number of pairs in Park Z, which usually built their nests in the higher trunk bifurcations of deciduous trees. This is also confirmed by a similar height of nesting in both parks for the first period of the breeding season when only testing those pairs with coniferous plants in their territories.

### Hiding of the nest and predation

Changes in plant preferences for nest building can be also explained by a shortage of available nest sites. Early in the breeding season, many nests were built in conifers that ensured good shelter. In the second half of the season, most

nests were placed in deciduous trees where the sites were well hidden. Similar changes were observed in the urban population of Greenfinch *Carduelis chloris* in Poland (Kosiński 2001). According to Ludwig et al. (1995) the reason for changing preferences was the growth of leafy canopies and hence a greater opportunity to protect the nests. Several cases of bigamy observed in the study parks (Wysocki 2004b) and even two breeding pairs in one nest (Wysocki & Walasz 2004) seem to corroborate the theory of the shortage of nest sites.

However, a decrease observed in the frequency of nest building in conifers between the first (pentads 1–3) and the second (pentads 4–6) period of the breeding season — despite the lack of other equally well-sheltered sites — suggests that these changes can also be due to the strong impact of predators, as the full development of the deciduous canopy does not occur before the seventh or eighth pentad (early in May) in the study parks. A similar change in the choice of nest sites as a result of nest predation was observed in the Field Sparrow *Spizella pusilla* (Best 1987) and Red-winged Blackbird *Agelaius phoeniceus* (Brown & Goertz 1978). In Park Z, an increase in the number of nests on branches probably occurs because the opportunity to hide nests on the branches of all deciduous trees increases with the passage of the breeding season. The absence of such a tendency in Park K can be attributed to the smaller numbers of oaks, whose branches — of all the deciduous trees — ensure the best shelter. In both parks, the number of nests built at the trunk decreased as the breeding season progressed. A nest is best hidden at the tree trunk at the beginning of the season in areas where no coniferous trees or bushes are found. Later, the development of leaves increases the ability to also hide a nest in other sites. Another possible reason for the decreasing number of nests in conifers is that predators easily find nests in such places. The decreasing share of such nests after the canopy of deciduous trees is fully developed also corroborates this observation.

In Park K, nests were better hidden in the early part of the breeding season above all by their placement in dense coniferous trees and bushes. In Park Z, where the number of conifers was smaller, nests were frequently located in deciduous trees, which at the beginning of the breeding season hardly ensure good shelter. The results of research conducted in Scotland (Cresswell 1997) showed that nest hiding plays a deciding role in

breeding success. However, this investigation was probably carried out in an environment characterized by a greater abundance of proper nest sites in low, dense shrubs (as indicated by the low average height of nest sites and a fairly low maximum height — 11 m). Therefore, regular penetration of this habitat by predators was hardly possible. As reported by Cresswell (1997), a greater breeding success in nests built in Lindens, compared with Rhododendrons and Yews, shows that Corvidae also concentrate on searching shrubs in this population. However, because of the larger area, well-hidden nests are less frequently discovered. The investigation on nesting preferences and the breeding success of Blackbird in farmland (Møller 1988) showed that nests placed in coniferous plants had greater breeding success than those built in deciduous plants — the shelter of the nest probably played a deciding role in this case also.

Investigations of the quality of the breeding area in Parks Z and K (Wysocki et al. 2004) show that the smallest number of fledglings were reared in locations with the greatest area of coniferous shrubs. However, at the same time, the areas colonized first are those strongly overgrown with shrubs. Hence, it is probable that they present an ecological trap. This could be the result of the urban Blackbird populations' inability to adapt to growing predator pressure, as the predators, until recently, had been absent from the centers of large cities (Marchant et al. 1990, Wysocki 2001).

Additional indicators of the selective penetration of conifers by corvids include a significant difference in the length of nest use between the first and later periods of the breeding season, as well as an average length of use of better sheltered nests in coniferous plants that is shorter by a factor of nearly two in comparison with nests built in deciduous plants in the first period of the breeding season in Park Z. No such differences were noted in Park K, probably owing to the presence of squirrels, which are less selective and carefully scour their entire territory.

#### **The effect of age on the choice of nest site**

Differences found in the hiding and height of nests between young and old females result above all from the more frequent use of coniferous plants by older females. In Blackbirds, older individuals occupy territories earlier (Schwabl 1983, Wysocki et al. 2004) and the first colonized fragments of the park in the study population are those with large areas of coniferous shrubs (Wysocki et al. 2004). In the first period of the



breeding season, coniferous shrubs are the most important sites for nest building. Hence, older females much more frequently occupy territories with a greater number of conifers, offering better protection for the nest and placement at lower heights. No such differences were found in Park K – probably owing to the more regular distribution of coniferous plants in the entire park, making the determination of preferences impossible. In Park Z, the lack of differences between young and old females in the frequency of building nests in trees with early leaf development in the middle part of the breeding season (pentads 7–12) may also be due to the uniform distribution of such trees.

To recapitulate, the results obtained confirm both the nest hiding and the predators' pressure hypotheses. In Blackbirds, the selection of a nest site depends above all on the accessibility of locations ensuring the best places to hide the nests. In the case of the high pressure of predators, which selectively penetrate such places, Blackbirds change their site preferences and choose deciduous plants, which offer poorer shelter, but are more rarely penetrated by corvids.

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## STRESZCZENIE

**[Wybór miejsca na gniazdo w miejskiej populacji kosa]**

Badania przeprowadzono latach 1997–2003 w dwóch parkach Szczecina — Żeromskiego (Z) i Kownasa (K). W obu parkach struktura wiekowa drzewostanu, powierzchnia krzewów i liczba drapieżników (z wyjątkiem wiewiórki, Tab. 1) były podobne. W obu parkach wyszukano od 100% zajętych gniazd na początku sezonu lęgowego do ok. 95% w czerwcu i lipcu. Stwierdzono wzrost wysokości sytuowania gniazda (Fig. 1) oraz zmianę roślinności, na której gniazda były budowane (Tab. 2). Zdecydowana większość samic pierwszy lęg odbywała zakładając gniazdo w roślinach iglastych (jeżeli wziąć pod uwagę tylko terytoria w których występowały rośliny iglaste), natomiast później w miarę rozwoju

ulistnienia, częściej wybierały rośliny liściaste (Fig. 2). Krótszy okres używania gniazda wybudowanego w roślinach iglastych na początku sezonu lęgowego (Tab. 3) wskazuje na selektywne penetrowanie tych roślin przez krukowate. Większe straty mimo lepszego ukrycia gniazd w roślinach iglastych powodowały spadek częstotliwości budowania gniazda w roślinach iglastych między pierwszym (pentady 1–3) i drugim (pentady 4–6) okresem sezonu lęgowego. Różnice między samicami młodymi i starymi (Tab. 4) w sposobie sytuowania gniazda wynikają z wcześniejszego zajmowania terytoriów lęgowych przez samice stare. Jednakże średnia długość funkcjonowania gniazda w poszczególnych okresach sezonu lęgowego samic młodych i starych nie różniła się (Tab. 4). Wybór miejsca gniazdowania kosa potwierdza zarówno hipotezę presji drapieżników jak i hipotezę ukrycia gniazda.



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