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DOES THE MAGPIE *PICA PICA* (L.) PREFER POPLARS AS A NESTING TREE IN THE URBAN ENVIRONMENT?

ABSTRACT: This paper aims to verify the hypothesis that magpies in urban environments favour poplars as nesting trees, as suggested by previous authors. The fieldwork was conducted in a 180 ha area in a district of Gdańsk (North Poland). The study area held 5294 trees and high shrubs, where 124 magpie nests were found in 10 species of trees. Results of log-linear analysis showed that the magpies chose particular tree species rather than types of spatial tree organization. The lombardy poplar (*Populus nigra "Italica"*) is the species most frequently chosen as a nest tree, however – the magpies showed a significant preference for trees growing separately or in pairs. The choice index (the ratio of expected to observed frequency) confirmed the magpies' strong preference for black poplar cultivars and for birches, regardless of the trees' grouping. The magpies preferred lombardy poplar when they had the choice of two poplar cultivars. This cultivar has a crown suitable for the magpie's nest construction because of the small angle between the trunk and the branches. The thin, almost vertical branches probably also limit predators from penetrating the crown because these branches do not provide much support for tree climbers. The large-scale planting of lombardy poplars in Polish towns in the 1960s and 1970s has probably contributed to the significant increase of the magpie population in the urban environment.

KEY WORDS: urban avifauna, synantropization, nesting tree, spatial tree organization

1. INTRODUCTION

The population of magpies *Pica pica* increased rapidly in the second half of the 20th century, especially in towns and villages (Cramp 1994, Jerzak 2001). The colonization of towns by this species was connected with changes in the habitat structure of urban areas, where green recreation areas, lawns and rows and clumps of tall fast-growing trees were established (Jerzak 2005). The magpie's close association with human settlements has been attributed to abundant anthropogenic food sources as well as to the higher percentage of successful breeding pairs and the higher survival of young in urban than in rural habitats (Jerzak 1995). According to Tatner (1982) the abundance of trees is the main factor determining the density of breeding magpies in urbanized areas. Many papers dealing with the breeding ecology of the magpie in the urban environment have shown that this species most often nests in poplars (*Populus sp.*) (*e.g.* Harmata 1985, Witt 1985, Górska and Górski 1997, Jerzak 1997, 2001, Indykiewicz 2001, Antonov and Atanasova

2002, Mitrus and Woźniak 2002, Pakuła *et al.* 2005). This very tall tree with a slim and dense canopy is thought to provide magpies excellent breeding sites because locating a nest high above the ground reduces the likelihood of brood destruction from mammalian predators (Tatner 1982). Birkhead (1991) has suggested that the extensive tree planting programme that was a part of urban redevelopment after the Second World War created suitable conditions for magpies' rapid colonization of European towns. Poplars started being planted in high numbers in Poland at that time. They were introduced most intensively between 1961 and 1975, when about 168 million trees were planted (Jastrzębski 1959). Poplars grow to about 15 m in 15 years (Zabielski 1973) when they become an attractive nest site for magpies (Jerzak 1997). And indeed the breeding populations of magpies increased the most rapidly between 1960 and 1990 in many Polish towns (*e.g.* Nowakowski 1996, Górski 1997, Luniak *et al.* 1997, Meissner and Duś 2005, Janiszewski *et al.* 2005). In Gdańsk a rapid increase was observed in the 1980s, when the nest density rose from 0.35 to 1.20 nests per 10 ha (Meissner and Duś 2005). Magpies have become the most important predator of bird nests in most European towns (Cramp 1994), but their effect on the breeding success of other birds with open nests remains disputed (Birkhead 1991, Groom 1993, Chiron and Julliard 2007).

Some authors maintain that magpies generally place their nests in rows or clumps of trees (Górska and Górski 1997, Jerzak 1997, Bocheński *et al.* 2001). However in towns most poplars were planted in rows along streets, paths and the edge of lawns, and it remains unknown if magpies prefer poplars in rows and clumps or if their choice of nesting sites is a result of the manner the trees were planted in towns. Thus this paper aims to verify the hypothesis that magpies in urban environment favour poplars as nesting trees.

2. MATERIAL AND METHODS

The research was conducted in Zaspa, a 180 ha district in the city of Gdańsk with mostly medium (4- to 5-storey) and tall (10- to 12-storey) buildings. This urban district was developed in the early 1970s and almost all the trees were planted between 1974 and 1979 (A. Dąbrowski – pers. comm.). A high density of magpie nests, up to 4.7 nests per 10 ha, was noted in the area (Meissner and Duś 2005).

In April 2004 we counted all trees and shrubs in the district taller than 3 m, the minimal height assumed suitable for magpie nesting based on previous observations. These observations had found that in the 1395 ha of Gdańsk's urban area no nest was placed lower than 4 m above the ground (Duś 2003, Meissner and Duś 2005). All poplars noted in study area were *Aegeiros* black poplar cultivars. Two types were distinguished by their canopy structure: lombardy poplar (*Populus nigra* L. *"Italica"*) with a slim canopy and narrow fastigiated angles to their branches, and others with rounded, wide and rather loose crowns (Seneta and Dolatowski 2008). Each tree's species and position in the tree spatial organization were noted. We distinguished various spatial organizations of the trees: rows of more than two trees planted in a line; clumps of more than two trees growing close to each other in a random pattern; two trees growing close together; and single trees. Groups of trees were treated as separate entities when they were spaced at least 10 m apart.

The choice index was calculated as the quotient of the observed and the expected frequency of magpie nests in a given tree species. For each tree species:

$$expected\ frequency = \frac{number\ of\ trees\ of\ a\ given\ species}{total\ number\ of\ trees} * total\ number\ of\ nests \quad (1)$$

and

$$choice\ index = \frac{observed\ frequency}{expected\ frequency} \quad (2)$$

The index indicates the frequency with which magpies chose a particular species of tree as a nest site compared with the abundance of that species in the study area (Tatner 1982, Jerzak 1997). This index was calculated for the entire study area and for each type of spatial tree organization. Log-linear analysis was used to check the possible influ-

ence of tree species and spatial tree organization on the presence of magpie nests.

The Latin nomenclature of trees and shrubs follows Mirek *et al.* (2002), except for poplars, which follows Seneta and Dolatowski (2008).

3. RESULTS

We counted 5294 trees and high shrubs in the study area. The most numerous were maples (*Acer* sp.), followed by lindens (*Tilia* sp.) and sorbs (*Sorbus* sp.) (Table 1). We found 124 magpie nests in 10 different species of tree, more than 80% in maples, lindens and both types of poplars.

Most of the trees in the study area were planted in rows and clumps (Table 2). Trees planted separately or in pairs made up 7% of those in the district and 34% of the spatial organizations we distinguished (Table 2). More than 90% of the magpie nests were built in trees growing in rows and clumps, the most frequent types of spatial tree organization, making up 66% of all the trees and shrubs we observed (Table 2). The mix of species was different in the different types of spatial tree organization. More than 50% of the plums (*Prunus domestica* L.), ashes (*Fraxinus excelsior* L.), black locusts (*Robinia pseudoacacia* L.), birches (*Betula sp.*) and willows (*Salix sp.*) grew in clumps, but both types of poplars, maples, lindens and sorbs were planted mainly in rows (Table 3).

Log-linear analysis showed a significant relationship between the types of spatial tree organization and tree species (χ^2 = 600.3, df = 33, P <0,001) as well as tree species and the presence of magpie nests (χ^2 = 86.0, df = 11, P <0,001). The relationship between the type of spatial tree organization and the presence of nests remained statistically insignificant (χ^2 = 6.1, df = 3, P = 0.107). These results confirmed that the proportion of different species in the different types of spatial tree organization varied and that magpies preferred

Table 1. The number and percentage of different tree species and the number of Magpie nests found in the studied urban district (+ - the percentage below 1).

Tree species	Number of trees		Number of Magpie nests	
	N	[%]	N	[%]
Acer sp.	2038	39	45	36
Tilia sp.	958	18	22	18
Sorbus sp.	763	14	5	4
Prunus domestica	426	8	3	2
Populus nigra	338	6	15	12
Robinia pseudoacacia	170	3	4	3
Populus nigra L*"Italica"*	122	2	18	15
Betula sp.	91	2	8	6
Salix sp.	90	2	2	2
Fraxinus excelsior	81	2		
Aesculus hippocastanum	67	1		
Quercus sp.	44	1		
Elaeagnus communtata	27	1		
Cerasus sp.	22	+		
Crataegus sp.	18	+		
Populus tremula	10	+		
Abies alba	9	+	2	2
Larix sp.	6	+		
Gleditsia triacanthos	6	+		
Pinus sylvestris	3	+		
Malus sp.	2	+		
Junglans sp.	2	+		
Hippophaë rhamnoides	1	+		
Total	5294	100	124	100

Table 2. The quantity of particular types of spatial tree organization and the number of Magpie nests and trees planted within each type in the studied urban district.

Spatial tree organization type	Number of tree groups		Number of trees		Number of nests	
	N	[%]	N	[%]	N	[%]
Row	350	39	2684	51	69	56
Clump	248	27	2237	42	43	35
Two trees	66	7	132	3	5	4
Single tree	241	27	241	4	7	5
Total	905	100	5294	100	124	100

Table 3. The percentage of tree species in different types of spatial tree organizations. Firs (*Abies* sp.) were omitted because of the small sample size. Values higher than 50% are in bold face.

Species	Percent share in:			
	Clumps	Rows	Two trees	Single tree
Populus nigra	28	**66**	3	3
Acer sp.	43	**51**	2	4
Populus nigra L"*Italica*"	22	**68**	5	5
Tilia sp.	33	**60**	3	4
Sorbus sp.	16	**78**	2	4
Aesculus hippocastanum	42	38	9	11
Salix sp.	**56**	22	10	12
Betula sp.	**65**	11	9	15
Robinia pseudoacacia	**63**	30	3	4
Fraxinus excelsior	**51**	27	7	15
Prunus domestica	**66**	8	6	20

Table 4. The choice index (formula 1, 2) for various tree species in which Magpie built nests. Firs (*Abies* sp.) were omitted because of their small sample size.

Species	Number of trees available for nesting	Number of nests	Choice index			
			Clumps	Rows	Two and single trees	All trees
Populus nigra L"*Italica*"	122	19	4.7	6.0	16.9	6.0
Betula sp.	91	8	2.1	8.5	6.0	3.6
Populus nigra	338	15	2.7	1.7	0	1.8
Robinia pseudoaccacia	170	4	0.4	1.6	4.2	1.0
Tilia sp.	958	21	0.7	1.2	0	0.9
Salix sp.	90	1	0	2.1	0	0.9
Acer sp.	2038	45	0.2	1.0	0.7	0.9
Prunus domestica	424	3	2.0	0	0	0.3
Sorbus sp.	763	5	0.4	0.3	0	0.3

poplars regardless of their proportion in the species of trees that made up the different spatial organizations.

The small number of the magpie nests located in trees growing separately or in pairs compelled us to combine those types when estimating the choice index. Values of that index indicate that certain tree species are always preferred, regardless of their spatial organization (Table 4.). The highest values of the choice index (9.0) were established for fir trees (*Abies alba*), but this species was omitted from the analysis because it was so poorly represented. The index showed magpies' strong preference for lombardy poplar and birch regardless of the type of tree grouping. Wide-crowned poplar cultivars and *Robinia pseudoacacia* had choice index values higher than one, but not in all types of tree groups. The other tree species had low index values, with the exception

of *Tilia* sp. and *Salix* sp. growing in rows and *Prunus domestica* in clumps, though we found only 1 magpie nest in *Salix* sp. (Table 4). The statistically significant difference between the observed and the expected frequency of nests built in different tree species supports the hypothesis on magpies' preference for certain species of trees (G test, G = 31.82, $P = 0.0001$).

4. DISCUSSION

Ambiguous results of previous studies on magpies' preference for particular types of tree grouping (*e.g.* Górska and Górski 1997, Jerzak 1997, Bocheński *et al.* 2001) might have resulted from their failure to consider that different species of trees were planted with different spatial organizations in different towns. In the urban area we studied, maples, poplars, sorbs and lindens were usually planted in rows, but willows, birches, locusts, ashes and plums were usually planted in clumps. Thus, magpies usually built their nests in rows and clumps of trees in this urban district because their preferred tree species were planted this way. About 68% of the lombardy poplars grew in rows and 65% of the birches in clumps. Magpies showed a clear preference for the lombardy poplars and birches in this urban area.

Data from other towns showed that magpies also often choose birches as nesting trees (Jerzak 1997, Bocheński *et al.* 2001, Indykiewicz 2001). Most magpie nests in towns are located at the top of tree (Kulczycki 1973, Jerzak 1988), which is higher than in areas outside human settlements (Jerzak 1988, 1997, Górska and Górski 1997, Mitrus and Woźniak 2002). The nest's elevation above the ground is a good predictor of this species' breeding success (Antonov and Atanasova 2002), because nests placed higher are safer from mammalian predators (Deckert 1968). The magpies' preference for birches and poplars is a result not only of the availability of these two species, but also because of their height. Poplars and birches are among the tallest trees commonly planted in Polish towns (Seneta and Dolatowski 2008). Antonov and Atanasova (2002) also suggested that natural selection might favour higher nesting early in the season when the nests are not concealed by foliage. This phenomenon has also been observed in other bird species (Kosiński 2001).

Of the two types of poplar cultivars, magpies preferred lombardy poplar (Jerzak 1997, Barszcz 1998, Antonov and Atanasova 2002). The crown of the lombardy poplar is suitable for magpie nests because the angle between the trunk and the branches is less than 50 degrees (Jankiewicz 1973), which allows the birds to attach their nests to many adjacent, densely growing branches. Thin, almost vertically ascending branches also limit any penetration of the crown by predators, because these branches provide little support to climbers. Branches in the wide crowns of other poplars grow at an angle of more than 70 degrees to the trunk (Jankiewicz 1973), similar to many other trees. However, the wide crowns of these poplars do grow high, which is probably why many magpie nests are found on poplar cultivars other than lombardy in some towns (Barszcz 1998, Antonov and Atanasova 2002). The highest value in the choice index was established for one or two lombardy poplars growing separately.

Magpies might prefer these trees because the offer good all-round visibility from the nest site (Götmark *et al.* 1995), which is at least partly restricted in clumps and rows of trees. Thus, it seems that magpies prefer particular species of trees rather than any type of spatial organization of trees. But with lombardy poplar, the species most frequently chosen as a nest tree, they show a significant preference for trees growing separately or in pairs. It seems that the large-scale plantings of lombardy poplars in Polish towns in the 1960s and 1970s is probably one factor influencing the significant increase of the magpie population in the urban environment.

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