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Competition for nest sites between the Starling *Sturnus vulgaris* and other cavity nesters — study in forest park

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Abstract: Three species of cavity nesters potentially competitive with the Starling — the Great Spotted Woodpecker *Dendrocopos major*, Middle Spotted Woodpecker *D. medius* and Nuthatch *Sitta europaea* were studied in the years 1997–1999. The number of suitable nest sites for Starlings and competitive pressure were manipulated by increasing or decreasing the availability of nest boxes. Increased nest-site competition did not lead to significant changes in number among the studied species. The Starling was found to take over up to 25% of holes chosen by Nuthatches for breeding. Increased availability of nest sites did not protect Nuthatches from cavity losses, but reduced their frequency. Only 20% of Nuthatch pairs that lost their holes renested successfully in the same breeding season. No impact of Starlings on breeding woodpeckers was noted.

Key words: Starling, *Sturnus vulgaris*, competition, nest sites, hole nesters

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INTRODUCTION

The results of many studies indicate that the number of available nest sites for cavity nesters is limited (review in: Newton 1994). Therefore interference competition for this environmental resource is very frequently studied (e.g. Slagsvold 1975, Minot & Perrins 1986, Sasvári et al. 1987, Gustafsson 1988, Barba & Gil-Delgado 1990, Finch 1990, Meek & Robertson 1994, Bechard & Bechard 1996). However, most results are based on nest box studies and the problem is generally less investigated in natural condition, with some papers even showing a surplus of suitable nest sites (Rendel & Robertson 1989, Waters et al. 1990, Walankiewicz 1991).

European studies which deal with nest-site competition have mainly concerned tits *Parus major*, *P. caeruleus*, and flycatchers *Ficedula hypoleuca* and *F. albicollis* (e.g. Slagsvold 1975, Dhondt 1977, Dhondt & Eyckerman 1980, Minot & Perrins 1986, Gustafsson 1987, Sasvári et al. 1987, East & Perrins 1988, Dhondt 1989, Merilä & Wiggins 1995, Walankiewicz & Mitrus 1997). Relationships between other hole nesting species are investigated very rarely (Busse & Gotzman 1962, Barba & Gil-Delgado 1990).

The Starling *Sturnus vulgaris* is able to usurp the holes of many primary and secondary cavity nesters (e.g. Allen & Nice 1952, Busse & Gotzman 1962, Weitzel 1988, Ingold 1991, 1994). The impact of Starlings on other cavity nesting species has been studied in North America in great detail (e.g. Weitzel 1988, Ingold 1989, Kerpez & Smith 1990, Ingold 1991, 1994). It was found that Starlings may influence the populations and breeding biology of cavity nesters. Some species may even disappear from particular areas because of this competition (Weitzel 1988).

Unlike in North America, competition for nest sites between the Starling and other hole nesting species is rarely studied in Europe. In forest and park habitats the Starling mainly utilizes holes excavated by the Great Spotted Woodpecker *Dendrocopos major*, and less frequently those excavated by the Middle Spotted *D. medius* (Mazgajski 1994). The Nuthatch *Sitta europaea* often also builds its nests in both kinds of holes (Wesołowski 1989, Mazgajski 1994). Both Starlings and Nuthatches have been found to prefer breeding in woodpecker holes as opposed to natural cavities, and may use the same holes in succesive years (Wesołowski 1989). Starlings might therefore be assumed to be in strong competition for nest sites with the Great Spotted Woodpecker and the Nuthatch, while interference with the Middle Spotted Woodpecker should be smaller.

Many papers describe cases or even the frequent occurence of the usurpation by Starling cavities in North America (e.g. Shelley 1935, Howell 1943, Kilham 1968, Ingold 1991, 1994), but similar data for Europe are rare. Nilsson (1987) found that an average of 8.2% of Nuthatch nest holes were taken over by Starlings, while an additional 6.3% were lost due to interference with woodpeckers and flycatchers. During a two-year study in the Białowieża Primaeval Forest no cases of the usurpation of Nuthatch nest holes were noted, although this was said to have happened in previous years (Wesołowski & Stawarczyk 1991). Describing the breeding biology of the Great Spotted Woodpecker, Tracy (1938) found that competition with Starlings was responsible for 80% of the nesting failures of that woodpecker.

Only primary cavity nesters (PCN's), i.e. woodpeckers, are able to excavate new holes after their loss. Secondary cavity nesters (SCN's), e.g. nuthatches, are not, for this reason, interference competition should influence the Nuthatch population much more strongly. As Starlings readily accept nest boxes for breeding, it is easy to manipulate the number of available nest sites for this species. An increased number of potential nest sites should reduce the competitive pressure imposed by Starlings on other cavity nesters breeding in natural holes.

The aim of this study was to estimate the influence of Starlings on a population of Nuthatches and Great and Middle Spotted Woodpeckers — species potentially competitive for similar nest holes. Some other parameters e.g. frequency of cavity losses, were also described.

STUDY AREA AND METHODS

The study was carried out in the 103-hectare Młociny forest park on the outskirts of Warsaw, Poland. The forest is in suburban habitat bordered by a highway and the Vistula river. Tree stands mainly comprise mixed forest with Pine *Pinus silvestris* and Oak *Quercus* sp. The central part of the forest and banks of the Vistula have fragments of wet riverine forest with Alder *Alnus glutinosa*, Ash *Fraxinus excelsior*, White Poplar *Populus alba*, etc. The age of tree stands exceeds 100 years, and there are many holes of both natural and woodpecker excavated origin available to hole nesting birds. The location of the park — close to the city — enssures intensive human penetration, although it is mostly the park paths that are used for public recreation leaving the major part of the area relatively undisturbed by humankind.

Ca 50 nest boxes suitable for Starlings were placed in the study area in 1996. In subsequent years the number varied from 30 to 50. The years 1996–1999 (except 1998) witnesses the breeding of ca 20–30 pairs of Starling (own data). In 1998, during the first days of the Starling nest-building period, nest box entrances were closed and thus made unavailable to birds. The aim here was to increase competition for nest sites, as Starlings had to breed in natural holes only, competing for them with other cavity nesting species.

Detailed study of cavity nesting species commenced in 1997. Nuthatches and woodpeckers were mist-netted near temporary feeders and individually marked. Almost 50–70% of nesting pairs of Nuthatches were ringed, along with just a few woodpeckers. In the period 1997–1999 the number of breeding pairs of woodpeckers was established on the basis of the number of nests found. Territories of pairs of Nuthatches were determined in the years 1998–1999, and the nest holes chosen distinguished on the basis of the singing of males and especially entries by females with nest material. All observations were made in late March and April. Such holes were monitored again in May, when the birds were feeding their nestlings. In all but one case such holes were used by pairs observed in April,

or by other bird' species, which suggested cavity usurpation. Woodpeckers excavating holes were searched for In late April and early May.

If holes were not found during the nest-building stage observations were prolonged through the rest of the breeding season. When cases of hole usurpation were observed the entire territories of pairs losing their nests were searched thoroughly for a new nest.

18 nest holes of Nuthatches, 3–5 of Great Spotted Woodpeckers and 1 of Middle Spotted Woodpeckers were found every year during nest building. Additional nests of Nuthatches (1–2), Great Spotted (6–8) and Middle Spotted (1) Woodpeckers were found during the nestling phase. Estimations of the frequency of usurpation of holes were confined to nests found during the nest-building period.

In the course of the elaboration of data two observations from 1998 were classified as "probable usurpation". It seems that Starling took over Nuthatch holes in both cases but I did not observe females entering with nest material; only singing males were recorded. In those territories other nests were not found, and in one case the same pair bred in the same hole in following year (unfortunately the second pair was not ringed). The assumption as to the probability of hole usurpation is based on results of Nilsson (1989) suggesting that over 70% of Nuthatches bred in the same holes in successive seasons.

RESULTS

A decrease in the number of suitable nest sites for Starlings, and associated potential increase in interference competition did not lead to major changes in the numbers of breeding pairs of cavity nesters potentially exposed to competition. In the year when nest boxes were available to Starlings, 26–28 territories of Nuthatches, 12 nests of Great Spotted Woodpeckers and 2 nests of Middle Spotted Woodpeckers were found. This compared with 25–28 of Nuthatch territories, 11 nests of Great Spotted Woodpeckers and 1 of Middle Spotted Woodpeckers in the absence of nest boxes.

The availability of suitable nest sites for Starlings (and other hole nesters) did not influence the frequency of loss of Nuthatch cavities, even when the two cases of "probable usurpation" (see Methods) were added ($\chi^2 = 0.69$, df = 1, with Yates correction for continuity, ns).

In 1998 when the number of suitable nest sites for Starlings decreased, some 18 nests of Nuthatches were found during the nest building stage, of which 3 were later taken over by Starlings. 2 cases classified as "probable Starling usurpation" also occured in that year. One further hole was taken by Pied Flycatchers *Ficedula hypoleuca*. 30% of Nuthatch holes were thus usurped (25% by Starlings; n = 20 when probable usurpation is included). In 1999, when the availability of suitable nest sites increased Starling competition also took place. Two out of 18 Nuthatch nests were usurped, and as in the previous year, one hole was taken over by flycatchers. In total 17% of Nuthatch holes were thus taken over by other cavity nesters (11% by Starlings).

Only one out 5 (20%) of Nuthatch pairs losing their holes to Starlings was found to have nested successfully during the same season. Other two (individually marked) pairs were observed during the breeding season but they probably migrated from the study area subsequently.

During two years of study no observation of competition between Starlings and woodpeckers for freshly excavated holes was made.

DISCUSSION

In Europe, the Starling, although a powerful competitor, is probably not able to influence the cavity nesting community to a great extent. All the species concerned have occurred sympatrically for many centuries, so those that lost their holes frequently in earlier times were able to develop various methods to avoid competition from Starlings.

It is probably for this reason that competition for nest sites between cavity nesters in natural conditions in Europe is rather weak (e.g. Walankiewicz 1991). Pairs that lost their nests were found to be present in their territory, while there were no effects of competition on numbers. Nuthatches in this study lost 17–30% of their holes. This is more than Nilsson (1987) found in South Sweden (average 14.5%), though in particular years he did obtain similar results (range 0–33%). It is interesting that both studies shoved a

similar number of pairs losing holes and going to made second breeding attempts (20% — this study, 23% — Nilsson 1987).

In this study increased availability of nest sites (through the introduction of nest boxes) did not lead to a significant decrease in interference competition. It seems that even when various nest sites are available, Starlings may choose those that are more suitable and try to take over the holes even when they are occupied. Results suggesting that the provisioning of nest boxes does not lead to a decrease in Starling pressure on other species have also been found in North America (Ingold 1997).

Starling competition is much more intense in North America. The Starling was introduced in New York at the end of the 19th century, and from there it spread slowly over the whole continent (Feare 1984). As a new species to the North American avifauna it imposed unavoidable competition upon American cavity nesters. Several species thus lose their nest holes very frequently such that over 50% of freshly excavated holes of Red-bellied Woodpeckers *Melanerpes carolinus* are usurped every year (Ingold 1989), and other woodpecker species are losing their few excavated holes one after another (Erskine & McLaren 1976, Troetschler 1976). In particular areas, cavity nesting species have declined in numbers, or even been forced to desert their breeding sites (e.g. Weitzel 1988).

Such a situation in which the Starling is respectively either an old or a new component of the cavity nesters communities in Europe and North America, may stimulate studies (especially in Europe), and lead to interesting comparisons.

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REFERENCES

Allen R. W., Nice M. M. 1952. A study of the breeding biology of the Purple Martin (*Progne subis*). Am. Midl. Nat. 47: 606–665.

Barba E., Gil-Delgado J. A. 1990. Competition for nest-boxes among four vertebrate species: an experimental study in orange groves. Holarct. Ecol. 13: 183–186.

Bechard M. J., Bechard J. M. 1996. Competition for nestboxes between American Kestrels and European Starlings in an agricultural area of Southern Idaho. In: Bird D. M., Varland D. E., Negro J. J. (eds.). Raptors in human landscapes. Academic Press., pp. 155–162.

Busse P., Gotzman J. 1962. [Nesting competition and mixed clutches among some birds inhabiting the nest-boxes]. Acta orn. 7: 1–32.

Dhondt A. A. 1977. Interspecific competition between great and blue Tit. Nature 268: 521–523.

Dhondt A. A. 1989. Ecological and evolutionary effects of interspecific competition in tits. Wilson Bull. 101: 198–216.

Dhondt A. A., Eyckerman 1980. Competition between the Great Tit and the Blue Tit outside the breeding season in field experiments. Ecology 61: 1291–1296

East M. L., Perrins C. M. 1988. The effect of nestboxes on breeding populations of birds in broadleaved temperate woodlands. Ibis 130: 393–401

Erskine A. J., McLaren W. D. 1976. Comparative nesting biology of some hole-nesting birds in the Cariboo Parklands, British Columbia. Wilson Bull. 88: 611–620.

Feare C. 1984. The Starling. Oxford University Press. New York.

Finch D. 1990. Effects of predation and competitor interference on nesting success of House Wrens and Tree Swallows. Condor 92: 674–687.

Gustafsson L. 1987. Interspecific competition lowers fitness in Collared Flycatchers *Ficedula albicollis*: an experimental demonstration. Ecology 68: 291–296.

Gustafsson L. 1988. Inter — and intraspecific competition for nest-holes in a population of the Collared Flycatcher *Ficedula albicollis*. Ibis 130: 11–16.

Howell B. A. 1943. Starlings and woodpeckers. Auk 60: 90–91.

Ingold D. J. 1989. Nesting phenology and competition for nest sites among Red-headed and Red-bellied Woodpeckers and European Starling. Auk 106: 209–217.

Ingold D. J. 1991. Nest site fidelity in Red-headed and Red-bellied woodpeckers. Wilson Bull. 103: 118–122.

Ingold D. J. 1994. Influence of nest-site competition between European Starlings and woodpeckers. Wilson Bull. 106: 227–241.

Ingold D. J. 1997. Do nest boxes help alleviate nest-site competition by European Starlings on Northern Flickers? Sialia 19: 83–91.

Kerpez T. A., Smith N. S. 1990. Competition between European Starlings and native woodpeckers for nest cavities in saguaros. Auk 107: 367–375.

Kilham L. 1968. Reproductive behaviour of Hairy Woodpeckers. II. Nesting and habitat. Wilson Bull. 80: 286–305.

Mazgajski T. D. 1994. [Woodpeckers' holes as nest site of secondary cavity nesters]. M. Sc. thesis. Dept. Ecology, Warsaw University.

Meek S. B., Robertson R. J. 1994. Interspecific competition for nestboxes affects male guarding in Eastern Bluebirds *Siala sialis*. Anim. Behav. 47: 295–302.

Merilä J., Wiggins D. 1995. Interspecific competition for nest holes causes adult mortality in the Collared Flycatcher. Condor 97: 445–450

Minot E. O., Perrins C. M. 1986. Interspecific interference competition — nest sites for blue and great Tits. J. Anim. Ecol. 55: 331–350.

Newton I. 1994. The role of nest sites in limiting the numbers of hole-nesting birds: a review. Biol. Conserv. 70: 265–276.

Nilsson S. G. 1987. Limitation and regulation of population density in the Nuthatch *Sitta europaea* (Aves) breeding in natural cavities. J. Anim. Ecol. 56: 921–937.

Nilsson S. G. 1989. Fledging dates of Nuthatches *Sitta europaea* in relation to age, territory and individual variation. Bird Study 36: 134–140.

Rendell W. B., Robertson R. J. 1989. Nest-site characteristics, reproductive success and cavity availability for Tree Swallows breeding in natural cavities. Condor 91: 875–885.

Sasvári L., Torok J., Tóth L. 1987. Density dependent effects between three competitive bird species. Oecologia 72: 127–130.

Shelley L. O. 1935. Flickers attacked by Starlings. Auk 52: 93.

Slagsvold T. 1975. Competition between the Great Tit *Parus major* and the Pied Flycatcher *Ficedula hypoleuca* in the breeding season. Ornis Scand. 6: 179–190.

Tracy N. 1938. Der grosse Buntspecht. Beitr. Fortpfl. Biol. Vögel 14: 41–48.

Troetschler R. G. 1976. Acorn Woodpecker breeding strategy as affected by Starling nest-hole competition. Condor 78: 151–165.

Walankiewicz W. 1991. Do secondary cavity-nesting birds suffer more from competition for cavities or from predation in a primeval deciduous forest. Natural Areas Journal 11: 203–212.

Walankiewicz W., Mitrus C. 1997. How nestbox data have led to erroneous generalizations: the case of the competition between Great Tit *Parus major* and *Ficedula* flycathers. Acta orn. 32: 209–212.

Waters J. R., Noon B. R., Verner J. 1990. Lack of nest site limitation in a cavity-nesting bird community. J. Wildl. Manage. 54: 239–245.

Weitzel N. H. 1988. Nest-site competition between the European Starling and native breeding birds in northwestern Nevada. Condor 90: 515–517.

Wesołowski T. 1989. Nest-sites of hole-nesters in a primaeval temperate forest (Białowieża National Park, Poland). Acta orn. 25: 321–351.

Wesolowski T. Stawarczyk T. 1991. Survival and population dynamics of Nuthatches *Sitta europaea* breeding in natural cavities in a primaeval temperate forest. Ornis Scand. 22: 143–154.

STRESZCZENIE

[Konkurencja o miejsca gniazdowe między szpakiem a innymi dziuplakami — dane wstępne]

Badania konkurencji o miejsca lęgowe prowadzone w Europie obejmują głównie interakcje między sikorami i/lub muchołówkami. Szpak jest gatunkiem, który może silnie konkurować o dziuple z kowalikiem, dzięciołem dużym i w mniejszym stopniu z dzięciołem średnim.

Badania prowadzono w latach 1997–99 na terenie parku leśnego Młociny na przedmieściach Warszawy. Jako, że szpaki chętnie zasiedlają skrzynki lęgowe można łatwo manipulować liczebnością odpowiednich miejsc lęgowych dla tego gatunku, a więc presją konkurencyjną wywieraną na inne gatunki. W 1998 skrzynki lęgowe były niedostępne dla szpaków.

Stwierdzono, że zwiększona konkurencja o dziuple nie powodowała istotnych zmian w liczebności badanych gatunków. 11–25% gniazd wybranych przez kowaliki do lęgów zostało następnie zabranych przez szpaki, dodatkowo co roku jedna para kowalików traciła swą dziuple na rzecz muchołówki żałobnej. Zwiększenie liczebności miejsc lęgowych dostepnych dla szpaka nie likwidowało całkowicie presji konkurencyjnej, choć częstość zabierania dziupli przez szpaki była dwukrotnie niższa, w porównaniu z sezonem, gdy szpaki zmuszone były do gniazdowania wyłącznie w dziuplach. Nie stwierdzono zabierania przez szpaki dziupli świeżo wykuwanych przez dzięcioły.

Uzyskane wyniki porównano z danymi z Ameryki Północnej, gdzie szpak jest nowym elementem zespołu dziuplaków.