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# NESTBOX FLOOR AREA SIZE AND BREEDING PERFORMANCE: A STUDY ON THE COMMON STARLING *Sturnus vulgaris*

## *Odnos između škrinjica različitih podnih površina i obilježja gniježđenja čvorka Sturnus vulgaris*


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**ABSTRACT**

A Common Starling *Sturnus vulgaris* population nesting in a Mokrice rural area, northwestern Croatia, was studied during the 2019 breeding season. I compared some breeding characteristics (laying date, clutch size, number of hatchlings and number of fledglings) of first clutches of the Common Starling for different nestbox sizes. There was no any statistically significant difference found between parameters for "normal nestboxes" with a floor area of 256 cm² and "small nestboxes" with a floor area of 121 cm² (all comparisons with $p > 0.05$). My results are aligned with those papers that have illustrated no connection between breeding performance parameters and nestbox size in secondary hole-nesting passerines.



**Keywords:** Common Starling, *Sturnus vulgaris*, nestbox size, floor area, laying date, breeding performance



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## INTRODUCTION

Numerous ornithological papers around the world (e.g. Mänd *et al*. 2005, Hoove *et al.* 2020) and in Croatia (e.g. Dolenec 2006, Dolenec 2020) have been based on use of artificial nest sites (nestboxes) by secondary hole-nesting bird species. In this study, nestboxes were used to examine the breeding performance in relation to nestbox floor area size. Previous papers documented that floor area size affects breeding traits in some secondary hole-nesting bird species. For example, female Great Tits *Parus major* (Löhrl 1973), Tree Swallows *Tachycineta bicolor* (Rendel & Robertson 2008) and House Sparrows *Passer domesticus* (Lowther 2012) laid more eggs in nestboxes with larger floor area. Conversely, Karlsson & Nilsson (1977) found that the clutch size of Common Starlings *Sturnus vulgaris* was not related to the floor area of nestboxes. Similarly, the size of the nestbox did not impact the breeding success in the Thorn-tailed Rayadito *Aphrastura spinicauda* and the House Wren *Troglodytes aedon* (Vergera 2007), or the Italian Sparrow *Passer italiae* (Sorace & Carere 1996).

Here, I used the Common Starling as a model bird species to investigate breeding performance in relation to two nestbox sizes. This secondary hole-nesting species is a common breeding bird in the study area and a short-distance migrant wintering in the Mediterranean region (southwest Europe and a northwest Africa) (e.g. Dolenec 2013). The Common Starling readily uses nestboxes (Dolenec 1997).

## MATERIAL AND METHODS

A nestbox-breeding populations of Common Starling was studied during 2019 in the village of Mokrice and Krušljevo Selo (45˚58'– 46˚00'N, 15˚51'–15˚55'E), about ca. 20 km north of Zagreb, northwestern Croatia. The altitude of the study area is approximately 140 m above sea level. All nestboxes were put up in oak *Quercus robur* and hornbeam *Carpinus betulus*, the dominant tree species of a small isolated woods (0.5 – 1.5 ha). In this study, I investigated differences in several breeding performance parameters between nestboxes having two (different floor size areas): laying date (date of first egg in nest), clutch size (number of eggs), the number of hatchings (number of eggs hatched) and the number of fledglings (offspring surviving to 12 days of age). Fifty nestboxes were made of fir wood (2.5 cm thickness), with a 5-cm diameter entrance hole, comprising 25 "normal nestboxes" with internal dimensions of 16 x 16 x 22.5 cm (floor area 256 cm$^2$); and 25 "small nestboxes" with internal dimensions of 11 x 11 x 22.5 cm (floor area 121cm$^2$). The roof of nestboxes could be opened to facilitate visits. Only first clutches included in this study. Nestboxes were installed between 2.5 and 3.0 m above ground with 10-m spacing between the nestboxes. In the study area, breeding performance has not been influenced by height of nestboxes

(Dolenec 2018). Nestboxes occupied by Common Starlings were monitored every 3–4 days. Both nestbox types were randomly placed in the same area to avoid confounding factors (see Bueno-Enciso *et al*. 2016). Dates were expressed as progressive days with 1 March being day 1.

Statistical analyses were performed using the SPSS 17.0 statistical package for Windows. Data on occupation were analysed by $\chi^2$ test and data on breeding traits were compared with Student t-test. All statistical tests were two-tailed, and the differences were considered significant at $p < 0.05$.

## RESULTS AND DISCUSSION

Out of 50 nestboxes used, 45 (90%) were occupied. Results for occupation, laying date and breeding performance according to nestbox types are as follows:

a) "normal nestboxes" – 23 out of 25 (92%) nestboxes were occupied; the mean date of laying was 29.79 March ± 1.22 SD; mean clutch size was 5.54 ± 0.79 SD; mean brood size at hatchling 5.25 ± 0.78 SD and mean brood size at fledgling 4.92 ± 0.77 SD.

b) "small nestboxes" – 22 out of 25 (88%) nestboxes were occupied; the mean date of laying was 29.91 March ± 1.02 SD; the mean clutch size was 5.4 ± 0.81 SD; the mean hatchling success was 5.18 ± 0.85 SD and the mean fledgling success was 4.63 ± 0.91 SD.

I did not detect differences between "normal nestboxes" and "small nestboxes" for date of laying (Student t-test, $t = 0.641$, $p = 0.53$, $n = 46$), clutch size ($t = –0.195$, $p = 0.85$, $n = 46$), number of hatchlings ($t = 0.374$, $p = 0.71$, $n = 46$) or number of fledglings ($t = –1.133$, $p = 0.26$, $n = 46$). Karlsson & Nilsson (1977) also found that clutch size and some other breeding performance of Common Starlings were not related to the floor area of nestboxes size, but Trillmich & Hudde (1984) found a significant relationship in this species with the clutch size of first clutches in large nestboxes being 5.1 eggs and only 4.3 eggs in small nestboxes. Trillmich & Hudde (1984) suggested that the Common Starling had smaller clutch sizes in small nestboxes to avoid hyperthermia and offspring motality, which has also been asserted by others (e.g. Martens 1977, Van Baler 1984). In this study there was no difference in number of fledglings between "normal" and "small nestboxes". "Small nestboxes" in this study probably did not have microhabitat conditions that could cause differences in offspring mortality. It has been faund in Tengmalm's Owl *Aegolius funereus,* that during years with higher food availability, there was tendency for an increase in average clutch size with increasing floor area of nestboxes, but this was not the case during years with lower food availability (Korpimäki 1985). In conclusion, my results support those of papers that have shown no association between breeding characteristics and differences in nestbox size in secondary hole-nesting passerines. Understanding

the interactions between nestbox characteristics and breeding performance is a complex challenge for ornithology and surely requires further investigations.

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**SAŽETAK**

Na području Mokrica (sjeverozapadna Hrvatska) 2019. godine obavljeno je istraživanje utjecaja škrinjica (umjetnih duplji) različitih dimenzija: na početak nesenja (dan polaganja prvog jajeta u gnijezdo), veličinu pologa (broj snesenih jaja u gnijezdo) broj izvaljanih čučavaca te broj opernaćenih ptica (mladih ptica u gnijezdu u dobi od 12 dana) za vrstu čvorak *Sturnus vulgaris*. U manje šumske površine (šumarke) postavljena su dva tipa škrinjica s obzirom na dimenzije; „male škrinjice" unutarnje površine poda 121 cm² i „normalne škrinjice" klasične dimenzije podne površine 256 cm² koje se najčešće koriste za gniježđenje čvorka kao ptice sekundarne dupljašice. Cilj istraživanja je bio utvrditi u kojoj mjeri dva različita tipa škrinjica utječu na gore spomenute parametre gniježđenja. Većina objavljenih članaka, za više vrsta ptica dupljašica, spominje manji broj jaja i manju produktivnost u manjim škrinjicama. Manji broj jaja u manjim škrinjicama tumači se prilagodbom ptica, kako bi se manjim brojem jaja u gnijezdu izvaljalo manje ptica čime bi se spriječila prenatrpanost, međusobno gaženje čučavaca te izbjegla loša termoregulacija. Dosadašnja istraživanja ponašanja čvoraka dala su dvojake rezultate; u jednih je došlo do značajnog smanjenja broja jaja u gnijezdu, a u drugih nema razlike između dva tipa škrinjica. Rezultati istraživanja populacije čvoraka na području sjeverozapadne Hrvatske idu u prilog člancima koji govore da kod čvoraka nema razlike u obilježjima gniježđenja između škrinjica različitih dimenzija. Oba tipa škrinjica imala su približno podjednaku produktivnost, odnosno, statistički značajna razlika nije zabilježena za niti jedan parametar gniježđenja.