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INTRASEASONAL VARIATION OF CLUTCH SIZE IN FEMALE TREE SPARROWS *PASSER MONTANUS*

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In 2005 the variation of clutch size of tree sparrows *Passer montanus* was investigated in the Mokrice rural area, north-western Croatia. Average clutch size of first clutches was 5.00 eggs (SD = 0.62), of the second 5.36 eggs (SD = 0.66) and of the third 4.86 eggs (SD = 0.71). Repeatability (r) of clutch size in first, second and third clutches (within-year) was significant (p = 0.005). This means that 33% of the variation in clutch size is due to intraindividual variation of genetic factors (intrinsic »female quality«).

Key words: Tree Sparrow, *Passer montanus*, clutch size, repeatability, north-western Croatia

Dolenec, Z.: Unutarsezonska promjenjivost veličine pologa kod ženke poljskog vrapca *Passer montanus*. Nat. Croat., Vol. 17, No. 1., 35–39, 2008, Zagreb.

Obilježja promjenjivosti veličine pologa poljskog vrapca *Passer montanus* istraživana su na području sela Mokrice (Hrvatsko zagorje, sjeverozapadna Hrvatska) 2005. godine. Prosječna veličina pologa prvog gniježđenja iznosi 5,00 jaja (SD = 0,62), drugog 5,36 jaja (SD = 0,66) i trećeg gniježđenja 4,86 jaja po gnijezdu (SD = 0,71). Ponovljivost (repeatability, r) između prvog, drugog i trećeg pologa iznosi 0,33 i statistički je značajna (p = 0,005). Znači da se 33% varijacija u veličini pologa odnosi na genetičke čimbenike (intrinsic »female quality«).

Ključne riječi: poljski vrabac, *Passer montanus*, veličina pologa, ponovljivost, sjeverozapadna Hrvatska

INTRODUCTION

The clutch size of birds varies between as well as within species and/or populations. In birds, clutch size is an important feature of the investment of individual females in reproduction. Variability of clutch size is usually assumed to result from interaction of environmental (»territory quality«) and genetic factors (»female quality«) (GWINER *et al.*, 1995) adjusted through natural selection to maximize the par-

Fig. 1. Ringed tree sparrow (*Passer montanus*) female (Photo: Z. Dolenec)

ents' contribution to feature generations. In recent years, there has been an increase in the number of studies of the repeatability of ecologically important traits in natural populations (e.g. GOODBURN, 1991; FLINT *et al*., 2001; PRZYBILO *et al*., 2001; MURPHY, 2004; YOSEF & ZDUNIAK, 2004; DOLENEC, 2005). In general, the repeatability of the feature studied expresses the proportion of the variation between different measurements due to consistent differences between the objects measured (HÕRAK *et al*., 1995). Thus, repeatability is used as a measure for the constancy of the feature in individuals, and gives an upper estimate for its additive genetic variance (MACINNES *et al*., 1988). Here data on within-year phenotypic variation of clutch size in individually marked Tree Sparrow *Passer montanus* females are analysed.

STUDY SITES AND METHODS

Data on the clutch size of an individually marked population of the species were collected in 2005 in the in the village Mokrice (46°00′ N, 15°55′ E) in north-western Croatia. In the study area tree sparrows are widespread, mostly sedentary hole-nesting birds (DOLENEC, 1990; SCHERNER, 1972). For investigating the degree of intraindividual variation of clutch size only data of females that produced three

Fig. 2. Clutch of tree sparrow (*Passer montanus*) with five eggs, photographed in Mokrice village 20 April 2005 (Photo: Z. Dolenec)

consecutive clutches during 2005 are used. I then utilized the data on females that had bred three times in our study area (22 females). All clutches were laid in artificial nesting boxes with constant internal dimensions of 120 x 120 x 250 mm. The entrance hole for the birds was 32 mm in diameter. Nesting boxes were placed in deciduous trees 2.5 to 4 m above ground. All nesting boxes had a sliding top for minimizing disturbances while nesting was being monitored. Adult females were marked in nesting boxes with a numbered metal ring (Fig. 1). A clutch size was assigned when the same number of eggs was recorded on two consecutive visits to the nest. For this analysis only data for individual females using the same territory for consecutive nesting attempts are used.

Repeatability is a measure used in quantitative genetics to describe the proportion of variance in a character that occurs among rather than within individuals (LESSELLS & BOAG, 1987) (10). Repeatability, r, is estimated by:

$$r = (VG + VEg)/ VP,$$

where VG is the genotypic variance, VEg the general environmental variance, and VP the phenotypic variance (FALCONER, 1981). Intra-class correlation coefficients

Tab. 1. Average clutch size in a single breeding season (same females and same territory) in 2005.

	First clutches			Second clutches			Third clutches		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Clutch size	5.00	0.62	22	5.36	0.66	22	4.86	0.71	22

Tab. 2. Intraseasonal repeatability of clutch size in individual female Tree Sparrow in 2005 (1 = within female variance, 2 = among females variance, 3 = repeatability, 4 = standard error, SE).

Parameter	1	2	3(4)	F	df	p
Clutch size	0.318	0.158	0.33(0.13)	2.488	21,44	0.005

can be calculated using the among-groups variance component and within-group variance, derived from a one-way analysis of variance, ANOVA (see SOKAL & ROHLF, 1981; LESSELLS & BOAG, Standard errors estimates of the repeatability were calculated according to BECKER (1984). Statistical analyses were performed using the SPSS 13.0 statistical package, assuming probability of error of $P < 0.05$ as statistically significant.

RESULTS AND DISCUSSION

Clutch size characteristics of individually known tree sparrows are presented in Tab. 1. Average clutch size of first clutches was 5.00 eggs (SD = 0.62), of the second 5.36 eggs (SD = 0.66) and of the third 4.86 eggs (SD = 0.71) (Fig. 2). No significant differences between first, second and third nesting (chi-square test, $p > 0.05$) were found. This agrees with findings in other species that the clutch sizes of resident multi–brood bird species show a mid–season peak, with smaller clutches laid both early and late in the season (CRICK *et al.*, 1993). Repeatability (r) of within-year clutch size in first, second and third clutches of females is significant (repeatability = 0.33; $n_o = 3.0$; ANOVA, $F_{21.44} = 2.488$; $p = 0.005$) (Tab. 2). This means that 33% of the variation in clutch size was due to intraindividual variation in response to genetic factors. A non-significant higher, intraseasonal repeatability of clutch size was found in the magpie *Pica pica* by GOODBURN (1991). However, in some bird species a much lower intraseasonal repeatability was reported. MURPHY (1978) has found a much lowery intraseasonal repeatability of clutch size in house sparrows *Passer domesticus* ($r = 0.08 – 0.12$), like KENNEDY & WHITE (1991) for house wrens *Troglodytes aedon* ($r = 0.17$). In conclusion, clutch size of tree sparrows in my study population in NW Croatia is considerably influenced by intrinsic characteristics of female quality, which explain approximately a third of clutch size variation.

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