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NEST DENSITY, CLUTCH SIZE AND EGG DIMENSIONS OF THE HOODED CROW (*CORVUS CORONE CORNIX*)

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This study was conducted in Krapina river valley in north-western Croatia during 2004 – 2005. The mean nest density of the hooded crow on the research was 3.73 nest/km². The mean clutch size was 4.34 and egg size (volume) was 17.63 cm³. Mean egg length (2004 – 2005) was 41.11 mm, breadth 28.97 mm and egg shape index 1.42. The positive correlation between length and breadth was ($p<0.05$). There was no significant correlation between clutch size and the volume of eggs ($p>0.05$).

Key words: hooded crow, *Corvus corone cornix*, nest density, clutch size, egg dimensions

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Istraživanje je obavljeno u nizini rijeke Krapine na području sjeverozapadne Hrvatske u razdoblju od 2004. do 2005. godine. Gustoća gnijezdećih parova iznosila je 3,73/km² (prosjek za obje godine istraživanja). U gnijezdima je bilo prosječno 4,34 jaja, a prosječni volumen jaja iznosio je 17,63 cm³. Prosječna dužina jaja iznosi 41,11 mm, širina 28,97 i indeks oblika jaja 1,42. Značajna je pozitivna korelacija između dužine i širine jaja ($p<0.05$). Korelacija između veličine pologa i veličine jaja (volumena) ($p>0.05$) ne podržava »hipotezu ustupka« (BROCKELMAN, 1975) prema kojoj bi se u gnijezdima s većim brojem jaja morala nalaziti jaja manjeg volumena.

Ključne riječi: siva vrana, *Corvus corone cornix*, gustoća gnijezda, veličina pologa, dimenzije jaja

INTRODUCTION

Many studies on the breeding ecology and density of hooded crow (*Corvus corone cornix*) populations have been published during the last 40 years (e.g. TENOVUO, 1963; PICOZZI, 1975; SONDELL, 1976; LOMAN, 1977, 1980; FASOLA, 1983; MELDE, 1984; PARKER, 1985; CRAMP, 1998). However, there are no data for Croatia. The hooded crow is found in most open habitats (CRAMP, 1998) and is adaptable in its

feeding behaviour (e.g. COOMBS, 1978). The dimensions of eggs are important life-history variables in birds as hatching mass is highly correlated with egg size for a large number of bird species (e.g. HEGYI, 1996). Being hatched from a large egg could be beneficial for a chick; from the viewpoint of the laying female, however, high investment into egg quality (size) might conflict with her own energetic demands and willingness to produce more offspring (HÕRAK *et al*., 1995).

In this paper I present nest density and some breeding characteristics (clutch size, egg length, egg breadth, egg volume and egg shape index) of the hooded crow in a mixed agricultural and wooded area in north-western Croatia. The question of whether females laying larger clutches produce smaller eggs was also analysed. The relationships among different egg dimensions were also investigated.

MATERIALS AND METHODS

The study was conducted in the Krapina river valley (11 km²) in NW Croatia (45°00' N, 15°55' E). My studies cover the period from 2004 to 2005 (middle March – early May). Eighty-two clutches were investigated (356 eggs). The hooded crow is a common bird in the study area. The altitude of the study area is about 140 m above sea level. The tree vegetation is dominated by pedunculate oak (*Quercus robur*) and hornbeam (*Carpinus betulus*). Nest density was estimated only on the basis of found nests. Egg length (maximum) and breadth (maximum) were measured to the nearest 0.01 mm using sliding callipers. Egg volume (V) was computed from the length (L) and breadth (B) of each egg, using the formula developed by Hoyt (1979): $V = 0.51 \times L \times B^2$. Egg shape index (ES) was calculated using the formula: ES = L / B. This study was based only on complete clutches. According to some authors (e.g. KNOX *et al*., 2002), the hooded crow and carrion crow can be considered different species; *Corvus cornix* and *Corvus corone*. The aim of this study is to present data about density and breeding characteristics of the hooded crow in Croatia. These are the first published data of the kind for Croatia.

Statistical analyses were performed using the SPSS 12.0 statistical package.

RESULTS AND DISCUSSION

The mean nest density of the hooded crow in the research area was 3.73 nest/km² (2004 = 3.55 and 2005 = 3.91 nests/km²). This is high density for crow populations in a rural area. Similar results were found by ZDUNIAK & KUCZYNSKI (2003) – 3.2 nests/km², while most authors mention a lower density (e.g. VOGRIN, 1998; 1.5 pairs/km²) for such a habitat. Table 1 shows data on nest sites in trees. Out of 82 nests, the majority were situated in pedunculate oak and hornbeam (61.0%). Nests were situated at a height of 4.5 – 18.5 (mean = 9.5 m, SD = 2.13).

We recorded 2–6 eggs in the clutch. The mean clutch size was 4.34, SD = 0.835 (2004 – 2005). There are no differences from other parts of Europe (e.g. WITTENBERG,

1968 = 4.53; LOMAN, 1984 = 4.3; MELDE, 1984 = 4.7; ZDUNIAK & KUCZYNSKI, 2003 = 4.43).

Mean egg length (2004 – 2005) was 44.11 mm (SD = 1.311, range 35.81 – 43.91 mm), egg breadth 28.97 mm (SD = 0.974, range 27.19 – 30.52 mm), egg volume 17. 63 cm^3 (SD = 1.526, range 12.21 – 20.32 cm^3) and egg shape index 1.42 (SD = 0.071, range 1.29 – 1.59) (Tab. 2). There is no difference in egg dimensions between years (length,

Tab. 1. Height of nests above ground and nest sites of the hooded crow in NW Croatia during 2004 – 2005

nest size	height of nest		n	%
	mean	range		
pedunculate oak (*Quercus robur*)	12.3	6.5 – 22.0	31	37.8
hornbeam (*Carpinus betulus*)	11.1	5.5 – 18.0	19	23.2
ash (*Fraxinus angustifolia*)	10.8	6.0 – 18.5	3	3.7
common elm (*Ulmus minor*)	8.5	8.5	1	1.2
willow (*Salix* sp.)	7.7	4.5 – 11.0	14	17.1
sticky alder (*Alnus glutinosa*)	7.1	4.5 – 15.5	8	9.8
common maple (*Acer campestre*)	9.0	5.5 – 12.5	6	7.2
total	9.5	4.0 – 18.5	82	100.0

Tab. 2. Egg dimensions of hooded crow in NW Croatia during 2004 – 2005, number of clutches = 82

parameters	mean	SD	range
length (mm)	41.11	1.311	35.81 – 43.91
breadth (mm)	28.97	0.974	27.19 – 30.52
volume (cm^3)	17.63	1.526	12.21 – 20.32
egg shape index	1.42	0.071	1.29 – 1.59

Tab. 3. Annual variation in egg dimensions of the hooded crow in NW Croatia (n = number of clutches, t = Student's test)

year	n	length (mm)		breadth (mm)		volume (cm^3)		egg shape index	
		mean	SD	mean	SD	mean	SD	mean	SD
2004	39	41.13	1.248	28.86	0.905	17.49	1.129	1.43	0.044
2005	43	41.09	1.482	29.07	1.005	17.76	1.818	1.42	0.089
t		0.141		0.835		0.801		0.543	
p		0.889		0.409		0.425		0.589	

Tab. 4. Egg dimensions of the hooded crow in NW Croatia according to clutch sizes during 2004 – 2005

clutch size	n	%	length (mm)		breadth (mm)		volume (cm^3)		egg shape index	
			mean	SD	mean	SD	mean	SD	mean	SD
2	2	2.4	40.11	1.211	29.11	0.534	17.31	0.362	1.38	0.057
3	8	9.8	41.46	1.277	29.23	1.009	18.09	1.535	1.42	0.056
4	37	45.1	41.21	1.208	29.05	0.934	17.76	1.007	1.42	0.084
5	30	36.6	40.95	1.438	28.82	1.114	17.41	2.048	1.43	0.071
6	5	6.1	41.11	1.376	28.81	0.788	17.63	0.740	1.43	0.049

Student's test (t) = 0.141, p = 0.889; breadth, t = 0.835, p = 0.409; volume, t = 0.801, p = 0.425; egg shape index, t = 0.543, p = 0.589) (Tab. 3). A statistically significant positive correlation was found between egg length and egg breadth (Pearson's correlation (r) = 0.31, $p < 0.01$, n = 82). Very slight differences in egg dimensions can be observed if we compare nests according to different clutch sizes (Tab. 4). The average egg dimensions in my study area were similar to those found by other authors in Europe (e.g. NIETHAMMER, 1937; DURANGO, 1973; ROFSTAD & SANDVIK, 1985; CRAMP, 1998).

According to LACK (1967), species producing relatively large eggs must compensate by laying fewer eggs. There was no significant correlation between clutch size and the volume of eggs ($p > 0.05$). So we can conclude that the results of our research do not support predictions based on the hypothesis of optimal clutch/egg dimensions (BROCKELMAN, 1975).

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SAŽETAK

Gustoća gnijezda, veličina pologa i dimenzije jaja sive vrane (*Corvus corone cornix*)

Z. Dolenec

Ovo su prvi podaci o obilježjima gniježđenja sive vrane na području Hrvatske. U osnovnim parametrima nema značajnih razlika u odnosu na neke druge europske zemlje. To se odnosi i na gustoću gnijezdećih parova. Sve prisutniji antropogeni čimbenik ostavlja sve veći trag u istraživanom krajoliku, pa je stoga nužno daljnje praćenje i istraživanje populacije sive vrane.