IS THERE A TRADE-OFF BETWEEN CLUTCH SIZE AND EGG VOLUME IN MAGPIE *Pica pica* IN NORTHWESTERN CROATIA?

Postoji li inverzija između veličine pologa i volumena jaja u svrake *Pica pica* u sjeverozapadnoj Hrvatskoj?

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**ABSTRACT**

A negative relationship, or trade-off, between egg size (egg volume or egg mass) and clutch size is a central component of life-history theory. This paper presents evidence for a relationship between clutch size and egg volume (egg size) of the Magpie (*Pica pica*). Magpies are common and sedentary birds in study area. Egg characteristics were recorded in Mokrice rural area (46°00’N, 15°55’E), northwestern Croatia; carried out during the breeding season (April–May) in the year 2012. I have not detected any negative correlation (trade-off) between mean estimated egg volume (egg size) and clutch size in the Magpie. The results indicate that, in researched Magpie population, in northwestern Croatia, there is a positively significant correlation between clutch size and egg volume. It can probably be explained by good environmental conditions and/or good quality females, which other authors offer as a plausible explanation. In conclusion, these results do not seem to support the prediction based on the theory of optimal egg/clutch size concerning the inverse relationship between egg size and clutch size.

**Keywords:** Magpie, *Pica pica*, egg volume, clutch size, trade-off hypothesis, northwestern Croatia

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INTRODUCTION

A central hypothesis of life-history theory is a trade-off between egg size (mass or volume) and clutch size (e.g. Smith & Fretwell 1974). Egg size combined with clutch size constitutes a major energetic investment of females; it could hence be expected that these two variables should be negatively correlated (Zielinski & Banbura 1998). Some papers demonstrated negative correlation between clutch size and egg size (e.g. Blackburn 1991, Sanches-Lafuente 2004), some positive (e.g. Encabo et al. 2001, Aslan & Yavuz 2010), and the most papers report that clutch size and egg size were unrelated (e.g. Hepp et al. 1987, Fernandez & Reboreda 2008, Hõrák et al. 2008, Polak 2010). A trade-off between clutch size and egg size, as assumed by optimal offspring size model, has been detected in other animal species; for example, in turtles (Rowe 1994). Furthermore, egg size is important for offspring survival in many bird species (e.g. Schifferli 1973, Williams 1994). Therefore, relationships between clutch size and egg size in birds have long attracted the interest of ornithologists.

This paper presents evidence for a relationship between clutch size and egg volume (egg size) of the Magpie (Pica pica). Magpies are common and sedentary birds in study area and population density was 4.79 pairs/km² (Dolenec 2000). According to Vaurie (1959) the birds in my study area belong to the subspecies Pica pica pica.

MATERIAL AND METHODS

Egg characteristics were recorded in Mokrice rural area (46°00’N, 15°55’E), northwestern Croatia; carried out during the breeding season (April–May) in the year 2012. This area is a mixed farming area with small meadows and arable land. The arable land contains small woods (up to 10 ha) dominated by Common Oaks Quercus robur and Hornbeams Carpinus betulus. All nests were found in bushes and deciduous trees. I measured the length (L, maximum, mm) and breadth (B, maximum, mm) of eggs the nearest 0.01 mm with sliding calliper and calculated the volume (V, mm³) using the formula (Hoyt 1979): V = 0.51LB². Mean values of egg dimensions for full clutches were used as observation units in this paper. Characteristics in egg length, breadth and volume were based on clutch averages. Statistical analyses were performed using the SPSS 13.0 statistical package for Windows. All statistical tests were two-tailed, and the differences were considered significant at p = 0.05 or p < 0.05.

RESULTS

I measured 243 eggs from 45 nests in Mokrice rural area (NW Croatia). In this study (April–May 2012) Magpie clutches contained from 4 to 7 eggs. Mean clutch
size was 5.41±0.889 and modal clutch size was six. Mean values of egg dimensions are the following: egg length 33.95±1.44 mm (range: from 31.41 to 35.82 mm), egg breadth 23.23±0.72 (range: from 21.43 to 24.44 mm), volume 9359.21±742.55 mm³ (range: from 7567.33 to 10692.62 mm³). Egg volume were positively correlated with clutch size (Pearson’s correlation coefficient (r) = 0.355, p = 0.017, n = 45; regression equation was y = 7758.24 + 296.68x; Figure 1).

**Figure 1.** Relationship between clutch size and egg volume of the Magpie (northwestern Croatia), 2012 (r = 0.355, p = 0.017, n = 45; y = 7758.24 + 296.68x).

**DISCUSSION**

A negative relationship, or trade-off, between egg size and clutch size is a central component of life-history theory, yet there is little empirical evidence for such a trade-off (Williams 2001). I have detected negative correlation between mean estimated egg volume (egg size) and clutch size in the Magpie. However, in this study mean egg size was positive related to clutch size. My finding is in agreement with results of some previous studies done on individual species (e.g. Encabo *et al.* 2001, Aslan & Yavuz 2010). According to Encabo *et al.* (2001), a pos-
itive relationship between average egg size and average clutch size would have meant that, in good years, the birds produce large clutches of big eggs, while small clutches of small eggs would be produced in bad years. Furthermore, females in good condition after clutch completion tended to have larger clutches and laid significantly larger eggs in clutches than females in poor condition (Lifjeld et al. 2005). All previous researches on trade-off hypothesis in Croatia have illustrated non-significant relationship between clutch size and egg size (Great Tit Parus major, Dolenec et al. 2005; Hooded Crow Corvus corone cornix, Dolenec 2006; Tree Sparrow Passer montanus, Dolenec et al. 2007; Common Starling Sturnus vulgaris, Dolenec et al. 2008 and Pied Wagtail Motacilla alba, Dolenec 2011).

In conclusion, the results indicate that, in researched Magpie population in northwestern Croatia, there is a positively significant correlation between clutch size and egg volume. It can probably be explained by good environmental conditions and/or good quality females, which other authors offer as a plausible explanation (e.g. Järvinen 1996, Lifjeld et al. 2005).

References


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