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Nest-site preference of Hooded Crow (*Corvus cornix* L.) in Debrecen, Hungary

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SUMMARY

In the past decade, the population of the Hooded Crow has shown significant growth in Debrecen, Hungary. The aim of this study was to become acquainted with the nest-site selection behavior of Hooded Crows in urban spaces. While our research revealed that the Hooded Crow is not particular when it comes to selecting among tree species for nesting, we did notice differences regarding nesting height. Hooded Crows living in the city build their nests higher up than those living outside Debrecen's city limits. We also discovered a slight, insignificant difference between nesting heights and tree species, which is probably due to the different characteristics of the given tree species. As for nesting heights, we found that in typical urban habitats there were no relevant differences. However, when we compared these habitats in pairs, it came to light that nesting heights -when comparing solitary trees - wood segments and tree rows - wooded segments- did show significant differences, which can be explained by the various conditions provided by the habitats mentioned.

In summary, the following results emerged from our research:

1. The Hooded Crow prefers approximately the same nesting heights in all kinds of habitats, urban environment and tree species.
2. The nesting height does not significantly depend on the habitat itself or on the tree species.

INTRODUCTION

The urbanization of the Hooded Crow

The urbanization of birds is concurrent with the development of civilization. This process is an active and expansive phenomenon. A city may be considered to be an independent ecosystem due to the characteristic species dwelling within a given city (Davis & Glick 1978, Bezzel 1985, Parlange 1998). The composition of species is determined by biotic and abiotic factors (Böhning-Gaese 1997, Roy et al. 1999).

The appearance of the Hooded Crow has been observed in many European countries since 1960. Many studies tell about the crow's settlement and continuous population increase; for example: in Hungary (Tapfer 1974, 1978, 1985, Juhász 1983, Fintha 1994, Ujhelyi 2005, Kövér & Juhász 2008), in Finland (Hugg 1994, Vuorisalo et al. 2003), in Norway (Munkejord et al. 1985, Parker 1985), in Poland (Mazgajski et al. 2008), in Russia (Konstantinov et al. 1982, Korbut, 1996). There are several factors driving this species' urbanization. Primarily there are the possibilities provided in urban settings for nesting and diverse sources of food (Kalotás 1995, Bedő & Heltai 2003, Vuorisalo et al., 2003). In addition, cities provide defenses against predators (Kalotás 1995, Vuorisalo et al. 2003). In local cases, disturbances by man, including intense game management activities, would be influential factors, as well (Sorace 2001, Withey & Marzluff 2005). Last, but not least, Hooded Crows are highly intelligent and ecologically flexible (Konstantinov et al. 1982, Ilyichev et al. 1990; Von Busche 2001), and these traits led them to adopt the excellent habitat cities provide.

As a nesting species, we note the appearance of the Hooded Crow in Debrecen in 1959, when one pair hatched in the botanical garden (Juhász 1983). Afterwards, the species "disappeared" for twenty years, only nesting here again in 1972 (Fintha 1994), and again in 1979 (Juhász 1983). Since the 1980s, we have witnessed their continuous population increase in the city. An example includes their appearance in the city cemetery, as well (Juhász 1999). At present, the Hooded Crow is a permanent, common breeding species in Debrecen, observable in all parts of town (Juhász et al. 2009).

The nesting habit of the Hooded Crow

The Hooded Crow is a typical solitary nesting species, with a stable territorial system maintained year by year (Hewson & Leitch 1982, Smedshaug et al. 2002). Pairs appear at their nest-sites as early as February and they begin to build their nests soon thereafter. The species is not particular when it comes to selecting the species of tree for nesting; the bearing ability of its branches and the protective functions of each tree are the criteria for selection. Faragó (2002) found nests in *Acer campestre*, *Carpinus betulus*, *Pyrus pyraister*, *Morus alba* *Salix* sp., *Alnus* sp., *Fraxinus* sp. Tapfer (1985) mentioned nests in *Aesculus hippocastanum* in an urban environment. Havasi (1993) has identified nests in *Prunus spinosa*, as well. Juhász et al. (2009) wrote about nesting in 12 species (*Quercus robur*, *Pinus silvestris*, *Pinus nigra*, *Sophora japonica*, *Celtis occidentalis*, *Robinia pseudoacacia*, *Platanus hybrida*, *Ulmus pumila* *celer*, *Acer saccharinum*, *Gleditsia triacanthos*, *Maclura pomifera*, *Populus alba*) in an urban environment. The Hooded Crow builds its nests in the upper third of the

crown of a tree. In the placing of its nest, a crow prefers a southeast direction, because the nest is thus protected from the western winds and enjoys the southern sun at the same time (Moller 1981). Faragó (2002) determined the average nest height at 6.4 meters (3-13 m) (n= 45) on areas outside Hungarian cities. Hooded Crows build nests up to 3-4 meters in cases of less disturbed areas (Havasi, 1993). Ternovác (1983) reported on a pair of Hooded Crows nesting on the ground. Recently, observations about nesting on high-voltage pylons have become more common (Ujhelyi 2005). In areas outside city limits, mean nesting heights were noted at 9 meters in Sweden (Loman 1975), 14.5 meters (Kulczycki 1973) and 9.9 meters in Poland (Zduniak & Kuczynski 2003), 12.6 meters in Germany (Abshagen 1963) and 9.9 meters in Finland (Tenovuo, 1963). The nesting of Hooded Crow in urban areas was thoroughly researched in Finland. In Turku, depending on the habitat type, 1.4-25.5 nests/km² were determined (Hugg 1994), while in Helsinki, this figure numbered 18.4 nests/km² (Vuorisalo et al. 2003).

MATERIALS AND METHODS

We researched the nest-site selection of the Hooded Crow in an urban environment (Debrecen, Hungary) from 2006 to 2010. We located active nests, mainly in the north part of the city, because of the nesting and feeding possibilities in this area of town, i.e. 16 km², in every spring of each of the given years. For each active nest (n=102), we described the habitat (single tree, tree row, park, wooded segment) and noted the tree species and height of the nest. We used laser distance-meter (TruPulse 200) in order to measure the nest height. We recorded the GPS coordinate of every nest (Garmin GPSMap 60 CSx). For evaluation of the data, we used Kurskal-Wallis and Mann-Whitney U tests and correlation analysis.

RESULTS

During the 5 years of examinations, we localized 102 inhabited nests in 13 different tree species (*Quercus robur*, *Quercus rubra*, *Pinus silvestris*, *Pinus nigra*, *Sophora japonica*, *Celtic occidentalis*, *Robinia pseudoacacia*, *Platanus hybrida*, *Ulmus pumila celer*, *Acer saccharinum*, *Gleditsia triacanthos*, *Maclura pomifera*, *Populus alba*). Nest density has grown year by year (2006: 0,68 nest/km², 2007: 0,75 nest/km², 2008: 1,5 nest/km², 2009: 1,56 nest/km², 2010: 1,88 nest/km²) (R²=0,9139). According to our observations, crows build new nests every year, and show no tendency to rebuild or renovate previously used nests. Nesting height was between 12-21 meters, with an average of 16.22 meters (Table 1).

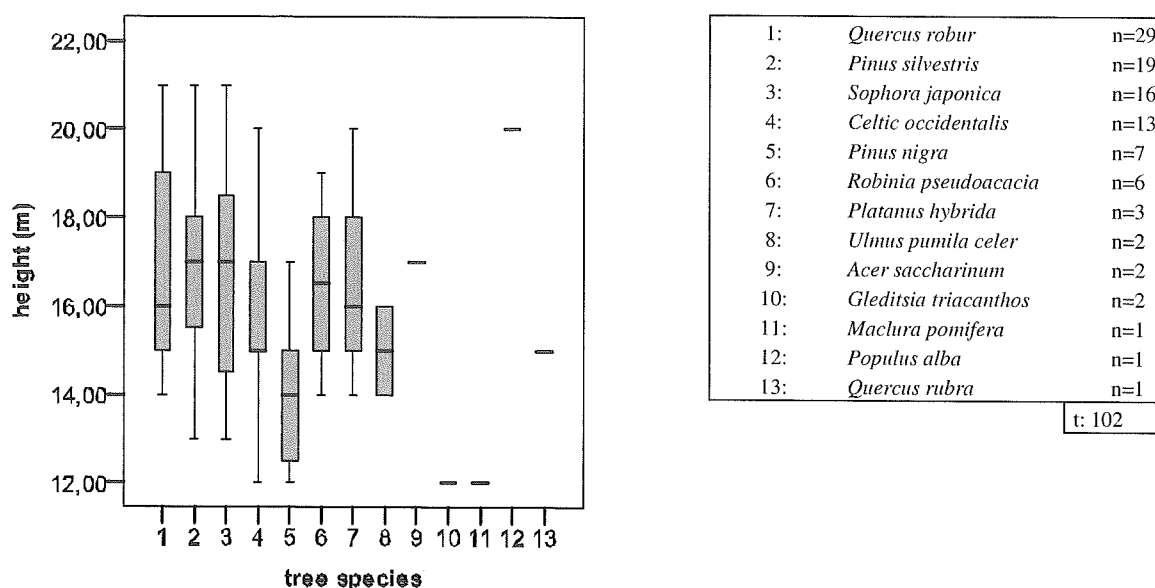
Table 1

The range of the nest height of Hooded Crow (*Corvus cornix*) (n=102)

Height (m)	Frequency	%
12	6	5,9
13	6	5,9
14	17	16,7
15	13	12,7
16	14	13,7
17	14	13,7
18	11	10,8
19	12	11,8
20	6	5,9
21	3	2,9
Total:	102	100
Mean: 16.22		
Deviation: 2.36		

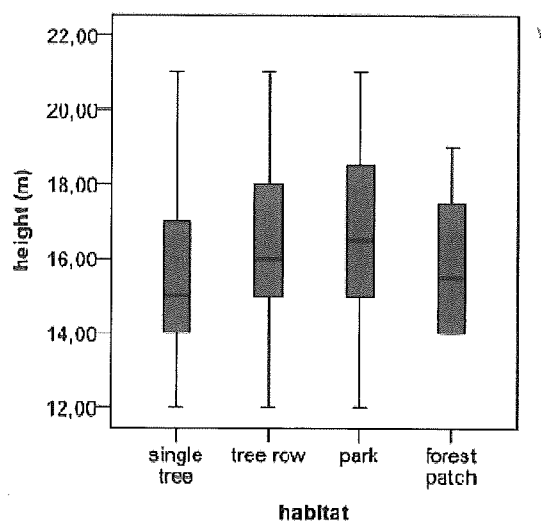
We compared nest height with the tree species (Figure 1), and found a slight but insignificant difference (Kruskal-Wallis test, H=21,357, df=13, p=0.045). In the case of *Quercus robur* a considerable number (75.86%, n=29) of crows built their nests in the roots of *Loranthus europaeus*.

Figure 1. The nesting height of Hooded Crow (*Corvus cornix*) in different tree species (n=102)



Nest height was also compared with different categories of habitats (Figure 2). After examining the nesting heights of Hooded Crows, the results revealed no important difference between habitats (Kruskal-Wallis test, $H=3,559$, $df=3$, $p=0,313$). However, when these habitats were compared in pairs, in two cases: single tree-wood segments (Mann-Whitney U test, $U=58,500$, $Z=-0,565$, $p=0,588$) and tree rows-wooded segments (Mann-Whitney U test, $U=109,500$, $Z=-0,242$, $p=0,814$) we found a significant discrepancy.

Figure 2. The nesting height of Hooded Crow (*Corvus cornix*) in different habitats (n=102)



DISCUSSION

In the past decade, Hooded Crows have showed an intense move towards urbanization in Debrecen. Various factors may be driving this phenomenon, including the nesting possibilities in towns, which is one of the key factors of settlement. Crows living in urban environments are not particular in selecting among tree species, as is proven by the 13 species described above. Nest density has grown year by year ($R^2=0.9139$), which means that the city's capacity to support Hooded Crows has not reached its maximum yet. As a consequence, the population of this species is expected to grow further, as is confirmed by Finnish researchers, who have recorded data containing much larger numbers (Hugg 1994, Vuorisalo et al. 2003). Average nest height was 16.22 meters (12-21 m) (n= 102) which is higher than data collected in areas outside the city, where Faragó (2002) measured an average of 6.4 meters (3-13 m). Building nests at a higher altitude may be due to anthropogenic disturbance. Altitude is the most important element of choosing a nest- which is why nests are built in the highest possible areas. As mentioned previously, in the case of *Quercus robur* (75.86%, n=29), many crows tend to build their nests in the roots of *Loranthus europaeus*, which can be explained by this tree's ability to provide greater safety

and better possibilities for concealment. Our data showed a slight, insignificant difference between nesting heights and tree species, which is probably due to the different characteristics of the given tree species.

Our data regarding nesting heights shows that, in typical urban habitats, there are no relevant differences. However, when habitats are compared in pairs, when comparing single trees with wood segments and tree rows with wood segments, nesting heights show significant differences, which can be explained by the various conditions provided by the habitats we mentioned.

To sum up, the Hooded Crow in urban environments prefers approximately the same nesting height in all kinds of habitats and tree species, and nesting height does not significantly depend on the habitat itself or on the tree species.

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