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Nesting phenology and breeding success in Great Spotted Woodpecker *Picoides major* near Warsaw (Central Poland)

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Abstract. The study was carried out between 1996 and 1998 on a plot covered by mixed woodland near the southern boundary of the city of Warsaw. A total of 39 nests were investigated. The woodpeckers laid their eggs during the last ten days of April and at the beginning of May. The mean clutch size was 5.6 (n = 18). The number of young reared differed from season to season and was associated with the fledging date. More fledglings left nests with earlier broods. 81% of broods were successful, i.e. at least one young was reared. The duration of the breeding season — from the laying of the first egg to the fledging of the last chick — was 40–42 days.

Keywords: Great Spotted Woodpecker, *Picoides (Dendrocopos) major*, breeding biology, primary cavity nesters

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INTRODUCTION

The breeding biology of avian species nesting in tree holes is well known for secondary cavity nesters, as these birds readily occupy nest boxes. For this reason, the breeding ecology of tits, flycatchers as well as the Starling, have been well documented from many locations. Woodpeckers Picinae excavate their own nest holes and most often use new ones each year. As a result, there is significantly less data available on their breeding ecology, as it is more difficult to locate and study their nests during each stage of the development of the brood. Not much information has been collected on the breeding phenology, number of fledglings or breeding success of the woodpeckers occurring in Europe. This type of data is most often available for those species whose numbers have been declining over recent years, such as the Middle Spotted Woodpecker *Picoides medius*, White-backed Woodpecker *P. leucotos* or the Lesser Spotted Woodpecker *P. minor* (e.g. Pettersson 1984, Wesołowski 1995, Hogstad & Stenberg 1997, Wiktander 1998, Pasinelli 1999).

The Great Spotted Woodpecker is the most common species of woodpecker in Europe (Hegemeijer & Blair 1997), however detailed data about its breeding biology is scarce and in most cases incomplete (Pynnönen 1939, Durango 1945, van Manen 1993). Its preferred nesting sites have been fairly well described (e.g. Aulen 1988, Wesołowski 1989, Stenberg 1996). The literature also includes information on the timing of when young birds leave the nest (Wesołowski & Tomiałojć 1986) and contains much data on parental care and frequency of feeding (e.g. Steinfatt 1937, Pynnönen 1939, Stahlbaum 1959), as these data are easily collected without having to observe the interior of the hole.

The aim of this study was to describe the elements of the breeding biology of the Great Spotted Woodpecker — timing of egg laying, size of clutch, number of young leaving the nest and breeding success. The characteristics of nest

locations and data on the division of labour among the male and female in the care of the young in the study population were the subjects of separate publications (Mazgajski 1998a, Woźniak & Mazgajski in press).

THE STUDY AREA AND METHODS

The study was conducted in the Kabacki Forest nature reserve located near the southern border of Warsaw (52° N, 21° E). This reserve is a large forest of about 1000 ha, mostly deciduous and mixed woods. The reserve is thickly intersected by dirt roads and hiking trails, and is heavily visited by the public, especially on weekends. The specific characteristics of the study terrain and Great Spotted Woodpecker nest sites located therein can be found in Mazgajski (1998a).

Fieldwork on the breeding biology of the woodpeckers was conducted from 1996 through 1998. Weather conditions (mean temperature and precipitation) of the three breeding seasons differed quite significantly (Fig. 1), which could have influenced the course of the woodpecker's breeding process.

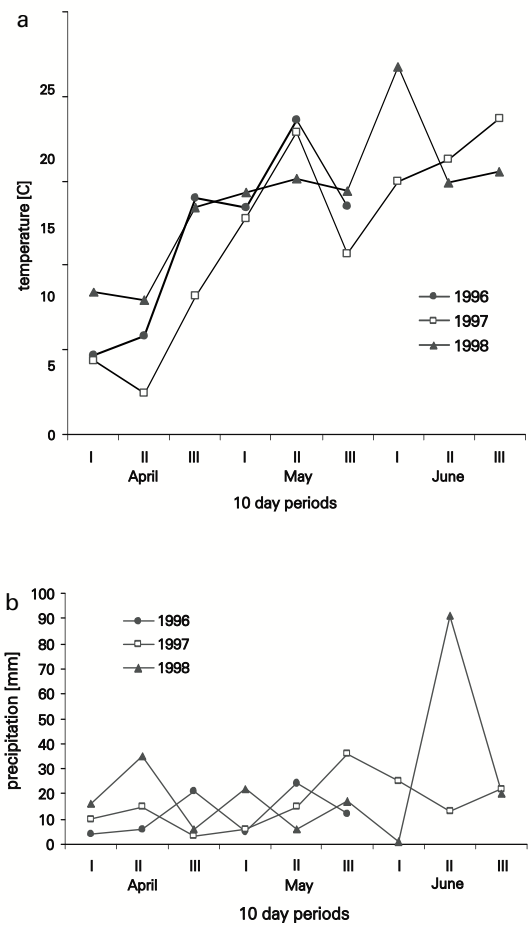

Fig. 1. Mean atmospheric temperature (a) and amount of precipitation (b) in specific ten-day periods of the breeding season from 1996–1998

At the beginning of the breeding season, birds excavating new nests were sought and nests found in previous years were also checked. Nests were sought throughout the entire breeding season up until the time the young fledged. Small light and mirror were used to observe the interior of the tree holes to determine the timing of egg laying, clutch size and number of nestlings. Observations were terminated several days before the estimated time of fledging so as not to provoke the young to leave the nest prematurely. After the interior observations were completed, the presence of young were checked every 2 days exclusively from the ground based on their calls from the hole or observations of the adults bringing food. After the young fledged, the holes were investigated to determine whether they held any dead nestlings.

The entire period of fledging — from the day the first young from the earliest clutch left the nest to the day the young left the last nest — was divided into two equal parts in describing the relationship between the number of fledged young and the timing of leaving the nest. Early clutches were defined to be those where the young were observed to leave the nest during the first half of this period, while late clutches were those where the young fledged during the second half of this period. The date of fledging was defined as the time the first nestling left the hole. Success in breeding was defined as those nests where at least one young fledged. The timing of egg laying and breeding success are given for only those nests studied from the egg laying stage. A total of 39 woodpecker nests were observed at various stages of the breeding cycle.

RESULTS

From 1996–1998, woodpeckers began laying eggs during the last 10 days of April (Table 1). The earliest date the first egg was laid was 21 April 1998, but the remaining pairs observed during this year began laying eggs about a week later (Table 1). The latest date recorded for the commencement of egg laying was 12 May 1998.

The woodpeckers in the population studied laid an average of 5.56 ± 0.92 eggs (n = 18). No significant difference was found in clutch size

Table 1. Timing of commencement of egg laying (%).

Period	1996 n = 8	1997 n = 12	1998 n = 8	Total n = 28
21–27 April	—	—	25.0	7.0
28 April–3 May	88.0	17.0	50.0	46.0
4–10 May	12.0	83.0	12.5	43.0
Later than 11 May	—	—	12.5	4.0

among the years of the study (Kruskal-Wallis ANOVA, H = 0.25, ns, 1996: mean 5.4 ± 0.89 n = 5; 1997: 5.67 ± 0.87 n = 9; 1998: 5.5 ± 1.29 n = 4). The most frequent clutch size of the woodpeckers was 6 eggs (Fig. 2). There was also no significant difference found in the clutch size of birds using old nest holes or newly excavated ones (Mann-Whitney U test, z = -0.67 ns; old holes: 5.67 ± 0.87 n = 9, new holes: 5.38 ± 1.06 n = 8).

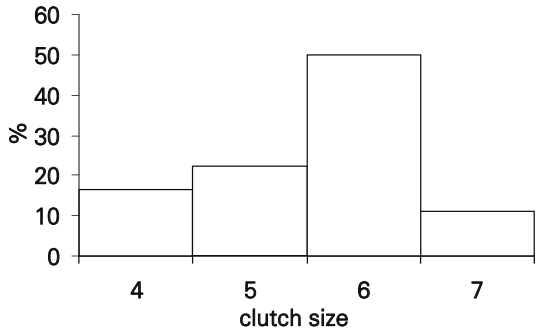

Fig. 2. Variation in clutch size (n = 18).

In calculating the results of only those nests experiencing breeding success, a significant difference was found in the average number of young leaving the nest in 1997 and 1998 (Mann-Whitney U test, z = -3,92, p < 0.0001; 1997: 2.91 ± 0.83, n = 21, 1998: 4.1 ± 0.72, n = 16). Pairs that were able to fledge their young earlier in the breeding season fledged more young than those pairs whose young left the nest later (Mann-Whitney U test, 1997: z = -2.37, p < 0.02; 1998: z = -2.06, p < 0.04; Fig. 3).

Fig. 3. Relationship between the timing of nesting and mean number of fledging (early broods 1997: n = 13, 1998: n = 8; late broods 1997: n = 8, 1998: n = 8).

The period of fledging was very extended. Significant differences were found between the years studied in the timing of the young leaving the nest (χ^2 = 14.87, df = 2, p < 0.01; Table 2).

Table 2. Timing of fledging of young (%).

10-day periods of June	1997 (n = 17)	1998 (n = 16)
I	5.8	69.0
II	76.6	31.0
III	17.6	—

Breeding success of the woodpecker population studied was 81% (n = 32). No differences were found among birds nesting in old holes (86%, n = 14) and those nesting in newly excavated holes (78%, n = 18)(χ^2 = 0,3, df = 1, ns). Cause of nesting failure was able to be determined for 5 nests – in 3 cases either the eggs or young fell victim to predators, while in 2 cases the probable cause of failure was hypothermia. 50% of the eggs laid produced fledged young among those broods studied from the time of egg laying to fledging.

The study was able to determine the length of the breeding cycle, from the laying of the first egg to the fledging of the last nestling, for 11 pairs. For 9 pairs, this cycle lasted from 40–42 days, for the remaining 2 — from 43–45 days.

DISCUSSION

The timing of egg laying by woodpeckers is often correlated with the progression of leaf development or described in relation to the time breeding is initiated by other hole nesters — such as tits or Starlings (Ingold 1989, Wiktander 1998, Pasinelli 1999). The results obtained from the population studied can be compared to data collected on the Starling in the same location and during the same time period. Woodpeckers' earliest egg laying began 4 days after Starlings laid their first eggs. The timing of first egg laying by both these species overlapped in cases where woodpeckers used old, existing holes (Mazgajski 1998b). The timing of the beginning of the breeding cycle in the population studied is similar

to that found for this species in the Netherlands (van Manen 1993).

Observed differences in the timing of egg laying among the study years were most likely due to weather conditions — mainly temperature — and related to this, the availability of food. A similar correlation has been found for other bird species (Perrins 1970, Davies & Lundberg 1985, Meijer & Langer 1995, Meijer et al. 1999). It seems that the strongest link is between the initiation of egg laying and the temperature predominating in April, as the higher the temperature during this period, the earlier woodpeckers began laying eggs (cf. Tables 1 and 2). However, the study was too short to analyse this more specifically. As with other European species of woodpeckers, a link was found between the mean temperature of spring months (March, April) and the time the breeding cycle began or the time of fledging (Wesołowski 1995, Hogstad & Stenberg 1997, Pasinelli 1999).

The lack of a difference in clutch size among the years studied suggests that the supply of food was similar for each of these periods. However, the finding of no difference in clutch size among nests in old or new holes is related to the fact that most of the excavation work is done by males (Michalek 1998, Woźniak & Mazgajski in press), so females do not invest much energy in nest site preparation before laying eggs. The average clutch size observed during this study (5.56) is very similar to those presented by other authors, even from locations quite far geographically (range of 5.6–5.7 — Pynnönen 1939, Durango 1945, Cramp 1985, van Manen 1993).

A decrease in the clutch size in later broods was found in earlier research on the Great Spotted Woodpecker as well as for other species of woodpeckers (e.g. van Manen 1993, Ingold 1996). This could explain the observed differences in the number of nestlings from early and late broods, but other factors could also influence this. Based on the results obtained, it also seems that the prevailing weather during the breeding season could have influenced the number of young leaving the nest. In 1997, weather conditions were unfavourable. It was much cooler with more rainfall than in comparable periods in other years (cf. Fig. 1), especially during the first week of life of the nestlings (the last 10 days of May), when they were fed and brooded by the adults. This is the probable reason for the low number of fledged young in this year compared with 1998, as well as with other studied (mean of 3.7 — Pynnönen 1939).

The timing of fledging among the young of the study population occurred almost at the same time as that reported for the Białowieża Primeval Forest, even though the fledging period there can extend through the first 10 days of July (Wesołowski & Tomiałojć 1986). Fledging is, of course, related to the date of egg laying, though it is also related to the period of incubation and feeding of the nestlings. It is accepted that 40–45 days pass between the time the first egg is laid to the fledging of the last nestling for this species (Wesołowski & Tomiałojć 1986). The 40–42 day period found for the majority of pairs in the study group does not diverge from this result.

Breeding success for the woodpeckers studied (81%) is similar to that found in other locations (range of 71–93% — Tracy 1938, Pettersson 1984, van Manen 1993). The frequency of brood loss was similar for birds nesting in old holes and newly excavated ones. The opposite result was found for the Black Woodpecker *Dryocopus martius* (Nilsson et al. 1991), however this species has a holes with a much larger opening, making them more vulnerable to predation. Nest losses could also be influenced by weather conditions. In 2 nests, nestlings died during the last 10 days of May in 1997 when weather conditions were very poor for birds (see Fig. 1). This was probably not caused by the death of the adult birds, as in one case the male was seen near its nest during the next breeding season.

Breeding success as measured by the relationship between the number of eggs laid and the number of young fledged was found to be similar to that determined for other woodpeckers (Wiktander 1998, Pasineli 1999) as well as for other bird species, even those weaving open nests (Nilsson 1986).

It seems the geographic latitude of study locations has no effect on the breeding biology of the Great Spotted Woodpecker, as has been found to be a factor for other bird species (Møller 1984, Soler & Soler 1992, Sanz 1997, 1998). A more significant factor influencing the results obtained from this study, starting with the time egg laying commences to the number of young that leave the nest, could be the weather conditions.

translated by Barbara Przybylska

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STRESZCZENIE

[Terminy i wyniki lęgów dzięcioła dużego w okolicy Warszawy]

Badania prowadzono w latach 1996-98 w rezerwacie „Las Kabacki" — lesie mieszanym, położonym blisko południowej granicy Warszawy. Warunki pogodowe — średnie temperatury i suma opadów różniły się znacznie pomiędzy poszczególnymi sezonami lęgowymi (Fig. 1), co mogło wpływać na uzyskane wyniki. Dzięcioły rozpoczynały składanie jaj w trzeciej dekadzie kwietnia i na początku maja (Tab. 1), najczęściej składając 6 jaj (Fig. 2). Liczba piskląt opuszczających gniazdo różniła się istotnie pomiędzy sezonami (1997: 2.91 ± 0.83, n = 21, 1998: 4.1 ± 0.72, n = 16; Mann-Whitney U test, z = -0.67) i zależna była od terminu wylotów — większa liczba piskląt wyprowadzana była z lęgów wczesnych (Fig. 3). Pisklęta opuszczały gniazda w pierwszej i drugiej dekadzie czerwca (Tab. 2). 81% lęgów (n = 32) zakończyło się wyprowadzeniem przynajmniej jednego młodego. Najczęściej cały okres lęgowy dzięciołów, od złożenia pierwszego jaja do wylotu ostatniego podlota trwał 40–42 dni.

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