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Authors: Mitrus, Cezary, and Soćko, Beata

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Natural nest sites of the Red-breasted Flycatcher *Ficedula parva* in a primeval forest

Cezary Mitrus & Beata Soćko

Department of Zoology, University of Podlasie, Prusa 12, 08–110 Siedlce, POLAND, e-mail: ficedula@ap.siedlce.pl

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Abstract. 117 nests of Red-breasted Flycatchers in Białowieża primeval forest (NE Poland) were characterised. Most nests (79%) were built in Hornbeam *Carpinus betulus* and lime *Tilia cordata*. Three types of nest sites were distinguished: chimney shaped (26.4%), half cavities (46.4%) or shelves — the nest was wedged under a piece of bark against the main trunk (27.3%). Most cavity entrances were exposed to the south. Compared to other species of secondary cavity nesters in Białowieża National Park, Red-breasted Flycatchers used cavities of a different shape, with a smaller bottom area and at a relatively low height above the ground ($\bar{x}$= 4.9 ± 3.13 m). Nesting trees had a smaller diameter ($\bar{x}$= 31.2 ± 21.4 cm) and were more often dead (29.8%) than trees used by the other secondary cavity nesters. Only four nest sites were used in consecutive seasons.

Key words: Red-breasted Flycatcher, *Ficedula parva*, nest sites, cavity nesters, holes, Białowieża National Park

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INTRODUCTION

Nest site features can affect reproductive success by limiting clutch size and cause partial or complete losses of clutches and broods (e.g. van Balen 1973, Slagsvold 1987, Walankiewicz 1991, Rendell & Robertson 1993). Long-term intensive forest management often damages natural habitats and restricts suitable places for breeding (e.g. Bruns 1960, Haapanen 1965). Shortage of suitable nest sites may increase inter- and intra-specific competition and consequently restrict population size (Newton 1998). Knowledge of nest site characteristics can help to formulate management guidelines in order to protect a population.

The Red-breasted Flycatcher is a small passerine that breeds in "half cavities" in forests from Kamchatka to Central Europe (Cramp 1993). The species occurs mainly in mature or young, dense deciduous and mixed forest (Flade 1997). In the oak-hornbeam stands of Białowieża National Park, the Red-breasted Flycatcher reaches breeding densities of up to 2.0 pairs/10 ha (Wesołowski et al. 2002).

Characteristic of natural nest sites of the most secondary cavity nesters breeding in primeval forest has been presented in few papers so far (Wesołowski 1989, 1996, Mitrus et al. 1996, Walankiewicz 1991, Czeszczewik & Walankiewicz 2003) and only incidental data exist about nest sites of the Red-breasted Flycatcher (Glutz von Blotzheim & Bauer 1993).

The aim of this study was to fill this gap and to describe natural nests sites of the Red-breasted Flycatcher in primeval stands of the Białowieża National Park.

STUDY AREA AND METHODS

Data were collected in 1977–2003 in the Białowieża National Park (BNP) (52°41'N, 23°52'E, NE-Poland). It is the best preserved and strictly protected area of the Białowieża Forest. Almost all nests ware located in oak-hornbeam *Tilio-Carpinetum* stands characterised mainly by Hornbeam *Carpinus betulus*, Small-leaved Lime *Tilia cordata*, Pendunculate Oak *Quercus robur*, Norway Maple *Acer platanoides* and Norway Spruce *Picea abies* (Tomiałojć et al. 1984, Tomiałojć 1991).

Most nests (88 out of 117) were found during the last four breeding seasons (2000–2003).

Nests were located following females during nest construction, searching sites where birds were frequently seen, and following adults when they were feeding nestlings. For almost all nests the following parameters were described: nesting tree species, height of the nest above the ground, diameter of the trunk at breast height (DBH), stage of tree (dead or living), type of nest site and for some of the nests depth and bottom area of the cavity. Bottom area was calculated used formula:

$$V = \pi^* \text{ radius}_{1*} \text{ radius}_2$$

only for half cavities and chimneys. To analysis were included multiple nests which were used more than once.

The data presented in this paper may posses some bias caused by searching methods. The Red-Breasted Flycatcher is a very shy species, especially during incubation period and some nests are very difficult to find. Due to area size and spatial distribution of the species we were able to find only a part of nests of the entire population breeding in Białowieża Forest.

RESULTS

During the study period 117 nests sites occupied by Red-breasted Flycatcher were found. Only four of them were used more then one time (out of 88 sites checked). Most of them were in living trees (70.2%) and mostly situated in Hornbeam and Lime (Table 1). An average height above ground was 4.9 m, but more than 70% were located lower then 6.0 m (Table 1, Fig. 1). The highest nests were situated in hornbeams, but differences in nest height between tree species were not significant ($F_{7,79} = 0.91$, $p = 0.90$, Table 1).

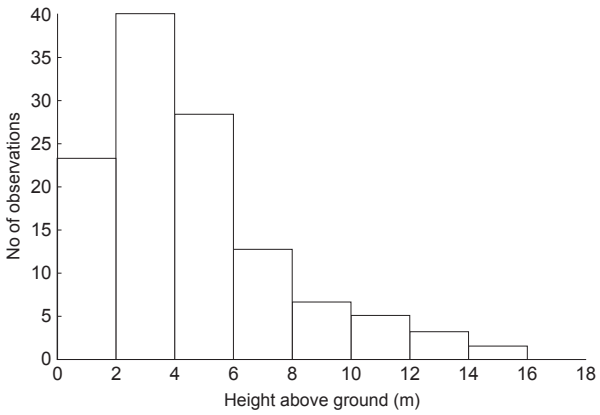

Fig. 1. Distribution of the height above ground of the Red-breasted Flycatcher's nests.

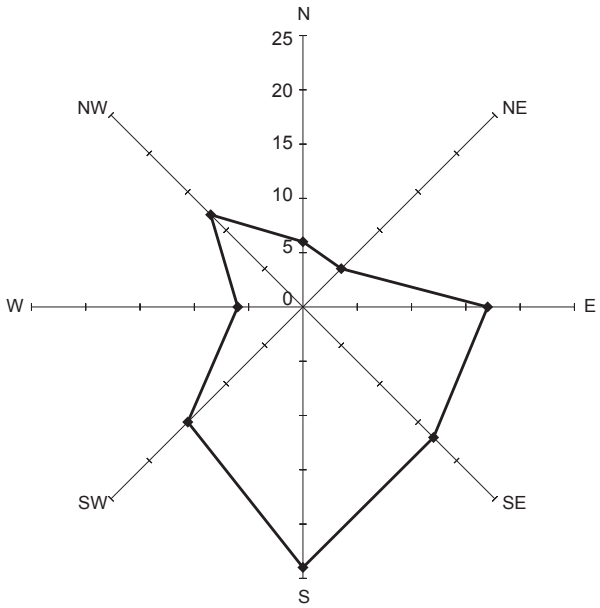

Fig. 2. Entrance orientation of the nests.

Table 1. Features of nesting trees used by Red-breasted Flycatcher in Białowieża 1977–2003.

Tree species	Height above ground (m)			Diameter at breast height (cm)		
	N	Range	Mean±SD	N	Range	Mean±SD
Carpinus betulus	64	1.3-16.0	5.4±3.34	41	13.0-75.0	33.1±12.96
Tilia cordata	27	1.5-13.0	4.7±2.89	27	10.0-103.0	20.1±22.25
Pinu silvestris	11	1.6-13.0	4.9±3.13	8	47.0-106.0	67.9±21.27
Picea abies	6	0.7-6.0	2.9±1.94	4	11.0-46.0	25.5±15.37
Ulmus sp.	3	2.5-4.5	3.2±1.15	3	12.0-22.0	15.3±5.78
Quercus robur	2	2.0-6.0	4.0±2.83	2	10.0-53.0	31.5±30.41
Others	4	1.9-2.5	2.2±0.32	2	30.0-30.0	30.0±0.0
Total	117	0.7-16.0	4.9±3.13	87	10.0-106.0	31.2±21.44

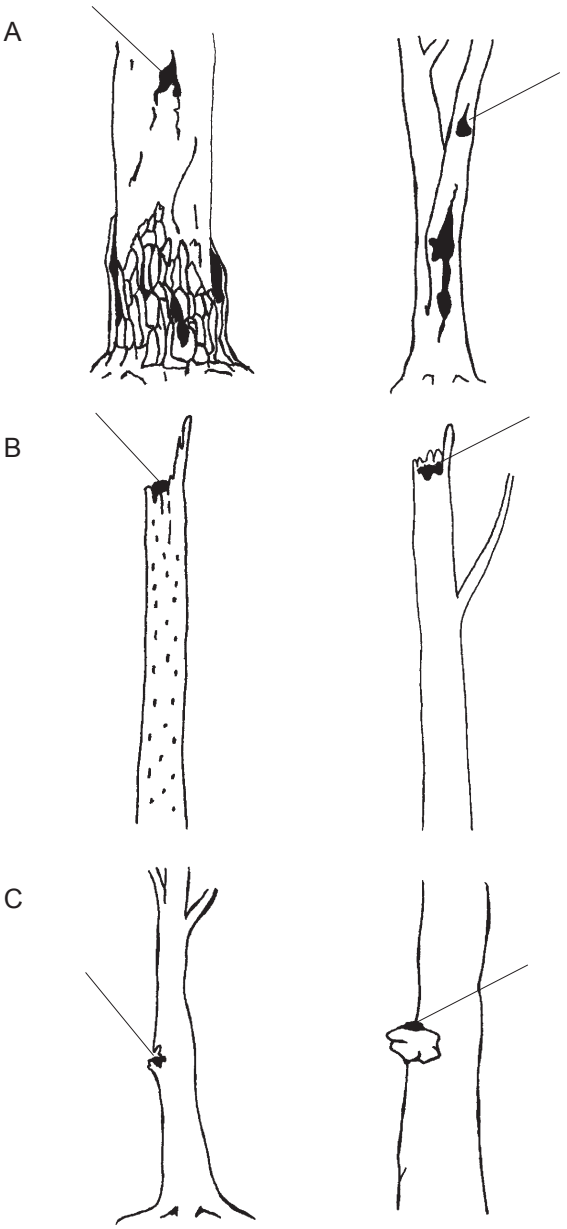

Fig. 3. Types of nest sites: A — half holes, B — chimneys, C — shelves.

The diameter of the nesting tree varied from 10 to 106 cm ($\bar{x}$ = 31.2 ± 21.4, n = 87) and depended on the species ($F_{7,79}$ = 6.97, p < 0.001), pines being the thickest and elms the thinnest (Table 1). Nests were built in shallow cavities ($\bar{x}$ = 6.1 ± 2.05, n = 12) with a small bottom area ($\bar{x}$ = 43.9 ± 16.99, n = 26). The bottom area was not related to tree diameter (r = 0.07, p = 0.74, n = 26) and height above ground (r = -0.07, p = 0,74, n = 26). Most of holes entrances were directed south, south-east and east (Fig. 2). Distribution differed significantly than normal curve (K-S d = 0.14, p < 0.05).

Three types of nest sites were distinguished: half cavity (shallow cavity with big entrance), chimney (usually in broken and rotten top of thin tree), shelf (place outside the main trunk, usually under bark, Fig. 3). Most nests were located in half cavities (46.4%), 26.4% were built in chimneys and 27.3% on shelves. The type of nest site was strictly related to tree species. Most chimneys were found in limes (72.5%), whereas half holes and shelves (76.5% and 40.0%, respectively) were located mainly in hornbeams, which is connected with different features of those tree species. Types of nests sites were not related to height above the ground ($F_{2,84}$ = 2.3, p = 0.10) but were so to tree diameter ($F_{2,84}$ = 34.15, p < 0.001, Fig. 4).

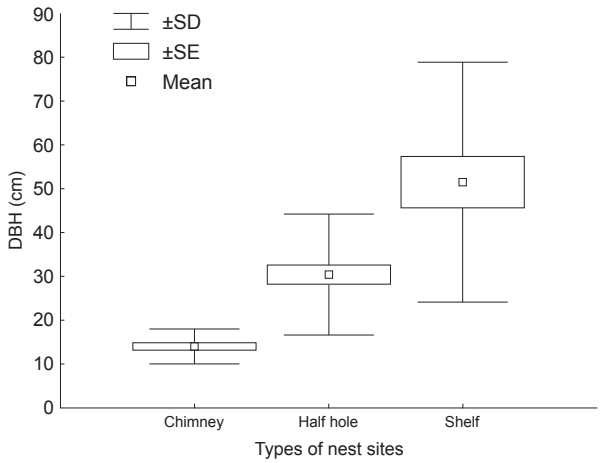

Fig. 4. Types of nests sites and tree diameter.

DISCUSSION

Only few authors have described nests sites of the Red-breasted Flycatcher so far. The most numerous data presented by Aleknonis (1976) from Lithuania, much less was know from Germany (Weber 1958, Miera 1978), Belarus and Russia (Peklo 1987, Byshnev & Stavrovsky 1998) and other countries (Glutz von Blotzheim & Bauer1993). The Red-Breasted Flycatcher is usually described as a half-cavity nester. We, however, divided nest sites into tree groups: half cavities, chimneys and shelves. Nest site types were connected with tree species and diameter. Using different nest sites is probably a result of the diversity of conditions and tree stands in Białowieża National Park. The choice of nesting tree species differed from that described in other studies in Europe, probably reflecting the species composition in the nesting

habitat. In northern Russia and Lithuania most birds bred in Alder *Alnus glutinosa*, in Beskidy Mountains in Beech *Fagus silvatica*, Silver Fir *Abies alba* and Norway Spruce (Aleknonis 1976, Peklo 1987, Byshnev & Stavrovsky 1998). Similarly to Red-breasted Flycatcher, other hole-nesters in Białowieża national Park often use hornbeam and lime as a nesting tree (Wesołowski 1989).

Only four cases of using the same place in subsequent seasons for breeding could be anti-predator adaptation or result of changing features and quality of nest site after winter. Nests sites of Red-breasted Flycatcher are more open, often in dead trees and seems to be less durable than holes using by other cavity-nesting birds (Wesołowski 1995)

An average height of nests above the ground in Białowieża Forest (4.9 m) was higher than in Germany and Russia (Muller 1970, Cramp 1993, Glutz von Blotzheim & Bauer 1993) and similar to Lithuania (Aleknonis 1976). Other hole-nesters from Białowieża Forest, except Marsh Tit *Parus palustris,* build nests usually much higher then Red-breasted Flycatcher (Wesołowski 1989, 2002, Mitrus et al. 1996, Walankiewicz 1991, Czeszczewik & Walankiewicz 2003). There is lack of data about diameter of tree trunk used by Red-breasted Flycatcher in other parts of the Europe. In BNP on average this species breeds in much thinner trees than other hole nesters (Wesołowski 1989, 1996, Czeszczewik & Walankiewicz 2003). This is probably connected with the type of holes used by the species.

In the Beskidy Mountains, as in Białowieża, 30% of the nests were located in dead trees (Glutz von Blotzheim & Bauer 1993). Other sources do not mention the percentage of nests in dead or living trees. Other secondary hole-nesters breeding in BNP use dead trees in various rates, but other flycatcher species breed in dead trees less frequently (Wesołowski 1989, Czeszczewik & Walankiewicz 2003).

So far no data were published about hole-entrance exposure in Red-breasted Flycatcher nests. Similar to others hole-nesters from BNP most nest were directed to the south, southeast, southwest and east (Wesołowski 1989, 1996, Mitrus et al. 1996, Walankiewicz 1991, Czeszczewik & Walankiewicz 2003).

Usually the rims of the nests were visible from the ground and they were build in the shallow cavities with small bottom areas. This type of cavity distinctly differs from cavities preferred by other secondary hole-nesters in BNP (Walankiewicz 1991, Mitrus et al. 1996, Wesołowski 1989, Czeszczewik & Walankiewicz 2003). It could be result of late arrival of this species, in the time when other *Ficedula* flycatchers and tits take many of holes and start to breed (Mitrus 2003, Czeszczewik & Walankiewicz 2003). On the other hand surplus of free cavities in Białowieża National Park was reported and low competition for nests sites were suggested (Wesołowski 1989, Walankiewicz 1991, Mitrus et al. 1996).

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STRESZCZENIE

[Miejsca lęgowe muchołówki małej w naturalnym lesie (Białowieski Park Narodowy)]

Obserwacje prowadzono w latach 1977–2003 na terenie Białowieskiego Parku Narodowego. Większość gniazd (88 z 117) opisano w ostatnich czterech sezonach lęgowych (2000–2003), natomiast wcześniejsze dane pochodzą z Kartoteki Gniazd i Lęgów. Gniazda wyszukiwano obserwując samice podczas budowy, przeszukując miejsca wcześniej stwierdzonych par lub śledząc dorosłe ptaki w okresie karmienia piskląt. Dla większości gniazd opisano: gatunek drzewa, wysokość nad ziemią, pierśnicę, kierunek wlotu do dziupli, stan drzewa (martwe lub żywe), typ lokalizacji gniazda i dla niektórych średnicę dna i głębokość dziupli. Większość gniazd znajdowała się w drzewach żywych (70.2%), najwięcej w grabach *Carpinus betulus* i lipach *Tilia cordata* (Tab. 1). Wyróżniono następujące typy miejsc gniazdowych: półdziuple (płytkie dziuple z dużym otworem wejściowym — 46.4%), kominy (płytkie zagłębienia, zwykle w złamanym szczycie cienkiego drzewa — 26.4%) i półki (miejsca na zewnątrz pnia głównego, zwykle pod odstającym fragmentem kory — 27.3%, Fig. 3). Rodzaj miejsca gniazdowego zależał od gatunku drzewa. Większość kominów zlokalizowano w lipach (72.5%), podczas gdy półdziuple (76.5%) i półki (40.0%) charakterystyczne były dla grabów. Wlot do dziupli znajdował się najczęściej od strony południowej (Fig. 2). Gniazda były budowane stosunkowo nisko nad ziemią (średnio 4.9 ± 3.12 m). Najwyżej umiejscowione gniazda znaleziono w grabach (Tab. 1), ale różnice w wysokości gniazd w zależności od gatunku drzew nie były znaczące ($F_{7,79} = 0.91$, $p = 0.90$). Drzewa gniazdowe miały małą średnicę (31.2 ± 21.4 cm). Pierśnica zależała od gatunku drzewa ($F_{7,79} = 6.97$, $p < 0.001$), najgrubsze były sosny, a najcieńsze wiązy. Stwierdzono tylko cztery przypadki powtórnego wykorzystania tego samego miejsca lęgowego.