

Breeding ecology of the Sedge Warbler (*Acrocephalus schoenobaenus*) in the Biebrza marshes (NE Poland)

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The study was carried out in a natural fen mire in the Biebrza River Valley (NE Poland). Sedge Warblers avoided settling in an open sedge meadow: their territories were situated in places overgrown with reed and bushes, often close to canals. Population density ranged from 10 to 24 pairs/10 ha. The majority of nests were built on tufts of sedges or small trees. Egg-laying period lasted from 8 May to 22 June. Clutches contained 4-6 eggs (mean = 5.2) and clutch size significantly decreased over the season. Nest losses were caused only by predation and accounted for 14.8% (calculated with the Mayfield method). The average production of fledglings per nest was 3.9 and per successful nest 4.6. The fledgling probability per egg was 77.6%.

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1. Introduction

The Sedge Warbler (*Acrocephalus schoenobaenus*) has a broader ecological niche and is more widespread than its European congeners. However, data on breeding biology and ecology of the species are relatively scarce (Koskimies 1991). The goal of this study was help to fill this gap and ascertain some basic parameters in the species' natural habitat. Additionally, the present paper includes a comparison of some breeding statistics of the Sedge Warbler with those of the Aquatic Warbler (*Acrocephalus paludicola*), a sibling species with an uniparental care that breeds sympatrically in the study area.

2. Study area and methods

Data presented in the paper were collected between April and July 1993 as part of a study of breeding ecology and behaviour in the genus *Acrocephalus* (Hałupka, in prep.). Some preliminary research on relations between distribution of breeding pairs and vegetation types were also carried out in 1990 and 1991. The study area was situated 5-6 km from the river in a non-flooded zone. The area of about 70 ha was controlled. However, breeding places were concentrated mainly along water canals (3.8 km long) and in patches of sparse reedbeds (15 ha). The ground was covered by tussocks of sedges with *Carex elata* or, in some places, *Carex appropin-*

quata as dominants. Marsh fern (*Thelypteris palustris*), bog bean (*Menyanthes trifoliata*), marsh cinquefoil (*Comarum palustre*) and mosses were also abundant. Edges of the dam and canals as well as drier places in the sedge meadow were overgrown with small trees and bushes of alder, willow and birch. Some places were invaded by reed (*Phragmites communis*).

In total, 37 nests and 15 places with newly fledged young (could be trapped by hand) were found.

3. Results

3.1. Timing of the breeding season

The first male arrived on 23 April and the first female on 2 May. On average, females came about two weeks later than males. The last male and last female (new at the study area) were recorded, respectively, on 28 May and 18 June (Fig. 1).

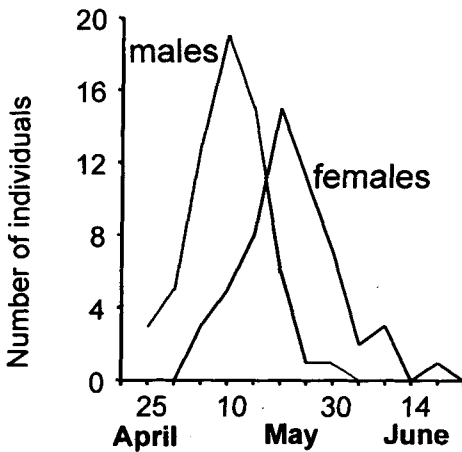


Fig. 1. Number of Sedge Warblers settling at the study area in consecutive five-day periods.

The start of egg laying was recorded in 14 nests. In the remaining cases (nests and places with newly fledged young), first egg dates were estimated by „counting back” (see below for data on the duration of incubation and nestling period). Egg laying started between 8 May and 22 June (median=27 May). Distribution of dates of clutch initiation is shown in Fig. 2.

Territories of early pairs were searched for second nests (they are built within the original territory or up to 50 m from the first nest: Koskimies 1991, M. Borowiec pers. com.), but despite considerable effort, no nests were found. Clutches laid in June (see Fig. 1) were either replacement ones (1-2 days after the nest loss, the female started to build a new nest) or belonged to males that attracted a mate after several weeks of persistent singing.

Incubation (hatching of most nestlings was assigned as the first day of nestling period) lasted 12-13 days (median=13, n=13) and the young stayed in nest for 11-13 days (median=12, n=20).

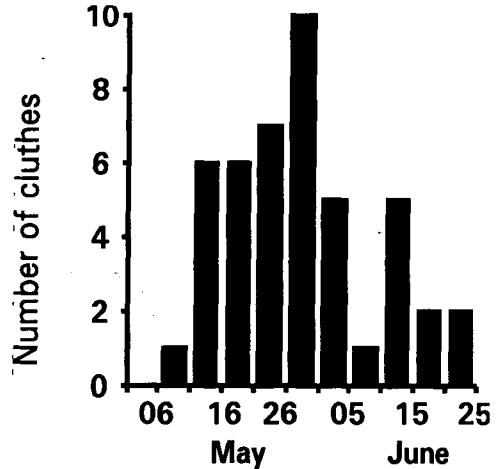


Fig. 2. Distribution of first egg dates of Sedge Warblers expressed as number of clutches (n = 45) commenced in consecutive five-day periods.

3.2. Density of breeding pairs, characteristics of nest patches and nest sites

Most pairs settled along a 3.8 km stretch of canal making a density of 10.5 territories per 1 km. Two concentrations of nests were situated in sparse reedbeds where the population density was assessed, respectively, at 12 and 24 pairs/10 ha.

Sedge Warblers avoided an open sedge meadow. Nests were located close to water (median=7 m, range=0-220 m, $n=37$; if not stated otherwise, all statistics given in this section refer to this sample), in places with small trees and bushes (median=4.3 m from the nearest bush/tree, range=0-50 m). A total of 73% of nests were built among the reed (density from 1 to 90 stems per m^2 , median=20, $n=27$ measurements). Water around nests was a few centimetres deep, only a few nests at the edges of canals were situated over water of more than 50 cm deep.

Nests were placed on tufts of sedges (73% of nests) or low on small (up to 1.5 m high) trees or bushes (21.6%). A single nest was built on the moss and another one was supported mainly by reed stems. The bottom of nest cup was 17-80 cm above the water level (median=25.5 cm). Nests, including those placed on trees, were covered mainly by sedges (50-130 cm high, median=70 cm) which formed a kind of roof above the nest and often contained more dry blades than sedges in the vicinity. Among other plant species that formed nest cover the most common were: marsh fern (47.2% of nests), marsh cinquefoil (33.3%) and bog bean (11.1%).

3.3. Clutch size, breeding success and production of fledglings

Average clutch size was 5.2 ($s=0.60$, $n=19$) and clutches contained 6 (26.3%), 5

(63.2%) or 4 (10.5%) eggs. Clutch size decreased with the advancing breeding season (Kendall's correlation coefficient=-0.401, $p=0.013$, $n=19$); in May average clutch size was 5.4 and in June 4.7.

In 14 nests number of eggs was monitored from the start of incubation. Clutches laid in one nest (7.1% of all) were taken by a predator. Partial losses were recorded in 4 nests (30.8% of 13 nests that survived to hatching time). In one (7.7%) nest, a single egg (1.5% of 67 eggs) fell out of the nest. In 4 nests (30.8%) some eggs (6.0% of 67 eggs) did not hatch (hatching failures were due to some physiological defects: infertility or death of embryos). Overall, 86.1% of 72 eggs observed from the beginning of incubation period produced nestlings.

The fate of 18 broods was followed from hatching to fledging. A single brood (5.6%) of 5 nestlings was predated. Partial losses were recorded in two broods (11.8% of remaining 17 broods that survived to fledging): in both, two nestlings died for unknown reasons (4.7% of 86 chicks). In sum, 90.1% of 91 chicks successfully fledged. Thus the probability per egg of fledging was 77.6% (0.861×0.901).

Total losses were caused only by predation: 10.8% of nests ($n=37$) were destroyed (one during egg-laying, one during incubation and two in the nestling period). Following the Mayfield (1975) method, 14.8% of nests failed to produce fledglings (487 nest-days without losses, 3 nest-days with predation, breeding cycle has 26 days). The failure rates of clutches equalled 7.1% (176 nest-days without predation, 1 day with predation, 13 days of exposure) and broods 8.0% (311 nest-days without predation, 2 days with predation, 13 days of exposure). These did not differ significantly ($z=0.103$, $p>0.8$).

The average production of fledglings per successful nest was 4.6 ($s=0.97$, $n=33$). The number of fledglings per nest decreased through the season, but not significantly (Kendall's correlation coefficient = -0.141, $p=0.343$, $n=30$). Considering that total failure rate was 14.8%, the production of fledglings per nest could be estimated at 3.9 (0.852×4.6).

4. Discussion

Characteristics of the breeding habitat and nest-sites reported in this study are quite typical of the species, which was associated with areas of sedge, osier and reed beds even by early authors (Howard 1907, Witherby *et al.* 1943, Bannerman 1953, Sokołowski 1958). Similar habitats, luxuriant, heterogeneous vegetation of different types, often overgrown with reed, were recorded by many authors (Catchpole 1972, Svensson 1978, Haland & Byrkjeland 1982, Thomas 1984, Shennan 1985, Shennan 1986, Anselin & Meire 1989). Like elsewhere (Anselin & Meire 1989, Catchpole 1972, Thomas 1984, Shennan 1985, Lewartowski & Piotrowska 1987) Sedge Warblers in the Biebrza Valley avoided breeding in pure reed.

In contrast to Great Britain, where no nests were placed over water (even though most territories included parts of marshland: Catchpole 1973, Thomas 1984), nests located over water or wet ground has been often reported from Central and Northern Europe (Schiermann 1927, Raitasuo 1958, Rogge 1959, Svensson 1978, Koskimies 1991, this study). Similarly, nests located in sedges seem to be common in Central and north-eastern Europe (Schiermann 1927, Rogge 1959,

Raitasuo 1958, Koskimies 1991, this study) whilst in western Europe nests are generally built in vegetation associated with drier places (e.g. bramble, willow herb, nettle: Catchpole 1972, Catchpole 1973, Thomas 1984, Shennan 1985).

Breeding densities found in the study, high in comparison with most passerines, were similar both to those reported elsewhere for the Sedge Warbler (e.g. Eberhardt & Mildenberger 1971, Catchpole 1972, Sellin 1974, Thomas 1984, Lewartowski & Piotrowska 1987) and to that found previously in this population (Dyrz *et al.* 1984, Dyrz *et al.* 1985).

Data on clutch size and timing of egg laying of the studied population fell between those from western and north-eastern Europe. In Great Britain (Bibby 1978) and Germany (Mildenberger 1984) clutches contained on average, respectively, 5.0 and 4.6 eggs, whereas in Estonia and Finland clutch size accounted for 5.3 eggs per nest (Koskimies 1991). In Britain and Germany the earliest clutches were laid in late April (Bibby 1978, Mildnerberger 1984), in Lithuania in mid May (Pukas 1986) while in northern Europe at the end of May (Koskimies 1991, Malczievskij & Pukinskij 1983). On average, in comparison with British population (Bibby 1978), Sedge Warblers from Biebrza initiated clutches about ten days later. In Finland (Raitasuo 1958, Koskimies 1981) and in Russia near Petersburg (Malczievskij & Pukinskij 1983), peak of laying fell in mid June.

In comparison with other studied populations (Raitasuo 1958, Catchpole 1970, Catchpole 1972, Bibby 1978, Koskimies 1991) Sedge Warblers in the Biebrza Valley suffered fewer losses, had greater

nesting success and produced more fledglings per nest. Only in Finland, in some years, did nesting success reach 80% (Koskimies 1991). The production of fledglings per pair was higher than in Finland, where it was 3.0 (Raitasuo 1958) but lower than in Britain, where some pairs reared two broods and produced 4.8 young (Bibby 1978). Contrary to Sedge Warblers nesting elsewhere (Catchpole 1970, Bibby 1978, Rogge 1959, Malczewskij & Pukinskij 1983), the only cause of failures was predation and no nests failed due to cuckoo parasitism, nest abandonment, adverse weather or death of all nestlings.

In the study area, the Sedge Warbler and its congener, the Aquatic Warbler, show different habitat preferences though some nests are placed as close as a few dozen meters apart. The Aquatic Warbler selects fairly homogeneous habitat of an open sedge meadow. The ecotone, where sedges are mixed with reed, bushes and some herbaceous plants, is occupied by Sedge Warblers. Breeding statistics of both species studied within the same plot were slightly better for the Sedge Warbler. In Aquatic Warblers, nest losses due to predation accounted for 22.2% and total losses 37.3% (Dyrcz & Zdunek 1993b). Additionally, in 3 of 4 study years some nests (1.3-6.1%) failed due to nestlings' starvation (Dyrcz & Zdunek 1993b), whereas in the Sedge Warbler such cases were not observed. Aquatic Warblers produced on average 3.25 fledglings per nest. However, as many Aquatic Warbler females raise two broods (Dyrcz & Zdunek 1993a), their production of fledglings per season might be higher than that of Sedge Warblers.

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Összefoglalás

A foltos nádiposzáta (*Acrocephalus schoenobaenus*) költés ökológiája a Biebrza lápon (ÉK Lengyelország)

A vizsgálatot a kelet-lengyelországi Biebrza folyó völgyében levő mocsaras területen végeztük. A foltos nádiposzáta elkerülték a nyílt sásos részeket, territóriumuk a nádas, bokros helyeken volt, gyakran közel a csatornához. A populáció sűrűsége 10-24 pár volt 10 hektáron. A fészkek többsége sás csomókon, vagy kis fákon volt. A tojásrakás május 8 és június 22 között történt. A fészkealjok 4-6 tojásból álltak (átlag: 5,2). A fészkealjméret szignifikánsan csökkent a költési szezon előrehaladtával. Fészkepusztulást csak predáció okozott, a mértéke 14,8% volt (Mayfield módszerével számolva). Az átlagos fiókaszám fészkenként 3,9 volt, illetve 4,6 a sikeres fészkek esetében. A teljes, tojásra vonatkoztatott kirepülési siker 77,6% volt.

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