Nestling growth and mating system in four *Acrocephalus* species

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Abstract. Dyrcz, A., M. Borowiec & A. Czapulak (1994): Nestling growth and mating system in four species of *Acrocephalus*. – Vogelwarte 37: 179–182.

The four species studied (*A. arundinaceus, A. paludicola, A. schoenobaenus, A. scirpaceus*) differ significantly with respect to the rate of nestling growth and to the duration of nestling period. The differences are associated with differences in parental care. Nestling growth was slowest and nestling period longest in the Aquatic Warbler where quasi-promiscuity and uniparental (female) care occur. On the other hand, nestling growth was fast and the nestling period short in the monogamous Reed and Sedge Warblers where both parents feed the nestling with more or less equal intensity. The Great Reed Warbler with its facultative polygyny is intermediate and the male's participation in feeding nestling is on average lower than the female's.

Key words: *Acrocephalus* spp., nestling growth, nestling period, mating system.

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Introduction

A variety of mating systems were found in the genus *Acrocephalus*: from strict monogamy to quasi-promiscuity and the amount of paternal care varies accordingly (e. g. Leisler 1985). Here we will show that the mating system is related to the growth rate of nestlings through the type of parental care.

Material and methods

All nestlings were weighed daily using a Pesola balance with an accuracy of 0.5 g. An attempt was made to weigh each brood at about the same time each day. Data are based on 8 broods (28 nestlings) of the Aquatic Warbler (*Acrocephalus paludicola*) weighed in 1990 on the Biebrza marshes (NE Poland), 9 broods (42 nestlings) of the Sedge Warbler (*Acrocephalus schoenobaenus*) weighed in 1990 and 1991 near Wrocław (SW Poland), 16 broods (44 nestlings) of the Reed Warbler (*Acrocephalus scirpaceus*), and 11 broods (42 nestlings) of the Great Reed Warbler (*Acrocephalus arundinaceus*). The latter two species were weighed between 1971 and 1975 at Milicz fishponds (SW Poland).

To compare growth rates between species irrespective of their body size, the growth rate constant k was used. This was derived from the logistic equation to which observed growth rates of birds approximate (Ricklefs 1967).

The duration of the nestling period was determined to within one day's accuracy. The age of nestlings in a brood was counted from the day the oldest hatched.

Results

The constant k was calculated for each nestling: in Table 1 mean durations of the nestling period (brood averages) are shown. In the Fig. the average constant k of a species was calculated from individual nestlings rather than from brood averages (as in Table 1).

Nestling growth was decidedly slowest in Aquatic Warbler and fastest in its sibling species Sedge Warbler (Tab. 1, Fig.). The next slowest was that of Great Reed Warbler. Aquatic Warbler is a quasi-promiscuous species with uniparental (female) care (e. g. Leisler 1985, Dyrcz 1993). In the Great Reed Warbler facultative polygyny occurs (Beier 1981, Catchpole et al. 1985, Dyrcz 1986). Reed and Sedge Warbler are more or less monogamous (Koskimies 1991, Schulze-Hagen 1991).

Table 1: Percentage distribution of the duration of nestling period (days) in four *Acrocephalus* spp.

Tab. 1 Prozentuale Verteilung der Nestlingsdauer (in Tagen) für 4 *Acrocephalus*-Arten.

Duration of nestling period	9	10	11	12	13	14	15	16	x̄ ± SD (n)	Growth index
*A. paludicola**	–	–	–	–	4.0	12.0	44.0	40.0	15.2±0.16 (25)	0.396
*A. arundinaceus***	–	–	3.5	28.1	43.9	19.3	5.3	–	12.9±0.12 (57)	0.497
*A. scirpaceus***	–	–	51.7	43.1	5.2	–	–	–	11.5±0.08 (58)	0.532
*A. schoenobaenus****	2.0	16.0	50.0	28.0	4.0	–	–	–	11.2±0.12 (50)	0.594

* - Dyrcz 1993, ** - A. Dyrcz, unpublished data, *** - M. Borowiec, in prep.

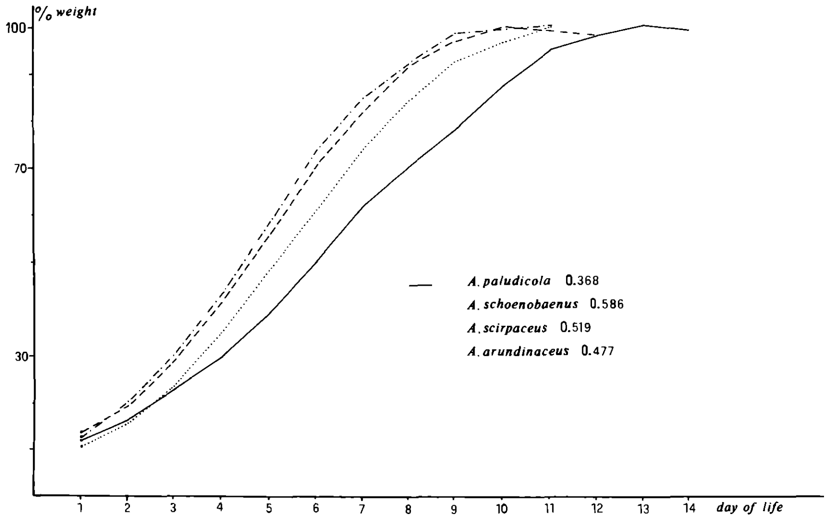

Fig.: Growth of nestlings of four species of *Acrocephalus*; values of growth rate constant are given next to species name.

Abb.: Jungenwachstum bei 4 *Acrocephalus*-Arten; neben dem Artnamen ist jeweils der Wert der Wachstumskonstanten angegeben.

The range of the growth rate constant for individuals of the species under study was as follows: Aquatic Warbler – 0.157–0.501, Great Reed Warbler – 0.363–0.642. Reed Warbler – 0.364–0.661, and Sedge Warbler – 0.453–0.727. The range of average growth rate constants for individual broods was as follows: Aquatic Warbler – 0.280–0.460, Great Reed Warbler – 0.405–0.598, Reed Warbler – 0.466–0.632, and Sedge Warbler – 0.518–0.688. Differences in average values of the constant between all species were significant (see Tab. 2).

The slower the nestling growth, the longer was the nestling period (Tab. 1), which suggests that nestlings left the nest as soon as possible.

Table 2: Statistic significance of differences in the growth rate constant (Tab. 1) between four *Acrocephalus* species.

Tab. 2: Statistisch signifikante Unterschiede zwischen den Wachstumskonstanten (Tab. 1) von 4 *Acrocephalus*-Arten.

	A. paludicola	*A. arundinaceus*	*A. scirpaceus*	*A. schoenobaenus*
A. paludicola	X			
A. arundinaceus	$t = 6.76$ $p < 0.001$	X		
A. scirpaceus	$t = 7.75$ $p < 0.001$	$t = 2.22$ $p < 0.05$	X	
A. schoenobaenus	$t = 12.60$ $p < 0.001$	$t = 7.15$ $p < 0.001$	$t = 4.20$ $p < 0.001$	X

Discussion

The specific mating system of the Aquatic Warbler can be called quasi-promiscuity (Heise 1970, Leisler 1985, Dyrcz & Zdunek 1993a), and males do not help to raise nestlings or fledglings (Wawrzyniak & Sohns 1977, Dyrcz 1993). The male emancipation is probably due to the unusual abundance of large insects and spiders in the habitat of the Aquatic Warbler in comparison to that of other species of *Acrocephalus* (Schulze-Hagen et al. 1989, Dyrcz in prep.). Moreover, the Aquatic Warbler nests tend to be grouped where food is more abundant (Dyrcz & Zdunek 1993a). However, a far-reaching male emancipation was possible due to some additional adaptations, namely the short attendançe (and unattendance) periods of incubating and brooding females. A female is never fed by its male (Dyrcz 1993). This might explain why during the early period of nestling life, nestlings of the Aquatic Warbler are fed less intensely than nestlings of its congeners (Dyrcz 1993). The less intense feeding rate results in a slower nestling growth and a longer nestling period (Tab. 1 and 2, Fig. 1). From the view-point of natural selection the longer nestling period in the Aquatic Warbler is possible because of the exceptionally low rate of predator-caused nest losses (Dyrcz & Zdunek 1993b). The average value of the growth rate constant obtained for the Aquatic Warbler is close to the average for 40 neotropical passerine species (0.365, range 0.126–0.604) reported by Ricklefs (1976) and Oniki & Ricklefs (1981). The values found here for three other species of *Acrocephalus* seem to be more typical for temperate-zone passerines. Ricklefs (1983) maintains that among small passerine birds tropical species grow about 23% more slowly on average than temperate-zone and arctic species. However, differences between related species in the two regions were smaller, suggesting the possibility of a phylogenetic component in the comparison.

The Great Reed Warbler showed distinctly lower nestling growth than the Sedge and Reed Warblers. In the Great Reed Warbler facultative polygyny occurs. The mean incidence of polygyny is about 15% in Central European populations (Dyrcz 1986) and 25% in the subspecies *orientalis* (Urano 1985, Leisler & Catchpole 1992). Secondary females are generally not helped by males in feeding nestlings (Dyrcz 1986). Males feed the nestlings somewhat less often than females (Dyrcz 1983). In spite of the Great Reed Warbler's nestling period being longer than that of the Reed Warbler, its nest losses are slightly lower than those of the Reed Warbler (Dyrcz 1981).

The Sedge Warbler represents monogamous species with a polygyny incidence of 2–7% (Borowiec & Lontkowski 1988, Koskimies 1991). The contribution of sexes to feeding nestlings is more or less equal (Borowiec in prep.), and their nestling growth is the fastest.

In the Reed Warbler polygyny is very rare (Schulze-Hagen 1991). During a period of 20.5. hours of observation of two nests containing 5 and 10–11 day old nestlings, the individually ringed males fed the nestlings 153 (57.5%) times altogether, and females 113 (42.5%) times (Dyrcz unpublished data). The nestling growth was fast in both cases.

The above data strongly support the view that the mating system affects the rate of nestling growth via degree of male emancipation.

Zusammenfassung

Nestlingsentwicklung und Paarungssystem bei vier *Acrocephalus*-Arten.

Die 4 untersuchten Rohrsänger-Arten (*A. arundinaceus, A. paludicola, A. schoenobaenus, A. scirpaceus*) unterscheiden sich signifikant hinsichtlich Wachstumsrate und Nestlingsdauer der Jungen, was parallel zu den Unterschieden in der elterlichen Jungenbetreuung verläuft. Die langsamste Nestlingsentwicklung und längste Nestlingsperiode besitzt der Seggenrohrsänger, der praktisch ohne Paarbindung lebt (Promiskuität) und dessen Junge allein vom ♀ gefüttert werden. Bei den monogamen Teich- und Schilfrohrsängern, deren Junge von beiden Eltern in annähernd gleichem Maße gefüttert werden, verläuft das Nestlingswachstum dagegen schnell und die Nestlingsperiode ist kurz. Beim in fakultativer Polygynie lebenden Drosselrohrsänger (♂ beteiligen sich im Durchschnitt weniger als ♀ an der Jungenfütterung) liegen die entsprechenden Parameter intermediär.

References

Beier, J. (1981): Untersuchungen an Drossel- und Teichrohrsänger (*Acrocephalus arundinaceus, A. scirpaceus*): Bestandsentwicklung, Brutbiologie, Ökologie. J. Orn. 122: 209–230. ✻ Borowiec, M., & J. Lontkowski (1988): Polygyny in the Sedge Warbler *Acrocephalus schoenobaenus*. Vogelwelt 109: 222–226. ✻ Catchpole, C. K., B. Leisler & H. Winkler (1985): Polygyny in the great reed warbler, *Acrocephalus arundinaceus*: a possible case of deception. Behav. Ecol. Sociobiol. 16: 285–291. ✻ Dyrcz, A. (1981): Breeding ecology of Great Reed Warbler (*Acrocephalus arundinaceus*) and Reed Warbler (*Acrocephalus scirpaceus*) at fish-ponds in SW Poland and lakes in NW Switzerland. Acta orn. 18: 307–334. ✻ Idem (1983): Polygyny among Great Reed Warblers (*Acrocephalus arundinaceus*) at Milicz fish-ponds. Dolina Baryczy 2: 11–18. ✻ Idem (1986): Factors affecting facultative polygyny and breeding results in the Great Reed Warbler (*Acrocephalus arundinaceus*), J. Orn. 127: 447–461. ✻ Idem (1993): Nesting biology of the Aquatic Warbler on the Biebrza marshes (NE-Poland). Vogelwelt 114: 2–15. ✻ Dyrcz, A., & W. Zdunek (1993a): Breeding ecology of the Aquatic Warbler *Acrocephalus paludicola* on the Biebrza marshes, northeast Poland. Ibis 135: 181–189. ✻ Idem (1993b): Breeding statistics of the Aquatic Warbler *Acrocephalus paludicola* on the Biebrza marshes, northeast Poland. J. Orn. 134: 317–323. ✻ Heise, G. (1970): Zur Brutbiologie des Seggenrohrsängers (*Acrocephalus paludicola*). J. Orn. 111: 54–67. ✻ Koskimies, P. (1991): *Acrocephalus schoenobaenus*. In: Glutz von Blotzheim, U. N., & K. M. Bauer (eds): Handbuch der Vögel Mitteleuropas. Vol. 12, pp. 291–340. Aula, Wiesbaden. ✻ Leisler, B. (1985): Öko-ethologische Voraussetzungen für die Entwicklung von Polygamie bei Rohrsängern (*Acrocephalus*). J. Orn. 126: 357–381. ✻ Leisler, B., & C. K. Catchpole (1992): The evolution of polygamy in European reed warblers of the genus *Acrocephalus*: a comparative approach. Ethology, Ecology & Evolution 4: 225–243. ✻ Oniki, Y., & R. E. Ricklefs (1981): More growth rates of birds in the humid New World tropics. Ibis 123: 349–354. ✻ Ricklefs, R. E. (1967): A graphical method of fitting equations to growth curves. Ecology 48: 978–983. ✻ Idem (1976): Growth rates of birds in the humid New World tropics. Ibis 118: 179–207. ✻ Idem (1983): Avian postnatal development. In: Farner, D. S., J. R. King & K. C. Parkes (eds): Avian Biology. Vol. VII, pp. 2–83. Academic Press, New York, London. ✻ Schulze-Hagen, K. (1991): *Acrocephalus scirpaceus*. In: Glutz von Blotzheim, U. N., & K. M. Bauer (eds): Handbuch der Vögel Mitteleuropas. Vol. 12, pp. 433–486. Aula, Wiesbaden. ✻ Schulze-Hagen, K., H. Flinks & A. Dyrcz (1989): Brutzeitliche Beutewahl beim Seggenrohrsänger *Acrocephalus paludicola*. J. Orn. 130: 251–255. ✻ Urano, E. (1985): Polygyny and the breeding success of the Great Reed Warbler, *Acrocephalus arundinaceus*. Res. Popul. Ecol. 27: 393–412. ✻ Wawrzyniak, H., & G. Sohns (1977): Der Seggenrohrsänger. Neue Brehm Bücherei 504. Ziemsen, Wittenberg-Lutherstadt.