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Inter-habitat morphometric differentation of male Willow Warblers *Phylloscopus trochilus*

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In many bird species inhabiting a wide range of habitats, environment-specific morphological differences have been found (Lundberg et al. 1981, Ulfstrand et al. 1981, Lemel 1989).

In the present study I compared wing, tail and tarsus length of male Willow Warblers, *Phylloscopus trochilus*, inhabiting three different habitats. Previous studies have shown that Willow Warbler males, which inhabit supposedly suboptimal habitats, are smaller in comparison with males from optimal habitats (Ebenman & Nilsson 1981, Tiainen 1982).

The study was conducted during four breeding seasons (from 1990 to 1993), in three different habitats in central Poland (52°N, 19°E). (1) Deciduous forest (DEC; 150 ha) dominated by birches (*Betula pendula*), oaks (*Quercus* spp.), alders (*Alnus glutinosa*), with an admixture of conifers and dense understorey in some parts of the area. (2) Willow-dominated wetland (WDW; 40 ha) with rich sedge-grass-herb vegetation along the Bobrówka River. (3) Coniferous forest (CON; 35ha), covering low sandy hills, dominated by immature pines (*Pinus silvestris*) with no understorey.

Density estimates, based on spot-mapping of territorial males, showed that the breeding density of the Willow Warbler was highest in WDW (> 1.0 pairs/ha) and lowest in CON (< 0.2 pairs/ha). In DEC a density of 0.3 pairs/ha was recorded.

I captured a total of 114 males in mist nets using song playback: 92 males in DEC, 10 males in WDW and 12 males in CON. While ringing, I measured lengths of wing, tail and tarsus (see Tiainen 1982).

Table 1. Difference in mean (mm) wing length, tail length and tarsus length of males captured in three habitats, i.e. deciduous forest (DEC), willow-dominated wetland (WDW) and coniferous forest (CON).

	Habitats					
Trait	DEC	WDW	CON	F	df	p
Wing	70.54	71.40[1]	69.83[1]	3.163	111	0.046
Tail	52.97[3]	54.44[2,3]	52.17[2]	3.334	108	0.039
Tarsus	20.12	20.28	19.89	1.106	108	0.335

Habitat specific values marked with the same superscript differ according to Student-Newman-Keuls test at $p < 0.05$. The other pair-wise comparisons are not significant.

Males from WDW were the largest, while those from CON were the smallest in relation to wing length and tail length (Table 1). A posteriori test of Student-Newman-Keuls revealed that wing length differed significantly only between WDW and CON, while tail length differed between WDW and CON as well as between DEC and WDW (Table 1). The pattern in tarsus length was similar but non-significant (Table 1).

The present study confirms that male Willow Warblers differ in size among habitats of supposedly different quality. Ebenman & Nilsson (1981) found that Willow Warbler males from the mainland were larger with respect to several body morphometrics than those from small lake islands in southern Sweden. The islands presumably constituted a suboptimal habitat in relation to food abundance for the Willow Warbler, as shown by the collection of flying insects. Inter-habitat differences in morphometry of the Willow Warbler have also been recorded in southern Finland. Males occupying territories in the spruce-dominated area had shorter wings than those in the deciduous forest (Tiainen 1982).

The pattern of morphometric differentiation is subject to three alternative explanations. First, the larger males have prior access to optimal territories and force subordinate, smaller individuals to occupy suboptimal habitats (ideal despotic distribution; Fretwell 1972). Second, the Willow Warblers may choose niches for which they are morphologically best adapted (adaptive habitat choice; Wilson 1975, Lemel 1989). Third, a microevolutionary process may also be responsible for morphometric differentiation within a species. Such forces as selection and genetic drift, when coupled with reduced gene flow between habitats, may give rise to parapatric divergence (Marchetti 1993, Bush 1994).

The present data does not permit one to distinguish between the three hypotheses. A critical test would require data on settling order of Willow Warbler males in different habitats, reproductive success, food availability, or some other direct measure of habitat quality.

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References

Bush, G. L. 1994: Sympatric speciation in animals: new wine in old bottles. — Trends Ecol. Evol. 9: 285–288.

Ebenman, B. & Nilsson, S. G. 1981: Size patterns in willow warblers Phylloscopus trochilus on islands in a south Swedish lake and the nearby mainland. — Ibis 123: 528–534.

Fretwell, S. D. 1972: Populations in a Seasonal Environment. — Princeton University Press, Princeton.

Lemel, J. 1989: Habitat distribution in the Great Tit Parus major in relation to reproductive success, dominance, and biometry. — Ornis Scand. 20: 226–233.

Lundberg, A., Alatalo, R. V., Carlson, A. & Ulfstrand, S. 1981: Biometry, habitat distribution and breeding success in the Pied Flycatcher Ficedula hypoleuca. — Ornis Scand. 12: 68–79.

Marchetti, K. 1993: Dark habitats and bright birds illustrate the role of the environment in species divergence. — Nature 362: 149–152.

Tiainen, J. 1982: Ecological significance of morphometric variation in three sympatric Phylloscopus warblers. — Ann. Zool. Fennici 19: 285–295.

Ulfstrand, S., Alatalo, R., Carlsson, A. and Lundberg, A. 1981: Habitat distribution and body size of the Great Tit (Parus major). — Ibis 123: 494–499.

Wilson, D. S. 1975: The adequacy of body size as a niche difference. — Am. Nat. 109: 769–784.