Acta Biol. Univ. Daugavp. 15 (2) 2015
ISSN 1407 - 8953

SYLVIA WARBLERS IN DIFFERENT PARTS OF BREEDING RANGES: ADAPTIVE STRATEGIES IN NEST CONSTRUCTION

Sergey A. Simonov, Maria V. Matantseva

Simonov S.A., Matantseva M.V. 2015. *Sylvia* warblers in different parts of breeding ranges: adaptive strategies in nest construction. *Acta Biol. Univ. Daugavp., 15 (2): 359 – 365.*

In order to succeed within the bounds of a vast breeding range, birds have to be behaviourally flexible and develop site-specific adaptations. Particularly, for the most birds a nest is the crucial thing for reproduction and degree of nest conformity to local conditions could promote reproductive success and offspring survival. On the example of four bird species of genus *Sylvia* (Scopoli, 1769), Blackcaps *S. atricapilla* (Linnaeus, 1758), Garden Warblers *S. borin* (Boddaert, 1783), Common Whitethroats *S. communis* (Latham, 1787), and Lesser Whitethroats *S. curruca* (Linnaeus, 1758), we estimated the site-specific variability of nest parameters in two geographical locations: close to the central parts of the model species breeding ranges, on the Courish Spit of the Baltic Sea, and close to the northern periphery of them, in Karelia, Russia. Our research was based on the classic methods of breeding biology investigations, including measure of nest main parameters, characteristics of a construction and following fate of controlled nests. We found out that the nest parameters varied essentially within and between different geographical locations. On the one hand, according to some parameters, the nests in the northern region were significantly bigger than ones in the more southern places that seemed to be connected with the importance of good thermal insulating properties in more cold regions. Although, the larger nest size also could possibly be linked with an increase in clutch size observed in the northern regions in some species. For example, the clutch size of Blackcaps in Karelia was statistically larger than on the Courish Spit. On the other hand, within the same region we registered different types of nest shapes depending on plant-substrates. The other factors caused deviations in the nest shape and structure varied in the different taxa are discussed as well.

Key words: typical warblers, nest constructions, plant-substrates, species range.

Sergey A. Simonov, Maria V. Matantseva.Group of Ornithology, Laboratory of Zoology, Institute of Biology of the Karelian Research Centre, Russian Academy of Sciences, Petrozavodsk, Pushkinskaya Str., 11, Russian Federation, 185910, e-mail: ssaves@gmail.com

INTRODUCTION

A nest is one of the most significant parts of bird life, except few species. One can say that great variety of nest constructions and different nest material compositions can be two real demonstrations of birds' adaptations to different environmental conditions. High quality and optimal parameters of a nest construction can promote successful reproduction. On the one

hand, the optimal nest size and location together with the best behaviour strategy can realize the spatial function of nests and that can protect eggs and nestlings. On the other hand, optimal nest material compositions may guarantee good thermal insulation, ventilation, and humidity. All these qualities are interrelated, and only the summarized effects let birds realize reproduction function in a breeding range in temperate climate and in northlands.

The breeding parts of the bird species ranges in Europe embrace areas with absolutely different climate characteristics, plants and geomorphological conditions. Birds have the great variety of adaptations to different conditions, and the ethological plasticity lets them find the niche in anthropogenic changing biotopes. We can estimate the reserve of this plasticity by studying the behaviour and nest constructions in different parts of the breeding ranges and in the areas of a varying anthropogenic impact. The man-made ecological disturbance can force birds to use man-made materials; the anthropogenic transformation of biotopes force birds to breed in suboptimal and unspecific biotopes and plant-substrates. In the framework of this research we tried to analyze significance of differences of the nest constructions within and between the regions of the investigations.

MATERIAL AND METHODS

The study was conducted on 231 nests of typical warblers at two locations: in the Rybachy Biological station of the Zoological Institute, Russian Academy of Sciences, on the Courish Spit of the Baltic Sea, Kaliningrad region, Russian Federation (55°12' N, 20°50' E) and in the Mayachino Ornithological station of the Institute of Biology of the Karelian Research Centre, Russian Academy of Sciences, on the south-east shore of the Ladoga Lake, Karelian Republic, Russian Federation (60°46' N, 32°48' E). We selected four typical warbler species as the model objects: Blackcaps *Sylvia atricapilla* (Linnaeus, 1758), Garden Warblers *S. borin* (Boddaert, 1783), Common Whitethroats *S. communis* (Latham, 1787), and "Lesser Whitethroats *S. curruca* (Linnaeus, 1758). We provided the investigations in Rybachy during the breeding seasons of 2003 – 2005 and in Mayachino during the breeding seasons of 2007 – 2014. In order to analyze the nest constructions we selected basic measurements according to

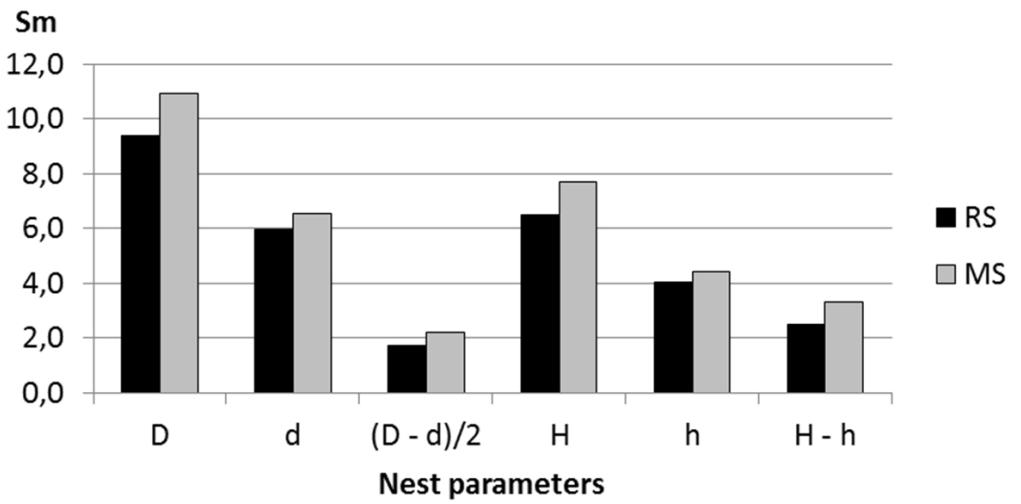

Fig. 1.Comparison of basic measurements of nest constructions in Blackcaps: D – an external diameter of a nest construction; d – an internal diameter of a nest construction; (D - d)/2 – thickness of a nest wall; H – nest height; h – nest depth; H - h – nest bottom thickness; RS – Rybachy Biological station (n = 38); MS – Mayachino Ornithological station (n = 51).

the traditional methods: internal and external diameters of a nest construction, height of a nest and depth of a nest construction. Using these parameters we had an ability to estimate thickness of insulation nest materials. Also we registered the species of plant-substrates and measured height of trees and shrubs and altitude of nest constructions in plant-substrates. All results were registered in field using pocket personal computers and special databases; besides that, we made photos with GPS tags of nests and plants-substrates. We realized the comparison of the measurements of the nests on the Courish Spit and in the Ladoga Lake Region using Mann-Whitney U-test in software StatGraphics 2.1 (Statistical Graphics Corp., 1994 – 1996) with $\alpha = 0.05$.

RESULTS

In Blackcaps of the Courish Spit we observed the smaller external diameter of nest constructions than in Karelia (Fig. 1; U = 195.5; p = 0.0004). The same situation is in the internal diameter of nest constructions of Blackcaps – nests on the Courish Spit are smaller than in Karelia (U = 189.0; p = 0.0005). Thickness of nest walls depends on the external and internal diameters of nests and according to our data the walls of nests in Karelia are thicker than on the Courish Spit (U = 190.5; p = 0.0008). The nest height and depth in Karelia are bigger than on the Courish Spit (U =166.5; p = 0.0146, and U = 164.0; p = 0.0154 correspondingly). But we did not find the significant difference in the nest bottom thickness between the regions.

Parameters of external diameters of nest constructions in Garden Warblers on the Courish Spit are smaller than in Karelia, too (Fig. 2; U = 149.0; p = 0.0097). But we did not observe the difference in internal diameters and in thickness of the walls of nest constructions. Nevertheless, we registered the difference in nest height, and in Karelia this parameter is bigger than on the Courish Spit (U = 137.0; p = 0.0351). In spite of this fact, we did not observe the difference in nest depth in Garden Warblers (U = 146.0; p = 0.0135).

In Lesser Whitethroats we registered that nest diameters in Karelian were bigger than on the Courish Spit (Fig. 3; U = 97.5; p = 0.0005). We observed the same situation for internal diameters (U = 73.5; p = 0.05), thickness of nest

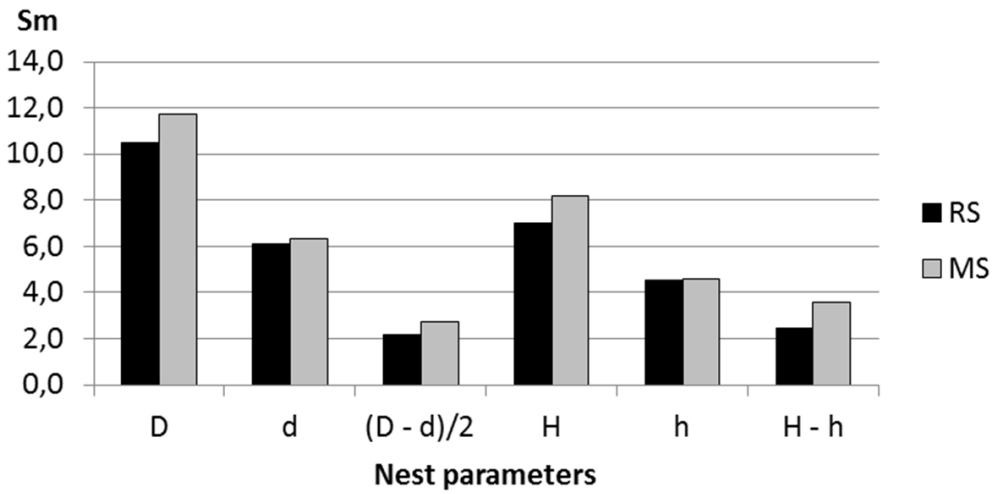

Fig. 2. – Comparison of basic measurements of nest constructions in Garden Warblers: D – an external diameter of a nest construction; d – an internal diameter of a nest construction; (D - d)/2 – thickness of nest wall; H – nest height; h – nest depth; H - h – nest bottom thickness; RS – Rybachy Biological station (n = 14); MS – Mayachino Ornithological station (n = 56).

walls (U = 94.0; p = 0.0012) and nest height (U = 74.5; p = 0.05). However, there were no differences in nest depth and in thickness of nest bottoms.

Specific of the territories and available nest construction materials stimulated birds to skip some materials. Furthermore, external conditions may necessitate birds to search appropriate equivalent materials. For example, Blackcaps and Lesser Whitethroats commonly use very thin spruce twigs as a basis of a nest construction and we did not register any exception for that in Karelian warblers. But on the Courish Spit and especially on the territory of Biological station Rybachy there were no appropriate coniferous and, as a result, we did not register spruce twigs in nest constructions.

In addition, we registered that warblers use available equivalents and they can use man-made materials in anthropogenic transformed biotopes. Birds on Courish Spit used the wild boar's bristle at the final stages of the nest construction process. But in the areas with high level of anthropogenic pressure birds used man-made materials in nest walls and bottoms (Table 1). Warblers preferred fishing-lines, parts of plastic packages and other artificial materials, but in all cases visually the shape of these materials was equivalent to natural. We did not register any situation of artificial materials in typical warblers' nests on territories of low anthropogenic pressure.

Against a background of differences in basic nest measurements, we pointed out that Typical Warblers in Karelia construct their nests higher than the birds on the Courish Spit (fig. 4).

DISCUSSION

On the whole, nest parameters in warblers are known (Ptushenko 1954, Averin & Ganya 1970, Persson 1971, Zatsepina 1978, MacDonald 1979, Maltchevsky & Pukinsky 1983, Simms 1985, etc.). In the paper we want to discuss some characteristics which differ between the regions, biotopes and in a result of anthropogenic pressure.

As stated earlier in the paper, the internal diameter of Blackcap nests in Karelia was bigger than on the Courish Spit. At the same time we registered the differences in the clutch sizes

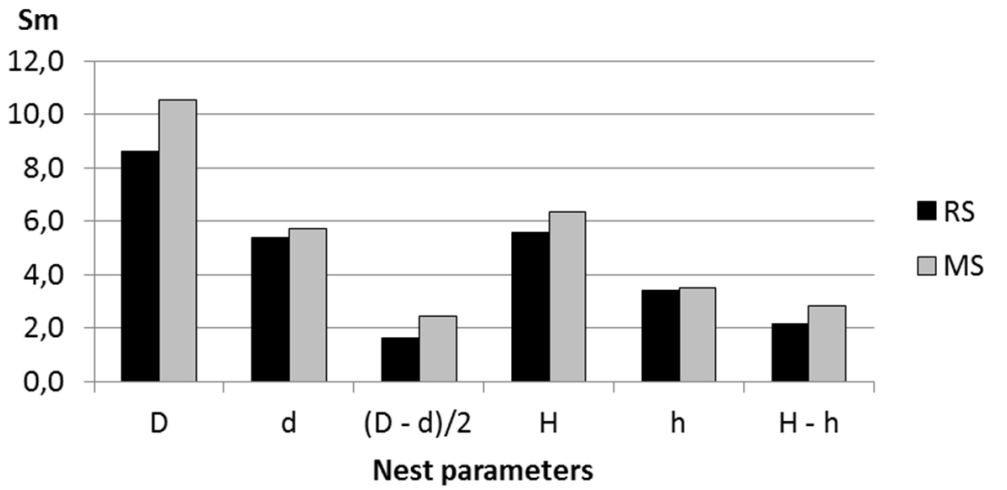

Fig. 3. – Comparison of basic measurements of nest constructions in Lesser White-throat Warblers: D – an external diameter of a nest construction; d – an internal diameter of a nest construction; (D - d)/2 – thickness of nest wall; H – nest height; h – nest depth; H - h – nest bottom thickness; RS – Rybachy Biological station (n = 13); MS – Mayachino Ornithological station (n = 34).

Table 1. Man-made materials in nests of typical warblers at the territory of Rybachy biological station, number of cases of use

Materials	*S. atricapilla*	*S. borin*	*S. communis*	*S. curruca*
Cuttings of fishing line	3	1	1	1
Synthetic fiber	1	1	–	–
Cuttings of threads	1	–	–	1
Fragments of polyethylene	–	–	1	–
Nests	38	14	19	13

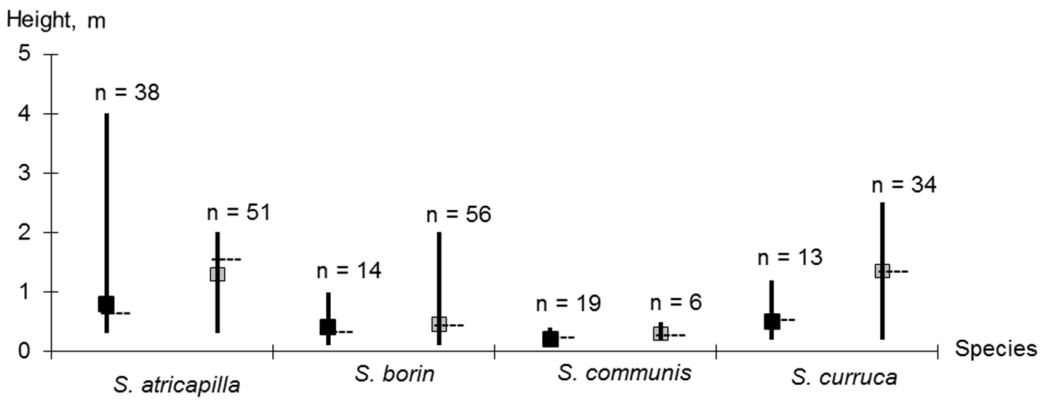

Fig. 4. Height of nest constructions at plants-substrates (minimum, maximum, ■ – median on Courish Spit, ■ – median in Karelia, ---- – mode).

between the regions: in nests on the Courish Spit we found fewer eggs than in Karelia ($U = 206.5$; $p = 0.0375$). Thus, the differences in clutch size in Blackcaps can be a reason of inequalities in nest parameters. On the other side, all parameters of Blackcap nests in Karelia were bigger than on the Courish Spit. That can be an attempt to compensate heat losses in the bleak climate of Karelia.

It is interesting, that in spite of the differences in plants-substrates between the regions of our investigations, we did not register significant inequalities in the ways by which Blackcap nests were fixed on the plants-substrates (Matantseva & Simonov 2008).

As noted earlier, we registered the differences in the nest parameters of Garden Warblers between the regions of investigations. At the same time, we did not find out significant differences in the clutch size and other measurable and countable parameters of Garden Warbler nest life, except one. Biotopes and plants in the regions of investigations are different, and as a result of this Garden Warblers have to select plants-substrates between available vegetation. Garden Warblers in Karelia prefer ferns (mostly *Dryopteris filix-mas* (Linnaeus) Schott, 1834) as plants-substrates and on the Courish Spit birds construct nests in shrubs (Matantseva & Simonov 2008). On the territory of Rybachy we registered the different ways by which Garden Warbler nests were fixed on the shrubs' branches, but within this area we did not find significant differences in the nest parameters (Matantseva & Simonov 2007). On the contrary, breeding in ferns is a reason of significant transformation of a nest construction. On the one hand, a nest in a fern may have triangle shape if we see the side view (Fig. 5). Thus, a bird starts a nest construction from whorl, and

the nest bottom becomes high (Fig. 5, A). On the other hand, birds choose ferns with vertical fronds, and then warblers "sew" nests to fronds. Most of Garden Warbler nests in Karelia are constructed by this way. But that is not typical way of nest constructions. So, birds "sew" nest walls to fern fronds using such materials as blades of grass, spider webs and others, so the force of friction hold the nest construction on the fronds (Fig. 5, B). Unfortunately, there we observed two situations when nest constructions slithered down with big nestlings. Fortunately, all nestlings survived. We suppose that most Garden Warblers in Karelia prefer second type of nest constructions (Fig. 5, B) because these nests become higher in the landscape. That can be adaptive as far as high position is drier and more protected against some small ground predators.

We did not register differences in the clutch size of Lesser Whitethroats between the regions of the investigations. But as it was mentioned previously, the nests of this species in Karelia were bigger than the nests on the Courish Spit. These differences can be a result of differences in available and preferable plants-substrates between the regions. So, on the Courish Spit Lesser Whitethroats prefer common junipers (*Juniperus communis* Linnaeus, 1753) and spruce (*Picea abies* (Linnaeus) H. Karst., 1881) whorls. These substrates cut down abilities to enlarge the external diameter of a nest construction. To the contrary, in Karelia there are not enough junipers, and the birds prefer two small spruces growing together or hanged down boughs of a big spruce (Fig. 6). These types of plants-substrates do not limit external diameter of nests. Moreover, in such a situation it can be adoptive to enlarge the external diameter of a nest construction. Firstly, that can be useful for better fixing the nest construction. Secondly, that can provide additional thermal insulation (Redman et al. 1999; Lamprecht & Schmolz 2004). Good thermal insulation qualities may be crucial in regions with unstable climate, which is Karelia. That can be a particular problem for birds in surroundings of the Mayachino, because the Ladoga Lake shore is very windy, but appropriate spruces can be found close to the shore. So, birds can be subjects to strong winds and storms. Under such rough conditions all adaptations may increase the reproductive success of birds.

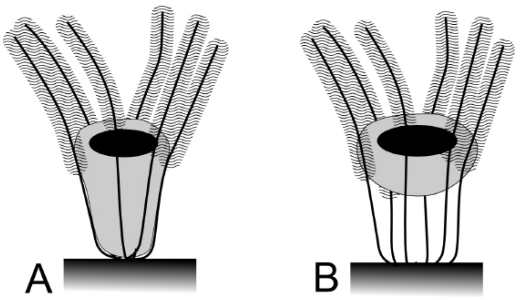

Fig. 5. Positions of nest constructions in fern fronds: A – a high nest, B – a "sewed" nest.

The reasons of differences in the height of the nest locations are not clearly defined. At the first glance, it can be a result of the different plants-substrates. Besides, warblers in Karelia, whether they are shrubs-breeders or ferns-breeders, may protect the nests against reptiles and mammal predators.

CONCLUSIONS

As has been shown in this study, adaptive approaches in the nest construction process may vary from a location to a location and from a biotope to a biotope. The basic trends of the warblers' adaptations are the following:

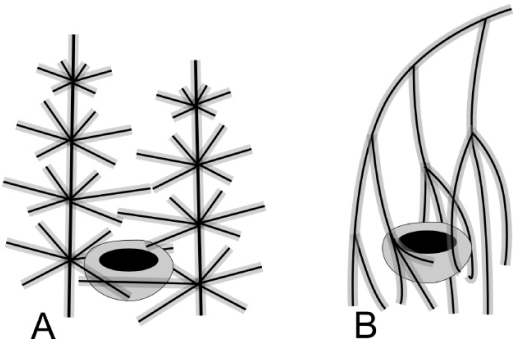

Fig. 6. Positions of nests in spruces: A – two small spruces growing together, B - hanged down boughs of a big spruce.

- In the bleak climate of the northern areas nest parameters are bigger, than in central parts of the range.
- If we register differences in the clutch size between the regions, then the bigger clutch have to be accompanied by the bigger nest size.
- Some plants-substrates change the nest shape, and the construction can become higher or wider than usually.
- If necessary, birds can find appropriate equivalents for typical nest materials as well as the fact that birds can use man-made materials with suitable physical characteristics.

ACKNOWLEDGEMENT

We are grateful to the leadership of Rybachy Biological station of the Zoological Institute, Russian Academy of Sciences and the Institute of biology of Karelian Research Centre, Russian Academy of Sciences that allowed us to provide field work. We also thank our colleagues and directorate for their support. Our work was financially supported by the grant of the President of the Russian Federation MK-3599.2015.4, the Russian Foundation for Basic Research 15-05-03493_a and the State order, project № 0221-2014-0006.

REFERENCES

Averin Y.V., Ganya I.M. 1970. Птицы Молдавии. (Birds of Moldavia). Vol. 2. Kishinev. Pp. 1 – 240. (In Russian).

Lamprecht I., Schmolz E. 2004. Thermal investigations of some bird nests. *Thermochimica Acta*, 415: 141 – 148.

MacDonald D. 1979. Notes on the Whitethroat in Sutherland. Scott. *Birds*, 10: 296 – 305.

Maltchevsky A.S., Pukinsky Y.B. 1983. Птицы Ленинградской области и сопредельных территорий: в 2 т. (Birds of Leningrad Region and surroundings: 2 volumes). Vol. 2. L. Pp. 1 – 504. (In Russian).

Matantseva M.V., Simonov S.A. 2007. Особенности биологии размножения славок в мозаичных местообитаниях Куршской косы Балтийского моря. (Characteristics of reproductive period in typical warblers on the Courish Spit of the Baltic Sea). Materials of Int. Conf. Biology of XXI Century: theory, practice, development. Kiev. Pp. 435 – 437.

Matantseva, M.V. & Simonov, S.A. 2008. Ecological and ethological characteristics of *Sylvia* Warblers colonies in patchy habitats on the Courland spit, Baltic sea. *Russian Journal of Ecology*, 39 (5): 353 – 358.

Persson B. 1971. Habitat selection and nesting of a South Swedish whitethroat *Sylvia communis* Lath. population. *Ornith Scand*., 2: 119 – 126.

Ptushenko E.S. 1954. Семейство славковые *Sylviidae*. (*Sylviidae* family). In: Dementiev G.P. et al (eds.): Птицы Советского Союза. (Birds of USSR). Vol. 6. M. Pp. 142 – 398. (In Russian).

Redman P., Selman C., Speakman J. R. 1999. Male short-tailed field voles (*Microtus agrestis*) build better insulated nests than females. *J. Comp. Physiol. B.*, 169: 581 – 587.

Simms E. 1985. British Warblers. London. Pp. 1 – 432.

Zatsepina R.A. 1978. Семейство славковые *Sylviidae* (*Sylviidae* family). In: Птицы Волжско-Камского края: Воробьиные. (Birds of Volga-Kama rivers Region: Passeriformes). M. Pp. 94 – 132.

Received: 28.04.2015.
Accepted: 06.07.2015.