

- SHELDON B.C., RASANEN K. & DIAS P.C. 1997: Certainty of paternity and paternal effort in the collared flycatcher. — *Behav. Ecol.* **8**: 421–428.
- SHY M.M. 1982: Interspecific feeding among birds: A review. — *J. Field Ornithol.* **53**: 370–393.
- SKUTCH F.A. 1961: Helpers among Birds. — *Condor* **63**: 198–226.
- SKUTCH F.A. 1999: Helpers at bird nests. A worldwide survey of cooperative breeding and related behaviour. An expanded edition. University of Iowa Press, Iowa City.
- TABORSKY M. & LIMBERGER D. 1981: Helpers in Fish. — *Behav. Ecol. Sociobiol.* **8**: 143–145.
- TÖRÖK J. 1985: Comparative ecological studies on blackbird (*Turdus merula*) and song thrush (*T. philomelos*) populations. Nutritional ecology. — *Opusc. Zool. Budapest* **21**: 105–135.
- VIVALDI M. M., MARTINEZ J. G., PALOMINO J. J. & SOLER M. 2002: Extrapair paternity in the Hoopoe *Upupa epops*: an exploration of the influence of interactions between breeding pairs, non-pair males and strophe length. — *Ibis* **144**: 236–247.
- WINKEL W., BRUN J. & LUBJUHN T. 1998: Paternity analyses of a trigyneous Pied Flycatcher (*Ficedula hypoleuca*). — *J. Ornithol.* **139**: 349–351.

Došlo: 22. 8. 2009

Prijaté: 8. 9. 2009

Habitat characteristics of the Wallcreeper (*Tichodroma muraria*) breeding and wintering sites in the Western Carpathians

Charakteristiky habitatu v hniezdných a zimných lokalitách murárika červenokrídneho (Tichodroma muraria) v Západných Karpatoch

Miroslav SANIGA

Institute of Forest ecology SAS, Research station, 976 02 Staré Hory, Slovakia; uelsav@bb.sanet.sk

The fact that the very rare Wallcreeper (*Tichodroma muraria*) is a typical habitat specialist, occupying rock faces often remote from human civilization explains the low level of knowledge about its life and behaviour. There have been several key ecological and ethological studies of this bird in Central Europe, both in the wild (e.g. Noll 1957, Müller 1962, 1965, Bezzel 1967, 1993, Dorka 1976, Maire 1987, Hernández et al. 1993, Géroutet 1994a, b), and in the captivity (Noll 1956, Kottek 1965). The most comprehensive appraisal Wallcreeper biology was made by Löhr (1967, 1970, 1971), who had studied Wallcreepers in the wild as well as in the captivity. Habitat selection and habitat require-

ments were studied especially by Hauri (1970, 1978) and Löhr (1975, 1976). The populations of the Wallcreeper in the Veľká Fatra Mts. were systematically studied in the period 1982–1998 and in the Malá Fatra Mts. in 1988–2008. Some results concerning the ecology and ethology of this bird have already been published (Saniga 1993, 1995a, b, 1999). The aim of this study is to describe habitat characteristics of the breeding and wintering grounds of the Wallcreeper in the Western Carpathians.

In the period 1982–2008, the habitat requirements of the Wallcreeper were studied in the wild throughout the year (breeding territory size, structure of rock faces and vegetation co-

ver). Great care was taken to avoid disturbance of this rare species. Birds were always observed from a hide, so that their behaviour was not affected. Because the Wallcreeper inhabits a large territory, both horizontally and vertically, which is often very rugged with many split and shattered rock faces, the observer cannot overlook the whole territory from one location. Continuous recording of Wallcreeper activity is seldom possible. Wallcreeper populations were studied in the mountains of central Slovakia (Veľká and Malá Fatra Mts., Chočské vrchy Mts.; N 48°47' – 49°19', E 18°50' – 19°35'). Behavioural observations were carried out at 15 different breeding haunts and 11 winter sites (for details see Saniga 1995a, b).

In the study area, Wallcreepers breed two typical habitats; in mountain regions in areas of steep rock faces (73%, n = 15) and in precipitous boulder-strewn slopes (27%, limestone being exclusively the preferred substrate). Individual breeding rock faces were characterized by a markedly structured and fissured surface (overhangs, crevices, fissures, ledges) covered with clumps of vegetation (grass, trees, and moss in the gorges) (Figs. 1, 2). Typically, in all breeding grounds, different sections of rock face were bathed in sunlight at different times of day. The birds studied favoured rocky sites where sections of rock faces lay at varied aspects to the sun. Optimal habitat comprised such locations with a markedly broken and structured surface (overhangs, crevices and ledges). These localities allow diverse plant communities, and their attendant insect and spider communities to flourish, thus providing the Wallcreeper with a greater abundance of food than can exist on solid, smooth rock walls of a single aspect to the sun. The latter habitat is suboptimal for the Wallcreeper, and remain unoccupied if they lack overhangs, ledges and cavities, because not only is vegetation and food scarce, but there are no dry feeding places during rainy weather. Potential Wallcreeper breeding sites have certain limiting characteristics: 1) a considerably structured rock face surface whose overhangs, ledges, fissures and crevices contain clumps of vegetation; 2) the component rock faces lie at

various aspects to the sun, or whose aspect is modified by tree-shadow moving across it; 3) within the rock face vegetation, an abundance of food (insects and spiders); 4) availability of suitable potential nest- and roost-crevices inaccessible to mammalian predators (particularly to *Mustela erminea* and *Martes foina*); 5) potential nest- and roost-crevices which remain dry during and also after precipitation.

Although flowing water is often present in the vicinity of a Wallcreeper breeding haunt, it is not a necessary precondition (contrary to Dorka 1976, Löhrl 1976). In study area, 75% of pairs occupied limestone rock faces remote 200 to 1100 m from flowing water (distance from nest crevice). Löhrl (1976) had stated that all investigated sites included or were adjacent to running water, and that it would be unlikely that Wallcreeper would breed on rock faces lacking water. Similarly Dorka (1976) suggested that the presence of moisture in the immediate neighbourhood of the nest was an essential factor in the Wallcreeper's choice of a breeding site.

The territory size differed according to habitat quality, smaller territories occurring in optimal habitat. It is limited by geomorphology of particular breeding site, and most of breeding sites is occupied only by one pair (80%). Feeding territory varied in size, but proved to be much larger than those of similar-sized bird species occupying the same habitat (e.g. *Phoenicurus ochruros*). The size of Wallcreeper territories in the end is not easy to measure, because the area of suitable feeding habitat within a territory can neither be observed nor measured to its full extent due to the territory's inaccessibility and the nature of its heavily indented and fissured surface. The birds range widely for food across their territories, often being lost to sight.

Regarding general knowledge, the Wallcreeper inhabits rock faces in the high mountain ranges of Europe and Asia, extending from the Cantabrians and Pyrenees in the west, through the Alps, the Carpathians, the Balkan peninsula, Asia Minor, the Caucasus, Iran, and particularly to the Himalayas and their extensions (Cramp & Perrins 1993). In the Western Palearctic, it breeds in the montane regions of lower middle



Fig. 1. Breeding habitat of Wallcreeper in the Veľká Fatra Mts., Slovakia, limestone rock face of about 800 m in length and 30–40 m in height at an altitude of 1400–1480 m, prevailing SE aspect (Photo by M. Saniga).

Obr. 1. Hniezdny biotop murárika červenokrídleho vo Veľkej Fatre, Slovensko, vápencovo-dolomitová skalná stena 800 m dlhá a 30–40 m vysoká v nadmorskej výške 1400–1480 m, prevažne juhovýchodná expozícia (Foto: M. Saniga).



Fig. 2. Limiting characteristic of the Wallcreeper breeding habitat – a considerably structured rock face with overhangs, ledges, fissures and crevices (Photo by M. Saniga).

Obr. 2. Limitujúca charakteristika hniezdného biotopu murárika červenokrídleho – značne štrukturovaný skalný povrch s prevismi, skalnými policami, nerovnosťami a škárami (Foto: M. Saniga).

latitudes, in rocky, broken terrain (Löhr 1976, Cramp & Perrins 1993). It prefers rocky (especially limestone) terrain with varied plant cover which harbours insects and spiders, rather than bare rock faces. Its territory is often near flowing water (Löhr 1976, Hernández et al 1993).

In central Slovakia, the general character of the Wallcreeper winter habitat created prevalently abandoned limestone quarries between 450 and 800 m a.s.l (1–150 ha). Also villages and towns situated near the breeding grounds were used by Wallcreepers as winter sites (e.g. Ružomberok, Banská Bystrica, Staré Hory, Liptovské Revúce, Terchová, Zázrivá, Valaská Dubová). There have been a few observations of Wallcreeper in the breeding grounds also during the winter months (December – February); almost exclusively during favourable spells of weather (inversion with the temperature above zero). Such behaviour was observed during prevailing inversion weather, as the higher rock faces on the ridges are illuminated by the sun much earlier, and during the day they become much warmer than rock walls (quarries) in the gorges. Furthermore, the rock faces on the ridges engender greater activity amongst insects and spiders, enabling Wallcreepers to find food more easily. Moreover, on these rock faces, birds can begin to sunbathe much earlier than in the shadowed rock walls in gorges in the most part of the day. During meteorological inversions (in lower altitudes cold and foggy, in higher localities sunny and warm), birds have remained on the rock cliffs above the fog until it dispersed (November 18 and 22, 2007 in the Veľká Fatra Mts.).

Súhrn

V rokoch 1982–2008 boli skúmané charakteristické črty hniezdných a zimných lokalít výskytu murárika červenokrídleho (*Tichodroma muraria*) v oblasti stredného Slovenska (Malá a Veľká Fatra, Chočské vrchy). Všetky hniezdne lokality boli situované v intervale nadmorských výšok 400 až 1550 m. Päť hniezdisk bolo zistených v skalných tiesňavách medzi 500 až 1000 m n. m. Desať hniezdných lokalít bolo situovaných na skalných stenách viac-menej ďaleko (200–500

m) od vody v nadmorských výškach 500 až 1550 m n. m. Dvanásť z pätnástich hniezdných lokalít ležalo v intervale nadmorskej výšky 800–1200 m. Hniezdne lokality charakterizoval značne štrukturovaný skalný povrch (previsy, škáry, skalné police, výstupky) pokryté trsmi vegetácie (tráva, kvety, mach). Charakteristickou črtou hniezdného biotopu bola značná diferenciácia v orientácii skalných partií voči svetovým stranám. Muráriky preferovali lokality, kde sekcie skál mali rôznu orientáciu k svetovým stranám. Optimálny biotop predstavovali takéto skalné lokality so značne štrukturovaným skalným povrchom. Takéto stanovišťa podmieňujú výskyt pestrejších rastlinných spoločenstiev, ktoré následne znamenajú vyššiu druhovú diverzitu hmyzu a pavúkov, ktoré dominujú v potrave murárika. V skúmaných pohoriach hniezdne lokality murárika boli lokalizované výlučne na vápencovo-dolomitickom podklade. Stanovišťa zimného výskytu murárika predstavovali v prevažnej miere opustené kameňolomy lokalizované v nadmorskej výške 450 až 800 m n. m. o veľkosti 1 až 150 ha. Taktiež dediny a mestá situované v blízkosti hniezdných lokalít boli murárikmi využívané počas zimného obdobia (napr. Ružomberok, Banská Bystrica, Staré Hory, Liptovské Revúce, Terchová, Zázrivá, Valaská Dubová).

Acknowledgements

This work was founded from the grants of VEGA (Nos. 2/0130/08 and 2/0110/09).

References

- BEZZEL E. 1967: Einige Notizen über den Mauerläufer (*Tichodroma muraria*) in den Bayerischen Alpen. — Anz. orn. Ges. Bayern **8**: 172–174.
- BEZZEL E. 1993: Der Mauerläufer *Tichodroma muraria* im Werdenfelser Land, Oberbayern. — Limicola **7**: 35–48.
- CRAMP S. & PERRINS C. M. 1993: Handbook of the birds of Europe, the Middle East and North Africa. Voll. VII. — Oxford, Oxford Univ. Press.
- DORKA V. 1976: Beobachtungsnotizen zum Nestbau – und Lautverhalten eines Pyrenäen–Mauerläufers. — Anz. orn. Ges. Bayern **15**: 202–215.

- GEROUDET P. 1994a: Le Tichodrome échelette (*Tichodroma muraria*) dans le Jura suisse: répartition des nicheurs. — Nos Oiseaux **42**: 379–410.
- GEROUDET P. 1994b: Autour du Tichodrome et de ses nidifications jurassiennes: réflexions sur l'oiseau et es hommes. — Nos Oiseaux **42**: 461–475.
- HAURI R. 1970: Zur Lebensweise des Mauerläufers *Tichodroma muraria* im Winter. — Ornithol. Beob. Bern **67**: 14–34.
- HAURI R. 1978: Beiträge zur Brutbiologie des Mauerläufers *Tichodroma muraria*. — Ornithol. Beob. Bern **75**: 173–192.
- HERNÁNDEZ A., ALEGRE J., VELASCO T. & CASAS V. M. 1993: Hábitat del Treparriscos *Tichodroma muraria* en la Península Ibérica e Islas Baleares. — Bull. GCA **10**: 39–45.
- KOTTEK E. 1965: Die Aufzucht junger Mauerläufer, *Tichodroma muraria* (L. 1766). — Beitr. z. Vogelkde. **11**: 48–54.
- LÖHRL H. 1967: Bewegungsweisen des Mauerläufers *Tichodroma muraria* im Hinblick auf die Anpassung an seinen Biotop. — J. Ornithol. **108**: 165–186.
- LÖHRL H. 1970: Studies of less familiar birds. 158 Wallcreeper. — Brit. Birds **63**: 163–168.
- LÖHRL H. 1971: *Tichodroma muraria* (Sittidae), Sand- und Sonnenbaden. — Encyclopaedia Cinematographica, Göttingen.
- LÖHRL H. 1975: Brutverhalten und Jugendentwicklung beim Mauerläufer, *Tichodroma muraria*. — J. Ornithol. **116**: 229–262.
- LÖHRL H. 1976: Der Mauerläufer. — A. Ziemsen Publishers, Wittenberg-Lutherstadt.
- MAIRE M. 1987: Nidification du Tichodrome au Salève (Haute-Savoie). — Nos Oiseaux **39**: 49–52.
- MÜLLER A.K. 1962: Zur Biologie des Mauerläufers (*Tichodroma muraria*). — Anz. orn. Ges. Bayern **6**: 359–361.
- MÜLLER A. K. 1965: Weitere Beiträge zur Biologie des Mauerläufers (*Tichodroma muraria*). — Anz. orn. Ges. Bayern **7**: 333–335.
- NÖLL H. 1956: Aus Leben und Forschung von E.H. Zollikofer. — Ber. St. Gallen naturw. Ges. **75**: 68–74.
- NÖLL H. 1957: Notizen von E. H. Zollikofer über das Freileben des Mauerläufers, *Tichodroma muraria*. — Ornithol. Beob. **54**: 45–50.
- SANIGA M. 1993: Some knowledge on the Wallcreeper (*Tichodroma muraria* L.) in the Malá and Veľká Fatra mountains. — Tichodroma **5**: 143–153.
- SANIGA M. 1995a: Seasonal distribution, habitat, and territory of Wallcreeper (*Tichodroma muraria*) in the Veľká Fatra mountains (West Carpathians). — Biologia, Bratislava **50**: 195–202.
- SANIGA M. 1995b: Seasonal distribution, altitudinal and horizontal migration of the Wallcreeper (*Tichodroma muraria*) in the Malá Fatra mountains, Slovak Carpathians. — Folia Zool. **44**: 237–246.
- SANIGA M. 1999: An ecological and ethological study of Wallcreeper (*Tichodroma muraria*) in the Slovak Carpathians. — Folia Zool. Monogr. **2**: 1–54.

Došlo: 17. 1. 2009
Prijaté: 28. 10. 2009