Bird Study (2000) **47,** 252–254

SHORT REPORT

The Roller *Coracias garrulus* in Extremadura (southwestern Spain) does not show a preference for breeding in clean nestboxes

JESÚS M. AVILÉS*, JUAN M. SÁNCHEZ and DESEADA PAREJO

Grupo de Investigación en Conservación, Biología Animal, Universidad de Extremadura, Avda de Elvas s/n, E-06071 Badajoz, Spain

Many hole-nesting birds show a preference for clean nestboxes for breeding[1,2] in order to avoid parasites accumulated in the nest material that might reduce the fitness of nesting birds.[3,4] However, many birds do not increase their breeding rates by nesting in clean nestboxes, and some even show preference for used nestboxes.[5,6] The Roller *Coracias garrulus* is a typical hole-nesting bird whose breeding populations are declining across the Palearctic region.[7] In Spain their populations are highly fragmented,[8] although some local increase in steppes of the southwest of Iberia have been recorded because of nestbox installation.[9] However, there are no data available on nestbox selection by Rollers in relation to their previous use. We report on nestbox selection and breeding performance of Roller in boxes installed and occupied by the species the previous year and in boxes installed the year of study.

The study was undertaken in the Serena region (39°03′N, 5°14′W) in the southwest of Spain. It is in the mesomediterranean climate area,[10] and during May and June the mean temperature is 17.7°C and the mean rainfall is 11.6 mm. The area is characterized by the predominance of dry pastures and cereal crops.[11]

In 1989, 69 nestboxes were installed on the supports of electric power lines crossing the pasture land area.[12] We visited nestboxes weekly from early May to determine occupancy. In 1989, 39.1% ($n = 27$) of nestboxes were occupied. In 1990, 181 new boxes were installed in the same pasture land as in 1989. Rollers nesting in the previously occupied (henceforth: used nestboxes) and in the non-used boxes were monitored weekly from early May. Visits were increased (one visit every 3–4 days) during the nesting period to accurately determine breeding success. First-egg date was determined by subtracting the incubation period of the species from the hatching date.[13] Hatching date was determined by experienced observers, who took into account the two dayslaying interval of Roller.[13] We measured the percentage hatching success as the percentage of eggs within each clutch that hatched and the number of fledglings per successful nest in which at least one chick fledged. Breeding success was estimated as the number of fledglings per pair that laid at least one egg, and the proportion of breeding pairs as the proportion of pairs with fledglings of the pairs that laid eggs.

In 1990, Kestrels *Falco tinnunculus* occupied six used nestboxes before Rollers began to breed. Therefore, we calculate the availability of used nestboxes as the number of boxes previously occupied by Rollers minus the number selected by Kestrels before the start of laying. The number of non-used nestboxes available is described as the number of nestboxes installed in 1990 minus the 32 nestboxes used by Kestrels before the start of laying of Rollers.

Nestbox selection was tested by means of the Savage electivity index.[a] Non-parametric methods were used for statistical analyses: Mann–Whitney (Z) was used to test differences in median reproductive rates and in comparing the percentage of breeding pairs. Sample sizes for each calculation are indicated in parentheses.

Rollers occupied 76.2% ($n = 21$) of the used and 32.9% ($n = 149$) of the non-used nestboxes.

*Correspondence author.
Email: javiles@unex.es

However, in no instance was the selection of nestbox type different than expected from the availability (W_i = 1.99 and W_i = 0.85 respectively for used and non-used nestbox types, $P > 0.05$ in both cases[a]). Rollers breeding in used nestboxes showed a significant earlier laying date (Table 1), while no significant differences were detected in clutch size, hatching success, breeding success, number of fledglings per successful nest and percentage of breeding pairs in relation to nestbox type (Table 1).

Rollers did not show any clear preference for non-used nestboxes in the Serena region. A similar result has been reported for Pied Flycatcher in northern Europe,[5,6] where the low level of nest parasites allows a non-adaptive choice of nestboxes. However, in southern study areas, where a higher prevalence of nest parasites is expected,[5] Pied Flycatchers clearly preferred the non-used nestboxes to increase their breeding success.[1] Earlier studies in northern Europe show that Rollers change nest holes every three or four years.[16] These changes are most probably explained by the fact that Rollers do not expel faeces from their nest,[13] and the accumulated dry mass over one breeding season may occupy about 0.1 m^2 – a good habitat for mites and lice.[16] However, in spite of the higher expected pressure of nest ectoparasites in southern latitudes,[5] Rollers in our study area did not show any difference in breeding performance in non-used nestboxes.

Some birds clean out used nestboxes[17,18] or they construct new nests,[19] which reduces nest parasitism. However, we did not observe Rollers cleaning the nestboxes or carrying new materials to any of the boxes.

Although the absence of an adaptive choice of nestboxes and the evidence from our observations of birds suggest a low prevalence of nestbox parasites in the Roller in southern latitudes, specific studies on prevalence of ectoparasites and their effects are needed to test this hypothesis.

Early occupation of used nestboxes by Rollers might be interpreted as nest-site fidelity of a pair to the nestbox already used by them in the previous breeding season. However, this could not be confirmed because Rollers were not ringed during this study. Previous studies where nest-site fidelity of this species is documented are based on yearly successive occupation of one nest without birds individually identified.[16]

ACKNOWLEDGEMENTS

We are grateful to C. Fuentes, E. Costillo, M. Flores and the Guard service of Dirección General de Medio Ambiente de la junta de Extremadura for their field assistance. We thank J.C. Senar and one anonymous referee for constructive criticism of an earlier version of the manuscript.

ENDNOTE

a. $W_i = U_i/D_i$ (ref. 14) where $U_i = u_i/u$ (u_i is the observed number of each nestbox type used by

Table 1. Roller breeding performance in relation to nestbox use. Values are mean ± sd. Sample size *n* is given in parentheses. Mean laying date is expressed in days from January 1.

	Nestboxes		Statistics	
	Not-used	Used	*Z*	*P*
Mean laying date	151.2 ± 7.7	145.6 ± 10.6	2.3	0.02
	(49)	(16)		
Mean clutch size	4.1 ± 1.2	4.3 ± 1.1	–0.8	0.42
	(49)	(16)		
Hatching success	70.6 ± 36.5	58.9 ± 42.7	0.9	0.37
	(47)	(16)		
Breeding success	2.9 ± 1.6	2.7 ± 2.2	–0.9	0.36
	(47)	(16)		
Fledglings per successful nest	3.6 ± 1.0	4.0 ± 1.4	0.2	
	(39)	(11)		0.87
% of breeding pairs	82.9	68.8		0.24

the species, u is the total number of nestboxes used in the study area) and $D_i = d_i/d$ (d_i is the total number of each nestbox type available, d is the total number of nestboxes in the study area). The index ranges from 0 to infinity; values approach 0 for increasing avoidance and infinity for increasing preference. The index has a value of 1 when use is proportional to availability. The departure of the use of each nestbox from a distribution proportional to its availability was tested using the statistic $(W_i - 1)^2/ es(W_i)^2$, which follows a χ^2 distribution with 1 degree of freedom. $[es(W_i)]$ is the standard error of the index approximately given by $\sqrt{(1 - D_i)/(u + D_i)}$.[15]

REFERENCES

1. Merino, S. & Potti, J. (1995) Pied Flycatchers prefer to nest in clean nestboxes in an area with detrimental nest ectoparasites. *Condor*, **97**, 828–831.
2. Rendell, W.B. & Verbeek, N.A.M. (1996) Old nest material in nestboxes of Tree Swallows: effects on nest-site choice and nest building. *Auk*, **113,** 319–328.
3. Møller, A.P. (1989) Parasites, predators and nestboxes: facts and artefacts in nestbox studies of birds? *Oikos*, **56**, 421–423.
4. Møller, A.P. (1997) Parasitism and the evolution of host life history. In *Host-parasite Evolution. General Principles & Avian Models,* (eds D.H. Clayton & J. Moore), pp. 105–127. Oxford University Press, Oxford.
5. Orell, M., Rytkönen, S. & Ilomäka, K. (1993) Do Pied Flycatchers prefer nestboxes with old nest material? *Ann. Zool. Fenn*., **30**, 313–316.
6. Mappes, T., Mappes, J. & Kotaho, J. (1994) Ectoparasites, nest site choice and breeding success in the Pied Flycatcher. *Oecologia*, **98**, 53–60.
7. Tucker, G.M. & Heath, H.F. (1994) *Birds in Europe: Their Conservation Status.* Birdlife International, Cambridge.
8. Purroy, F. (1997) *Atlas de las Aves Ridificantes de España. 1975–1995.* Lynx Editions, Madrid.
9. Avilés, J.M. & Sánchez, A. (1997) Evolución del numero de parejas reproductoras de Carraca *Coracias garrulus* en cinco hábitats de Extremadura. *Butlletí del Grup Catalá D'Anellament*, **14**, 25–29.
10. Rivas-Martínez, S. (1981) *Memoria del Mapa de Series de Vegetación de España.* Ministerio de Agricultura Pesca y Alimentación, ICONA, Madrid.
11. Avilés, J.M. & Sánchez, A. (1998) Crecimiento de los pollos de Carraca *Coracias garrulus* en medios esteparios de Extremadura: (SO península ibérica): influencia de las precipitaciones. *Misc. Zool.*, **21**(2), 1–7.
12. Sánchez, A. & Sánchez, J. M. (1991) Resultados de la ocupación de cajas anidaderas en tendidos eléctricos en Extremadura (Oeste de España): 1986–1990. *Ecología,* **5**: 375–381.
13. Cramp, S. & Simmons, K.E.L., eds (1988) *The Birds of the Western Paleartic,* Vol 5. Oxford University Press, Oxford.
14. Savage, R.E. (1931) The relation between the feeding of the herring off the east coast of England and the plankton of the surrounding waters. *Fish. Invest. Minist. Agric. Food Fish.* **12**, 1–88.
15. Manly, B., Mcdonald, L. & Thomas, D. (1993) *Resource Selection by Animals. Statistical Design and Analysis for Field Studies.* Chapman & Hall, London.
16. Sosnowski, J. & Chmielewski, S. (1996) Breeding biology of the Roller *Coracias garrulus* in Puszcza Pilicka Forest (Central Poland). *Acta Ornithol.*, **31**, 119–131.
17. Thompson, C.F. & Neill, A.J. (1991) House Wrens do not prefer clean nestboxes. *Anim. Behav*. **42**, 1022–1024.
18. Johnson, L.S. (1996) Removal of old nest material from the nesting sites of House Wrens: effects on nest site attractiveness and ectoparasite load. *J. Field Ornithol.* **67**, 212–221.
19. Winkler, D.W. (1993) Use and importance of feathers as nest lining in Tree Swallows (*Tachycineta bicolor*). *Auk*, **110**, 29–36.

(MS received 29 August 1999; revised MS accepted 15 November 1999)