

HABITAT AND NEST SITE PREFERENCES OF *SYLVIA* *ATRICAPILLA* AND *S. MELANOCEPHALA* IN MAJORCA

PREFERENCIAS DE HÁBITAT Y SITIOS DE NIDIFICACIÓN
DE *SYLVIA ATRICAPILLA* Y *S. MELANOCEPHALA* EN MALLORCA

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Sylvia melanocephala (*S. m.*) and *S. atricapilla* (*S. a.*) are common in woody habitats of the western Mediterranean. Nevertheless, detailed information on habitat and particularly nest site preferences is scarce. Within its western Palaearctic distribution, *S. m.* breeds in the Mediterranean zone, mainly in dry coastal regions and on islands (Snow & Perrins, 1998). Blackcap is distributed over all middle latitudes in Europe to the Ural Mountains, including temperate, boreal and Mediterranean climates. Habitat and nest site preferences of these two species were examined, one in the centre, the other almost at the edge of its range. Two coastal pine forests on the Balearic Island of Mallorca were chosen, where both species breed sympatric in high densities (Avella *et al.*, 1997). We expected that both species would cover their entire spectrum of suitable habitats and possibly meet in the ecotone between maquis and coastal pine forest vegetation (Cody & Walter, 1976).

Three study plots (Puig Sant Marti, PSM, 30 ha; Son Sant Marti, SSM, 8 ha; and Can Sant Marti CSM, 17,4 ha) were chosen at almost sea level near the eastern coast of Majorca (39°50' N, 3°15' W), where singing individuals were recorded in a mosaic of pine forest and maquis. Approximately half of the areas were grown with Aleppo pines *Pinus halepensis*, which allow a dense shrub layer below the canopy, mostly *Pistacea lentiscus* and other shrubs in diverging portions. The remaining areas were grown by a low maquis vegetation dominated by *Pistacea* also, but with higher densities of *Erica arborea*, *Smilax aspera*, *Myrtus*

communis, young *Pinus halepensis*-trees, and grass stands.

Territories were mapped at a 1:5000 scale at the beginning of the breeding season in April when activities of territorial behaviour were highest. For detailed information on habitat selection, the following parameters of the nearest shrubby plant were recorded at 310 random points: 1. plant species; 2. height to the nearest dm; 3. diameter at a height of 1 m to the nearest dm; 4. distance in m to the next shrub in four cardinal directions. In some cases not only a single plant was recorded at a location, which increased the sample size of recorded plants. Random points were classified as in territory of *S. a.* and/or *S. m.* Territories were compared regarding plant species composition and vegetation structure, using measurements of mean heights, diameters and distances between shrubs. For proper testing of plant species composition, we grouped plant species into large shrubs (*Arbutus*, *Erica*, *Olea*, *Phillyrea*, *Pinus*, *Quercus*), small shrubs (*Myrtus*, *Cistus*, *Rosmarinus*), clammers and herbs (*Asparagus*, *Smilax*, *Poa*, *Rubia*, *Lonicera*, *Ampelodesmos*), and *Pistacea* as a single category, as it was very abundant in the study sites. To show differences between both *Sylvia* species, a logistic model was calculated, including these parameters of vegetation structure (but not plant species) and «study plots», as the study plots proved to differ strongly from each other. Plant species composition was analysed separately.

Moreover, nests systematically searched for in the case of *S. a.*, as nests are easily detectable, and both systematically and by observing

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adult birds in the case of *S. m.* The following parameters were recorded: 1. nesting plant species; 2. height in nesting plant; 3. height of the nesting plant; 4. diameter of nesting plant in height of the nest; 5. distance of the nest to the rim of the plant to the nearest dm; 6. visibility of the nest from the four cardinal directions, above and below was estimated in % to the nearest 0, 25, 50, 75 or 100%, and from all measures a value of «mean visibility» was calculated; 7. distance to the nearest forest edge. These characteristics are independent of whether a nest is occupied. As the study started early in the vegetation period, it is unlikely that relative visibility had changed since the nest was built, so all nests were taken into analysis. To analyse differences in nest site selection between both species, a logistic model, including the parameters 2. - 7. and «study plot», was calculated as study sites differed in vegetation structure. The use of plant species was analysed separately. Statistical analyses were performed in JMP 5.1 (SAS Coop.).

24 *S. a.* territories and 50 territories of *S. m.* were recorded. Population density was highest in SSM for both bird species. The density of *S. a.* was 7.5 breeding pairs per 10 ha and *S. m.* was 11.3 bp/10 ha. Lowest densities were calculated in CSM for *S. a.* with 2.9 bp/10 ha and in PSM for *S. m.* with 7.3 bp/10 ha. Pooled population density was twice as high in *S. m.* as in *S. a.* Territories overlapped in any of the three study plots as 39.8% of random points were recorded in areas used by both species. For the following description of habitats, all random points were used within territories of each species. As many points were shared by both species, for analyses of differences, the category «in territories of both species» was introduced in order to not exaggerate sample size. Habitats used by *S. a.* and *S. m.* differed in plant species composition if areas used exclusively by one of the species ($\chi^2 = 13.09$, $P = 0.049$, $df = 6$ were compared; Fig. 1). *S. atricapilla* territories included more mastix (53.1%) and less small shrubs (4.2%) and climbers/herbs (13.4%) than *S.*

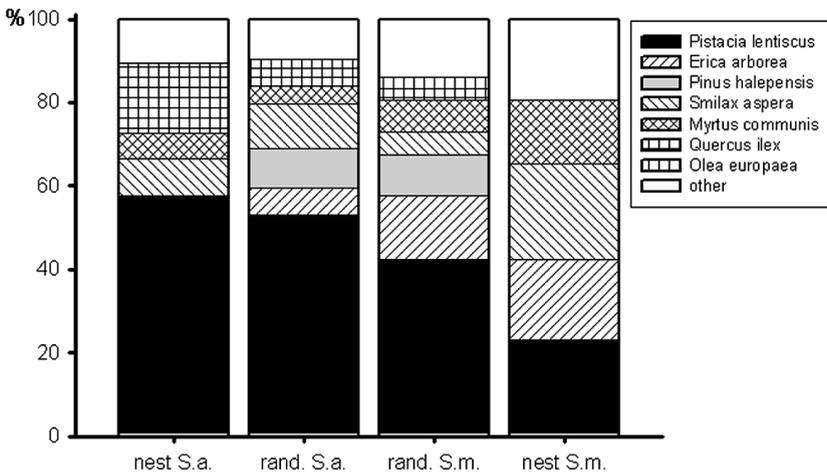


FIG. 1.—Percentage of nest plants over all study sites in *Sylvia atricapilla* (nest S.a.) and *S. melanocephala* (nest S.m.) compared with plant composition at random points in territories of each bird species exclusively (rand. S.a./rand S.m.). For plant species summarized as 'other' at random points, see description in text. 'Other' species in nest S.a. include *Phillyrea* ($n = 5$), *Rhamnus carthagica*, and *Hedera helix* (1, respectively); 'other' species in nest S.m. include *Rubia* (2), *Rosmarin*, *Cistus*, and *Poa* (1, respectively).

[Porcentaje de nidos en los distintos tipos de plantas en *Sylvia atricapilla* (nest S.a.) y *S. melanocephala* (nest S.m.) en comparación de la composición de plantas en puntos al azar dentro del territorio exclusivo de cada especie (rand. S.a./rand S.m.). Para las especies de plantas categorizadas como 'other' en los puntos al azar, vease la descripción en el texto. Otras ('other') en los nidos de S.a. incluye *Phillyrea* ($n = 5$), *Rhamnus carthagica* y *Hedera helix* (1, respectivamente), y para S.m. incluye *Rubia* (2), *Rosmarin*, *Cistus* y *Poa* (1, respectivamente).]

m. (39.8%; 12.6%; 18.9%) territories. The percentage of larger shrubs was similar (*S.a.* 29.2%; *S.m.* 28.9%). As a consequence, and despite of the differences between study plots, habitats of *S. a.* and *S. m.* differed significantly in vegetation structure (Table 1). Shrubs in *S. a.*-territories were higher (mean \pm SD; 277 \pm 169 cm, $n = 200$) than in *S. m.*-territories (238 \pm 127 cm, $n = 238$), and vegetation density was higher in *S. a.*-territories (504 \pm 612 cm, $n = 200$) than in *S. m.*-territories (98 \pm 769 cm, $n = 238$), despite the differences between study plots. The diameter of plants did not differ between species territories, which led to territories with a thick vegetation layer in *S. a.* and open territories in *S. m.*

Out of 12 plant species used for nesting, only 3 (*Pistacea*, *Smilax*, and *Myrtus*) were used by both bird species (Fig. 1), so the plants used for nesting differed between both species ($\chi^2 = 14.55$, $P = 0.0022$, $df = 3$). 57.8% of *S. atricapilla*'s nests were found in Mastix, another 25.0% in *Quercus ilex* and *Pyrillea* spp. Nests of *S. melanocephala* were found in herbs and climbers (33.0%), Mastix trees (29.2%), and smaller shrubs (25.0%). Nesting plants differed from random points in both species (Table 2). Compared with random points within their territories, *S. a.* tended to favour Mastix and larger shrubs, which had the same height but a smaller diameter than random (Table 2). *S. m.* preferred climbers and smaller shrub species over Mastix and larger shrubs, which were significantly smaller than random (Table 2). Accordingly, nest sites of *S. a.* and *S. m.* differed

significantly in nest height (*S. a.*: 157.8 \pm 52.5, $n = 66$; *S. m.*: 68.8 \pm 33.4, $n = 25$) and mean visibility (*S. a.*: 65.4 \pm 24.1, $n = 61$; *S. m.*: 21.6 \pm 17.2, $n = 22$) in any of the study plots (Table 3). Plants used by *S. a.* were significantly higher (*S. a.*: 261.7 \pm 150.2, $n = 66$; *S. m.*: 164.6 \pm 132.1, $n = 25$, t -test, $P < 0.001$), but this was not consistent over the study plots (Table 3). Diameter of nesting plants (*S. a.*: 188.4 \pm 141.0, $n = 66$; *S. m.*: 214.2 \pm 115.2, $n = 25$) and distance to a nests edge (*S. a.*: 40.1 \pm 39.8, $n = 65$; *S. m.*: 43.2 \pm 27.5, $n = 25$) did not differ. Nests of *S. a.* were placed clearly visible in the upper part of higher shrubs, nests of *S. m.* were found at well hidden sites in lower parts of smaller plants.

The findings on habitat and nest site characteristics match with previous studies. Territory sizes of *S. m.* in similar habitats average between 0.5 and 1 ha (Cody & Walter, 1976; Zbinden & Blondel, 1981), population densities between 7.6 bp/10 ha (Zbinden & Blondel, 1981) and 25.9 bp/10 ha (Cody & Walter, 1976). *S. atricapilla* breeds at densities between 2 bp/10 ha (Carbonell & Telleria, 1998b, maximum density in a comparison of 5 populations: 15 bp/10 ha) and 22.2 bp/10 ha (Cody & Walter, 1976).

Even if territories overlap broadly, the species differ in both, diet (Jordano, 1987) and foraging behaviour (Cody & Walter, 1976; Gutierrez, 1988), which explains differences in habitat selection (Martin & Thibault, 1996). While *S. a.* prefers arboreal habitat structures, *S. m.* prefers vegetation apart from trees (Snow

TABLE 1

Test statistics of the logistic model for differences between habitats used by *S. atricapilla* and *S. melanocephala* on Majorca.

[Resultado de la regresión logística para comprobar las diferencias entre los hábitats usados por *S. atricapilla* y *S. melanocephala* en Majorca.]

Variable	df	Wald ChiSquare	P
Study site [Área de estudio]	4	41.66	< 0.001
Plant distance [Distancia entre plantas]	2	13.91	0.001
Plant height [Altura de plantas]	2	23.44	< 0.001
Plant diameter [Diámetro de las plantas]	2	1.56	0.458

TABLE 2

Test statistics of the logistic model for deviations of *S. atricapilla* (A) and *S. melanocephala* (B) nesting sites from random points.

[Resultado de la regresión logística para comprobar las diferencias entre los hábitats usados por *S. atricapilla* y *S. melanocephala* de los puntos al azar dentro de sus territorios.]

A	df	Wald ChiSquare	P
Study site [Área de estudio]	2	9.38	0.009
Plant type [Tipo de plantas]	3	8.39	0.038
Plant height [Altura de plantas]	1	1.55	0.21
Plant diameter [Diámetro de las plantas]	1	3.59	0.058
B			
Study site	2	0.66	0.72
Plant type	3	23.46	< 0.001
Plant height	1	8.18	0.004
Plant diameter	1	0.76	0.38

& Perrins, 1998). However, in the breeding period, when insects are the most important food components, *S. a.* also feeds in the canopy of trees and in higher shrubs, whereas *S. m.* mainly feeds in lower shrub vegetation and occasionally on the ground. Competition, as mentioned elsewhere (Cody & Walter, 1976), is unlikely between both species.

One major ecological difference between both species could be different anti predator strategies. Low, well hidden nest sites in dense vegetation are quite safe from avian predators (Santos & Telleria, 1991; Schaefer, 2002) and suffer lower amounts of predation than nests at more elevated sites, especially in the genus *Sylvia* (Bairlein *et al.*, 1980). Compared to *S.*

TABLE 3

Test statistics of the logistic model for differences of *S. atricapilla* and *S. melanocephala* nesting sites.

[Resultado de la regresión logística para comprobar las diferencias entre los lugares de nidificación usados por *S. atricapilla* y *S. melanocephala*]

Variable	df	Wald ChiSquare	P
Study site [Área de estudio]	2	0.12	0.93
Plant height [Altura de plantas]	1	0.66	0.42
Nest height [Altura del nido]	1	9.30	0.002
Plant diameter [Diámetro de las plantas]	1	0.63	0.43
Distance from edge [Distancia al borde]	1	0.66	0.42
Overall visibility [Visibilidad]	1	9.67	0.002

communis or *S. melanocephala*, *S. atricapilla* avoids such dense vegetation. Promising nest sites, with low amounts of predation, are within nettle *Urtica dioica* and particularly Bramble (*Rubus* ssp.; Schaefer, 2002), a preferred nesting plant of *S. atricapilla* in general (Carbonell & Telleria, 1998a, 1998b). The use of large shrubs by *S. a.* on Majorca, then, is surprising. The observed preference of Pistacea-habitats is common to Majorcan ornithologists (J. S. Aguilar, *pers. obs.*), but rarely observed on the Iberian Peninsula, where *S. a.* shows a strong preference for moist habitats with a dense shrub layer of e.g. brambles (Carbonell & Telleria, 1998a). The authors assume this to be substantial to maintain self-sustaining populations, as those habitats stay relatively humid during the dry breeding period and provide suitable conditions for rearing young. The results from Majorca offer another explanation, as in absence of avian predators brambles as a resource for nesting may lose significance and *S. a.* can breed in other habitats as well. In Mediterranean climate, *S. a.* is at the edge of its distribution and suffers high environmental stress (Carbonell & Telleria, 1998b; Carbonell *et al.*, 2003; Perez-Tris & Telleria, 2002). Here, at similar population densities and with a broad spectrum of potential predators (Santos & Telleria, 1991), predation rates are less than half, compared to central European habitats (Barkow, 2001; Schaefer, 2002; De La Puente & Yanes, 1995; Yanes & Suarez, 1997). Nests appear to be quite safe in Mediterranean brambles. Temporal and nutritional restrictions in the breeding season may disable compensation of nest losses and thus avoid nesting in less concealed habitats on the mainland. An altered nest site selection in absence of avian predators and lower predation rates may allow *S. a.* to breed in habitats where they do not appear on the mainland (Lopez & Moro, 1997). For the authors, *S. a.* is an ideal species to investigate the constraints species suffer at the edge of their distribution and comparative studies between mainland and islands are strongly encouraged to get more information on that topic.

RESUMEN.—*En este estudio se compara la selección de hábitat y de nidificación en dos especies de Currucas en Mallorca. S. atricapilla prefirió áreas con arbustos densos dentro del bosque, mientras que*

S. melanocephala seleccionó áreas menos densas para reproducirse. Los nidos de S. atricapilla, que eran fácilmente detectables a la vista, se encontraban encima de arbustos grandes y sobre árboles de porte pequeño, mientras que los de S. melanocephala, más difíciles de detectar, se situaban bajo arbustos pequeños o plantas trepadoras. Esta selección del hábitat reproductor por S. atricapilla no es común en la península Ibérica y presentamos posibles explicaciones de ello.

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