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Ants and Paridae share nesting boxes in continental Mediterranean habitat

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Abstract. Different species visit or exploit cavities for survival or reproduction, including human-made boxes. Ants and Paridae from mainland southern France share artificial boxes at different life-history stages. Colonies of the ant *Crematogaster scutellaris* occasionally prevent Paridae from roosting or breeding in boxes and therefore might influence nest-site selection in avian cavity-nesters. Factors that influence coexistence or avoidance in bird-ant interactions in the Mediterranean region are discussed.

Key words: *Parus major*, *Cyanistes caeruleus*, *Crematogaster scutellaris*, ant-bird interactions

Introduction

Different species interact and influence how and where individual species will live and reproduce. This has also been shown in studies of vertebrate-invertebrate interactions (Thompson 1988, Loye & Zuk 1991, Clayton & Moore 1997, Veiga et al. 2013). Birds are often in contact with insects (Møller 1989, Loye & Zuk 1991, Christe et al. 1994, Clayton & Moore 1997), including different species of ant (e.g. Haemig 1997, Estany-Tigerström et al. 2013). Birds and ants can share or compete for resources at places where birds roost or breed, as shown in studies that used human-made boxes as tools (e.g. Juškaitis 1995, Roy et al. 2013). Birds and different species of ant interact directly or indirectly during the reproductive or non-reproductive life-history stages (e.g. Judson & Bennett 1992, Haemig 1997, 1999, Estany-Tigerström et al. 2013). Ants may influence how and where birds look for food or *vice versa* (Haemig 1992, 1996, 1997). Birds can exploit ants for plumage maintenance or as food source (e.g. Judson & Bennett 1992). Ants sometimes have been reported to predate on bird nestlings (Haemig 1999, Lambrechts et al. 2008). However, investigations on causes and consequences of interactions between avian hole-nesters and ants sharing the same cavities are rare, despite numerous long-term investigations on cavity breeding birds throughout Europe.

A preliminary study described various interactions between ants and breeding Paridae in two distinct oak habitat types in Corsica (Lambrechts et al. 2008). Here we present the first results of nest box sharing between ants and Paridae from two study plots from continental southern France near Montpellier. Different species of ant observed in nest-box chambers erected to study avian cavity-nesters were monitored in more detail in one study year. Several ant species, especially *Crematogaster scutellaris* (e.g. Soulié 1961), are found in boxes erected to attract avian cavity nesters. A simple mechanism is presented how *C. scutellaris* ants may prevent Paridae from roosting or breeding in cavities.

Material and Methods

Concrete or wood-concrete Schwegler-type boxes with the same internal dimensions were occupied by blue tits (*Cyanistes caeruleus*), great tits (*Parus major*), or other cavity-exploiters, like mammals or insects. The boxes were visited by ornithologists and students following basic protocols presented in Lambrechts et al. (2008, 2010). Boxes were usually checked at least once a week from prior to nesting till the birds leave the nest, usually from March till June. In long-term studies that use nesting boxes as a tool, old bird nests (i.e. from a former breeding season) or nests from mammalian or invertebrate hole-nesters were removed prior to the onset of each avian breeding season (Møller 1989, Lambrechts et al. 2007, 2008, 2010). Ants recolonized yearly empty boxes or shared boxes with breeding or roosting tits in our rural woodland plot monitored since 1991 (plot R dominated mainly by oak *Quercus humilis*, La Rouvière; Dias & Blondel 1996, 89-273 boxes per year, 1991-2008), despite efforts to remove ants. Because the ornithologists did not identify ant species in plot R we present here the long-term data ignoring ant species identity following Lambrechts et al. (2008). Quantifying exact ant numbers was practically impossible. Our study therefore focused on presence versus absence of ants in boxes. In each study year, we classified each box either as "empty" or "exploited" by ants. In an "empty" box, ants were never seen or reported despite the multiple visits per box per year. In a box exploited by ants, only the first ant observation per season was considered. We calculated for each study year the % of boxes that contained ants, and then calculated an average value for the whole study period. These same procedures of data selection were used by Lambrechts et al. (2008).

In 2008, we identified which species of ant occupied avian boxes. *C. scutellaris* ants and their activities were monitored in more detail in both the rural woodland plot R (Plot R: 224 boxes) and an urban Plot C (field experimental garden, CNRS Campus, route de Mende, 10 boxes). *C. scutellaris* ants that occupied the avian nesting boxes could either be classified as "foragers" when they were moving in the boxes in the absence of ant eggs, or as "nesters" when workers were taking care for a brood or when they expressed signs of nesting (cf. Lambrechts et al. 2008). *C. scutellaris* often colonised nest boxes in large numbers, frequently exceeding ca. 300 individuals per box. Blatrix et al. (2013) identified ant species other than *C. scutellaris* based on individuals brought to the laboratory (*Camponotus fallax*, *Camponotus lateralis*). Ant species identity could not be determined during one visit at one box (Plot R, box 330, 13 June 2008). The described morphological and behavioural characteristics of the unidentified species differed from those of *C. scutellaris*, *C. fallax*, and *C. lateralis*.

Results and Discussion

Despite the efforts to remove ants prior to the onset of bird nesting at plot R, ants were frequently observed within the boxes between half March and the end of June (% of boxes with ants: 19.4 ± SD 14.4, 1991-2008). Ants were usually observed in boxes that did not contain bird nesting material (54.5 ± SD 20.2 %). However, ants were also observed in boxes that contained bird nests prior to the onset of egg laying (13.3 ± SD 9.7 %), during the bird egg stage (8.4 ± SD 10.1 %) or during the bird nestling stage (7.9 % ± SD 5.5 %). Ants were also found later in the season shortly after the birds fledged (16.1 ± SD 16.5 %). Ants were reported in boxes that contained nests constructed by great tits or blue tits, therefore confirming the conclusions from the study in Corsica (Lambrechts et al. 2008).

In urban plot C, ants visited or occupied 70 % of the boxes provided. This relatively high occupation rate could either be attributed to the fact that ants were not removed before the onset of avian nesting or local "unidentified" environmental characteristics favoured ants.

In 2008, we identified *C. scutellaris* in > 80 % of the boxes that contained ants both in plot R (81.5 %) and plot C (83.3 %). This species is an arboricolous, polydomic (with secondary nests) and dominant species in Mediterranean trees (Soulié 1961, Casevitz-Weulersse 1970, 1972, Schatz & Hossaert-McKey 2003, Cagniant 2005, Debout et al. 2007, Estany-Tigerström et al. 2010). Its alarm pheromone toxic and repellent towards different ant and invertebrate species (Marlier et al. 2004) may explain this numeric and behavioural dominance. Boxes were occasionally visited or occupied by *Camponotus fallax* (plot R: 1.9 %; plot C: 16.7 %) or *Camponotus lateralis* (plot R: 7.8 %). The species *C. lateralis*, mimics *C. scutellaris* workers in colour, size, and shape, and is known to forage on the same sectors without apparent interspecific hostility (Kaudewitz 1955, Soulié 1961, Blatrix et al. 2013). *C.*

Table 1. The number of boxes with or without *Crematogaster scutellaris* activity in rural woodland plot R in 2008. Boxes were rarely occupied by ant species other then *C. scutellaris* (see main text).

		Tree species		
		Q. humilis	*Q. ilex*	Others
Nesting	with brood	30	5	2
	with mud without brood	6	1	2
	large colony without brood	7	2	2
	Total	43 (25.7 %)	8 (36.4 %)	6 (40.0 %)
Foraging		42 (25.2 %)	5 (22.7 %)	4 (26.7 %)
Boxes without *Crematogaster*		82 (49.1 %)	9 (40.9 %)	5 (33.3 %)

fallax is found in dead wood in oak forest and has an omnivorous diet (Blatrix et al. 2013).

C. scutellaris colonies have been seen closing nest-box entrance holes with mud or filling up boxes with mud (2008: plot R: 37 %, 30 colonies; plot C: 25 %, 4 colonies) (see also Table 1). That *C. scutellaris* can have an important impact on Paridae is clearly illustrated with long term observations of a single nest box in plot R (box 49). In this box, *C. scutellaris* blocked the cavity entrance hole with mud for more than six years. Blocking cavity entrances with mud therefore seems to be a simple mechanism to prevent avian hole-nesters from roosting or nesting. This would imply that *C. scutellaris* can have a significant impact on where Paridae from Mediterranean southern France will breed.

The probability that ants occupied a box-chamber was similar for boxes attached to broad-leaved deciduous and evergreen oak trees (Table 1), supporting conclusions from the Corsican study reported in Lambrechts et al. (2008). Ants therefore seemed to be mainly attracted by the cavity or its content independent from the chemical or morphological characteristics of the oak tree supporting a box, although tree morphology may influence ants' capacities to dig holes in bark (Soulié 1961, Casevitz-Weulersse 1970, 1972, Debout et al. 2007, Blatrix et al. 2013). We cannot exclude that tree species other than oak might influence where ants will forage and nest.

In winter, free-ranging blue tits have been seen roosting in boxes occupied by *C. scutellaris* colonies, i.e. when ambient temperatures were low and ants immobile. In laboratory conditions, we observed that continental *C. scutellaris* ants drink tap water. It suggests that bird-ant interactions are influenced by spatial variation in ambient temperature or humidity in or around cavities used for roosting or nesting.

Ants and Paridae most probably coexist already for a long time in the Mediterranean region, and therefore may have evolved mechanisms favouring co-existence or avoidance, such as development of repulsive odours not killing ants or preventing ants from entering cavities occupied by birds, or *vice versa*. Anecdotic observations of successful coexistence between *Crematogaster* ants and blue tits sharing simultaneously artificial nesting boxes have only been reported in Corsica (Lambrechts et al. 2008). *Crematogaster* ants predating on healthy nestlings were not observed in our study plots in mainland southern France, although the ants were observed on dead nestlings (M. Lambrechts, pers. obs.). In contrast to many other study regions, tit nests from our nest box plots rarely contained nest parasites that overwinter in cavities, such as fleas (Loye & Zuk 1991, Christe et al. 1994, Hurtrez-Boussès 1996, pers. obs.). Presence of ants foraging in cavities might have subtle beneficial effects for the birds when ants would remove invertebrates, like fleas (Lambrechts et al. 2008). How and why *C. scutellaris* ants interact with birds exploiting natural cavities or human-made boxes require additional field or laboratory approaches.

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Literature

Blatrix R., Galkowski C., Lebas P. & Wegnez P. 2013: Fourmis de France. *Delachaux & Niestlé*.

Cagniant H. 2005: *Crematogaster* of Morocco (Hym., Formicidae). Identification key and comments. *Orsis 20: 7–12. (in French)*

Casevitz-Weulersse J. 1970: Sur la biologie de *Crematogaster scutellaris* Olivier (Hymenoptera, Formicidae, Myrmicinae). *L'Entomologiste 26: 68–75.*

Casevitz-Weulersse J. 1972: Habitat et comportement nidificateur de *Crematogaster scutellaris* Olivier (Hym. Formicidae). *Bull. Soc. Entomol. Fr. 77: 12–19.*

Christe P., Oppliger A. & Richner H. 1994: Ectoparasite affects choice and use of roost sites in the great tit, *Parus major*. *Anim. Behav. 47: 895–898.*

Clayton D.H. & Moore J. (eds.) 1997: Host-parasite evolution. General principles and avian models. *Oxford University Press, Oxford.*

Debout G., Schatz B., Elias M. & McKey D. 2007: Polydomy ants: what we know, what we think we know, and what remains to be done. *Biol. J. Linn. Soc. 90: 319–348.*

Dias P.C. & Blondel J. 1996: Breeding time, food supply and fitness components in Mediterranean blue tits. *Ibis 138: 108–113.*

Estany-Tigerström D., Bas J.M., Clavero M. & Pons P. 2013: Is the blue tit falling into an ecological trap in Argentine ant invaded forests? *Biol. Invasions 15: 2013–2027.*

Estany-Tigerström D., Bas J.M. & Pons P. 2010: Does Argentine ant invasion affect prey availability for foliage-gleaning birds? *Biol. Invasions 12: 827–839.*

Haemig P.D. 1992: Competition between ants and birds in a Swedish forest. *Oikos 65: 479–483.*

Haemig P.D. 1996: Interference from ants alters foraging ecology of great tits. *Behav. Ecol. Sociobiol. 38: 25–29.*

Haemig P.D. 1997: Effects of birds on the intensity of ant rain: a terrestrial form of invertebrate drift. *Anim. Behav. 54: 89–97.*

Haemig P.D. 1999: Predation risk alters interactions among species: competition and facilitation between ants and nesting birds in a boreal forest. *Ecol. Lett. 2: 178–184.*

Hurtrez-Boussès S. 1996: Interactions hôte-parasite: le système mésange bleue-*Protocalliphora* en région Méditerrannéenne. *Université Montpellier II, France.*

Judson O.P. & Bennett A.T.D. 1992: 'Anting' as food preparation: formic acid is worse on an empty stomach. *Behav. Ecol. Sociobiol. 31: 437–439.*

Juškaitis R. 1995: Relations between common dormice (*Muscardinus avellanarius*) and other occupants of bird nest-boxes in Lithuania. *Folia Zool. 44: 289–296.*

Kaudewitz F. 1955: Gastverhältnis zwischen *Crematogaster scutellaris* Ol. mit *Camponotus lateralis bicolor* Ol. *Aus des Max-Planck-Institut: 69–87.*

Lambrechts M.M., Bourgault P., Mennerat A., Galan M.-J., Cartan-Son M., Perret P., Doutrelant C. & Charmantier A. 2007: Cavity-nesting black rats in distinct Corsican oak habitats and their potential impact on breeding Paridae. *Folia Zool. 56: 445–448.*

Lambrechts M.M., Schatz B. & Bourgault P. 2008: Interactions between ants and breeding Paridae in two distinct Corsican oak habitats. *Folia Zool. 57: 264–268.*

Lambrechts M.M. et al. 2010: The design of artificial nestboxes for the study of secondary hole-nesting birds: a review of methodological inconsistencies and potential biases. *Acta Ornithol. 45: 1–26.*

Loye J.E. & Zuk M. 1991: Bird – parasite interactions. Ecology, evolution and behaviour. *Oxford University Press, Oxford.*

Marlier J.F., Quinet Y. & Biseau J.C. 2004: Defensive behaviour and biological activities of the abdominal secretion in the ant *Crematogaster scutellaris* (Hymenoptera: Myrmicinae). *Behav. Process. 67: 427–440.*

Møller A.P. 1989: Parasites, predators and nest-boxes: facts and artefacts in nest box studies of birds. *Oikos 56: 421–423.*

Roy L., Bouvier J.-C., Lavigne C., Galès M. & Buronfosse T. 2013: Impact of pest control strategies on the arthropodofauna living in bird nests built in nestboxes in pear and apple orchards. *B. Entomol. Res. 103: 458–465.*

Schatz B. & Hossaert-McKey M. 2003: Interactions of the ant *Crematogaster scutellaris* (Formicidae; Myrmicinae) with the fig/fig wasp mutualism. *Ecol. Entomol. 28: 359–368.*

Soulié J. 1961: Les nids et le comportement nidificateur des fourmis du genre *Crematogaster* d'Europe, d'Afrique du Nord et d'Asie du sud-est. *Insect. Soc. 8: 213–297.*

Thompson J.N. 1988: Variation in interspecific interactions. *Annu. Rev. Ecol. Syst. 19: 65–87.*

Veiga J.P., Wamiti W., Polo V. & Muchai M. 2013: Interphyletic relationships in the use of nesting cavities: mutualism, competition and amensalism among hymenopterans and vertebrates. *Naturwissenschaften 100: 827–834.*