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**Foraging behaviour by the Fuerteventura Blue Tit  
(*Parus caeruleus degener*) during the pre-breeding period  
and its implications in long-term habitat management**

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**RESUMEN:** Se estudió la conducta de forrajeo del Herrerillo Común (*Parus caeruleus degener*) en Fuerteventura durante el periodo pre-reproductor. Los herrerillos fueron observados forrajeando en alturas comprendidas de 0-6 metros y seleccionaron preferentemente palmeras (*Phoenix* complejo *dactylifera*), Tabaco Moro (*Nicotiana glauca*) e higueras (*Ficus carica*) para buscar alimento. Se sugiere que las palmeras son las especies vegetales nativas de mayor importancia para este passeriforme durante el periodo de estudio y se recomienda que las políticas de conservación deben de intentar aumentar el número de palmeras en aquellas áreas críticas para el herrerillo en Fuerteventura (i.e. macizo de Betancuria y particularmente desde Betancuria a Vega de Río Palmas y Ajuy).

Palabras clave: Herrerillo Común, *Parus caeruleus degener*, forrajeo, Fuerteventura, islas Canarias.

**ABSTRACT:** The foraging behaviour of the Fuerteventura Blue Tit (*Parus caeruleus degener*) was studied during the pre-breeding period. Tits were observed foraging from 0-6 meters and mainly selected Palm Trees (*Phoenix dactylifera* complex), Tree Tobacco (*Nicotiana glauca*) and Fig-trees (*Ficus carica*) for foraging. It is suggested that Palm Tree is the most important native plant species for this passerine during the period under study and it is recommended that conservation policies should try to increase the number of Palm Trees on those critical areas for the Blue Tit on Fuerteventura (i.e. the Betancuria Massif, particularly from Betancuria to Vega de Río Palmas to Ajuy). Key words: Blue Tit, *Parus caeruleus degener*, foraging behaviour, Fuerteventura, Canary Islands.

## INTRODUCTION

The Blue Tit (*Parus caeruleus*) is a common passerine bird in the Western Palearctic (Cramp & Perrins, 1993) and can occupy a wide range of habitats, from deciduous oak woodland in northern Europe (Perrins, 1979), to evergreen forests in the Mediterranean region (Blondel & Dias, 1994), to palm oasis in Morocco (Snow, 1954a). In the Canary Islands, the south-western limit of its range (Grant, 1979), it has differentiated into four endemic subspecies (Cramp & Perrins, 1993), however some authors treat these as full endemic species (Sangster, 1996; Salzburger *et al.*, 2002). Three of these are common on the pine and laurel forests of the central and western islands (Bannerman, 1963) but one (*P.c. degener*) only occurs on Fuerteventura and Lanzarote in non forest habitat types, as no significant forested areas can be found there (Rodríguez *et al.*, 2000).

*P.c. degener* is the only Canarian subspecies included in the regional catalogue (Catalogo de Especies Amenazadas de Canarias, Decreto 151/2001 de 23 Julio) as category "S" (Sensible to the alteration of its habitat) and a recuperation plan is under way (pers. obs.). The Fuerteventura Blue Tit has been observed to be more common in *Phoenix/Tamarix* less common in Urban, very rare in Euphorbia Scrub and absent from pure *Tamarix* woodland and on this island tits occupy microhabitats with tall shrubs and trees and a higher percentage availability of grassy areas (García-del-Rey & Cresswell, 2004). These authors have also suggested that management conservation policies should aim to increase plant cover especially in those higher density areas. However the level of importance of the different plant species used by foraging Fuerteventura Blue Tits has not been quantified in the past (Martín & Lorenzo, 2001) and this sort of data is crucial in order to effectively design habitat management actions.

This study therefore, aims to quantify the foraging behaviour of the Fuerteventura Blue Tit to address the lack of data.

## STUDY AREA AND METHODS

This study was undertaken on the island of Fuerteventura, the second largest of the Canary Islands with 1660 km<sup>2</sup>. It is also the closest to the African continent (*c.* 100 km) and has a climate dominated by dry summers and some rain in winter (Marzol-Jaén, 1984). Field work was conducted on the Betancuria Massif, 28°25'N-14°03'W, on the *Phoenix/Tamarix* association from Betancuria to Ajuy.

To record the foraging behaviour of the tits a single field technique was used, i.e. repeated standard observations (Hartley, 1953) or point sample (Noon & Block, 1990), which is perfectly suitable for this sort of study when compared to other commonly used methods of measuring foraging (Carrascal, 1984). Observations of foraging tits were made from 1-25 January 2000 during the mornings from 7:00 am to 12:00 am (local time). The study areas were searched systematically, stopping when foraging birds were encountered. Precaution was taken not to alter the behaviour of the birds or to repeat observations of the same individual. For each bird a 5 second observation was made recording the following parameters: 1) height when first seen

above the ground (estimated by eye), 2) plant species in which it was foraging. A total of 153 records were obtained during this non breeding period. To study the plant composition of the study area, 30 random plots of 25m radius were visited to record the percentage of foliage volume cover, estimated by eye.

All statistical analyses were performed with SPSS 11.5 and Zar (1984).

## RESULTS

Statistically significant differences were observed between the four different height categories ( $\chi^2= 106.38$ ,  $df=3$ ,  $P<0.001$ ) and also between the two lower and the two higher categories ( $\chi^2= 102.56$ ,  $df=1$ ,  $P<0.001$ ) but not between the two lowest categories ( $\chi^2= 2.03$ ,  $df=1$ ,  $P>0.05$ ) or between the two highest ones ( $\chi^2= 0.76$ ,  $df=1$ ,  $P>0.05$ ) (Fig. 1). Blue tits therefore foraged more often at heights from 0-6m relative to heights from 7.5-22.5m.

From Fig. 2 three groups of plants were identified according to what was observed and what is available: group 1 (high observed, low availability) = FICA, NIGL, PHOE, group 2 (similar observed & availability)= TACA, KLNE, OTHER, CESI, ACAC and group 3 (low observed, high availability)= PUGR, LAAR, EUPH, LYIN. Testing whether tits simply forage according to availability showed statistically significant differences for group 1 ( $\chi^2= 231.60$ ,  $df=2$ ,  $P<0.001$ ) and group 3 ( $\chi^2= 35.16$ ,  $df=3$ ,  $P<0.001$ ) and not significant for group 2 ( $\chi^2= 231.60$ ,  $df=2$ ,  $P>0.05$ ). However for group 3 tits forage less on these plants than what is available. Therefore, tits strongly select to forage on *Phoenix* sp., *Nicotiana glauca* and *Ficus carica*; less so on *Punica granatum*, *Launaea arborescens*, *Euphorbia* sp. and *Lycium intricatum*; but do not particularly select *Tamarix canariensis*, *Kleinia neriifolia*, OTHER (= *Arundo donax*, *Agave americana*, *Opuntia* sp.), *Ceratonia siliqua*, *Acacia* sp..

## DISCUSSION

The present study suggests that the Fuerteventura Blue Tit forage mainly at low heights (0-6 m vs. 7.5-22.5) during the pre-breeding period, whereas tits during breeding occupy microhabitats with a higher percentage availability of grassy areas (Garcia-del-Rey and Cresswell, 2004) where they do forage for arthropods (pers. obs.). A simple explanation to this difference could be that the herbaceous layer has not yet developed before breeding starts or it was simply masked by the intervals used to collect the data.

The importance of *Phoenix* sp., *Nicotiana glauca* and *Ficus carica* is first revealed by data on this study. Both *Ficus carica* and *Nicotiana glauca* were brought by man to this island and suggest a possible link of the Blue Tit with man on Fuerteventura [this anthropogenic plant composition to the habitat of the Blue Tit on Lanzarote has been suggested by Concepcion (2000)]. *P.c. degener* has been seen feeding on figs (Concepción, 2000; Martín & Lorenzo, 2001) and *Nicotiana glauca* has been included as a possible source of nectar in the diet of Canary tits (Martín & Lorenzo, *op. cit.*). At the pre-breeding period figs were not available for the tits that exploited the *Ficus carica* possibly for arthropods (pers. obs.). All observations of foraging tits on *Nicotiana glauca* on this

study revealed an interesting behaviour never documented in the past. Fuerteventura tits were observed snatching the *Nicotiana glauca* flower and, by holding it with the two feet, they pecked at the calyx of the flower to exploit the nectar inside (pers. obs.). However, it is clear that species of *Phoenix dactylifera* complex are the most important in the habitat of this parid, at least at the pre-breeding period (see Fig. 2). The palm trees have been able to colonize naturally remote oceanic islands thanks to long distance dispersal aid by birds (Fernandez-Palacios & Morici, 2004). García-del-Rey & Cresswell (2004) suggested that tits on Fuerteventura were more common on the association between *Phoenix/Tamarix* but did not occur on pure *Tamarix* woodland. Therefore *Tamarix canariensis* seems to be less important for the tits in the association of *Phoenix/Tamarix* during this period.

In conclusion, this study justifies a habitat conservation policy that increases the number of native Palm Trees. Any action on the Palm Trees (e.g. cutting leaves) should not be undertaken during the pre-breeding period or breeding period and should be left to the post-breeding warmer summer months. Special attention should be paid to the Betancuria Massif (28°25'N-14°03'W) and particularly the “wadies” from Betancuria to Vega de Río Palmas to Ajuy, where the highest density of palm trees still survive and therefore the biggest concentration of tits occur.

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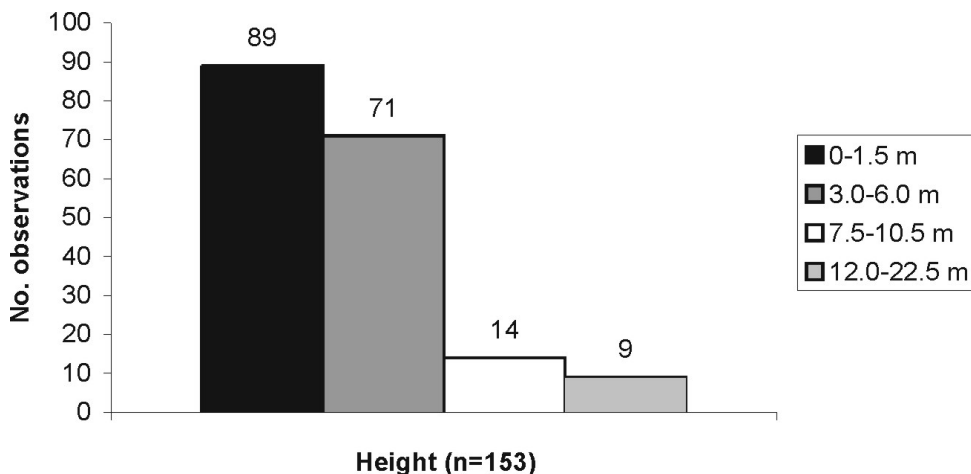


Figure 1. Height frequency distributions of foraging Fuerteventura Blue Tits. Sample size in brackets.

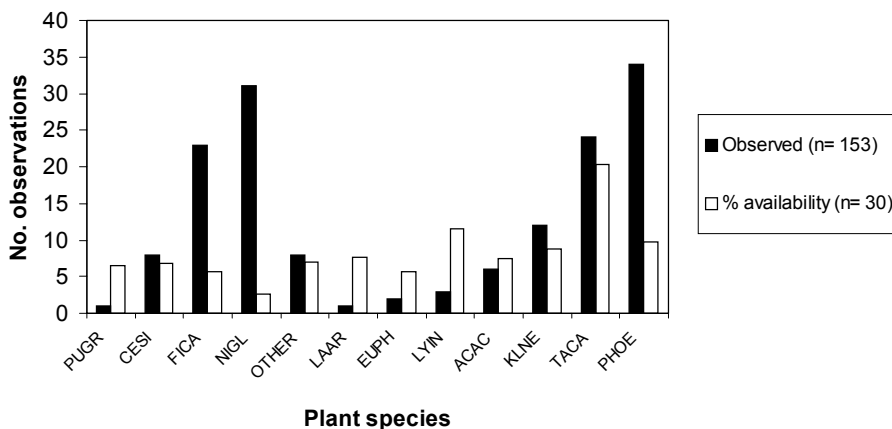


Figure 2. Frequency distributions of foraging Fuerteventura Blue Tits on the different plant species (i.e. PUGR=*Punica granatum*, CESI=*Ceratonia siliqua*, FICA=*Ficus carica*, NIGL=*Nicotiana glauca*, OTHER=*Arundo donax*, *Agave americana*, *Opuntia* sp., LAAR=*Launaea arborescens*, EUPH=*Euphorbia* sp., LYIN=*Lycium intricatum*, ACAC=*Acacia* sp., KLNE=*Kleinia neriifolia*, TACA=*Tamarix canariensis*, PHOE=*Phoenix* sp.) and the proportions of plant species available. Sample sizes in brackets.

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