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BREEDING PERFORMANCE
OF *PARUS CAERULEUS ULTRAMARINUS*
ON PANTELLERIA ISLAND (SICILIAN CHANNEL)

Abstract. — Clutch size of *Parus caeruleus ultramarinus* breeding on Pantelleria Island was 5.3 in 1994 (7 nestboxes) and 5.5 in 1995 (6 nestboxes); fledgelings were 4.4 in 1994 and 4.3 in 1995. These values resulted markedly lower than those recorded for the same subspecies in North Africa, but higher than those reported from another island, Tenerife (Canary Is.), for the subspecies *teneriffae*. The availability of caterpillars of two species of Limantriidae (*Thaumtopoea pityocampa* and *Euproctis chrysorrhoea*), widespread at Pantelleria (where they have been quoted since 1875), certainly consented the positive colonization of the bird into the island, but the seasonal fluctuation of food availability is probably responsible for the low clutch size and fledging success.

Riassunto. — *Parametri riproduttivi di Parus caeruleus ultramarinus nell'isola di Pantelleria.*

Sono stati controllati 7 nidi nel 1994 e 6 nel 1995 della sottospecie maghrebina *Parus caeruleus ultramarinus* nidificante nell'isola di Pantelleria. La dimensione della covata è stata di 5,3 uova nel 1994, 5,5 nel 1995, il numero di giovani involati 4,4 nel 1994, 4,3 nel 1995. I dati ottenuti, confrontati con analoghi valori rilevati in Nord Africa, sono risultati nettamente inferiori ad essi, ma appena superiori solamente a quelli riportati per *Parus caeruleus teneriffae* di Tenerife (Canarie). La disponibilità di larve di due specie di Limantriidae (*Thaumtopoea pityocampa* e *Euproctis chrysorrhoea*) numerose a Pantelleria, ove sono presenti almeno dal 1875, ha certamente permesso l'insediamento di questo insettivoro, ma la fluttuazione stagionale della disponibilità alimentare probabilmente è responsabile degli scarsi valori riproduttivi riscontrati.

Introduction

The subspecies *Parus caeruleus ultramarinus* is widespread in the North-western Africa (where it lives on broadleaved and coniferous woodland, as well as in fruit orchards, olive groves and palm oases). A small

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population also inhabits the Italian isle of Pantelleria (the only area outside Africa), between Sicily and Tunisia, where it were discovered in 1954 by MOLTONI (1971), but not observed neither by STEINFATT (1934) (who however recorded 21 *Parus major*) nor by FOSCHI (1968). It is probably increasing in the last fifteen years: less than 100 individuals have been estimated by BRICHETTI & VIOLANI (1986), while as much as 300-400 pairs by LO VALVO *et alii* (1993). There it occurs from the sea level to the highest top of Montagna Grande (836 m) on wood thickets dominated by *Pinus pinaster* or *Pinus halepensis* and the mediterranean maquis characterized by the Pino-Genistetum aspalathoidis and Erico-Quercetum ilicis associations.

Few data on the reproduction of this subspecies have been published by WHITAKER (1905), ETCHÉCOPAR & HÜE (1964), HEIM DE BALSAC & MAYAUD (1962), BAOUAB *et alii* (1986), ISENMANN (1987), MOALI & ISENMANN (1990). In 1993 we started a research on the biology of the population of Pantelleria; we report here the first results.

Material and methods

In September 1993 we placed 36 nestboxes on *Pinus pinaster* of Montagna Grande, between 500 and 600 m, within a habitat characterized by pines and some sclerophyll species, as *Quercus ilex*, *Erica* spp., *Pistacia lentiscus*, *Arbutus unedo*, etc. From April 1994 all the nestboxes were visited twice in a month and the following information was recorded: 1) date of the first egg, calculated assuming that females lay one egg each day; 2) clutch size; 3) brood size; 5) fledging success. In September 1994 all the nestboxes were cleaned and in 1995 the same information of the previous year was recorded.

Results and discussion

Seven and six nestboxes were occupied by Tits respectively in 1994 and 1995. In 1994 laying lasted from 14 April to 26 May, in 1995 from 7 to 21 April; clutch size was similar in the two years (5.3 eggs in 1994, 5.5 in 1995), as well as fledging success (4.4 fledgings in 1994, 4.3 in 1995) (Table I). Breeding success was as much as 78-83%.

Laying date at Pantelleria, even if very variable, lies among those recorded for North Africa, namely Algeria (MOALI & ISENMANN, 1990) and Morocco (both in *Quercus suber* woods and in montane woodland dominated by *Cedrus* and *Quercus*) (BAOUAB *et alii*, 1986; ISENMANN,

TABLE I. — Main data on the reproduction of Blue Tit on Pantelleria I. In brackets mean values \pm standard deviation.

	Laying date	Clutch size	Number of fledglings
1994 (n = 7)	14.IV-26.V (9.V)	5/5, 2/6 (5.3 \pm 0.49)	2/3, 1/4, 3/5, 1/6 (4.4 \pm 1.13)
1995 (n = 6)	7.IV-21.IV (14.IV)	4/5, 1/6, 1/7 (5.5 \pm 0.84)	1/1, 1/4, 3/5, 1/6 (4.3 \pm 1.75)

1987) (Table II), while clutch size is lower than the mean values reported from North Africa (WHITAKER, 1905; HEIM DE BALSAC & MAYAUD, 1962; ETCHÉCOPAR & HÜE, 1964), from coast sites of Algeria (MOALI & ISENMANN, 1990), Morocco (BAOUAB *et alii*, 1986) and one montane site (1600 m) of Morocco (ISENMANN, 1987), but higher than the very low values from Canary Is. (SNOW, 1954; ISENMANN, 1987; MORENO, 1988).

Breeding success of Blue Tit in North Africa is as variable as in Europe; MOALI & ISENMANN (1990) report values as 90% from Algerian nests in a *Quercus ilex* wood, and 84% in a *Cedrus atlantica* woodland; BAOUAB *et alii* (1986) record values between 0.56 and 0.98% in a *Quercus suber* wood in Morocco, and ISENMANN (1987) between 0.46 and 0.96 in a montane (1600 m) mixed wood of *Cedrus* and *Quercus*.

Values of clutch size and breeding success obtained at Pantelleria are lower than those recorded in Sicily by MASSA & LO VALVO (in press) for *P. c. caeruleus* in habitats qualitatively poor in resources (reafforestation by *Pinus halepensis*), and markedly lower than those obtained in natural habitats (evergreen and deciduous oakwoods) (Table II). Clutch size of North African *P. caeruleus ultramarinus* is lower than that of the European *P. c. caeruleus*, but that of the population of Pantelleria lies markedly below the mean values of North African Blue Tits and resulted higher than only that of another insular population (*P. caeruleus teneriffae* of Tenerife), for which we do not dispose data on prey availability. This may indicate the poorer quality and more variable environment of Pantelleria habitats, also stressed by its insularity.

Insularity in itself is not a factor bringing about the reduction of the brood size and breeding success, but should possibly operate through the lowering of the habitat productivity. Many factors responsible for the variation in clutch size influence the female in deciding how many eggs to lay. Considering the scarce difference between the clutch size and the number of fledglings at Pantelleria, factors influencing breeding

TABLE II. — Breeding data of Blue Tit; numbers are referred to minima and maxima or to mean and standard deviation (in brackets) according to various sources. Laying dates are referred to 1st January.

References: 1 = BAOUAB *et al.* 1986; 2 = BELLAVITA & SORACE 1991; 3 = BLONDEL & ISENMANN 1979; 4 = DELVIEUX *et al.* 1990; 5 = GIL DELGADO *et al.* 1992; 6 = ISENMANN 1982; 7 = ISENMANN 1987; 8 = ISENMANN *et al.* 1990; 9 = LAMBRECHTS & DIAS 1993; 10 = MOALI & ISENMANN 1990; 11 = LO VALVO & MASSA in press; 12 = present study.

	Laying date	Clutch size
EVERGREEN		
<i>oakwood</i>		
France	108.2(5.09) ^(4,6)	8.1(1.5) ^(4,6)
Spain	76-88 ⁽⁸⁾	7.5-8.5 ⁽⁸⁾
Spain	127(7.25) ⁽⁵⁾	9.5(1.4) ⁽⁵⁾
Italy	114.4(3.9) ⁽²⁾	8.3(0.9) ⁽²⁾
Algeria	130 ⁽¹⁰⁾	6.6(1.4) ⁽¹⁰⁾
Morocco	93-112 ⁽¹⁾	6.8(1.1) ⁽¹⁾
Sicily	96.6-120.4 ⁽¹¹⁾	6.5-10.3 ⁽¹¹⁾
Corsica	123.3-150 ^(3,6,7,9)	5.2-7.2 ^(3,6,7,9)
Mallorca		6.9(1.2) ⁽⁸⁾
DECIDUOUS		
<i>oakwood</i>		
France	100.0(4.2) ^(4,7)	10.9(1.8) ^(4,7)
Italy	101.7(8.7) ⁽²⁾	8.2(1.3) ⁽²⁾
Sicily	95.6-125 ⁽¹¹⁾	8-11.1 ⁽¹¹⁾
Corsica	117.7(6.2) ⁽⁷⁾	
CONIFEROUS		
<i>wood</i>		
France		8.8(1.3) ⁽⁷⁾
Italy	114.9(10.5) ⁽²⁾	8.2(1.3) ⁽²⁾
Morocco	135-147 ⁽⁷⁾	6.7(1.3) ⁽⁷⁾
Sicily	100.1-141.7 ⁽¹¹⁾	5.1-7.8 ⁽¹¹⁾
Corsica		6.3(0.5) ⁽⁷⁾
Canary Is.		3.5(1) ⁽⁷⁾
MIXED WOOD		
Pantelleria	104-146 ⁽¹²⁾	5.4(0.5) ⁽¹²⁾

Note. Further data on the clutch size in North Africa are the following: WHITAKER (1905) indicates 6-8 eggs per nest in Tunisia, ETCHÉCOPAR & HÜE (1964) report for North western Africa clutches of 6-9 eggs (min. 5, max. 10), and HEIM DE BALSAC & MAYAUD (1962) record a mean value of 7.6 ± 1.4 eggs (min. 5, max. 10) from 45 nests checked in Tunisia and Algeria.

parameters of this Tit population should operate above all in reducing the clutch size. At Pantelleria, within the study area, Tits dispose of a very good amount of prey during the reproduction period. Caterpillars of Lepidoptera Limntriidae *Thaumtopoea pityocampa* (Denis & Schiffermüller) living on *Pinus pinaster* and of *Euproctis chrysorrhoea* (L.) living on *Arbutus unedo* are particularly active and available prey for Tits, the former in March-May and from August to October, the latter in March-October (less in June-July); in winter they are active only in the warmest days, generally spending their time within the nests (LONGO, 1995; LO VERDE & MASSA, 1995). Outbreaks of *Thaumtopoea pityocampa* have been observed since the past century (RAGUSA, 1875) and regularly all the last ten years round (but probably the species has been always abundant on the isle); recent outbreaks of *Euproctis chrysorrhoea* have been recorded from 1991 onwards (LONGO, 1995; LO VERDE & MASSA, 1995); thus the low clutch size and breeding success of Tits are not dependent on the spring-summer food availability, but possibly on the scarce winter food availability, which in turn should indirectly influence the population dynamic.

This could be partially pertinent with the « trade-off » hypothesis; it suggests that if there is a cost to a bird in terms of its own survival incurred by producing a larger clutch, it may balance the value of the current brood against the value of future broods (GOSLER, 1993). Because of the fluctuation of the food availability in the different seasons of the year, according to this hypothesis, Blue Tits of Pantelleria, by reducing the number of eggs and chicks produced the present year, may increase the likelihood that they will survive in order to breed the next year.

With few exceptions, generally small islands do not hold *Parus* species, particularly *Parus caeruleus*; this is probably due to the food unavailability all the year round on small sized islands. Pantelleria is a true exception because it is a small island (83 km²), 67 kms far from the mainland (Tunisia): probably thank to the food availability during the majority of the seasons the Blue Tit colonized the isle, certainly from Tunisia, with a stable population; the more or less constant food availability in the last century, especially in the breeding season, should account for the positive result in its immigration to the isle.

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