

Breeding biology of Grey Wagtail *Motacilla cinerea canariensis* on Tenerife, Canary Islands

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Abstract. The paper reports on the breeding biology of the endemic subspecies of the Grey Wagtail in a human transformed area (banana plantations) on Tenerife (Canary Islands). Clutch size (3.96 ± 0.6) was lower than in continental zones, probably because of the climatic stability of the islands. Furthermore, the distance from the nest to the nearest water source and the length of the breeding season (late February–June) were greater than in other European populations. Some breeding traits fit the predictions of the so-called insular “syndrome”. Possible mechanisms underpinning these differences in breeding traits are discussed.

Key words: Grey Wagtail, *Motacilla cinerea canariensis*, nesting, nest site, cultivated area, island, latitudinal gradient

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Isolated populations occupying different environments often present variation in life history traits (Roff 1992). Latitudinal and altitudinal gradients may favour differences on avian breeding rates and strategies related with seasonality of resources utilized by a population (e.g. Ricklefs 1980, Van Zyl 1999, Badyaev & Ghalambor 2001, Cardillo 2002, Griebeler & Böhing-Gaese 2004). Ecological conditions on islands could also be responsible for particular differences in reproductive life history traits in birds (Cody 1966, Lack 1970, Williamson 1981, Blondel et al. 1990, Thibault et al. 1992, Blondel 2000). Island birds, compared with those of continental populations, are characterized by having smaller clutch sizes, later laying dates and higher productivity and adult survival (Cody 1966, Wiggins et al. 1998, Blondel et al. 2006).

Breeding biology of Grey Wagtail *Motacilla cinerea* has been well studied in Europe (e.g. Nicoll 1979, Flousek 1987, Smiddy & O'Halloran 1998). However, very little is known about Macaronesian endemic subspecies (*M. c. patriciae* from Azores, *M. c. schmitzi* from Madeira and *M.*

c. canariensis from Canary Islands). In these archipelagos no precise studies have been published on its biology and only limited information is available (Bannerman & Bannerman 1965, 1966, Martín & Lorenzo 2001). Canarian Grey Wagtail nests in ravine beds with water pools, cultivated areas, coastal cliffs and human centres in four of the seven major islands, where it is relatively common and well distributed (Martín & Lorenzo 2001).

In the present study we described some aspects of the breeding biology of an insular Grey Wagtail population and its relationship with nest site characteristics on a human transformed area. Our main goal was to evaluate breeding life history traits similarities and differences between this insular population and the continental ones.

Our study area was located in the northwest of Tenerife Island, the largest in Canarian Archipelago located 100 km off the north-west African coast ($27^{\circ}37' - 29^{\circ}25'N$ and $13^{\circ}20' - 18^{\circ}19'W$). It is a coastal zone (from sea level to 185 m altitude) characterized by the presence of banana

plantations, water ponds and dispersed human centres. Potential vegetation is almost inexistent and no natural running water occurs year around. The coastline is predominantly rocky with boulder shore and cliffs up to 50 m.

Data were collected during the breeding seasons 2005–2006. Nests were searched mainly along walls in the roads of the banana plantations, but also in coastal cliffs and natural caves. For each nesting attempt the following data were collected: position, orientation, height, altitude and distance to nearest water sources (ponds, pools or sea) of the nest, clutch size, brood size at hatching (1–3 days post hatching) and brood size at fledging (7–10 days old nestlings). An orientation index was used in statistical analysis with higher scores for the sunniest and most sheltered orientations in respect to NE dominant winds (1 — NE, 2 — N and E, 3 — NW and SE, 4 — W and S, 5 — SW). Height above ground, and nest-hole dimensions (entrance height and width, and cavity depth) were measured in all located nests. Nest experienced more than one breeding attempt was used only once to avoid pseudoreplication. In most cases, laying date (grouped in fortnights) of the first egg was back-calculated considering estimated age of chicks, 13 days as incubation period, and 1 day for each egg laid (Flousek 1987, Ormerod & Tyler 1987). Although we did not individually mark birds, we categorized each breeding attempt as 1st, 2nd or 3rd clutch whenever possible, based on the utilization of the same nest or other in the proximities.

We recorded the following breeding parameters: 1) brood size at hatching estimated as hatched chicks/nests with at least one hatched chick, 2) hatchability as the percentage of young hatched/egg laid, 3) fledging rate as fledging chicks/successful nests, 4) nesting success (calculated only from nests found at the egg stage) as the percentage of breeding attempts with at least one fledged chick, and 5) breeding success as the proportion of eggs producing surviving offspring. Since many nests were not detected from egg stage, sample size varied for each analysis. Whenever possible, causes of nest failure were classified as predation, abandoned eggs or unknown. Deserted and infertile eggs were collected and measured (length and width) using a calliper to the nearest 0.1 mm.

To assess possible differences in breeding rates between years or first and second clutches, Mann Whitney U-test was used. The Spearman's coefficient correlation analysis was used to determinate

the relationships between laying date and clutch size, and between nest site variables and breeding parameters (clutch size, brood size at hatching and brood size at fledging). To analyse longitudinal and latitudinal variation of clutch size in some Western Palearctic populations, Pearson correlation was used.

All studied nests ($n = 31$) were located in wall and cliff holes except one located just on the floor of an agricultural construction. The majority of nest locations (67.7%) were associated to walls of the banana plantations. Average nest height location above ground level was 159.7 ± 98 cm and mean distance to water edge was 31.1 ± 50.4 m, but some nests were beyond 100 m from water ponds. Hole dimensions used to place nests were on average: height = 12.1 ± 5.0 cm, width = 11.2 ± 4.3 cm and depth 20.2 ± 11.3 cm ($n = 29$). Slope aspect of 74.2% of nests was N ($n = 15$) or NW ($n = 8$).

A total of 45 breeding attempts of Grey Wagtails were found during both studied years. The breeding season in our study area extended from late February to early June, with the majority of eggs (60%) being laid in March and May (Fig. 1). No statistical differences were detected in clutch size, brood size at hatching and fledging rates between years ($U = 79$, $p = 0.74$; $U = 56$, $p = 0.32$; $U = 71$, $p = 0.37$, respectively) or between first and second clutches ($U = 20$, $p = 0.12$). Second clutches of the same pairs were assumed in 44.4% and third ones only in 11.1% ($n = 18$). Complete clutch sizes ranged from 3 to 5 eggs (average 3.96 ± 0.6), distributed as follow: 63% of four eggs, 22.2% of three and 14.8% of five. No significant correlation was detected between

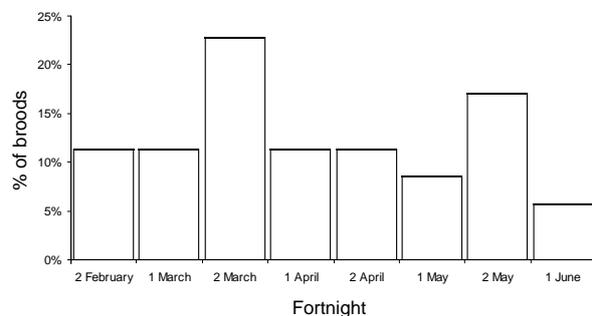


Fig. 1. Distribution of first egg laying dates of Grey Wagtail during seasons 2005–2006 in Tenerife Island. Dates are the first days of each fortnight ($n = 35$ broods).

Table 1. Breeding parameters of selected populations of Grey Wagtail (mean \pm SD). Sample sizes in brackets.

Locality (latitude-longitude)	Clutch size	Brood size at hatching	No of fledglings	Hatchability (%)	Breeding success (%)	Nesting success (%)	Source
Denmark (61°N-4°E)	5.45 \pm 0.88 (126)	-	-	80.9 (420)	56.8 (590)	-	Jørgensen (1977)
Czechoslovakia (49°N-15°E)	5.27 \pm 0.82 (168)	-	4.61 (114)	94.3 (-)	57.7 (-)	62.1 (182)	Flousek (1987)
Wales (51°N-9°W)	5.07 \pm 0.56 (147)	4.40 \pm 1.05 (171)	-	-	-	51.7 (89)	Ormerod & Tyler (1987)
Britain (52°N-0°)	4.93 \pm 0.70 (203)	-	3.91 \pm 1.18 (86)	94.3 (246)	42.3 (338)	34.5 (162)	Tyler (1972)
Ireland (52°N-3°W)	4.79 \pm 0.54 (175)	4.59 \pm 0.05 (139)	4.00 \pm 0.09 (147)	-	55.9 (630)	63.8 (138)	Smiddy & O'Halloran (1998)
Catalonia (41°N-1°E)	5.15 (24)	-	-	-	-	-	Muntaner et al. (1983)
Tenerife (28°N-16°W)	3.96 \pm 0.60 (26)	3.40 \pm 0.96 (25)	2.85 \pm 1.10 (27)	69.4 (72)	43.4 (99)	53.8 (26)	Present study

seasons in stable climates, which allows adults to nourish a large number of broods. In contrast, in temperate climates, large food resources variation accomplishes a high winter adult mortality which reduces intraspecific competition during breeding period. Other factors that may play an important role on clutch size reduction are dimension and isolation of the islands, migratory behaviour of the species, and/or rate of parasite infestation (Wiggins et al. 1998, Blondel 2000).

As in many passerine birds (De la Puente & Yanes 1995), predation is the main cause of nesting failure for Grey Wagtails (Flousek 1987, Ormerod & Tyler 1987, Smiddy & O'Halloran 1998). In our study, introduced rats *Rattus* sp. and endemic lizards *Gallotia galloti* could play an important role. Both predators are very common in the study area (pers. obs.), but lizards are more abundant and probably appropriate for predation because they also live in the banana plantation walls where the nests are situated. The fact that most nests were located in walls facing N or NW supports this explanation, because lizards do not use these shaded places.

Finally, Grey Wagtail populations in natural areas nearby to our study area may present different breeding traits. This fact could be related to varying food resource availability or predation rates, and therefore, insular 'syndrome' would be not correctly evaluated in our human transformed study area. More precise studies involving populations from human transformed/natural environments and continental/islands areas with similar latitude are needed.

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STRESZCZENIE

[Biologia lęgów pliszki górskiej na Teneryfie (Wyspy Kanaryjskie)]

W pracy zebrano dane dotyczące rozrodu dla endemicznego podgatunku *Motacilla cinerea canariensis*, występującego na Teneryfie. Prace prowadzono na terenie plantacji bananów, oraz przybrzeżnych klifach. Opisano wielkość miejsc gniazdowych, ich położenie (wysokość nad ziemią, odległość od najbliższego zbiornika wodnego), oraz termin przystępowania do lęgów, wielkość zniesienia i liczbę piskląt opuszczających gniazdo.

Ptaki gniazdowały przede wszystkim w niszach murów znajdujących się wzdłuż dróg plantacji. Okres lęgowy rozciągał się od lutego do czerwca, większość jaj składanych była w marcu i maju (Fig. 1). Wielkość zniesienia korelowała negatywnie z wysokością położenia gniazda (Fig. 2) i była mniejsza niż stwierdzana w populacjach z kontynentu, prawdopodobnie w związku ze stałością klimatu na wyspie (Tab. 1). Liczba jaj i wylatujących piskląt korelowała również z wielkością niszy zajmowanej na gniazdo oraz z orientacją otworu wejściowego względem kierunków świata (Fig. 2). Straty lęgowe spowodowane były głównie drapieżnictwem (57.1%). Odległość od gniazda do najbliższego źródła wody oraz długość okresu lęgowego były większe niż w innych populacjach europejskich.

Niektóre stwierdzone aspekty lęgów pasują do założeń "syndromu wyspowości". Mechanizmy leżące u ich podstaw są w pracy dyskutowane.