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BIOLOGY OF THE WREN, *TROGLODYTES TROGLODYTES*, IN A MEDITERRANEAN INSULAR AGROECOSYSTEM

Abstract – In the last years many species of birds have exploited urban and suburban habitats, taking opportunistically advantage of human presence for their niche parameters. The Wren is one of them and shows a high variability in the choice of nesting sites in the gardens of the outskirts of Palermo (Sicily). For many years the authors studied the breeding habits of this small bird, and thanks to the video-tape recordings on the nests, they were able to gather new information on its feeding habits and parental care. They could establish the role played by both parents, the different prey types carried to the chicks, and other data, scarcely known in the southern part of distribution of this passerine.

Key words – Wren, Sicily, citrus groves, nesting sites, breeding season, parental care, chick diet.

Riassunto – Biologia dello Scricciolo, Troglodytes troglodytes, in un agroecosistema insulare mediterraneo.

Negli ultimi decenni molte specie di uccelli hanno occupato le aree urbane e suburbane, sfruttando opportunisticamente alcune caratteristiche della loro nicchia e potendo avvantaggiarsi in tal modo della presenza umana. Lo scricciolo è una specie abbastanza adattabile, che ha dimostrato nell'area studiata, i giardini del Palermitano, una grande plasticità nella scelta dei siti di nidificazione. Per diversi anni è stato studiato il suo comportamento riproduttivo e, grazie all'uso di video-registrazioni realizzate presso i nidi, sono state raccolte molte informazioni inedite sull'alimentazione e sulle cure parentali. Lo studio ha permesso di chiarire il ruolo svolto da ambedue i sessi nella cura dei piccoli, nonché il tipo di alimentazione, informazioni poco note per l'area di distribuzione meridionale della specie.

Parole chiave – Scricciolo, agrumeti, sito di nidificazione, stagione riproduttiva, cure parentali, dieta dei pulcini.

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Introduction

The Wren, *Troglodytes troglodytes*, covers an enormous area of the world (ARMSTRONG, 1992; BREWER, 2001). Even though this inconspicuous bird is a very popular and known bird in the Palearctic region, it has rarely been object of specific researches (see CRAMP, 1988; ARMSTRONG, 1992; BREWER, 2001). The present paper aims to summarize all the available data on the Wren biology in a mediterranean island to compare them with information collected in other parts of its distribution.

Material and methods

Field work was carried out between 1979 and 2008, mainly in two orchards (loc. Altarello di Baida-Fondo Micciulla and Borgo Molara, Palermo, Sicily), between 80 and 200 m a.s.l., mostly dominated by *Citrus* spp., mixed with *Eriobotrya japonica* and scattered *Pyrus communis*, *Prunus persica*, *P. domestica*, *Ficus carica*, *Morus alba*, *M. nigra*; edges are characterized by the presence of ornamental trees and *shrubs* (*Cupressus arizonica*, *Thuja* sp., *Pinus halepensis*, *Melia azedarach*, *Laurus nobilis*, *Celtis australis*, *Rubus ulmifolius*, *Duranta ellisia* and *Hedera helix*). They are surrounded by other orchards with similar characteristics.

Wren nests were checked, collecting all the possible parameters (laying date, clutch size, chicks fledged); in April 2005, 2006, 2007 and 2008 five nests were monitored at Borgo Molara by a videotape, and data on relationships between adults and chicks were provided by recording images (243 hours of recordings, videotaped at random in different day times from hatching to fledging).

Results and discussion

Breeding and winter habitats

The Wren is recently increasing in Sicily (IENTILE & MASSA, 2008). ORLANDO (1936a, 1936b) found it as breeder at Palermo only in the Favorita Park and Villa d'Orléans, but since 1980s it was increasing in the city gardens and outskirts of Palermo. In Fondo Micciulla, where the vernacular name of this bird is unknown (LA MANTIA & MASSA, 2008), it arrived in 1979, while it colonized Borgo Molara in 1991-1992; previously, it was absent in both sites. Generally, in Sicily the Wren is typical of natural wooded and bushy areas, thus its old presence in the Favorita Park, characterized by Mediterranean maquis and thickets, seems obvious; the presence in the Villa d'Orléans, above recorded, is explainable by its subtropical vegetation, which characterizes historic gardens of Sicilian towns and is comparable to natural woods. It is absent from pure citrus groves (*Citrus* spp.), while it is present in citrus groves mixed with other cultivated trees (e.g.: loquats *Eriobotrya japonica*) (LA MANTIA & LO VALVO, 1982). This is confirmed by its distribution in Sicily (IENTILE & MASSA, 2008), with an evident absence in the Catania plain, characterized by pure citrus groves. The Wren inhabits many Italian urban habitats (e.g.: DINETTI, 2009), but it needs a structurally rich vegetation, which limits its spreading in respect to other adaptable birds.

In Fondo Micciulla, density of wrens increased in the first years after their colonization, even if many nests were destroyed during pruning and harvest of fruits, mainly when built within tree twigs. In the last years the number of pairs became stable (Table 1), and nests are generally built within holes of walls and houses (Table 2). Possibly, nest location in "secondary" situations gives better opportunities to avoid nest predation, as well as nests built among roots of uprooted trees instead of suspended in branches, cited by WESOLOWSKI (1983) as example of "secondary versus primaeval situations".

Year	Density (pairs/10 ha) and references					
1979	2 pairs					
1980	4 pairs (LA MANTIA, 1982)					
1981	10 pairs (LA MANTIA & LO VALVO, 1982)					
1982	35 pairs (Lo VALVO et alii, 1985)					
1983	25 pairs					
1984	15 pairs					
1985-2007	about 10 pairs					

Table 1 - Variation of Wren density (pairs/10 ha) at Fondo Micciulla (Palermo).

During the winter it may be erratic and reaches localities very far from its usual range; e.g.: one individual observed on the isle of Ustica on 10 March 1959 (GIAMBONA, 1971), another on the isle of Pantelleria on 15 November 1993 (T. La Mantia, pers. obs.), which could belong to the North African as well as to the Italian populations; additionally, according to SULTANA & GAUCI (1982), it is a winter visitor to Malta. North African populations do vertical movements (CRAMP, 1988). However, in our study-areas, it did not show any density increase in winter.

Breeding period

Nest building starts very early, sometimes in January (21th January 1984, 27th January 1995, 31th January 1993), generally in February (2nd

February 2002, 5th February 2008), at least one month before egg laying, but generally a two weeks period of break occurs after the first material is provided within the site; afterwards, the nest is built in a few days (e.g.: 7-10 March 2002, 3-6 March 2007, 22-24 February 2008). According to ARMSTRONG (1992), in Western Europe nest building begins in early March and continues for some months. Generally wrens avoid using nests for their second brood (ARMSTRONG, 1992). We observed only in one case a nest used by the same pair twice in one season, but it was built inside a nestbox for tits.

When the nest is finished, the male starts singing next to it (distance from the nest: 5-20 m, rarely more); the highest song activity lies in the first hours of the day and before sunset. During summer months wrens reduce singing activity, as already recorded in central Italy by FRATICELLI (1996).

Wrens may build more than one nest per breeding season; this possibly depends on the availability of sites, as well as on the availability of females. Being polygamous, they may at the same time mate with two females, but this occurs where habitat conditions consent a good resource availability. In Fondo Micciulla a male regularly built three nests every year, but polygamy has been verified only once, in 2006, when a male made a second brood, mating with two females in two nests, 20 m away from each other. On 13^{th} June fledglings left the first nest and on 23^{rd} the second one.

Nesting sites

There are some unusual sites reported in the literature, as a disused bicycle bag hanging in a summerhouse that was used several years in succession, or in the remains of a Sparrowhawk, Accipiter nisus, on a gamekeeper's gibbet (ARMSTRONG, 1992), among the boards of a small bridge (PAULUCCI, 1911-12), within a nest of a Swallow, Hirundo rustica, (BISCARETTI DI RUFFIA, 1975), or within a pocket of an overcoat hanging in a garage (Ravasini, 1995 in BRICHETTI & FRACASSO, 2007). As regards Sicily, GIGLIOLI (1891) reported the opinion of L. Dellafonte and O. Garofalo from Modica (Ragusa), who stated that wrens were nesting preferably between 1-3 m, within holes in caves, barnyards next to houses, and in the vicinity of mills. Actually, in most cases it prefers rocky areas, particularly when they are inside woods; this is documented by Sicilian vernacular names associated with rocks and walls ("Rijddu di rocca", "Riiddu percia mura") (LA MANTIA & MASSA, 2008). In addition, it takes often advantage from human buildings inside wooded areas, as sheds, small cottages, barns, etc., to build the nest outside or inside them.

Nests are placed on very different structures: they may be built among twigs and in crevices, as well as in holes; in June 1981 we found a nest inside the pocket of a pair of trousers abandoned on a loquat tree and in the following years many other nests built in different odd, but safe, locations, as among a set of reeds resting on the wall of a storehouse, within a bunch of dry grass abandoned on a tree or hanging on a nail in a storehouse, or within a porch candelabrum or a muzzle hung on a tree (Table 2, Plates 1-3).

Sites	1979	1980	1981	1982	1983	1984	1985	1986	Total
Between twigs of Eriobotrya japonica	1	4	1		2			1	9
Within the hole of a house				2	1	1	2	1	7
Within bunches of Borago officinalis (1)			2	1					3
Within the small branches of <i>Tradescantia</i> sp. (2)			1	2^{*}					3
Among some reeds of Arundo donax (3)			1	2					3
Within a hole of the old trunk of <i>Eriobotrya japonica</i> and <i>Citrus</i> sp.					3				3
On the leaf of Yucca elephantipes						1	1	1	3
Within abandoned clothes			1	1					2
Within plastic or paper bag (4)	1			2					3
Within dried twigs of Laurus nobilis (5)					1			1	2
Within a metallic tube			1						1
Within the leaves of Ampelodesmos mauritanica (6))		1						1
Within an engine (7)			1						1

Table 2 - Sites used by wrens to build nests in Fondo Micciulla between 1979 and 1986.

Notes: (1) Farmers use to collect bunches of plants of *Borago officinalis* to obtain dried seeds. (2) *Tradescantia* sp. is an infesting plant spreading by stolons; farmers collect and leave it among branch forks, where it dries up. It is also used as an ornamental plant; the asterisk (*) records a nest built within branches falling from a pot placed on a wall, one meter high and 20 cm far from the house door. (3) Farmers collect plants of *Arundo donax* and tie them for some different agricultural uses (e.g.: as canes for climbing vegetables). (4) Bags abandoned among branches. (5) Farmers use to hang some twigs of the Laurel, *Laurus nobilis*, on a tree to obtain dried flavouring leaves; sometimes the Wren exploits this site to build its nest. (6) In this case the Wren built a nest, 145 cm from the ground, within a bunch of *Ampelodesmos mauritanica*, bound together and hanging on a wall of a cattle shed, sheltering five cows; during the night the window was closed, and at the break of the day, the Wren sang continually up to the opening of the window and nest admittance. (7) In this case, the Wren nested within an engine, at the bottom of a well, 9 meters deep.

Since 1984 density of wrens in Fondo Micciulla decreased (Tab. 1) and their nesting among branches of loquats, where breeding success was very low, became rare (only two cases observed) (Plates 2-3); one occasional nesting site, probably safer, has been observed under the bark of a dead loquat (Plate 2). Further, reducing and partial abandonment of agricultural activity in Fondo Micciulla caused a progressive disappareance of some of the nesting sites listed in Tab. 1 (e.g.: nests within bunches of reeds became rarer, one nest within a pair of



Plate 1 - Different locations of Wren nests. From above on the left to bottom on the right: nests within a bunch of *Ampelodesmos mauritanica*, within branches of *Borago officinalis*, within some *Arundo donax* inside a storehouse, and on a hut made by reeds.

trousers abandoned on a loquat and another one in a newspaper left between two branches were found in March 1994) (Plate 3). Nowadays, nesting sites in Fondo Micciulla are nearly exclusively associated with human buildings (e.g.: on roof beams, in nestboxes, in a basket hanging on a roof, inside a small lamp, and between the branches of an orna-



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Plate 2 - Other locations of Wren nests. From above on the left to bottom on the right: nests inside the pocket of a pair of trousers abandoned on a loquat tree, between twigs of a loquat, built under the bark of a loquat, inside a wicker basket suspended at a storehouse, within a lamp and a nestbox.

mental *Cereus* sp. (Plates 2-4). In 1999 we found at Fondo Micciulla a nest with four eggs on *Eriobotrya japonica*; it was built within thick vegetation resprouted after strong pruning. On 2009 a nest with the same characteristics was found.

The Wren is double brooded; the first breeding occurs about one



Plate 3 - Other locations of Wren nests. From above on the left to bottom on the right: nests within a paper bag abandoned on the branches of a tree, among leaves of a loquat, concealed under an old jacket abandoned on a loquat, placed between the branches of an ornamental *Cereus* sp., and in three different buildings.

month after nest building, between early March and late April, the second one between April and June. It seems that any correlation between breeding date and latitude exists. According to PAZZUCONI (1997), in North Italy laying occurs between early April and late July, with first BIOLOGY OF THE WREN, TROGLODYTES TROGLODYTES, IN A MEDITERRANEAN INSULAR AGROECOSYSTEM



Plate 4 - A very odd location of a Wren nest, inside an ornamental brush suspended inside a storehouse.

brood in mid April and the second one in mid June; BRICHETTI & FRACASSO (2007) report egg laying in Italy between March and July, and CRAMP (1988) reports also for North-West Europe breeding from mid March. We checked egg laying of the first clutch between 5^{th} March and 8^{th} April and fledging between 13^{th} April and 6^{th} May, egg laying of the second clutch between 8^{th} and 18^{th} May and fledging between 11^{th} and 20^{th} June.

The interval between fledging of the first brood and laying of the first egg of second clutch averages ca. 20 days.

Number of eggs laid

Nests controlled contained 3-7 eggs (mean: 4.52 ± 0.95 ; n = 22; 5/3, 7/4, 6/5, 3/6, 1/7); this figure is just lower than the one recorded by Lo VALVO (1986) (mean: 4.86 ± 0.38 ; n = 7) at Favorita Park, Palermo. According to PAZZUCONI (1997) wrens in North Italy lay a mean of 5.07 eggs, while BRICHETTI & FRACASSO (2007) report for continental Italy figures between 4.9 and 5.9 and a mean of 5.1; PIACENTINI & THIBAULT (1991) give a lower number (4.1) for Corsica, and generally we consider that the mean number of eggs laid in the islands is lower than in continental areas.

Incubation

It seems that only the female incubates eggs. We never observed the male involved in egg incubation and we did not find any reference on this subject.



Plate 5 - Two images of a pair feeding chicks (Borgo Molara 2007), where the male (left) and the female (right) were an adult and a one year aged individual, respectively. The colour of the great coverts is uniformly medium brown with a tendency to have white tips to some of them in the adult, while it is rich rufous-brown in the first year.



Plate 6 - Wrens feed chicks always from the same nest locations; on the left the female, on the right the male of the pair videotaped in 2008.

Number of chicks hatched and fledged

On average we found 4-5 chicks in the nests $(4.4 \pm 0.60; n = 20)$ and 4-5 fledglings $(4.1 \pm 0.59; n = 25)$. The former figure is similar to the one recorded by Lo VALVO (1986) $(4.5 \pm 0.58; n = 5)$.

Parental care

Male and female of the pair recorded in 2007 at Borgo Molara were recognisable between them; they indeed were of different age, the male was adult, while the female was one year aged. It was possible to tell them apart by the colour of the great coverts, uniformly medium brown with a tendency to show white tips to some of them in the adult, rich rufous-brown in the first year (SVENSSON, 1992) (Plate 5). Recordings allowed to establish that the parents fed their chicks from different locations, always the same. This habit is known for the Great tit, *Parus major*, (KÖLLIKER & RICHNER, 2004; LESSELLS *et alii*, 2006), for which it has been suggested that by forcing chicks to choose between them, parents reduce the time cost of allocation to preferred offsprings, as nestlings move closer to the parent that will likely feed them (KÖLLIKER *et alii*, 1998). This may also apply to the Wren and should explain regularly different location on the nest used by the two parents. Also during 2008 recordings we could confirm that the parents fed their chicks from different locations, the female on the left, the male on the right of the nest hole. The male was also easily recognizable by its darker flanks (Plate 6).

Video recording of two nests with four chicks allowed to highlight a more frequent care (30%) by the female in respect to the male; the female visited the nest to feed chick on average 13.02 ± 4.09 , while the male 9.31 ± 2.68 times/hour (t test on the means \pm sd of different sexes, in different day times and days: -12.967; p < 0.0001; fd: 28). Altogether, adults fed the chicks 22.33 ± 5.24 times per hour, that is once every 2.7 minutes; considering also other nests, with 4-5 chicks, where it was impossible to distinguish between male and female, the adults fed the chicks between 18.22 ± 4.14 and 23.12 ± 5.11 times per hour, that is once every 2.59-3.29 minutes (Fig. 1).

Video recording of other three nests with three chicks confirmed higher care by the female; indeed, while the male visited the nest 3.04 ± 1.79 , the female fed chicks 11.27 ± 4.70 times/hour, that is a 73% higher effort than the male. In these cases (nests with three chicks), on the whole the adults fed their chicks 14.31 ± 3.14 times per hour, that is once every 4.2 minutes.

While the female rarely deserts the nest for more than 20-25 min, the male may desert chicks up to 2.0 hours, mainly in the 2-3 days before fledging, and particularly when the number of fledglings is less than four (2-3). They feed chicks from dawn till dusk, with fluctuating care and generally with higher rate one hour after dawn and before dusk, with minimum rate between 12:00 and 13:00. In April-May, when pairs were videotaped, in Sicily the sun rose at 5:40 and set at 18:40, that is wrens carried food to the nest with 3-4 chicks for 13 hours, amounting between 185 and 288 visits a day, respectively. On the whole, adults fed their chicks between 2,960 and 4,608 times in 16 days, with an increase between the 4th and the 9th day and a fluctuating rate between the 10th and 16th day (fledging day), when the number of visits is maximum (up to 26.6/hour) (Fig. 2).

In the first days after hatching, generally the female, after feeding the chicks, broods them for some minutes (8-10 min.). When chicks are 4-6 days old, the female enters the nest and remains inside it only for a



Fig. 1 - Above: Food intake by male and female during the day of the first brood (mean values of the first brood with four chicks). Below: Food intake by both adults.

short time (up to 4-5 min.), but, in the following days its resting periods inside the nest last no more than 1-2 minutes, during which the bird cleans the nest's bottom. Conversely, the male does not enter inside the nest after the hatching period.

Visit rates by males may vary between 9.5 in ssp. *zetlandicus* to 31 per hour in ssp. *troglodytes* (CRAMP, 1988). Goertz (1960, in CRAMP, 1988) found in Germany that a brood of five chicks received on average 19.3 \pm 2.1 visits per hour during 17-19 hours; in Britain three broods of four fed on average 106.3 times on the first day, increasing to 256 during 15 hours (17.7/hour) in the 15th day, while one brood of six fed 397 times per



Fig. 2 - Above: Food intake of male and female during the nesting days of the first brood with four chicks. Below: Overall food intake during the nesting days of the first brood with four chicks.

day (26.5/hour), two days before fledging (CRAMP, 1988). Rate of feeding visits to nest increases as the chicks grow (CRAMP, 1988); according to ARMSTRONG (1992), the number of visits with food steadily increases and may reach between 500 and 600 a day for three or four days towards the end of the nestling period. Overall, being spring daylight longer in Central Europe than in the Mediterranean region (15 and 13 hours respectively), the same mean food intake per hour should permit to bring more food during activity hours, and consequently to fledge more chicks.

In Borgo Molara, faecal sacs were removed by both parents; faeces were produced by chicks after feeding, the adults were waiting for



Fig. 3 - Overall faecal sacs removed by adults during the day (mean values of the first brood with four chicks).

excretion. In two nests with four chicks, the male removed faecal sacs from the nest 2.59 ± 1.42 , the female 2.80 ± 1.43 times/hour (t test on the means \pm sd of different sexes, in different day times and days: -0.9068; p = NS; fd: 28); in three nests containing three chicks, the male removed faecal sacs 0.59 ± 0.57 , the female 1.39 ± 1.44 times/hour (t test on the means \pm sd of different sexes, in different day times and days: -1.789; p = NS; fd: 22). Altogether, adults with four chicks removed 5.39 ± 2.51 , adults with three chicks removed 1.97 ± 0.73 faecal sacs per hour from the nest, peaking in the morning and fluctuating more or less not strictly in dependance of feeding rate (Fig. 3); correlation between the mean number of food intake and the one of faecal sacs removal was low and not significant (nests with four chicks: r = 0.323, t = 1.231, p =NS, fd = 12; nest with three chicks: 0.551, t = 2.086, p = NS, fd = 10). The nest is maintained very clean for the entire breeding period; in the last one or two days before fledging, sometimes the chicks do not wait for adults taking faecal sacs and drop them directly outside the nest.

Chicks stay inside the nest 15-17 days; the female roosts with them until the $5^{\text{th}}-6^{\text{th}}$ day. According to ARMSTRONG (1992), the nestling period usually lasts 16 days, it may be a day or two longer or shorter, depending on the rate of the chicks' development, and this in turn is related to the number to be fed and the availability of food. CRAMP (1988) reports a fledging period of 17.3 (14-19) days.

Young were observed to overnight inside the nest for a period between 9 and 14 days after fledging. According to ARMSTRONG (1992), the family may resort to the nest nightly for as long as fortnight. In winters 2004-2007 at Borgo Molara one adult male (identified by its song at sunset) overnighted next to the nest used in the previous season, and in the winter 2008-2009, it was observed to overnight during all the winter months inside the nest used for the first breeding of 2008. In Fondo Micciulla one adult male has been observed to overnight during the summer months inside a pot hanging to a house wall.

Chick diet

Prey identification on videotapes was possible only in a few cases, that is 609 prey items on the whole, a very small figure compared to the high number of feeding visits videotaped (more than 5,400) (Plate 7). 175 (28.7%) of them were Lepidoptera, of which 128 (21.0%) adult Lepidoptera Heterocera, 32 (5.2%) caterpillars, 15 (2.5%) chrysalids; 131 (21.5%) were small beetle larvae, 27 (4.4%) small Diptera, 59 (9.7%) Diptera Tipulidae, 69 (11.3%) larvae of Diptera Tipulidae, 9 (1.4%)



Plate 7 - Adults feeding chicks with lepidoptera (above), scale insects and larvae (bottom).



Plate 8 - Attempts of a Tree Sparrow, Passer montanus, to dispossess a Wren of its nest.

small Orthoptera Gryllidae, 6 (0.9%) young Phasmids, 24 (3.9%) Chilopoda, 19 (3.1%) Araneae, 12 (1.9%) small Mollusca Milacidae [*Tandonia sowerbyi* (Férussac)]; finally, in 33 (5.4%) and 36 (5.9%) cases, respectively, the adults fed the young with unidentified aphids and scale insects. Overall, diet of chicks suggests that adults capture their prey mainly on the litter soil, secondarily within low vegetation layers.

Relationships with other species

On 6th April 2007, in Borgo Molara a nest containing five chicks five days old was visited by a Tree Sparrow, *Passer montanus*, which took away two of them causing to drop on the ground; they were quickly put again into the nest by B.M., but one died the day after. In the following three days (7th, 8th and 9th April), the Sparrow tried at least four times to peck chicks inside the nest, but without injuring them (Plate 8). Because the Tree Sparrow begins to nest in mid-late April in Sicily, a possible reason of this odd behaviour is an usurpation attempt of the nest.

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