Eco. Env. & Cons. 28 (February Suppl. Issue) : 2022; pp. (S1-S5)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i02s.001

Parental investment of adult Barn swallow *Hirundo rustica rustica* at nestling feeding in the urban locality of El Bouni (Northeast, Algeria)

Dadci Walid [1]; Sakraoui Rym [1], Boukheroufa Mehdi [1], Abdallah Khadidja Wissal [2], Sakraoui Feriel [1] and Tahar Ali [1]

[1]Soil and Sustainable Development Laboratory, Department of Biology, Faculty of Science, Badji Mokhtar Annaba University BP 12, 23 200, Annaba, Algeria
[2]Faculty of Science, Chadli Bendjedid University BP 73, 36000, El Tarf, Algeria

(Received 23 June, 2021; Accepted 18 July, 2021)

ABSTRACT

The study on feeding frequency of nestlings of the Barn Swallow (*Hirundo rustica rustica*) was carried out in El-Bouni (36°51'11.36"N; 07°44'55.76"E), located in the south of the wilaya of Annaba. We used a camera attached to the nests, and we were able to record the daily feeding rate of breeding pairs of Barn Swallows in feeding their offsprings. We have observed that the parental effort is shared between feeding and sanitation, with moments of rest. The monitoring of the average daily feeding rate reveals that overall, the activity is more intense at noon, and this is explained by the abundance of flies during this time of day, and resume a little towards the end of the afternoon, due to the presence of aphids at the end of the day. The feeding frequency is according to the age of nestlings. This explains the fact that they are quickly satiated at noon to ask again at the end of the day, unlike when they are older, where they are in demand for more food, which is normal with their physiological development.

Key words: *Hirundo rustica rustica, Feeding frequency, Parental investment, Nestlings*

Introduction

The Barn Swallow (*Hirundo rustica rustica*) is a total migration passerine that has been particularly studied throughout its range, especially in North Africa which represents the southern limit of its breeding range (Sakraoui *et al.*, 2005; Sakraoui, 2012; Haddad *et al.*, 2015). In Algeria, the species breeds from the coasts to the northern oases (Touggourt, Messaad, Temacine, Laghouat, and may be Bechar (Dupuy, 1969 In Isenmann and Moali 2000), and sometimes in the Saharan Atlas (Germain, 1965 In Isenmann and Moali 2000). This sub species lays 4 to 6 eggs per clutch in her reproduction area (Møller, 1994; Sakraoui and *al*., 2005; Ambrosini *et al.*, 2006; Sakraoui, 2012; Haddad *et al.*, 2015). Diet studies support all data on trophic opportunism of the Barn Swallows (Turner, 2006; Orlowski and Karg, 2011; Fenghour *et al.*, 2018). This passerine feeds mainly flying insects available from April to September which gives it the possibility to lay up to two clutches during the breeding season throughout its breeding range (Cramp, 1998), and only two clutches in Algeria (Sakraoui *et al.*, 2005; Sakraoui, 2012; Haddad *et al.*, 2015). Many studies have focused on the feeding frequencies of nestlings by adult birds, either by a direct observation (Moreau and Moreau, 1939; Lorek, 1992; De Lope and Møller,

1993) or by using some cameras (Blondel *et al.*, 1991; Malacarne *et al.*, 1992, Bañbura *et al.*, 1994, Zieliñski and Wojciechowski, 1999). It can be seen that in the Bam Swallow, the food provisioning activity is related to insect abundance, air temperature and nestlings begging intensity (Zieliñski and Wojciechowski, 1999). In order to check this hypothesis, we conducted a study in a locality of the north of Algeria. The aim of this study is to investigate, by cameras observation, parental feeding frequency in the Bam Swallow in relation to nestling age during the first clutch.

Materiel and Methods

The study area is located in the municipality of El-Bouni, 4 km from the capital of the city of Annaba in the northeast of Algeria (Fig. 1). The city of El-Bouni is limited to the east and south by the plain of Annaba to the north by the Mediterranean and to the west by the Edough massif. It is crossed by the corridor of the valley of Seybouse and it contains the marsh of Boussedra. The barn swallow populations that nest in the region are unique as they make their nests in the stairwells of apartment buildings. Therefore, the nests were chosen according to their accessibility after their installation.

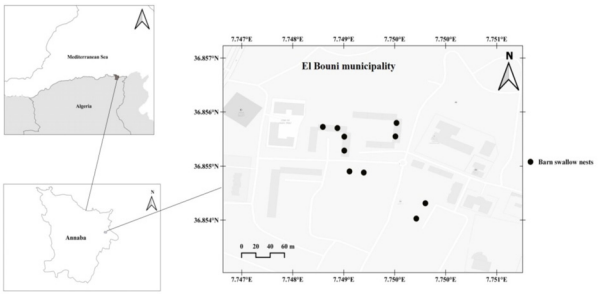

Fig. 1. Study area and localization of barn swallow nests (Present work)

This study was carried out from March to August 2019 where ten barn swallow nests were tracked in order to make direct and continuous observations of the feeding behavior of nestlings by adult birds. The work was established in favorable climatic conditions during the sunny period. The nests were observed during several time slots with cameras attached nearby (Sony Cyber-shot DSC-W230). The one hour / nest recording allowed us to obtain a cumulative observation of 11 hours per day (8 a.m. to 7 p.m.). At the end of this study, a total of 90 hours of recording was achieved. All these observations were grouped according to the age of the nestlings into two categories: (0 to 6 days) and (10 to 16 days). The first represents the age when the growth of the young is exponential, while the second is characterized by the end of the weight growth of the Nestlings (a stabilization of the weight). The feeding frequency, which was defined by Sokal and Rohlf (1981) as: "The number of visits to the nest per hour made by both parents'' was calculated. The number of times the pairs (male and female) sanitized the nest was also noted. All the results were illustrated in Microsoft Office Excel by histograms. For statistical analysis, Student's T-tests for the comparison of means by using Minitab 17 (2015 Edition) was used.

Results

Out of a total observation of 91 hours. A total of 1625 visits was recorded. The latter consists mainly of food trips, sanitation and zero visits where the parents only inspect the nestlings. The overall frequency of couples' visits on average is (16.22 ± 5.42) per hour. The results obtained showed that the females make on average more visits (9.86 ± 3.98) than the males (8.00 ± 3.33). Student's t test revealed a significant difference [t = 3.41; p = 0.0007; DF = 174.] In the number of total nest visits among pairs.

At the end of this study, 1146 food trips were recorded by the 12 swallow pairs followed. Thus, achieving an average of (12.59 ± 8.38) food bowls / h. However, there are no differences [t = -0.47; p = 0.642; DF = 171] between males (6.45 ± 3.91) and females (6.14 ± 4.94). Regarding the elimination of droppings, it represents a total of 568 cleanings, with an average of (6.24 ± 4.78) cleaning / h. However, the students' test did not show any significant difference [t = 0.40; p = 0.691; DF = 178.] within the couples.

The average daily feeding frequency

The ANOVA analysis of variance of the mean daily feeding frequencies (Fig. 2) revealed a significant difference between the set of values F = 2.39; p = 0.014 *; DF = 82. However, the differences between the time bands are shown in Table 1.

Feeding frequency according to the age of the nestlings

Parents bring on average about 10 food bowls per

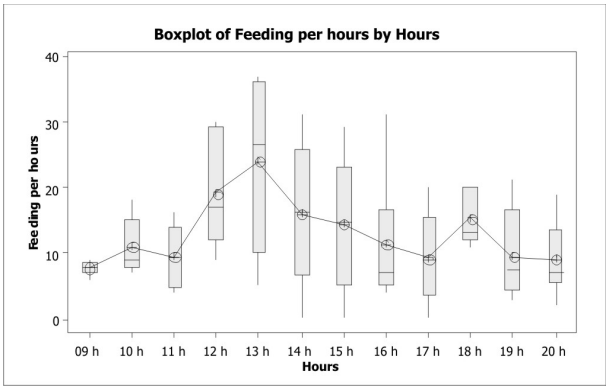

Fig. 2. Daily average feeding frequency

Table 1. Feeding differences between time slots

Time	T-Value	P-Value	DF
09h/12h	-3,10	0,027*	5
09h/13h	-2,93	0,033*	5
09h/06h	-4,55	0,003**	7
11h/13h	-2,48	0,048*	6
11h/18h	-2,34	0,041*	10
12h/17h	2,33	0,048*	8
12h/20h	2,47	0,043*	7
13h/17h	2,49	0,047*	6
13h/20h	2,57	0,043*	6
17h/18h	-2,20	0,046*	13
18h/20h	2,53	0,025*	13

hour (9.90 ± 6.46) for the young nestlings. This ration increases with age to reach on average 15 food bowls (15.54 ± 9.68) per hour for adults. The ANOVA test revealed a significant difference between the two categories [F = 2.89; p = 0.004, DF = 11] (Fig. 3).

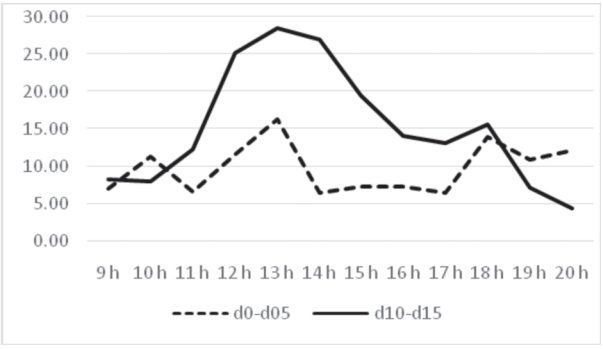

Fig. 3. Daily average feeding frequency nestlings Between d0-d5 and d10-d15)

Contribution of swallow pairs in cleaning nests

Parents routinely clean the nest every time one of the nestlings defecates. The results obtained revealed that the females clean a little more (3.40 ± 2.91) than the males (3.31 ± 2.49 Yet, the ANOVA test [F = 0.04; p = 0.841; DF = 165] does not reveal any difference in the cleaning between the pairs.

The analysis of the results of the effort of the pairs in cleaning Barn Swallow nests, according to the age of the nestlings, showed that during the first age group (young nestlings), the females perform on average (3, 02 ± 3.45) while the males are on average (3.41 ± 2.95). Student's t test, on the other hand, did not show any differences between males and females [t = -0.55; p = 0.583; DF = 80].

However, during the second age group, males and females clean on average (3.21 ± 1.97) and (3.76 ± 2.26) respectively. The same test did not show, however, any differences within the couples [t = 1.39; p = 0.16; DF = 81]. On the other hand, the ANOVA tests did not reveal any difference between the cleaning effort provided in the two age groups, by the females [F = 0.56; p = 0.854; DF = 11]; nor by males [F = 0.59; p = 0.833; DF = 11].

Time left in the nests

The results obtained showed that the females have a tendency to stay longer in the nests during the day than the males. So, on the average they stay respectively (128 ± 182) seconds against (46 ± 102) seconds. Student's t test confirms a very highly significant difference [t = 10.87; p = 0.00; DF = 1281].

Discussion

The food ecology of the Barn Swallow has been the subject of numerous studies throughout its breeding range (Beal, 1918; Møller, 1994; Brown and Brown, 1999a; Zieliński and Wojciechowski, 1999; Ambrosini *et al.*, 2002; Kim and Oh, 2017; Fenghour *et al.*, 2018). Through this work, we attempted to characterize the parental investment of adults for the feeding of nestlings. Through the analysis of the feeding rhythm from hatching to fledging, a late arrival of the first pairs of swallows compared to previous data was observed (Sakraoui *et al.*, 2005; Sakraoui, 2012). This delay is explained by many authors due to the variability of climatic conditions (Sparks and Braslavska, 2001; Dolenec, 2013). We have also found that parental investment is characterized by the feeding of the nestlings, the systematic cleaning of the nests to get rid of the droppings, and the ability to defend the offspring against predators.

This will disturb the feeding of the Nestlings. The results obtained showed that feeding represents the main activity of parents. This process is orchestrated by three factors: insect abundance, air temperature and the intensity of demand for Nestlings (Schulze-Hagen, 1970; Waugh, 1978; Turner, 1982; Bryant and Turner, 1982; Zieliñski and Wojciechowski, 1999; Egger, 2000; Turner, 2006). On the other hand, swallows are organisms that have an aerial hunting pattern (Bryant and Turner 1982). Indeed, due to their morphology and aerial maneuverability, these species feed mainly on flying insects (Beal, 1918; Turner, 2006). They can not only hunt, but feed and even drink in flight (Brown and Brown, 1999). They feed individually or in small groups above open land and open water (Savignac, 2011 *in* Haddad, 2015). Preys are chosen according to their availability and volume. Syrphidae and Muscidae are the main food source (Kozená, 1979; Loske, 1992) and make up about 70% of their diet (Hilty, 2003). These preys show a peak in activity around noon (Lewis and Taylor, 1965) which corresponds to the highest level of overall average nestling feeding activity noted in this study. We only observed an increase in feeding frequencies around 18h, corresponding to a peak of activity in aphids (Zieliñski and Wojciechowski, 1999).

The rate of feeding, according to age, is mainly regulated by the demand of the Nestlings. When they are small, they get full quickly during the hours when food is abundant (Zieliñski and Wojciechowski, 1999) which explains the lull in the frequency of feeding until the nestlings ask for food at the end of the day. However, this rhythm changes as the nestlings get older. Indeed, our results showed that feeding activity is more intense in chicks aged between 10 and 15 days than those aged between 0 and 5 days. These results confirm the findings obtained by Zieliñski, and Wojciechowski, (1999). Between two feeding, adults tend to spend a few moments in the nest. However, it seems that females spend more time compared to males, thus investing in the inspection of their offspring. These observations confirm with the study of Kim and Oh (2017).

References

Ambrosini, R., Bolzern, A. M., Canova, L., Arieni, S., Møller, A. P. and Saino, N. 2002. The distribution and colony size of barn swallows in relation to agricultural land use. *Journal of Applied Ecology*. 39(3) : 524–534. doi: 10.1046/j.1365-2664.2002.00721.x

Ambrosini, R., Ferrari, R. P., Martinelli, R., Romano, M. and Saino, N. 2006. Seasonal, meteorological, and microhabitat effects on breeding success and offspring phenotype in the barn swallow, *Hirundo rustica*. *Ecoscience.* 13(3) : 298–307. doi: 10.2980/i1195-6860-13-3-298.1

Bañbura, J., Blondel, J., de Wilde-Lambrechts, H., Galan, M.J. and Maistre, M. 1994. Nestling diet variation in an insular Mediterranean population of blue tits *Parus caeruleus*: effects of years, territories and individuals. *Oecologia.* 100 (4) : 413–420. doi: 10.1007/BF00317863

Beal, F. 1918. food habits of the swallows, a family of valuable native birds. Bulletin. united States Department of Agriculture, no, 619.

Blondel, J., Dervieux, A., Maistre, M. and Perret, P. 1991. Feeding ecology and life history variation of the blue tit in Mediterranean deciduous and Sclerophyllous habitats. *Oecologia.* 88 : 9-14.

Brown, C. R. and Brown, M. B. 1999a. Fitness components associated with laying date in the Cliff Swallow. *Condor.* 101(2) : 230–245. doi: 10.2307/1369986

Bryant, D. M. and Turner, A. K. 1982. Central place foraging by swallows (Hirundinidae): The question of load size. *Animal Behaviour.* 30 (3) : 845–856. doi: 10.1016/S0003-3472(82) : 80158-9.

Cramp, S. 1998. *The Complete Birds of the Western Palearctic on CD-ROM.* Oxford University Press, Oxford.

De Lope, F. and Møller, A.P. 1993. Female reproductive effort depends on the degree of ornamentation of their mates. *Evolution*. 47(4) : 1152-1160.

Dolenec, Z. 2013. Monitoring of the arrival time in the barn swallow (*Hirundo rustica*) population from Mokrice village (Croatia), 1980–2011. *Natura Croatica : Periodicum Musei Historiae Naturalis Croatici*. 22 (1): 183-187.

Egger, B. 2000. Foraging performance of barn swallows *Hirundo rustica* in relation to food supply and consequences for nestling growth and survival. Diploma thesis, *University of Bern and Swiss Ornithological Institute.*

Fenghour, H., Lazli, A., Chagra, A., Rouaiguia, M., Bouaguel, L., Bouguessa, L., Bouguessa, S. and Houhamdi, M. 2018. Menu trophique de deux espèces d'hirondelles (Passereaux) nicheuses dans la ville de tebessa (Est de l'Algérie). *Bull. Soc. Zool. Fr.* 143 (3) : 171-185.

Haddad, S., Hanane, S. and Houhamdi, M. 2015. La reproduction de l'Hirondelle rustique (*Hirundo rustica*) dans un milieu urbain nord-africain : quel impact des conditions climatiques et de l'application des insecticides/ ? *Revue d'écologie.* 70 (3) : 280–290.

Hilty, S. L. 2003. *Birds of Venezuela.* 2nd ed. Princeton. *Princeton University Press*, 878.

Isenmann, P. and Moali, A. 2000. The birds of Algeria Les oiseaux d'Algérie. Soc. Études Ornithol. France, Muséum *Nat. Hist. Nat.*, Paris, 336p.

Kim, S.L. and OH, H.S. 2017. Reproductive Behavior of the Barn Swallow (*Hirundo rustica*) in Korea. A Case Study in Gwangju Metropolitan City. *Korean Journal of Environment and Ecology.* 31 (2) : 127-134.

Kozená, I. 1979. A study of the qualitative composition of the diet of young swallows (*Hirundo rustica*) in an agricultural farm. *Folio Zool. Csk. Da*. 28. N°4 : 337.

Lewis, T. and Taylor, L.R. 1964. Diurnal periodicity of flight by insects. *Transactions of the Royal Entomological Society of London*. 116 (15) : 393–435. doi: 10.1111/j.1365-2311.1965.tb02304.x

Lorek, G. 1992. The case of altruism in the barn swallow (*Hirundo rustica*). (In Polish). *Notatki Ornitologiczne* 33 : 325-328.

Loskê, K.H. 1992. Nestling food of the Swallow (*Hirundo rustica*) in Central Westphalia. *Vogelvarte.* 36 : 173-187.

Malacarne, G., Cucco, M. and Orecchia, G. 1992. Nest attendance, parental roles and breeding success in the pallid swift, *Apus pallidus. Vogelwarte*. 36 : 203–210.

Møller, A.P. 1994. Sexual Selection in the Barn Swallow (*Hirundo rustica*). IV. Patterns of Fluctuating Asymmetry and Selection against Asymmetry. *Evolution.* 48 (3) : 658. doi: 10.2307/2410476

Moreau, R. E. and Moreau, W. M. 1939. Observations on Swallows and House Martins at the nest. *Brit. Birds.* 33 : 146-151.

Orlowski, G. and Karg, J. 2011. Diet of nestling Barn Swallows *Hirundo rustica* in rural areas of Poland. *Central European Journal of Biology*. 6 (6) : 1023–1035. doi: 10.2478/s11535-011-0070-4

Sakraoui, R., Dadci, W., Chabi, Y. and Bañbura, J. 2005. Breeding biology of Barn Swallows *Hirundo rustica* in Algeria, North Africa. *Ornis Fennica.* 82 (2) : 33–43.

Sakraoui, R. 2012. Impact du régime alimentaire et du parasitisme sur la reproduction des populations de l'hirondelles (*Hirundo rustica)* dans Le Nord Est Algérien. Thése de Doctorat ES Sciences. *Univ Badji Mokhtar.* 151.

Schulze-Hagen, K. 1970. Ein Beitrag zur Ernfihrung der Rauchschwalbe (*Hirundo rustiea*). *Charadrius.* 6 : 81-90.

Sokal, R. R. and Rohlf, F. J. 1981. *Biometry.* San Francisco: *W.H. Freeman and Co*, 776.

Sparks, T. H. and Braslavská, O. 2001. The effects of temperature, altitude and latitude on the arrival and departure dates of the swallow *Hirundo rustica* in the Slovak Republic. *International Journal of Biometeorology.* 45(4) : 212–216. doi: 10.1007/s004840100095

Turner, A. K. 1982. Optimal foraging by the swallow (*Hirundo rustica*, L): Prey size selection. *Animal Behaviour.* 30(3): 862–872. doi: 10.1016/S0003-3472(82)80160-7

Turner, A.K. 2006. *The Barn Swallow. T&A D Poyser*, London.

Waugh, D.R. 1978. Predation strategies in aerial feeding birds. PhD Thesis. *Department of Biology, University of Stirling*.

Zieliñski, P. and Wojciechowski, Z. 1999. Feeding frequency in the Barn Swallow *Hirundo rustica* in relation to time of the day. *Acta Ornithologica.* 34 (1) : 85–88.