Arxius de Miscel·lània Zoològica, 22 (2024): 17–24 ISSN: 1698–0476

Rewriting The Ugly Duckling tale: a Eurasian tree sparrow reared among great tits

I. Solís, C. Esteban, E. Álvarez, E. Barba

Solís, I., Esteban, C., Álvarez, E., Barba, E., 2024. Rewriting The Ugly Duckling tale: a Eurasian tree sparrow reared among great tits. *Arxius de Miscel·lània Zoològica*, 22: 17–24. DOI: https://doi.org/10.32800/amz.2024.22.0017

Abstract

Rewriting The Ugly Duckling tale: a Eurasian tree sparrow reared among great tits. Competitive relationships between hole–nesting passerine bird species can lead to mixed broods when two or more species lay their eggs in the same nest. On 5 May 2023, during a routine inspection of nest boxes in orange plantations in Sagunto, Eastern Spain, we found a Eurasian tree sparrow (*Passer montanus*) egg dumped among nine great tit (*Parus major*) eggs. From this clutch, six great tits and the Eurasian tree sparrow hatched, and four great tits and the sparrow fledged. Using a video camera inside the nest box, we observed that the nestlings, including the sparrow, were fed only by great tit adults. The adults brought caterpillars, moths and spiders, a typical great tit nestling diet in this habitat. To date, great tit eggs have been found in Eurasian tree sparrow nests, but to our knowledge this is the first report of a Eurasian tree sparrow chick successfully raised by great tits.

Key words: Mixed broods, Mixed clutches, Nestling diet, *Parus major, Passer montanus*

Resumen

Reescribiendo el cuento de El Patito Feo: un gorrión molinero criado entre carboneros comunes. Las relaciones competitivas entre especies de aves paseriformes que anidan en agujeros pueden dar lugar a nidadas mixtas cuando dos o más especies ponen sus huevos en el mismo nido. El 5 de mayo de 2023, durante una inspección rutinaria de cajas nido situadas en plantaciones de naranjos en Sagunto (este de España), se encontró un huevo de gorrión molinero (*Passer montanus*) entre nueve huevos de carbonero común (*Parus major*). De esta puesta nacieron seis pollos de carbonero común y el de gorrión molinero, volando del nido cuatro pollos de carbonero y el de gorrión. Mediante una videocámara colocada dentro de la caja nido se observó que solo los carboneros alimentaban a los pollos, incluido el de gorrión, aportándoles orugas, polillas y arañas, una dieta típica de pollos de carbonero en este hábitat. Hasta ahora se han documentado casos de huevos de carbonero común dentro de nidos de gorrión molinero, pero no al revés. Así pues, este es, según nuestro conocimiento, el primer caso de un pollo de gorrión molinero criado con éxito por carboneros comunes.

Palabras clave: Puestas mixtas, Nidadas mixtas, Dieta de pollos, *Parus major*, *Passer montanus*

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Resum

Reescrivint el conte de l'Aneguet Lleig: un pardal xarrec criat entre mallerengues carboneres. Les relacions competitives entre espècies d'ocells passeriformes que nien en forats poden donar lloc a niuades mixtes quan dues o més espècies ponen els ous dins del mateix niu. El 5 de maig de 2023, durant una inspecció rutinària de caixes niu situades en plantacions de tarongers a Sagunt (est d'Espanya), es va trobar un ou de pardal xarrec (*Passer montanus*) entre nou ous de mallerenga carbonera (*Parus major*). D'aquesta posta van néixer sis pollets de mallerenga carbonera i el de pardal xarrec, i van volar del niu quatre pollets de mallerenga i el de pardal. Mitjançant una càmera de vídeo col·locada dins la caixa niu es va observar que només les mallerengues alimentaven els pollets, incloent-hi el de pardal xarrec, amb erugues, arnes i aranyes, una dieta típica de pollets de mallerenga en aquest hàbitat. Fins ara s'han documentat casos d'ous de mallerenga carbonera dins de nius de pardal xarrec, però no a l'inrevés. Així doncs, aquest és, d'acord amb el nostre coneixement, el primer cas d'un pollet de pardal xarrec criat amb èxit per mallerengues carboneres.

Paraules clau: Niuades mixtes, Postes mixtes, Dieta dels pollets, *Parus major*, *Passer montanus*

Received: 26/07/2023; Conditional acceptance: 08/01/2024; Final acceptance: 26/02/2024

Iris Solís, Carla Esteban, Elena Álvarez, Emilio Barba, Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, c/Catedrático José Beltrán 2, 46980 Paterna, Spain.

Corresponding author: Iris Solís. E–mail: soheri@alumni.uv.es

ORCID ID: I. Solís: 0000-0001-7557-1463; E. Álvarez: 0000-0001-8256-443X;
E. Barba: 0000-0003-2882-9788

Introduction

Competitive relationships between hole–nesting passerine bird species can lead to mixed broods. Such broods occur when two or more species lay their eggs in the same nest (Busse and Gotzman, 1962; Merilä, 1994). For these species, it is generally thought that laying eggs in other species' nest is an "incidental, accidental, or maladaptive behaviour" and not a true parasitic behaviour (Barrientos et al., 2015). The usual case is that a normally subdominant species starts a nest and lays one or more eggs, but the nest is then taken over by a dominant species that adds its own eggs, resulting in a mixed clutch (Busse and Gotzman, 1962; Petrassi et al., 1998; Dolenec, 2002; Potti et al., 2021). It is also relatively frequent, however, that a species dumps one or more eggs in another species' nest while the last one is hatching, or even when all the clutch has hatched. As an example of relative frequencies, among 1,285 great tit nests, Barrientos et al. (2015) found 17 great tit nests where a blue tit had dumped one or two eggs, and another 16 nests where the great tit took over a blue tit nest with eggs and then laid its own clutch.

Hole nesting species do not have good skills in egg recognition (Davies and Brooke, 1989), so all eggs are usually treated as the birds' own eggs and incubated by the host species. Therefore, their fate mostly depends on the viability of the eggs. If they are viable, they hatch, and the resultant nestlings are fed by their foster parents. The fate of the foster nestlings likely depends on their competitive abilities in relation to those of their nest mates, and on food availability. If the intruders belong to a larger species, it could be expected that they would be able to obtain sufficient food and survive, whereas if they are smaller than the host nestlings, they could be outcompeted by their nestmates, and their growth and survival would be compromised.

Mixed clutches involving many hole–nesting passerine species have been reported to date. Great tits have been identified, either as a host or as an intruder, in many of these mixed clutches. Reports published to date include mixed clutches of great tits with blue tits (Busse and Gotzman, 1962; Baucells, 1990; Petrassi et al., 1998; Barrientos et al., 2015), Eurasian nuthatches (*Sitta europaea*) (Dolenec, 2002; Haraszthy, 2019), pied flycatchers (*Ficedula hypoleuca*) (Busse and Gotzman, 1962), wrynecks (*Jynx torquilla*) (Busse and Gotzman, 1962), redstarts (*Phoenicurus phoenicurus*) (Shy, 1982), varied tits (*Sittiparus varius*) (Suzuki and Tsuchiya, 2010), common starlings (*Sturnus vulgaris*) (Busse and Gotzman, 1962), European robins (*Erithacus rubecula*) (Lack, 1953) and Eurasian tree sparrows (*Passer montanus*) (Busse and Gotzman, 1962). Mixed clutches have also been reported between other species (Busse and Gotzman, 1962; Merilä, 1994; Samplonius and Both, 2014; Haraszthy, 2019; Garrido–Bautista et al., 2022). It has been suggested that great tits might even be parasitized by common cuckoos (*Cuculus canorus*) and raise both their own nestlings and the cuckoo nestlings (Grim et al., 2014).

Regarding the Eurasian tree sparrow (*Passer montanus*), Busse and Gotzman (1962) cited several cases in which these sparrows hosted great tit eggs among their own, but not vice versa. The closest thing to a European tree sparrow ('sparrow' hereafter) egg ending up among a great tit clutch is the case described by Haraszthy (2019), in which a sparrow egg remained in the nest box after its siblings fledged. This nest box was later occupied by great tits and the sparrow egg remained there along with the great tit clutch, but it never hatched.

Here we report the first case of a mixed brood in which a Eurasian tree sparrow egg was found in a great tit nest, and in which the sparrow chick successfully fledged along with its great tit nestmates.

Methods

Since 1986, we regularly monitor a great tit population breeding in nest boxes in orange (*Citrus aurantium*) plantations in Sagunto (eastern Spain, 39º 42' N, 0º 15' W, 30 m a.s.l.) (Álvarez and Barba, 2014; Rodríguez et al., 2016). Each year, we check the nest boxes weekly during the breeding season (from March to July) and we record the presence of nests, their progress and their contents. For each great tit clutch, we record the laying date of the first egg, clutch size, and number of hatchlings and fledglings (Rodríguez et al., 2016). We capture the parents using door–traps at the nest boxes when the nestlings are 10 days old. We note the sex and age (first year or older) of each individual (Svensson, 1992). We ring nestlings individually when they are 15 days old, and record their tarsus length and body mass. We also visit the nests of other species on a weekly basis.

In the present report, we modified the usual protocol after we found a Eurasian tree sparrow egg among the great tit eggs. Because sparrow nestlings grow faster than great tit nestlings (Barba et al., 1993; Matsui et al., 2011), we decided to ring and measure them when they were 12 days old rather than at 15 days old as in our usual protocol. We measured them again at the usual protocol date, at 15 days old, with 'day 0' being the date of hatching of the first egg. Also, as an extra procedure with this nest, we used a handycam camera (GoPro HERO9 Black) to film parental provisioning to nestlings when they were eight days old. For this filming, we followed the protocol of García–Navas et al. (2013). In short, the camera was concealed inside a changeable wooden bird house attached to the back of the nest box and facing the entrance hole in order to film the parent birds when they entered so that we could identify the prey delivered. To habituate the birds to this setup, on the day before filming (day seven post–hatching), the original nest box was exchanged for a nest box model adapted to attach fix the video camera the next day, and we removed the nest with the nestlings from the original nest box and placed them inside the adapted box. We carried out the recording for 103 minutes the next morning. From this video we

Fig. 1. A, mixed great tit and Eurasian tree sparrow clutch. Eurasian tree sparrow egg (in the centre) is marked with a yellow arrow; B, mixed great tit and Eurasian tree sparrow brood (10 days old). Eurasian tree sparrow nestling is marked with a yellow arrow.

Fig. 1. A, nidada mixta de carbonero común y gorrión molinero. El huevo de gorrión molinero (en el centro) está marcado con una flecha amarilla. B, cría mixta de carbonero común y gorrión molinero (10 días de edad). El polluelo de gorrión molinero está marcado con una flecha amarilla.

determined the bird species that entered the box and noted their sex (for great tits) and the prey type brought at each visit. Pagani–Núñez and Senar (2013) have shown that an hour of filming per nest gives a good idea of the diet of the nestlings.

Results

During regular inspections of nest boxes, on April 5, 2023, we found what seemed to be a sparrow nest under construction in one of the nest boxes. Both house and Eurasian tree sparrows breed in the study area, but their nests are not easily distinguishable at these early stages. The sparrow nest was graded as '1/3' in construction (i.e., approximately 33 % the material of a typical sparrow nest) on a visit on April 11. No advances in building occurred between this and the next check, on April 17. However, on April 24 we found that the nest box had been occupied by great tits, having built their own nest over the previous one, modifying its structure and adding moss. There were two great tit eggs in this 'new' nest, and six eggs four days later (April 28). On May 5 there were nine great tit eggs along with a Eurasian tree sparrow egg (fig. 1A).

The nest box was visited again on May 13, the expected hatching date. There were four great tit nestlings and one sparrow nestling, along with four unhatched great tit eggs. The great tits were weighed and it was determined that they had hatched the previous day. At

the previous check there was another great tit egg that should have hatched, but the chick must have died prematurely and was removed from the nest by the parents, as is usual for this species. Another great tit had hatched from these four eggs by May 15, while the three remaining eggs did not hatch and they were removed: they were partially developed, dead, embryos. On May 19, when the nest was visited to exchange nest boxes for video recording apparatus, only four great tits and the sparrow nestling were alive. In summary, from nine great tit eggs and one sparrow egg, six great tits and the sparrow hatched, three great tit eggs failed to hatch, and two of the six great tit nestlings died during the early nesting period and were probably removed from the nest by the parents.

During the visit when the nestlings were 12 days old, the tree sparrow chick fledged when we removed the door of the nest box. The two team members present were unable to catch it again. We had no trace of this fledging thereafter but it was considered successfully fledged. The four remaining great tit nestlings were measured and individually ringed at that time, and measured again three days later. Mean body mass (18.05 g, SD = 1.56) and tarsus length (20.08 mm, SD = 0.50) were within the range of the chicks born from first clutches in this population the same year (mean body mass: 16.51 g, SD = 1.40, range = 1.37–19.4 g; mean tarsus length: 19.34 mm, SD = 0.56, range = 17.09–21 mm; n = 124 nests). All four nestlings had fledged when the nest box was visited on June 1.

Concerning the provisioning trips by the parents, only male and female great tits entered the nest during the recording time (103 min). Although it was impossible to identify them individually from the images, it was assumed that only one male and one female were feeding the nestlings, including the sparrow nestling (the position of the camera did not allow to identify which nestling was been fed during the visits). The male made 11 visits and the female eight. Four great tit nestlings and the sparrow nestlings were present at the time of recording. Prey types identified included caterpillars (three items), moths (eight) spiders (seven), and one unidentifiable item.

Finally, a male great tit and a female great tit, both yearlings, were captured at the nest (EURING 5). There were four great tits and the sparrow nestlings at this time (fig. 1B). In summary, throughout the observation period, we did not observe any Eurasian tree sparrow near the nest at any time, or either in the recorded feeding visits, during the captures, or during our visits.

Discussion

To our knowledge this is the first documented case of a Eurasian tree sparrow laying an egg in a great tit nest while great tits were laying their own eggs, a case of what is known as 'interspecific egg dumping'. This foster egg was incubated by the female great tit. The nestling hatched, was fed, and it fledged successfully.

In the case presented here, a Eurasian tree sparrow pair presumably started to build its nest in early April. Building of the nest was probably abandoned soon after this because almost no progress was recorded during the following 2–3 weeks. The usual time for nest construction in this species is five days (Deckert, 1962). The existence of this interval between the cessation of activity by the sparrows and the occupation by the great tits suggests that there was no direct interaction that immediately resulted in the sparrows abandoning the nest box. However, as Eurasian tree sparrows have been shown to be dominant over great tits (Busse and Gotzman, 1962; García–Navas, 2016), a direct eviction by great tits seems unlikely.

We hypothesize that the great tits found a nest box with some material and no activity and proceeded to add their own material to complete a typical great tit nest. We should point out that in this study area, great tit and Eurasian tree sparrow nests may differ little

in the materials used in the initial stages of construction, since the proportion of moss in great tit nests in this population is low compared with other habitats (Álvarez et al., 2013). The female great tit had laid at least six eggs before the Eurasian tree sparrow egg was detected. Therefore, the earliest date at which the sparrow egg could have been dumped was April 29, almost a month after the sparrows presumably left the nest under construction. At this time, there were four Eurasian tree sparrow pairs breeding in the nest boxes within a radius of 200 m from the focal nest box. The females in three of the boxes were already incubating complete clutches, while in the fourth one the female was still laying eggs. This fourth nest box was 141 m away in a straight line from the focal box. It is inevitable to hypothesise that the female tree sparrow that was laying in the neighbouring nest box laid one of her eggs in the nest box occupied by the great tit. On further speculation, it is possible that she was the same female that originally occupied this nest box and participated in the building of the nest along with her partner (Deckert, 1962), so it was therefore familiar to her.

Once dumped, the sparrow egg was incubated and hatched successfully. It is not known to which degree this interfered with the normal incubation behaviour of the great tit, but it is not usual in this population that three out or nine eggs fail to hatch (Rodríguez et al., 2016). Great tits lay many eggs in relation to the brood patch size of the female, so she had to continuously change the relative position of the eggs in the nest so that all of them receive enough heat (Diez–Méndez et al., 2020). The sparrow eggs are larger, and probably more difficult for the female great tit to move. Once occupying the central position in the nest, as shown in fig. 1A, the female probably remained there. This is the warmest place (Hope et al., 2018), while the great tit eggs would have been in suboptimal positions throughout the incubation process, perhaps causing a relatively high hatching failure rate.

Another unusual observation is that after only 66 % of the eggs had hatched, two additional nestlings died (probably from starvation) on their first days of life. This means that the breeding success (number of fledglings per egg laid) of the great tit was 44 %, an extremely low figure for first clutches in this study area (Rodríguez et al., 2016). Possibly, the sparrow chick, being larger, could have taken up a significant part of the food provided by the parents, possibly accounting for the deaths of its 'half–siblings' shortly after hatching. In a previous study, it was observed that great tit nests holding blue tit nestlings (derived either from egg dumping or nest take–overs) did not show costs in terms of number and condition of the great tit fledglings produced (Barrientos et al., 2015), suggesting the probable costs in our study are probably derived from the superior competitive abilities of the Eurasian tree sparrow nestling.

Although the reported diet of Eurasian tree sparrow nestlings is mostly insectivorous, the commonly cited taxonomic groups are much more diverse than those consumed by great tits (e.g., Krištin et al., 1995; McHugh et al., 2016). Nevertheless, the sparrow thrived on a 'great tit' diet. The feeding rate of the parents and the quality of the food brought was good according to the standards of the great tit studies (Barba and Gil–Delgado, 1990b; Barba et al., 2009). The good growth rate shown by the tree sparrow nestling, as illustrated by its ability to fly straight out of the nest on its thirteenth day of life, supports that the high quantity and quality of the food received. This said, the final size and mass reached by the remaining 4 great tit nestlings agreed with the standard for first great tit broods in the studied population in general (Barba et al., 1993) and, particularly, for the 2023 breeding season.

In summary, to our knowledge, this is the first observation of a Eurasian tree sparrow dumping an egg in a great tit nest while the female great tit was laying. Out interpretation is that the tree sparrow laid an egg in the great tit nest, probably by mistake. This egg was accepted and incubated by the female great tit, but probably at the cost of poorer incubation of her own eggs, resulting in a relatively high hatching failure. Once hatched, the sparrow nestling probably took up a significant portion of the food resources, likely leading to the starvation of two of its half–siblings shortly after hatching. Finally, both the sparrow and the surviving great tit chicks fledged successfully. Though a 'mistake' is the proposed

explanation, the hypothesis of true interspecific brood parasitism cannot be ruled out. The third hypothesis, that of competition for the nest box, is unlikely considering the phenology of events. The regular checking of the nest boxes allowed us to provide a clear description of the dumping process, from nest building to fledging.

Acknowledgements

This study was supported by the project CGL2013–48001–C2–1–P and PID2021–122171NB–I00/ AEI/10.13039/501100011033/ FEDER, UE.

References

Álvarez, E., Barba, E., 2014. Incubation and hatching periods in a Mediterranean Great Tit *Parus major* population. *Bird Study*, 61: 152–161. DOI: 10.1080/00063657.2014.908819

Álvarez, E., Belda, E. J., Verdejo, J., Barba, E., 2013. Variation in Great Tit nest mass and composition and its breeding consequences: a comparative study in four Mediterranean habitats. *Avian Biology Research,* 6: 39–46. DOI: 10.3184/175815513X13609517587237

Barba, E., Atiénzar, F., Marín, M., Monrós, J. S., Gil–Delgado, J. A., 2009. Patterns of nestling provisioning by a single–prey loader bird. *Bird Study*, 56: 187–197. DOI: 10.1080/00063650902792049

Barba, E., Gil–Delgado, J. A., 1990a. Competition for nest–boxes among four vertebrate species: an experimental study in orange groves. *Holarctic Ecology*, 13: 183–186. DOI: 10.1111/j.1600-0587.1990.tb00606.x

Barba, E., Gil–Delgado, J. A., 1990b. Seasonal variation in nestling diet of the Great Tit Parus major in orange groves in eastern Spain. *Ornis Scandinavica*, 21: 296–298. DOI: 10.2307/3676396

Barba, E., Gil–Delgado, J. A., Monrós, J. S., 1993. Factors affecting nestling growth in the great tit *Parus major*. *Ardeola*, 40: 121–131.

Barrientos, R., Bueno–Enciso, J., Serrano–Davies, E., Sanz, J. J., 2015. Facultative interspecific brood parasitism in tits: a last resort to coping with nest–hole shortage. *Behavioural Ecology and Sociobiology*, 69: 1603–1615. DOI: 10.1007/s00265-015-1972-3

Baucells, J., 1990. Freqüència de postes mixtes en el gènere *Parus*. *Butlletí del Grup Català d'Anellament*, 7: 13–17.

Busse, P., Gotzman, J., 1962. Konkurencja gniazdowa i lęgi mieszane u niektórych gatunków dziuplaków. [Nesting competition and mixed clutches among some birds inhabiting the nest–boxes.] *Acta Ornithologica*, 7: 1–32.

Davies, N. B., Brooke, M. de L., 1989. An experimental study of co–evolution between the cuckoo, *Cuculus canorus*, and its hosts. I. Host egg discrimination. *Journal of Animal Ecology*, 58: 207–224.

Deckert, G., 1962. Zur ethologie des Feldsperlings (*Passer m. montanus* L.). *Journal für Ornithologie*, 103: 428–486.

Diez–Méndez, D., Rodríguez, S., Álvarez, E., Barba, E., 2020. The role of partial incubation and egg repositioning within the clutch in hatching asynchrony and subsequent effects on breeding success. *Ibis*, 162: 63–74. DOI: 10.1111/ibi.12730

Dolenec, Z., 2002. A mixed brood of Nuthatch (*Sitta europaea*) and Great tit (*Parus major*) species. *Natura Croatica: Periodicum Musei Historiae Naturalis Croatici*, 11(1): 103–105.

García–Navas, V., 2016. Gorrión Molinero – *Passer montanus* [online]. *Enciclopedia Virtual de los Vertebrados Españoles*. Museo Nacional de Ciencias Naturales, Madrid. Available online at: https://www.vertebradosibericos.org [Accessed on 3 July 2023].

García–Navas, V., Ferrer, E. S., Sanz, J. J., 2013. Prey choice, provisioning behaviour, and

effects of early nutrition on nestling phenotype of titmice. *Ecoscience*, 20: 9–18. DOI: 10.2980/20-1-3545

Garrido–Bautista, J., Santos–Baena, C., Ramos, J. A., Moreno–Rueda, G., Norte, A. C., 2022. A mixed brood of Coal Tits *Periparus ater* and Blue Tits *Cyanistes caeruleus* in Central Portugal. *Ardea*, 110: 239–242. DOI: 10.5253/arde.2022.a4

Grim, T., Samas, P., Procházka, P., Rutila, J., 2014. Are tits really unsuitable hosts for the Common Cuckoo?. *Ornis Fennica*, 91: 166–177.

Haraszthy, L., 2019. Cases of occasional interspecific brood parasitism and egg dumping in Hungary. *Ornis Hungarica*, 27(2): 115–141. DOI: 10.2478/orhu-2019-0020

Hope, S. F., DuRant, S., Hallagan, J. J., Beck, M., Kennamer, R. A., Hopkins, W. A., 2018. Free–moving artificial eggs containing temperature loggers reveal remarkable within–clutch variance in incubation temperature. *Journal of Avian Biology*, 2018: e01285. DOI: 10.1111/jav.01685

Krištin, A., Lebedeva, N., Pinowski, J., 1995. The diet of nestling tree sparrows (*Passer montanus*). Preliminary report. *International Studies on Sparrows*, 20: 3–19.

Lack, D., 1953. *The life of the Robin*. Penguin Books, London.

Matsui, S., Kasahara, S., Morimoto, G., Mikami, O. K., Ueda, K., 2011. Growth pattern of Tree Sparrow *Passer montanus* nestlings. *The Bulletin of the Japanese Bird Banding Association*, 23: 1–11. DOI: 10.14491/jbba.23.1

McHugh, N. M., Prior, M., Leather, S. R., Holland, J. M., 2016. The diet of Eurasian Tree Sparrow *Passer montanus* nestlings in relation to agri–environment scheme habitats. *Bird Study*, 63: 279–283. DOI: 10.1080/00063657.2016.1182964

Merilä, J., 1994. Two mixed clutches of Blue Tits *Parus caeruleus* and Collared Flycatchers *Ficedulla albicollis*. *Ornis Svecica*, 4: 188–189. DOI: 10.34080/os.v4.23022

Pagani–Núñez, E., Senar, J. C., 2013. One hour of sampling is enough: Great Tit *Parus major* parents feed their nestlings consistently across time. *Acta Ornithologica*, 48: 194–200. DOI: 10.3161/000164513X678847

Petrassi, F., Sorace, A., Tanda, F., Consiglio, C., 1998. Mixed clutches of Blue Tits *Parus caeruleus* and Great Tits *Parus major* in nest boxes in Central Italy. *Ornis Svecica*, 8: 49–52. DOI: 10.34080/os.v8.22303

Potti, J., Camacho, C., Canal, D., Martínez–Padilla, J., 2021. Three decades of crimes and misdemeanours in the nest box life of European pied flycatchers *Ficedula hypoleuca*. *Ardeola*, 68: 315–333. DOI: 10.13157/arla.68.2.2021.ra1

Rodríguez, S., Álvarez, E., Barba, E., 2016. Factors affecting fledgling output of great tits, *Parus major*, in the long term. *Animal Biodiversity and Conservation*, 39: 147–154. DOI: 10.32800/abc.2016.39.0147

Samplonius, J. M., Both C., 2014. A case of a three species mixed brood after two interspecific nest takeovers. *Ardea*, 102: 105–107. DOI: 10.5253/078.102.0113

Shy, M. M., 1982. Interspecific feeding among birds: A review. *Journal of Field Ornithology*, 53(4): 370–393.

Suzuki, T. N., Tsuchiya, Y., 2010. Feeding a foreign chick: a case of a mixed brood of two tit species. *The Wilson Journal of Ornithology*, 122(3): 618–620. DOI: 10.1676/09-192.1

Svensson, L., 1992. *Identification Guide to European Passerines*, 4th edition. British Trust for Ornithology, Stockholm.