Short Communication

Copying nesting attempts in a new site may be the wrong choice. A case in the European Bee-eater (*Merops apiaster*)

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Abstract - Insistent nesting attempts by a group of European Bee-eaters in a new site, a pebbly bank of the middle course of Trebbia River, northern Italy, mostly failed because of the unmovable pebbles encountered during tunnel excavation. The birds later nested in an artificial sand heap, with full success that time. Various considerations suggest that birds insisted in the unsuitable site because they copied the nesting activity of model conspecifics. Finding social attraction and "public information" from conspecifics in a place where no breeding attempt was previously made would allow disentangling social philopatry from spatial philopatry.

Key words: colonial birds, nesting site, copying behaviour, social attraction, group fidelity.

Riassunto - Copiare tentativi di nidificazione in un nuovo sito può essere la scelta sbagliata. Un caso nel gruccione (*Merops apiaster*).

I tentativi di nidificazione di un gruppo di gruccioni in una sponda ghiaiosa del medio corso del fiume Trebbia, un sito nuovo alla nidificazione di gruccioni, sono quasi tutti falliti a causa di ciottoli inamovibili incontrati durante lo scavo dei tunnel, inducendo gli uccelli a nidificare in un cumulo artificiale di sabbia, dove invece il successo è apparso completo. Il numero degli uccelli presenti nel primo sito già prima dell'inizio del primo scavo era compatibile con il numero delle nidificazioni riuscite nel secondo sito. Movimenti tra i due siti indicavano che gli uccelli avevano esplorato entrambi. Tuttavia, nel primo sito gli scavi sono avvenuti con più intervalli e più insistenza, producendo tunnel per lo più troppo corti per la nidificazione. Uno dei due soli nidi riusciti nel primo sito aveva il tunnel adiacente al tunnel del primo tentativo in assoluto. Queste osservazioni suggeriscono che l'attività di qualche membro del gruppo sia servita di modello ai conspecifici, portandoli a un fallimento quasi completo nel primo sito. Trovare attrazione sociale e "informazione pubblica" da parte dei conspecifici in un luogo dove nessun tentativo di riproduzione sia avvenuto in precedenza permetterebbe di svincolare la fedeltà al gruppo dalla fedeltà al luogo di riproduzione.

Parole chiave: uccelli coloniali, sito di nidificazione, comportamento imitativo, attrazione sociale, fedeltà al gruppo.

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Received: 7 October 2020
Accepted for publication: 3 November 2020
Online publication: 27 January 2021

Several studies suggest that "public information" (Danchin *et al.*, 2004), i.e. information arising from cues inadvertently produced by the behaviour of other individuals with similar requirements, may be important in bird coloniality. For example, Black-legged Kittiwakes (*Rissa tridactila*) appeared to rely on the reproductive success of locally breeding conspecifics, rather than on their own breeding experience, to choose the nesting cliff the year after (Danchin *et al.*, 1998). In Lesser Kestrel (*Falco naumanni*) colonies, immigration of both adult and first-breeding birds was positively related to the presence of philopatric adults, though not to the conspecific breeding success the year before (Serrano *et al.*, 2004). Concerning bee-eaters, a suggestion of public information is apparent in Supriya *et al.* (2012): having found no significant difference between habitat characteristics at solitary and colonial breeding sites of Chestnut-headed Bee-eaters (*Merops leschenaulti*), these authors considered the various hypotheses of coloniality proposed by Danchin & Wagner (1997) and discarded habitat-mediated aggregation, conspecific reproductive success (not found to vary among breeding sites) and hidden lek (bee-eaters being mostly monogamous); instead, they accepted the traditional aggregation hypothesis, which is based on the presence (i.e., group size) or cues of former presence (i.e., old nests) of conspecifics in traditionally occupied sites. Studied colonies are usually not new colonies and hypotheses of social attraction usually imply that some conspecifics have gained experience of the breeding site. Within the limits that are inherent to studying a single case in a genus of birds still understudied for public information, the following account suggests that social attraction and consequent information from conspecifics may occur in a site where no nesting attempt has previously been made.

Following is a commented summary of my field observations. Since many years, the European Bee-eater has been known to breed colonially along the lower course of Trebbia River, northern Italy (Ambrogio, 2001), but at no point of its middle course. My long birding experience in the latter area had included many sightings of these birds during their post-breeding movements, but no sighting of breeding birds. However, at the beginning of May 2020 I noticed birds flying to and from near the Trebbia in the southern outskirts of Bobbio, an area hereafter called Site A, and on 6 May I found the first

bird digging in a riverbank. The day after one other pair began digging a nest-hole and I did not find any further nest-holes along the entire riverbank. Thus, I preferred to leave the area undisturbed for several days, during which, observed from a distance, several birds appeared to keep foraging on the savanna-like ground in the back of the riverbank, although they sometimes left in groups and their overall presence decreased with time. On 22 May, while few birds were foraging in the area and no one was seen entering the soil, I explored the riverbank closely and counted 37 nest-holes. They encompassed the riverbank for about 300 m and formed one row in the seemingly less coarse upper layer of the alluvium, a conspicuous mixture of pebbles and cobbles for the rest. Subsequent observations revealed bird activity only at two, well-spaced, nest-holes (Fig. 1a). As one of them was just in front of a beach-aimed area backed by the car park of some industrial buildings, the locally most disturbed part of the river to an ecologist's eyes, I ruled out the possibility that most of the birds had deserted their nesting sites because of human disturbance. At least some of them seemed still to be linked to the place by foraging convenience. Especially in late afternoon I repeatedly saw birds in pairs, or small groups, flying to and from somewhere downriver. Thus, I searched for a substitute nesting settlement and found it 2.5 km straight line downstream in an old, consolidated sand heap within a disused gravel processing plant, a closed area, hereafter called Site B. From various observation points outside I counted 21 nest-holes there, at seven of which I saw intense food-bringing activity on 14 July. Having my country house between Site A and Site B, I could easily observe the to-and-fro movements of the birds, evident almost daily until the end of July. On 10 August I discovered a third nesting site 10.5 km further downstream, with at least 40 nest-holes in a clay slope bordering the river. Contrary to Site A and Site B, this site had birds still present in the surroundings, though not at nest-holes, and being in a less-known area to me, it might have hosted a colony some time before and be the origin of the birds settling upstream. Whatever the origin of these birds, the following considerations led me to assume that they first tried to nest in Site A and later fell back to Site B. The first and second digging attempts in Site A were well-spaced in time, and, as evident in Tab. 1, the two successful nests did not result from the first, or second, excavation. These are suggestions of slow recruitment in nesting activity at Site A. Given the greater proportion of successful nests relative to the number of nest-holes in Site B, which meant less repeated attempts, lesser delay in the production of nestlings after the first excavation attempts was expected in Site B. However, on 18 July, while three fledglings were already on trees in Site A, in Site B only few nestlings were looking out of nest entrance and only one fledgling was seen the day after. A logical conclusion is that Site B was settled later than Site A.

Nest-hole photographs (Fig. 1b) and measurements (Tab. 1) evidenced the reason of the massive nesting failure occurred in Site A: masked by softer soil on the face of the upper layer of the riverbank, unmovable stones prevented most of the birds from obtaining tunnels of sufficient length. Although the two successful nests made a small sample, the greater length of their tunnels is self-evident. The length of the other tunnels was in three cases (72, 122 and 74 cm) within reported ranges for used nest-tunnels (e.g., Kerényi & Ivók, 2013), but obstacles might have persisted for the size of the nest chamber or the beam of the passage. Some of the shorter tunnels might have been aimed at "false" nest-holes (to misguide predators, e.g., Inglisa & Vigna Taglianti, 1987), but the much larger proportion of unused tunnels compared to Site B strongly suggests that a large part of the tunnels in Site A had been aimed at true nests. Like other burrowing birds, European Bee-eaters avoid banks composed of too compact (as well too loose) soils and can discriminate not only between high- and low-quality breeding banks, but also between different soil layers within banks (Heneberg, 2009). Soil samples from nest-holes in homogeneous banks never had grains larger than 10 mm (Heneberg & Šimeček, 2004) and birds appeared very able to avoid the gravelly layers of heterogeneous banks (Del Guasta & Marcuzzi, 1993). In the present case, even if the first birds that tried digging were misguided by superficially suitable soil characteristics, why so many insistent attempts to dig across unmovable material, beginning at considerable intervals and mostly ending in failure? The birds moving to and from Site A before the first nesting attempt suggest that they had previous knowledge of other possible nesting sites. As the European Bee-eater has increased breeding in the region (Finozzi & Tralongo, 2002), it is quite possible that breeding sites on the lower part of the river were limited and less fit birds tried breeding upstream, but this cannot explain their initially massive preference for Site A over Site B, the latter being in this case a place closer to their provenance in addition to offering easier soil to dig. Whatever the reason for the first digging attempts in Site A, it seems likely that birds insisted there because they copied the digging activity of conspecifics that served as models.

Tab. 1 - Length (cm) of the 37 tunnels in Site A, obtained from a measuring tape and given in the sequence of the one-row positions of the tunnels in the riverbank, upstream. The ([a]) first and ([b]) second excavation attempts. ([c]) The two successful nests. / Lunghezza (cm) dei 37 tunnel nel Sito A, ottenuta con un metro a nastro e presentata nella sequenza delle posizioni in fila unica dei tunnel nella sponda del fiume, risalendo la corrente. ([a]) Il primo e ([b]) il secondo tentativo di scavo. ([c]) I due nidi riusciti.

72 23 122 13 27 74 37 14 40 13 40 48 27 35 298[c] 25[a] 15 31 38 29 47 53 31 190[c] 43 48 13 15 24 39[b] 17 23 21 25 28 17 24

Fig. 1 - Site A: a) the extension of nesting attempts of the new colony along a bank of Trebbia River and the position of the only two successful nests; b) a 40-cm excavation attempt, example of failure because of unmovable pebbles; c) the successful nest close to the first excavation attempt (see Tab. 1), with a fledgling at the top left of the photograph, 18 July. / Sito A: a) L'estensione dei tentativi di nidificazione della nuova colonia lungo una sponda del fiume Trebbia e la posizione dei due soli nidi riusciti; b) un tentativo di scavo di 40 cm, esempio del fallimento dovuto a ciottoli inamovibili; c) il nido riuscito adiacente al primo tentativo di scavo (vedi Tab. 1), con un giovane uscito dal nido in alto a sinistra, il 18 luglio.

No matter if produced by the same pair, or a copying pair, the presence of a successful nest (Fig. 1c) close to the very first excavation (Tab. 1) suggests that the choice of model conspecifics had some ground. If it is true that no bird in the group had previously bred there, this choice must have been based on a leadership that did not depend on local breeding experience. Recent large-scale research on Slender-billed Gulls (*Chroicocephalus genei*) (Francesiaz *et al*., 2017) and Cliff Swallows (*Petrochelidon pyrrhonota*) (Hannebaum *et al.*, 2019) has shown that colonial birds maintain groups with familiar conspecifics when they change settlement and fidelity is maintained even when the group splits to several nesting sites in a compromise with habitat requirements. This might explain the observed to-and-fro movements between Site A and Site B, as well as, not far from my study area, the scattered aggregation of small colonies and "solitary" nests of European Bee-eaters observed on a provincial scale (Pinoli & Gariboldi, 1987). Forced to leave a saturated colony site, sub-groups or even single pairs might try nesting in a new site, keeping the balance between seeming habitat suitability and closeness to the original colony. If successful, they might repeat breeding there, possibly attracting further familiar birds from the colony, and contribute to the spreading of the population. Both Francesiaz *et al.* (2017) and Hannebaum *et al.* (2019) aimed at disentangling the fidelity to a group (social philopatry) from the fidelity to a breeding site (spatial philopatry), both being possible causes of the staying with familiar conspecifics. In my opinion, a limit to this aim in their studies was that a group that changed breeding site might settle where at least some (older, more influential) members had bred previously, even if not the year before, which would suggest a mixture of social philopatry and recurrent spatial philopatry. My observations suggest that familiar conspecifics trust each other even (or even more?) when facing completely unknown situations. If so, through public information influential subjects might lead conspecifics to extended failures, as not rarely occurs in humans.

Acknowledgements

Giuliana Marzi, my wife, was of much help in measuring the nest-holes. An anonymous reviewer contributed to make my reasoning clearer.

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