

First record of Little Bittern *Ixobrychus minutus* laying in a Common Moorhen *Gallinula chloropus* nest

AWATIF TALBI^{1,2}, FARRAH SAMRAOUI^{1,2*}, LAID TOUATI^{2,3}, BOUDJEMA SAMRAOUI^{2,4}, CORRADO BATTISTI⁵

¹Department of Ecology and Environmental Engineering, University 8 Mai 1945, Guelma, Algeria

²Laboratoire de Conservation des Zones Humides, Université 8 Mai 1945, Guelma, Algeria

³Biology and Ecology Department, University of Constantine, Constantine, Algeria

⁴Department of Biology, University Badji Mokhtar Annaba, Annaba, Algeria

⁵Torre Flavia' LTER (Long Term Ecological Research) Station, Protected areas – Regional park Service, Città Metropolitana di Roma Capitale, viale G. Ribotta, 41, 00144 Rome, Italy

*corresponding author: fsamraoui@gmail.com



AT 0000-0002-2502-8056, FS 0000-0003-2407-3004, LT 0000-0002-6716-9914,
BS 0000-0002-0608-9021, CB 0000-0002-2621-3659

Abstract - We discuss the possible mechanisms explaining the potential brood parasitism between Little Bittern and Common Moorhen by reporting the first case worldwide of a Little Bittern *Ixobrychus minutus* laying on a nest of Common Moorhen *Gallinula chloropus* recorded at Bussedra Pond (Algeria, Northern Africa). In this regard we review the cases of possible brood parasitism between Little Bittern and Common Moorhen.

Keywords: Ardeidae, breeding, brood parasitism, egg dumping, Rallidae, waterbirds, wetlands

INTRODUCTION

Brood parasitism (Payne 1977, Ducatez 2014), egg dumping (Frederick & Shields 1986), brood amalgamation (Beauchamp 1997), and brood mixing (Amat 1998, Strong et al. 1986) are often used interchangeably to refer to a female laying its eggs into another female's nest or parents delegating the care of their offspring to other parents, a phenomenon largely documented in birds (Lyon & Eadie 2008, sample > 230 species: Yom-Tov 2001) and, secondarily, in mammals (Packer et al. 1992), amphibians (Summers & Amos 1997), fish (Taborsky 1994, Fraser & Keenleyside 1995), and insects (Tallamy 2005). It is important to note that intraspecific brood amalgamation or brood mixing may occur before hatching (laying

eggs in conspecifics' nests) or after hatching when offsprings are left for conspecifics to rear (Eadie et al. 1988, Beauchamp 1997, Amat 1998).

There may be a variety of reasons with little or no evolutionary significance (stochastic events, mistakes, etc.) for a female to misdirect its laying into a conspecific's or another species' nest (Andersson 1984). This behavior may depend on environmental conditions such as anthropogenic disturbances, nest competition or the parasite's age and experience. Indeed, such maladaptive epiphenomenon may reflect intense "scramble competition" for limited resources such as nests (Davies 2000, Lomnicki 2009), a misidentification of a conspecific's nest or a "best-of-a-bad-job" event involving a female in poor condition

or losing its nest during laying (Gowaty & Bridges 1991, Sandell & Diemer 1999).

However, because reproduction in birds involves many energetically expensive behaviors like courtship, nest building, egg laying, incubation, and parental care (Clutton-Brock 1991), some individuals may transfer the costs of incubation, defense, and provisioning of offspring by laying their eggs in the nests of foster parents of the same species (Conspecific Brood Parasitism, CBP) or a distinct species (Interspecific Brood Parasitism, IBP, Sorenson 1992, Yom-Tov 2001).

In addition, IBP may be obligate as found in the Common Cuckoo *Cuculus canorus*, or facultative (Lyon & Eadie 1991). Thus, an avian brood parasite may possess a number of adaptive traits aimed at evading the host's defenses (e.g. egg mimicry, particularly robust egg shells, short incubation periods) that may confer an edge to individuals adopting a parasitic reproductive strategy (Mermoz & Ornelas 2004, Birkhead et al. 2010, Antonov et al. 2012, Fiorini et al. 2019). As brood parasitism imposes fitness costs to the host (lower breeding success, lower nestling growth, higher energetic costs during nestling rearing, lower lifetime fecundity, etc.), the latter may develop adaptations to counteract the parasite's attempts; thus, these host-parasite interactions, especially in the context of IBP, may escalate to an evolutionary arms race (Johnsgard 1997, Davies 2000, Soler 2017).

Among water-related species, the Common Moorhen *Gallinula chloropus* (Rallidae) is a well-known conspecific and interspecific facultative brood parasite (e.g. Gibbons 1986, Ueda et al. 1993, McRae 1995, 1997, 2011, Post & Seals 2000, Meniaia et al. 2014, Haraszthy 2019). Common Moorhen eggs have been documented to successfully hatch in Little Bittern *Ixobrychus minutus* nests demonstrating that the latter is a suitable host for the former (Trnka 2015). An experimental approach demonstrated that in 12 of 14 cases the parasitic egg of Common Moorhen was effectively incubated by the Little Bittern hosts and hatched almost always synchronously with host eggs. Thereafter, the Common Moorhen

chicks remained in the host nest for 1–3 days before leaving the nest (Trnka 2015). Likewise, out of three cases involving the nests of the Chinese Little Bittern *Ixobrychus sinensis*, four Common Moorhen parasitic eggs hatched and, thereafter, all four Moorhen chicks successfully left their respective nests (Ueda & Narui 2004).

Furthermore, there is ample evidence of Common Moorhen parasitizing Little Bittern's nests (Romania: David et al. 2005, Hungary: Haraszthy 2018, Slovakia: Trnka 2015, Spain: Pardo-Cervera et al. 2010, Algeria: Samraoui et al. 2012, see for the congeneric *Ixobrychus sinensis* in Japan: Ueda & Narui 2004), whereas there are not records of the opposite parasite-host relationship: i.e. brood parasitism of Little Bittern on a Common Moorhen's nest.

MATERIALS AND METHODS

During 2018 we carried out a field study on the breeding ecology of Moorhen at Bousedra Pond (36°50'45" N, 7°43'47" E), a small freshwater marsh (55 ha in size; near the town of El Bouni, a suburb of the coastal town of Annaba; Northern Algeria). Bousedra Pond is recognized as an Important Bird Area (Fishpool & Evans 2001) for its role as a wintering and breeding site for many species of conservation concern (e.g. White-headed Duck *Oxyura leucocephala* and Ferruginous Duck *Aythya nyroca*, Samraoui & Samraoui 2008).

RESULTS

We monitored 26 nests of Common Moorhen. Among them, we recorded a nest with three host eggs (size: 41.29x31.55, 44.49x31.44, 44.32x31.72 mm; volume: 20.92, 22.38, 22.70 mm³; Hoyt's formula; Hoyt 1979) and an egg of a Little Bittern (Fig. 1). The nest was built with leaves of *Typha angustifolia* at 20 cm height from the ground and was 50 cm from the water (75 cm in depth). The closest conspecific nest was located at a distance of 44.60 m. In the surrounding area, vegetation was composed of a reedbed of *Typha angustifolia* (approx. 140 cm high) and, secondarily, *Scirpus maritimus* (Samraoui et al. 2012, 2013).

The Moorhen's eggs were laid from 9 to 13 June. The Little bittern egg subsequently disappeared, but all Moorhen chicks hatched on 5 July. During the study period and, for the first time at Bousseadra Pond, no adults of Little Bittern were recorded, and no nests were found. However, until recently (unpublished data) the Little Bittern was a regular breeding species at Bousseadra Pond. We assigned the parasitic egg to Little Bittern based on size, shape and our knowledge of the breeding birds in the region.



Figure 1. Nest of Common Moorhen *Gallinula chloropus* with an egg of Little Bittern *Ixobrychus minutus* at Bousseadra Pond (north-eastern Algeria).

DISCUSSION

To our knowledge, this is the first record worldwide of possible brood parasitism of Little Bittern on a nest of Common Moorhen. A set of evolutionary and ecological deterministic or stochastic causes may interact with local conditions and circumstances to make brood parasitism likely.

First, the relationship between anthropogenic disturbance and interspecific parasitism is largely known in fragmented landscapes (e.g. Cavalcanti & Pimentel, 1988, Robinson et al. 2000) and degraded habitats (Davis & Sealy 2000). Anthropogenic disturbance may prompt females living in fragmented habitats to adopt bet-hedging strategies such as polyandry or

brood parasitism to increase their fitness (Simmons 2005; Gregory et al. 2018). This is known also for wetlands. For example, Airola (1986) reported that host species parasitized in disturbed riparian habitats are most likely to decline due to nest parasitism (see also Croston & Hauber 2010). In some wetland birds (ducks) it has been observed that females decide to parasitize when changes of environmental conditions due to disturbances are unfavorable (Sorenson 1991, Lyon & Eadie 2008).

Environmental factors linked to anthropogenic disturbances (e.g. low relative resource availability), may also favour intra- and inter-brood parasitism: for example, in marginal conditions (degraded habitats and ecotones), where probability of breeding success is low, parasitic egg laying and/or brood amalgamation requires a lower level of effort (egg laying) and so this allows a female to adjust her investment to better match the probability of success (Lyon & Eadie 2008).

Secondly, at behavioural level, brood parasitism observed in waterfowl may be associated with inexperienced females (Eadie et al. 1988) since they are less able to find their nest site (e.g. after predatory events), or as an active response to nest predation (David et al. 2005). Stressful events such as loss of nests due to high predation or competition for nesting sites during droughts or in degraded habitats, may compel females to adopt a "parasitic" behaviour by dumping their eggs at the first opportunity (Colwell 1986).

In our study case, the occurrence of a host-parasite relationship between the Common Moorhen and the Little Bittern could be due to (i) their temporal and spatial coexistence, (ii) the overlap between either species-specific distributional range or local habitats, (iii) the relatively high density of at least one of the species to improve the probability of such relationship (local density is a factor affecting the probability of brood parasitism; see Ueda & Narui 2004), or (iv) indirect consequence of nest predation on waterfowls (locally frequent: A. Talbi, pers. obs.). Moreover: (i) these two species are largely distributed in

Northern Algeria (Samraoui & Samraoui 2008, Samraoui et al. 2015, Samraoui et al. 2013) and, locally, they are syntopic for nesting in the same *Typha* reed-bed (Samraoui et al. 2012). Finally: (ii) they show the same breeding phenology and (iii) Common Moorhen is relatively abundant when compared to Little Bittern. Recent surveys have indicated that this latter species has virtually been extirpated from Bousseadra Pond due to severe anthropogenic pressures (unpublished data).

Reporting the opposite behaviour (Moorhen parasitizing Little Bittern's nests), Trnka (2015) suggested that this parasitism could be a consequence of misidentification of host nests by parasitic females since nests of these two species are very similar and located often close together. A similar explanation could be put forward in the opposite case (i.e. Little Bittern parasitizing Moorhen's nest). Trnka (2015) also suggested as Little Bitterns parasitized by Moorhens did not have egg recognition abilities (therefore hatching also the Moorhen's eggs). We hypothesize that this is valid also in the opposite case (i.e. when the Little Bittern lays its eggs in the Moorhen's nest). This latter species is known to accept indiscriminately exotic parasitic eggs but is sensitive to the timing of their introduction (McRae 1995).

Interspecific brood parasitism appears more common among nidifugous species (Common Moorhen) than among species whose nestlings are nidicolous, as in Little Bittern (Lyon & Eadie 1991). In this regard, there is much evidence of the opposite brood parasitism (Moorhen's eggs in Little Bittern's nests) representing an alternative breeding tactic to enhance reproductive output (Ueda & Narui 2004, David et al. 2005) since Common Moorhen chicks leave the nest soon after hatching and the main cost to Little Bittern hosts should involve only the cost of incubation of the parasitic eggs (Ueda & Narui 2004). In Moorhen, chicks leave their nest immediately after hatching; therefore chicks require no parental care from the Little Bittern and the cost of this parasitism is low for this heron. However, Common Moorhen chicks require some parental care prior to their in-

dependence and thus must join a neighboring Moorhen brood (Huxley & Wood 1976). In this regard, Komdeur et al. (2005) suggested as highly probable that Moorhen's juveniles of parasitized nests could be adopted from other Moorhen broods located in proximity of the parasitized nest (McRae 1996; Ueda & Narui 2004). The opposite phenomenon, like the one we observed, is instead highly improbable since Little Bittern's chicks are nidicolous and in need of parental care.

The absence of recorded adults and nests of Little Bittern at Bousseadra Pond lends support to the hypothesis of a rare event (first case recorded worldwide; locally, 3.8% of nests recorded; $n = 26$, see also Samraoui & Samraoui 2013, Menaia et al. 2014). Thus, it could be suggested that this "parasitic" behaviour was probably a local and occasional phenomenon.

In conclusion, our knowledge of facultative interspecific brood parasitism remains unsatisfactory with progress probably hindered by the paucity of studies. Further investigations covering a range of environmental conditions may help improve our understanding of this common but often overlooked behavior (Cheriet et al. 2015, Djelailia et al. 2017, Fouzari et al. 2018).

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