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J. M. Zuñiga & T. Redondo

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Adoption of Great Spotted Cuckoo *Clamator glandarius* fledglings by Magpies *Pica pica*

J.M. ZUÑIGA* *and* T. REDONDO† **Departamento de Zoología, y Genética, Facultad de Ciencias, Universidad de Granada, 18071 Granada, Spain †Estación Biológica de Doñana, C.S.I.C., Apdo. 1056, E-41080 Sevilla, Spain.*

A bird which helps raising unrelated young seems to behave maladaptively, since it wastes parental effort for no genetic profit.[1] On reviewing this topic, Shy[2] found that most observed instances of interspecific alloparental care involving non-parasitic species may have an accidental proximate reason: caring for mixed clutches, hatching of another brood in a nest placed close to the adoptor's own nest, or loss of the adoptor's mate or nest. Bustamante & Hiraldo[3] also concluded that high breeding densities could be responsible for the existence of several cases of intraspecific adoption in Red Kites *Milvus milvus*. True instances of interspecific adoption (i.e. extended parental care of heterospecific young out of the above contexts) are, in fact, much rarer. Shy[2] reports on three such cases involving adoption of orphaned young (Eastern Wood Peewee, *Contopus virens*, feeding Eastern Kingbirds *Tyrannus tyrannus*, Robin *Erithacus rubecula* feeding Blackbirds *Turdus merula*, and Black-and-White Warblers *Mniotilta varia* feeding an Ovenbird *Seiurus aurocapillus*). In addition, McGowan[4] observed a pair of Fish Crows *Corvus ossifragus* with nestlings caring for a fledgling Blue Jay *Cyanocitta cristata* which arrived and remained at the crows' nest. Interestingly, in each case the adoptor and adopted belonged to the same family (Tyrannidae, Muscicapidae, Parulidae and Corvidae, respectively).

Another group of species for which interspecific adoption of fledglings has been reported are brood parasites. Woodward[5] reported 3 instances of adoption of Brown-headed Cowbird *Molothrus ater* fledglings by adult hosts which were breeding in the vicinity of their natal nest. Simultaneous feeding by adults of a different species than the parasite's foster parents has been reported for the European Cuckoo *C. canorus*,[6,7] the Pallid Cuckoo *C. pallidus*,[8] and the Brown-headed Cowbird *M. ater*.[9]

Here we report on 3 instances of adoption of fledgling Great Spotted Cuckoos *Clamator glandarius* by Magpies *Pica pica*, their major host in southern Europe. On 30 June 1990, we collected 3 Great Spotted Cuckoo fledglings 23–25 days old from two Magpie nests at Santa Fe, Granada (southern Spain). Chicks were marked with aluminium rings and a unique combination of plastic colour rings. Chicks 946R and 947G had been raised together with a third cuckoo chick. Nestling 950Y had grown with a single magpie chick. The cuckoos were taken to an outdoor aviary 27 km away from their natal area and fed by us. The aviary was close to a Holm Oak *Quercus rotundifolia* woodland where two Magpie pairs were caring for fledglings. Magpie pair P1 was feeding a single Great Spotted Cuckoo chick and P2 a single Magpie chick. Both pairs usually remained within 400 m of the aviary containing the cuckoos. On 10 July morning, 946R escaped from the aviary and fled towards the oakwood, where it began to beg persistently. The next day, it was located within a few metres of P1 between 1600 and 1700 h, continuously begging from Magpies. Adult Magpies fed both 946R and their own cuckoo chick from 1700 to 1900 hours. We recorded subsequent feeding of both cuckoo chicks by P1 Magpies on 13, 17, 19 and 25 July. On 3

†To whom all correspondence should be addressed.

August, both cuckoos were observed following Magpies and begging from them while the adults foraged on the ground. Chicks 947G and 950Y were released in the morning of July 15. Both flew toward a nearby tree, where they began to give begging calls. On July 17 afternoon, P1 and P2 were kept under observation simultaneously. Cuckoos 947G and 950Y remained together perching on a branch within a few metres of P2 Magpie chick. An adult P2 Magpie fed 947G. Subsequent feedings by an adult P2 Magpie to 947G and 950Y were observed on July 19 and 25. Both cuckoos were seen following P2 Magpies on August 3 for the last time. Magpies kept on feeding the alien Cuckoos for at least 3 weeks. This period is similar to the usual period of dependence for Magpie fledglings (c. 4 weeks). The case is interesting given the scarcity of reported instances of interspecific adoption of chicks at present. In addition, if adoption of cuckoo fledglings is widespread, it would have important implications for the coevolution of brood parasites and their hosts.

Recent studies of host defence against avian brood parasitism have revealed that parasitic cuckoos may have evolved egg mimicry in response to the ability of hosts to recognize and reject eggs unlike their own.[10,11] However, once the parasite hatches, it is readily accepted by its foster parents, which no longer discriminate against chicks showing no resemblance to their own nestlings.[12] Several hypotheses could explain why hosts have not evolved discrimination against non-mimetic parasitic chicks.[13,14] One possibility is that cuckoo nestlings provide hosts with supernormal stimuli which are more effective at eliciting parental care than the usual stimuli emanating from their own nestlings.[15] This hypothesis predicts that a young cuckoo will elict higher levels of host parental care compared with a young host under similar conditions. Evidence in support of this prediction is, however, controversial. Davies & Brooke[13] gave Reed Warbler *Acrocephalus scirpaceus* parents a choice between a Cuckoo *Cuculus canorus* nestling and a brood of Warbler chicks and recorded no preference with regard to the number of feedings delivered. In addition, Brooke & Davies[16] and Gill[17] found that raising a single cuckoo to fledging is not more costly to hosts than raising a conspecific brood of similar mass. On the other hand, evidence is accumulating that parasitic chicks can sometimes trigger feeding responses in adult birds other than their foster parents (see above). However, it is not known whether adoption is more prevalent among parasitic than among non-parasitic species. For example, R. Fraga (pers. comm.) failed to observe any case of adoption out of *c.* 100 individually-marked Shiny Cowbird *Molothrus bonariensis* and Screaming Cowbird *M. rufoaxillaris* fledglings.

Nevertheless, such instances of interspecific adoption are relevant to the 'superstimulus' hypothesis because parents are presumably selected to refuse feeding conspecific young other than their own offspring. There is evidence that Magpie fledglings often beg from unrelated adults but fail to obtain any feeding, which implies that parents can recognize and selectively feed their own offspring,[18,19] perhaps on the basis of a signature system encoded in the begging calls of fledglings.[19] This might indicate that Great Spotted Cuckoo fledglings are more efficient than Magpie fledglings at releasing parental responses from Magpie parents other than their own.

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