Almeida, S. & Anjos-Silva, E. (2015) Associations between birds and social wasps in the Pantanal wetlands. *Rev. Bras. Ornitol.* 23: 305–308.
Beggs, J. (2001) The ecological consequences of social wasps (*Vespula* spp.) invading an ecosystem that has an abundant carbohydrate resource. *Biol. Conserv.* 99: 17–28.
Edwards, R. (1980) *Social wasps: their biology and control.* Sussex UK: Rentokil.
Fu Y.-Q., Dowell, S. D. & Zhang Z.-W. (2011) Breeding ecology of the Emei Shan Liocichla (*Liocichla omeiensis*). *Wilson J. Orn.* 123: 748–754.
Grant, J. (1959) Hummingbirds attacked by wasps. *Can. Field Nat.* 73: 174.
Henriques, R. & Palma, A. (1998) Bird predation on nest of a social wasp in Brazilian cerrado. *Rev. Biol. Trop.* 46: 1145–1146.
Moller, H. (1990) Wasps kill nestling birds. *Notornis* 37: 76–77.
Richter, M. (2000) Social wasp (Hymenoptera: Vespidae) foraging behaviour. *Ann. Rev. Entomol* 45: 121–150.
Wild, O. H. (1927) Wasps destroying young birds. *British Birds* 20: 254.
Windsor, D. (1976) Birds as predators on the brood of *Polybia* wasps (Hymenoptera: Vespidae: Polistinae) in a Costa Rican deciduous forest. *Biotropica* 8: 111–116.

***Yi-Qiang FU & Ming XIANG**, Sichuan Institute Key Laboratory for Protecting Endangered Birds in the Southwest Mountains, College of Life Sciences, Leshan Normal University, Leshan 614004, Sichuan, China. Email: Yi-Qiang FU fyq512@126.com (corresponding author).*

***Chi-Ping KONG & Yong-Heng WU**, College of Animal Sciences Xinjiang Agricultural University, Urumqi 830052, Xinjiang Uygur Autonomous Region, China.*

Olive-backed Sunbird *Cinnyris jugularis* assisting Crested Bunting *Melophus lathami* at the nest: substantiated evidence for interspecific feeding, Guangxi, south-west China

AIWU JIANG, DEMENG JIANG, EBEN GOODALE, FANG ZHOU & YUANGUANG WEN

Introduction

Avian brood parasitism can occur at both intraspecific and interspecific levels. Intraspecific behaviour may be quite difficult to observe without marked individuals, but can have major effects on reproductive fitness (Semel & Sherman 2001). Interspecific brood parasitism is more obvious and usually encountered in cases of specialised brood parasites such as cowbirds and cuckoos (Rothstein & Robinson 1998). However, ornithologists have long been making observations of rare cases in which non-parasitic birds give parental care to heterospecific nestlings (Shy 1982). This behaviour is usually considered to be some sort of mistake, in which there was an error by the parent bird in their recognition of their offspring. Generally, feeding nestlings directly increases parental mortality (Owens & Bennett 1994). Therefore, interspecific helping at the nest is likely to be almost always maladaptive, unless interspecific helpers learn parenting skills, a suggestion for which there is little evidence as yet (Shy 1982).

The majority of observations of such interspecific nest feeding are quite old and did not use techniques such as nest videography, which has in recent decades revolutionised studies of avian parental care (Reif & Tornberg 2006), by allowing the investigation of events such as nest predation (Pietz & Granfors 2000). In the context of interspecific nest feeding, cameras can yield information on the magnitude of the mistake—for example, the extent of parental care provided, duration of the behaviour, how the behaviour compared with that at normal nests, including the types of food given to nestlings, and was the mistake ever recognised?

We report here on an observation of the Olive-backed Sunbird *Cinnyris jugularis* feeding nestlings of the Crested Bunting *Melophus lathami* in a limestone karst area of southern China.

Methodology

On 6 May 2014, we found adult Olive-backed Sunbird and Crested Bunting still actively incubating on their nests in a village area at an altitude of about 200 m adjacent to the Nonggang Forest Reserve (22.474°N 106.958°E), Guangxi, China. The reserve is largely limestone seasonal rainforest (Jiang *et al.* 2014), surrounded by degraded forest and agriculture, particularly sugarcane. When the eggs hatched, we noticed interspecific feeding at the bunting nest and placed a Kodak Zx1HD Pocket Videocamera near both nests. For the purpose of comparison, towards the end of the same month, we also video-recorded one other Olive-backed Sunbird nest and two other Crested Bunting nests, all less than 1.5 km away and fed by conspecific parents; we used two normal bunting nests because the nestlings in the first nest fledged after only one day (17 May). From the video-recordings, we measured the rates of food provisioning and also attempted to determine the kinds of food items provided. Observations ended when the chicks fledged.

Results

Nests and nestlings

The Olive-backed Sunbird and Crested Bunting nests, found on 6 May at a sugarcane farm, were 180 cm apart and each contained three nestlings (Plate 1). The Olive-backed Sunbirds' nest was an oblong purse, made of slender grasses and a few leaves, 22 cm in length, with a breadth of 6.2 cm, and was hung on the tip of a climbing fig *Ficus pumila* about 290 cm above ground (Plate 2). The Olive-backed Sunbird parents entered the side of the nest by a circular entrance about 2.5 cm in diameter. The Crested Bunting nest was an open cup (outer diameter 11.0 cm, inner diameter 7.8 cm, outer nest height 6.3 cm, bowl depth 2.5 cm), built mostly of dry grass and twigs and placed on the side of a wall about 188 cm above ground (Plate 3).

The control nests with two Crested Bunting parents and no helpers were both positioned on big rocks about 50 cm above the ground. The Olive-backed Sunbird control nest was hung from the branch of a *Ficus microcarpa* tree about 210 cm above the ground. The control nests were in similar habitat and were similar in size and construction to the original nests described above.

The Crested Bunting nestlings in the abnormal nest (hereafter referred to as the 'mixed nest') hatched by the morning of 7 May, and the Olive-backed Sunbird nestlings, at their nest adjacent to the mixed nest, hatched by the morning of 8 May. All the nests, including the controls, had three nestlings each.

Parental feeding behaviour

Throughout the period of our observations, we never observed the female Crested Bunting. Our video-recordings demonstrated that interspecific parental care was primarily given by the male Olive-backed Sunbird; the female sunbird was seen to feed interspecifically, but only a few times (Figure 1). The interspecific feeding visits by the male sunbird were frequent—almost as many as the male Crested Bunting—and prolonged, as they continued until the bunting chicks fledged. In comparison, his visits to his own nestlings were few.

The Olive-backed Sunbirds delivered very atypical food for bunting nestlings, appearing to bring either very small, unidentifiable insects, or nectar (Figure 2). In contrast, the majority of the male Crested Bunting's deliveries (70.7%) were large adult Orthoptera, and some earthworms, snails and larger insects, such as Odonata and Phasmatodea. The rate of provisioning by the male bunting at the mixed nest (mean 39 trips per day) was higher than the combined visits of male and female buntings at the control nests (mean 38 trips per day). The female sunbird at the adjacent nest also made more foraging trips (mean 56 trips per day) than did the female sunbird at the control nest (mean 32 trips per day).

The male Olive-backed Sunbird's parental care at the Crested Bunting nest also involved faecal sac removal; it was observed to take away eight faecal sacs. In comparison, the male bunting carried away 63 faecal sacs, and swallowed 17.

Both nests were successful. The bunting nestlings fledged on day six of our observations, and after that they were not seen to be fed by the sunbirds, although they continued to be fed by the male bunting. The control nests were also successful.

Discussion

Two aspects of our observations are unusual compared with other reports of interspecific feeding. First, our observations were made when the parents doing the interspecific feeding were still feeding young in their own nest; usually this behaviour is exhibited by young birds or birds that have lost their nests (Shy 1982). Second, we observed the male sunbird remove faecal pellets, a behaviour not mentioned in Shy (1982) but one that could have strong implications for keeping the nest safe from predation (Guigueno & Sealy 2012).

While the male sunbird was very active in interspecific feeding, it did not deliver large insects similar to those delivered by the male bunting. Indeed, the observation that the male bunting's provisioning at the mixed nest was higher than the combined parental provisioning of the control bunting nests suggests that the male sunbird's interspecific effort may have been irrelevant for the bunting chicks. However, his behaviour would seem to have been hurtful to his mate; the female sunbird's high provisioning rates at the adjacent nest suggest that she needed to compensate for her mate's lack of help. Even in the control nest, the male sunbird did not visit the nest nearly as frequently as did the female. The small amount of help with provisioning required from male sunbirds may have allowed this male to interspecifically provision another nest without penalising his own nestlings.

This case of interspecific feeding may have occurred because the absence of the female Crested Bunting accentuated the begging behaviour in that nearby nest, misdirecting the attention of the Olive-backed Sunbirds. Shy (1982) mentioned several cases of nests close together where begging might have acted to stimulate interspecific feeding. Mistakes of this nature indicate that birds could be susceptible to interspecific brood parasites, and indeed the Olive-backed Sunbird is known to be parasitised by cuckoos, at least in Australia (Cheke & Mann 2008). Further observations of this kind of behaviour, particular by making use of video-camera, may help to elucidate how birds recognise their young and what mistakes may occur in this process, allowing room for heterospecifics or conspecifics to parasitise nests.

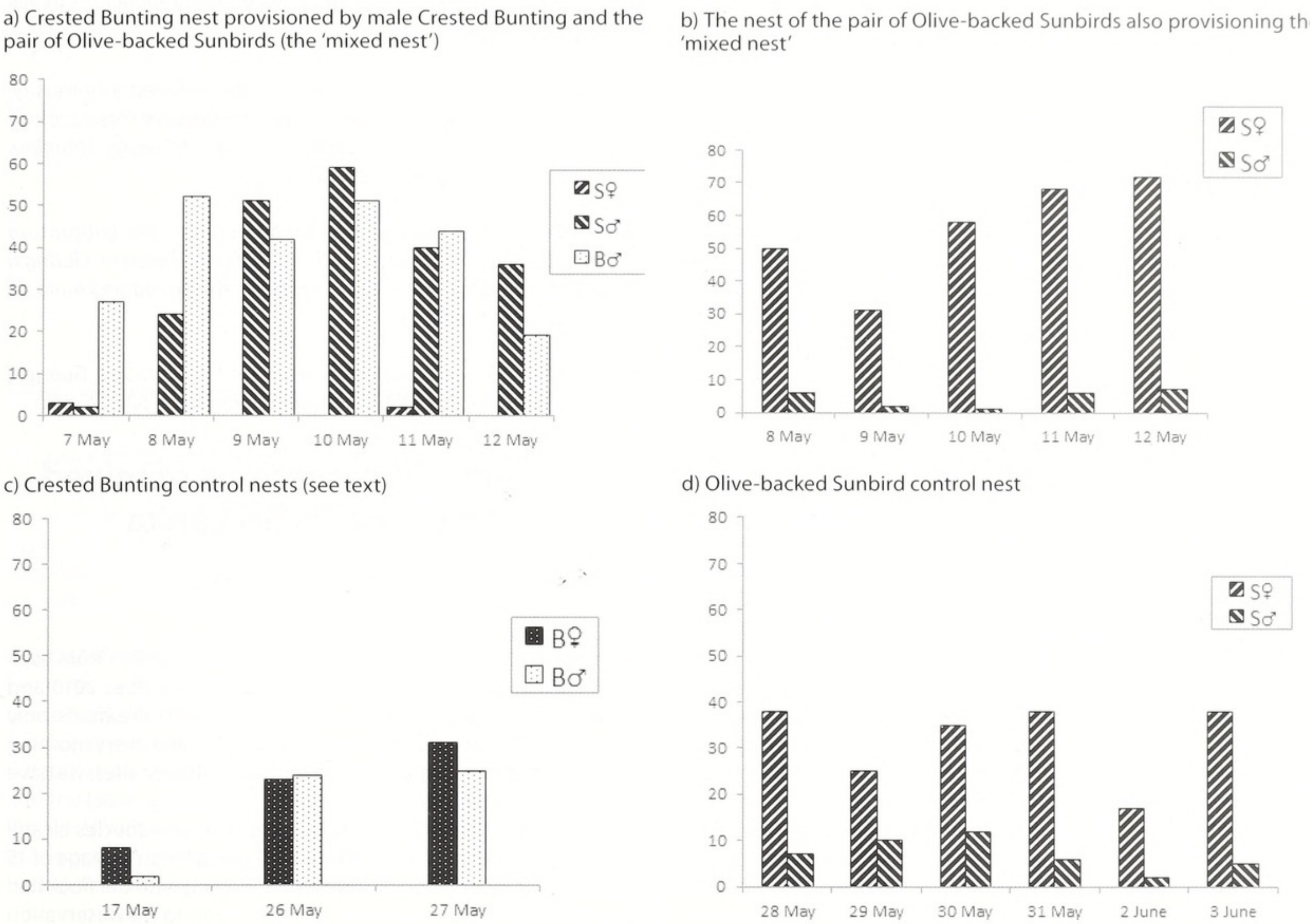
Plate 1. The juxta position of the Crested Bunting *Melophus lathami* 'mixed' nest (white arrow) and Olive-backed Sunbird *Cinyris jugularis* nest (yellow arrow), 11 May 2014.

Plate 2. Close-up of Olive-backed Sunbird nest, 12 May 2014.

Plate 3. Crested Bunting nestlings in 'mixed' nest, 12 May 2014.

Plate 4. Male Olive-backed Sunbird feeding Crested Bunting nestlings, 7 May 2014.

Figure 1. Number of daily feeding visits made by adult birds attending the nests under observation.



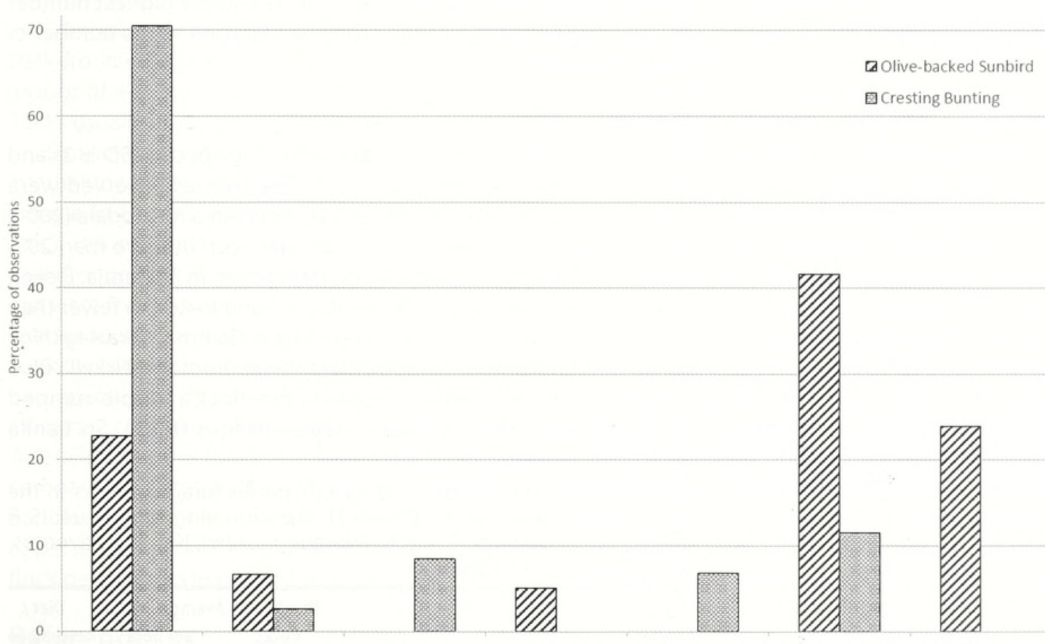


Figure 2. Breakdown (%) of food delivered to Crested Bunting nestlings by male Crested Bunting and Olive-backed Sunbird pair.

Acknowledgements

We thank the Nonggang NNR for permission to carry out this study. We also thank the warmhearted people who helped us with field work, including Rong Lu, Enqiu Nong, Ganwen Lin and especially Zhengquan Nong for the image of the Olive-backed Sunbird feeding Crested Bunting nestlings. This work was financed by the National Natural Science Foundation of China (31460567, 31172123), and the startup project of a post-doctoral fellowship in Guangxi University (B41049).

References

Cheke, R. & Mann, C. (2016) Olive-backed Sunbird (*Cinnyris jugularis*). *HBW Alive* (http://www.hbw.com/node/60062 accessed 15/09/2016).

Guigueno, M. F. & Sealy, S. G. (2012) Nest sanitation in passerine birds: implications for egg rejection in hosts of brood parasites. *J. Orn.* 153: 35–52.

Jiang A., Zhou F. & Liu N. (2014) Recent ornithological records from the limestone area of south-west Guangxi, China, 2004–2012. *Forktail* 30: 122–129.

Owens, I. P. & Bennett, P. M. (1994) Mortality costs of parental care and sexual dimorphism in birds. *Proc. Royal Soc. London B.* 257: 1–8.
Pietz, P. J. & Granfors, D. A. (2000) Identifying predators and fates of grassland passerine nests using miniature video cameras. *J. Wildlife Manage.* 64: 71–87.
Reif, V. & Tornberg, R. (2006) Using time-lapse digital video recording for a nesting study of birds of prey. *Eur. J. Wildlife Res.* 52: 251–258.
Rothstein, S. I. & Robinson, S. K. (1998) *Parasitic birds and their hosts: studies in coevolution.* New York: Oxford University Press.
Semel, B. & Sherman, P. W. (2001) Intraspecific parasitism and nest-site competition in wood ducks. *Anim. Behav.* 61: 787–803.
Shy, M. M. (1982) Interspecific feeding among birds: a review. *J. Field Orn.* 53: 370–393.

Aiwu JIANG, *Guangxi Key Laboratory of Forest Ecology and Conservation, College of Forestry, Guangxi University, Nanning, 530004, China. Email: aiwuu@163.com*

Demeng JIANG, *College of Forestry, Southwest Forestry University, Kunming, 650224, China and Guangxi Key Laboratory of Forest Ecology and Conservation, College of Forestry, Guangxi University, Nanning, 530004, China. Email: jdm447268365@163.com*

Eben GOODALE & ***Yuanguang WEN***, *Guangxi Key Laboratory of Forest Ecology and Conservation, College of Forestry, Guangxi University, Nanning, China, 530004. Email: eben.goodale@outlook.com & wenyg@263.net*

Fang ZHOU, *College of Animal Science and Technology, Guangxi University, Nanning, 530004, China. Email: zhoufang768@126.com*

What happens when the nuclear species is absent? Observations of mixed-species bird flocks in the Hiyare Forest Reserve, Galle, Sri Lanka

P. L. MEAURANGA M. PERERA, SARATH W. KOTAGAMA, EBEN GOODALE & H. S. KATHRIARACHCHI

Introduction

Mixed-species flocks play a prominent role in the social organisation of birds, especially in the tropics (Greenberg 2000, Sridhar *et al.* 2009) and it has long been observed that some 'nuclear' species play essential roles in the formation, maintenance and leadership of mixed-species flocks (Moynihan 1962, Goodale & Beauchamp 2010). Several authors have suggested that when nuclear species are absent, flocks may break up, and this might make flocking species vulnerable to human disturbance (Maldonado-Coelho & Marini 2004, Sridhar & Sankar 2008, Zhang *et al.* 2013). This could be a particularly interesting example of why non-trophic species interactions should be taken into consideration when devising strategies for conservation (Valiente-Banuet *et al.* 2015).

Here we report on flocks that persist in the absence of a typical nuclear species. In the lowlands of the wet zone of Sri Lanka, Orange-billed Babbler *Turdoides rufescens* demonstrates all the characteristics of a nuclear species: it is noisy and active, highly gregarious and leads most flocks (Kotagama & Goodale 2004, Jayarathna *et al.* 2013). A secondary nuclear species might be the Greater Racket-tailed Drongo *Dicrurus paradiseus lophorhinus*; this taxon—considered by some authorities to be an endemic monotypic species, the Sri Lanka Crested Drongo *Dicrurus lophorhinus*—makes loud alarm calls (Goodale & Kotagama 2005a) and is as attractive to other species as babblers in playback experiments (Goodale & Kotagama 2005b). However, it is not gregarious and does not facilitate the foraging of other birds, being a sallying species, and one that can also be aggressive and kleptoparasitic (Satischandra *et al.* 2007). At the Hiyare Forest Reserve study site there are no Orange-billed Babblers, but the Sri Lanka Crested Drongo is present.

Methodology

The study was made in the Hiyare Forest Reserve, Galle, a low altitude (about 350 m) rainforest patch in Southern province, Sri Lanka (6.667°N 80.283°E), about 16 km east of Galle (Figure 1A). We selected this site because it is similar in climate and vegetation to the Sinharaja Man and Biosphere Reserve, a long-term study site of mixed-species flocks (Kotagama & Goodale 2004), 70 km to the north-east, although the forests near Galle are more heavily fragmented. The reserve is small (about 240 ha), although it is close to the larger Kottawa-Kombala Forest Reserve; the forest at the site has been protected since 1919 because of the presence of a 20 ha reservoir, and thus is relatively mature. We made observations at three sites in the forest (Figure 1B) that were located more than 200 m from each other. Flocks were sampled in October and November 2010 and February to May 2011, between 06h00 and 14h00. We made only one observation per site per day. As flocks reformed every morning and showed as much variation at one site as between sites, we have pooled the observations here.

Flocks were defined as birds of more than one species clearly moving together in a group, and were followed for an average of 15 minutes until we believed all individuals moving with the flock had been counted. All species seen at least once during the observation period were counted as flock participants and the highest number of individuals seen at any one time was recorded as the number of individuals of that species in the flock.

Results

We observed 28 flocks, which averaged five species (SD ± 3) and nine individuals (SD ± 5.6) per flock. The species observed were quite similar to the flocks observed by Kotagama & Goodale (2004) at Sinharaja, with eight of the ten species seen in more than 20% of the flocks in Hiyare (Table 1) also being seen in Sinharaja. Eleven other species not mentioned in Table 1 participated in fewer than 20% of the Hiyare flocks (less than six flocks): Common Iora *Aegithina tiphia*, Golden-fronted Leafbird *Chloropsis aurifrons* and Tickell's Blue Flycatcher *Niltava tickelliae jerdoni* in five flocks, Purple-rumped Sunbird *Nectarinia zeylonica zeylonica* in four flocks, Sri Lanka

Table 1. Species recorded in 28 mixed-species foraging flocks in the Hiyare Forest Reserve in 2010–2011. Diet/foraging technique: IS = insectivorous, sallying; IP = insectivorous, probing; IG = insectivorous, leaf-gleaning; F = frugivorous.

Species	Number of flocks	Average number per flock	Diet / technique
Sri Lanka Crested Drongo *Dicrurus lophorhinus*	14	1.7	IS
Dark-fronted Babbler *Rhopocichla atriceps*	14	3.2	IG
Yellow-browed Bulbul *Acritillas indica*	13	1.7	IG, F
Malabar Trogon *Harpactes fasciatus*	12	1.4	IS
Black-naped Monarch *Hypothymis azurea*	12	1.6	IS
Asian Paradise-flycatcher *Terpsiphone paradisi*	8	1.0	IS
Black-capped Bulbul *Pycnonotus melanicterus*	8	1.6	F, IG
Orange Minivet *Pericrocotus flammeus*	7	1.7	IG
Black Bulbul *Hypsipetes ganeesa*	6	1.8	F, IG
Lesser Sri Lanka Flameback *Dinopium psarodes*	6	1.2	IP