RESEARCH NEWS

Complex domestic conflicts in a bird family

Raghavendra Gadagkar and H. S. Arathi

Birds exhibit, more than any other group of higher animals, such noble virtues as monogamy, pair-bonding for life, male parental care and cooperative efforts by both parents in nest building and care of the chicks. Not surprisingly, these virtues of the birds are often extolled by poets and philosophers, especially while admonishing fellow humans. However, as scientists probe deeper into the secrets of bird family life, many unexpected domestic conflicts are coming to the fore. A particularly devastating revelation has come from the recent use of DNA technology in determining the parentage of chicks being reared in nests of monogamously paired parents, much as forensic laboratories have begun to do in cases of disputed parentage among humans. Many species that were fondly thought to be monogamous have turned out to be rather promiscuous. Females from apparently monogamous pairs often mate, on the sly as it were, with males from neighbouring monogamous pairs and lay at least some of the eggs that are not sired by the partners who help them in parental duties[1-3].

A novel and more complicated domestic conflict has recently been documented by Norwegian scientists at the University of Oslo. Slagsvold *et al.*[4] conducted a four-year study of the breeding biology of the blue tit, a small passerine bird, not unlike the common house sparrow. These birds are monogamous and both parents share parental duties. The female lays about 10 eggs in a span of about 10 days and incubates them. While the male does not help with the incubation, he feeds the female while she does so and, later, when the chicks hatch, both parents feed the chicks. A matter of dispute concerns when the female should start incubating. If she starts too early (say, as soon as she lays her first egg), the chicks will all hatch on different days and the parents will have a very asynchronous batch of brood to take care of. If she starts late (say, after she has already laid all her eggs), then the chicks will all hatch at about the same time and the parents will have a very synchronous batch of brood.

It turns out that synchronous and asynchronous broods have very different consequences for the male and female parents. In one experiment, broods were artificially manipulated to produce especially synchronous or asynchronous broods. Male parents had a higher chance of surviving to breed again the following year when they were given asynchronous (47%; $n = 46$) brood than when they were given synchronous brood (25%; $n = 36$). Conversely, female parents had a higher chance of surviving to breed the following year when they were given synchronous brood (43%; $n = 43$) rather than asynchronous brood (29%; $n = 51$). As a precaution, it was confirmed that male and female parents had similar survival rates when synchronous and asynchronous broods were combined in the analysis (males = 35%; $n = 82$, and females = 37%; $n = 94$). Similarly, when data on male and female parents were combined in the analysis, birds attending synchronous and asynchronous brood have similar survival probabilities (synchronous brood = 37%; $n = 79$, and

asynchronous brood = 36%; n = 97). Thus, the mother is better off raising a synchronous batch of brood while the father is better off with an asynchronous batch of brood.

The most likely reasons for these male–female differences are the following. The authors of the same study have data suggesting that male blue tits, while participating in parental care, are apparently not as conscientious as the females. They take care of the larger and stronger chicks, and when such chicks are successfully fledged, they stop working and pay more attention to territorial defence and moulting and enhance their future survival probabilities. The burden of difficult and prolonged care of small and weak chicks falls on the mother. When the chicks are all of more or less the same age, the mother thus has more help from the father, who in turn has to work harder as all the chicks satisfy his criteria of being big and strong. When the brood is asynchronous, however, the male benefits by stopping his work early while the female carries on alone, caring for the smaller and weaker chicks, and in the process, lowers her chances of being alive and fit to breed again the following year.

Now why should males and females be so different in their commitment to parental care? Firstly, female parental care is more fundamental and as soon as there is any opportunity for one of the parents to desert, it is usually the male who is the first one to jump at it. This happens throughout the animal kingdom and may be related to the fact that females invest more in their offspring, starting right from the cost of an egg, while males invest much less, often nothing more than inexpensive sperm[5,6]. Hence, females have much more at stake in the survival of their offspring than males do. Secondly, the small and late-hatching chicks in a nest are more likely, at least in some species, to be sired by neighbouring males in extra-pair copulations[7,8], so that the male has even less interest in the welfare of these particular chicks[1,3,9,10]. Interestingly, however, it is the female that appears to win in this domestic quarrel about whether the brood should hatch synchronously or asynchronously. Only the female incubates and it is thus only she who decides when to start incubating and, therefore, how synchronous the brood should be.

Until not too long ago, unexpected conflicts among animals were buried under the carpet as being pathological. The evolutionary approach to animal behaviour permits us to face such unexpected conflicts head-on and even to predict when conflicts may occur and how they may be resolved. As a bonus, our understanding of animal behaviour grows in richness. But if these revelations of domestic conflict in birds appear to make them unsuitable as role models of good behaviour, we must reflect on the fact that they are still able to maintain an external appearance of faithfully bonded monogamous pairs in spite of such simmering discontent!

1. Burke, T., Davies, N. B., Bruford, M. W. and Hatchwell, B. J., *Nature*, 1989, **338**, 249–251.
2. Westneat, D. F., *Behav. Ecol. Sociobiol.*, 1990, **27**, 67–76.
3. Dixon, A., Ross, D., O'Malley, S. L. C. and Burke, T., *Nature*, 1994, **371**, 698–700.
4. Slagsvold, T., Amundsen, T. and Dale, S., *Nature*, 1994, **370**, 136–138.
5. Trivers, R. L., in *Sexual Selection and the Descent of Man* (ed. Campbell, B.), Aldine, Chicago, 1972, pp. 1871–1971.
6. Alexander, R. D. and Borgia, G., in *Sexual Selection and Reproductive Competition in Insects* (eds. Blum, M. S. and Blum, N. A.), Academic Press, New York, 1979.
7. Gottlander, K., *Ornis Scand.*, 1987, **18**, 269–276.
8. Westneat, D. F. and Sherman, P. W., *Behav. Ecol. Sociobiol.*, 1993, **4**, 66–77.
9. Davies, N. B., Hatchwell, B. J., Robson, T. and Burke, T., *Animal Behav.*, 1992, **43**, 729–745.
10. Westneat, D. F., *Am. Nat.*, 1994, **144**, 343–354.

Raghavendra Gadagkar is in the Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012, India and Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore 560 064, India; and H. S. Arathi is in the Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012, India.