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ON BLUEBIRD "RESPONSES TO APPARENT FEMALE ADULTERY"

David P. Barash (1976a) reported that female mountain bluebirds (*Sialia currucoides*) were attacked by their mates when he placed a male model near the nest site. They were not attacked after the clutch was complete and the resident male's paternity assured, even though the males continued to attack the male model. Barash interpreted this observation from an evolutionary perspective, suggesting that the male attacks on females early in the nesting cycle served to protect the male from being cuckolded in a "situation suggesting a high probability of adultery" (Barash 1976, p. 1099). Though the data were based on only two bluebird pairs, the interpretation is apparently intuitively compelling, for the study has been cited several times by Barash and others (Barash 1977a, 1977b, 1977c; Kolata 1975; Page 1977). Barash's observations stimulated us to perform similar experiments on the closely related eastern bluebird (*Sialia sialis*). We hoped to confirm that his tentative conclusions represented a widespread evolutionary reality, at least within the genus *Sialia*. Unfortunately, we were unable to do so.

We followed Barash's experimental paradigm, placing a mounted bird 1 m from the nest and counting the number of aggressive approaches to model and/or mate (within 10 min following the discovery of the model) at three stages in the nesting cycle: nest building, incubation (clutch complete), and nestling stage. Unlike Barash, we tested reactions toward a female model in addition to the male model and used a mounted hermit thrush (*Catharus guttatus*) as a control. This thrush is the same size and shape as a bluebird but differs in color, unlike Barash's American robin (*Turdus migratorius*)

TABLE 1
 APPROACHES (HOVERS AND ATTACKS) PER MINUTE DURING
 FIRST 10 MIN OF EACH OBSERVATION PERIOD

APPROACHES	BUILDING		INCUBATION		NESTLINGS	
	Hovers	Attacks	Hovers	Attacks	Hovers	Attacks
To male model:						
By female29 (5)	.23	.20 (2)	0	.07 (3)	0
By male	1.18 (5)	.85	1.65 (2)	.30	.37 (3)	.43
To female model:						
By female	No data		1.10 (1)	.80	.50 (1)	2.30
By male	No data		0 (1)	0	0 (1)	0
To thrush model:						
By female	No data		No data		.35 (2)	2.15
By male	No data		No data		0 (2)	0

NOTE.—() = sample size.

control, which is twice the weight of a bluebird and colored differently. Also, Barash presented his model to the same two pairs at three stages of their nesting cycles, whereas we presented each model only once to each pair, thus controlling for possible habituation. Barash reported no physical contact between his two males and the male model. However, our plans to present the three models to the 17 pairs breeding at our study area (the National Zoological Park's 3,000-acre Conservation and Research Center at Front Royal, Virginia) were thwarted by the total destruction of all three models by eastern bluebird males and females after only 14 presentations to eight pairs. Members of six of the eight pairs attacked at least one of the models, and in one pair the female attacked all three models. All attacks followed the same pattern: The attacker landed on the model's back and pecked vigorously and repeatedly at the head, nape, and upper back of the model.

Our results (table 1, fig. 1) showed no "anticuckoldry" behavior in male eastern bluebirds; we had no aggressive approaches by them toward their females at any nesting stage. In contrast, females often (60% of male-model presentations) approached aggressively and one female attacked the male model. Barash does not mention female aggression toward his male model in mountain bluebirds. The responses were also much more variable than Barash's.

If one breaks down the "aggressive approach" designation into hovers, wherein the model is approached but not touched, and attacks, wherein the model is pecked, one can only conclude that females attack female models more than males attack male models. Male hover: attack ratio toward the male model was 2.88. The female reaction to the female model resulted in a hover: attack ratio of 0.52. This violent response resulted in the near destruction of the female model after two presentations and its complete demise on the third, as a female flew off with the model's head early in the experiment to lose it for us in the brush. Males, in contrast, completely ignored the female model as well as the hermit thrush. Females again broke apart the hermit thrush after only two trials, with an even more aggressive response (hover: attack = 0.16 at a rate of 2.5 aggressive approaches/min). In retrospect, although the thrush equaled Barash's robin in not eliciting male aggressive responses, female eastern bluebirds responded aggressively. We suggest that bluebird pairs may have responded to it as if it were a female or juvenal-plumaged bluebird.

If we did not support Barash's suggestion that male bluebirds show anticuckoldry

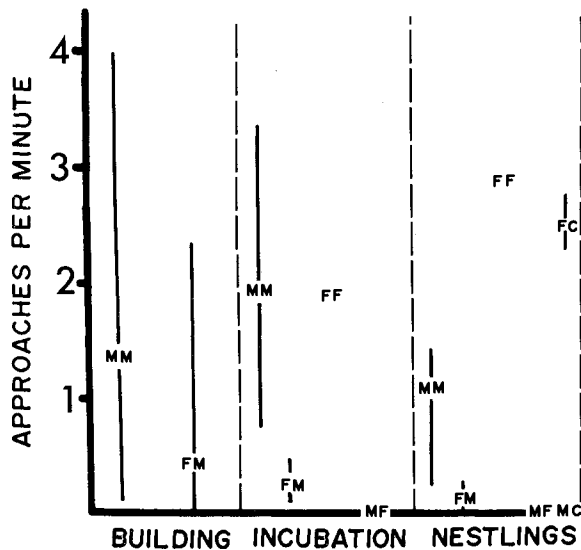


FIG. 1.—Frequency of male and female approaches to models during first 10 min following their return to the nest at three stages in the nesting cycle. The first letter of each pair represents the responding bluebird's sex, the second letter the model it responded to (M = male; F = female; C = control). The paired letters are positioned at the mean for that respondent/model combination, and vertical bars represent the range of values obtained. The FF refers to a single data point.

adaptations, we suggest that both studies still had “results that are consistent with the expectations of evolutionary theory” (Barash 1976a, p. 1099), as we presume any careful study would. The problem is in the interpretation of the sources of selection behind the results. As Barash points out, driving away a “suspected” adulterous female would be maladaptive if replacements were scarce. We have seen male eastern bluebirds that were successful in defending good nest sites but unsuccessful in attracting females. This may indicate a surplus of males. We doubt that mountain bluebirds differ in this respect given the similarity in biology between the two congeners, but this may explain the differences in our results. Power (1975) had only two female mountain bluebirds replaced out of 13 experimentally removed at a Montana site.

Our data do support observations reported by others that eastern bluebird females are dominant over their mates near the nesting site (Krieg 1971). The selfish interests of one sex may select for responses in the other. If males are programmed by selection to attract females to nesting sites, it falls upon the female to ensure the maximum continued investment from her mate after she has laid. Female dominance near the nest site should be viewed as a means to enhance her ability to drive competing females away by reducing male interference, ensuring a monogamous relationship with the male (which is to her benefit but not necessarily the male's).

Female eastern bluebirds exhibit what may be a form of deception with which they manipulate their males. At least five of our paired females sang when frightened from their nests by our approach when their mates were absent. These songs appeared identical to those given by males in territorial advertising and defense. This was the only context in which we observed female singing. Female singing is rare in temperate zone birds, and its significance is unknown. Here, in a potential predation context, the expected sounds are chevron-shaped, and female bluebirds do give these during

mobbing (rapidly uttered "chup" sounds) when the male is present. Males were quick to return to the nest, presumably primed to attack an intruding "male," but redirected this aggression toward us by hovering, bill snapping, and diving. Singing by females would not be adaptive if males commonly drove intruding females from their territories after pairing, but they do not. Thus, we suggest this represents a deceptive use of song selected to acquire male nest defense. It is also evolutionarily stable, since both parties are ultimately benefited by female singing and the male's reactions to it.

While we fully agree with Barash that it is necessary to use sociobiological concepts to gain a full understanding of social relationships, we feel that his example of "anticuck-oldry" behavior requires further experimental support. If support is obtained, one must reconsider the amount of generalization possible from current data in such a complex system.

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THE ADAPTATION OF *DROSOPHILA VIRILIS* TO LIFE
ON AN ARTIFICIAL CRAB

On February 27, 1974, Hampton L. Carson delivered the presidential address at the annual meeting of the American Society of Naturalists. The title of his address was "Three Flies and Three Islands." The substance of this address has subsequently been published (Carson 1974): three species of Drosophilid flies (*D. carcinochila*, *D. endobran-*