rence among cowbirds suggests that the interspecific head-down display arose in the intraspecific allopreening context, similar to that in other species of allopreening birds, and was then used in interspecific contexts.

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POSSIBLE "DECEPTIVE" USE OF SONG BY FEMALE BLACK-HEADED GROSBEAKS

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Among the species of birds in which females are known to sing is the Black-headed Grosbeak (*Pheucticus melanocephalus*; Weston 1947, Van Tyne and Berger 1976). In this species, such singing seems to function in maintaining family-groups after the young fledge (Ritchison 1983). Further, spectrographic analysis of 267 female songs and 521 male songs has shown that the songs of males and females differ in many respects, e.g., syllable morphology, song length, syllable duration, and intersyllable duration. Such differences allow Black-headed Grosbeaks to recognize the sex of an individual by its song (Ritchison 1980). These differences, however, apparently are not due to the inability of females to produce male-like songs. During a two-year study that I conducted, on two occasions females departed from their normal singing patterns and uttered remarkably male-like songs (Fig. 1). The situations in which the two female grosbeaks uttered these male-like songs were similar, i.e., their mates were long overdue at the nests and had failed to respond to repeated "chip" calls (the calls usually given when a pair of grosbeaks exchanged places on the nest).

One possible explanation for these male-like songs is that they simply represent one of the many vocalizations in the vocal repertoire of the female Black-headed Grosbeak. Such songs may serve to inform a male that the female has left the nest, and the eggs or young are in jeopardy if he does not return. Such an explanation seems unlikely, however, because it supposes individual recognition and my observations indicate that females sang these male-like songs so infrequently that their mates might not have had the opportunity to learn to recognize them.

Alternatively, the infrequent use of male-like songs by female grosbeaks suggests that the females may have been attempting to deceive their mates. There appear to be at least two requirements for successful deceit: the deceit must be relatively rare, so that on average a responder is paid for reacting as it does, and the responder must at least sometimes be unable to distinguish between fakes and the real thing (Dawkins and Krebs 1978). My observations of the grosbeaks suggest that these requirements appear to be satisfied, i.e., females rarely utter male-like songs and the songs appear similar enough to the songs of males that males would be unable to tell them apart. I hypothesize that upon hearing these male-like songs a female's mate would react as though another male were intruding. He would return to the nest to confront the intruder and, not finding any, would presumably remain to assume his incubation or brooding duties.

Such an observation has been reported by Morton et al. (1978) in a study of the Eastern Bluebird (*Sialia sialis*). These authors noted that at least five incubating or brooding females sang when frightened from their nests by an approaching investigator (and when the females' mates were absent). These were the only instances in which female bluebirds sang and, further, these songs were apparently identical to those given by male bluebirds in territorial advertising and defense. Upon hearing these female songs, males quickly returned to the nest, presumably primed to attack an intruding "male," but redirected their aggression toward the investigators. Morton et al. (1978:

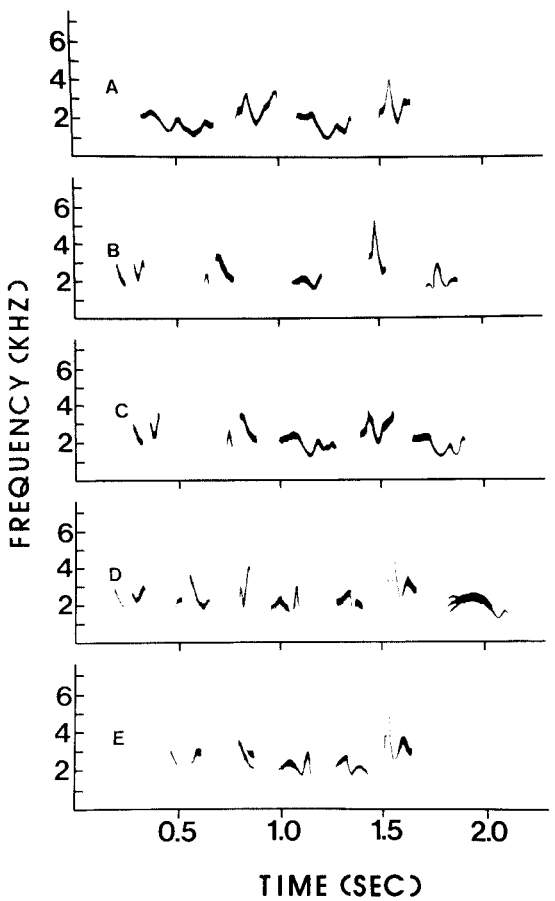

FIGURE 1. "Deceptive" songs used by female Black-headed Grosbeaks: (A) typical song of Female 1, (B) typical song of Male 1, (C) "deceptive" song uttered by Female 1, (D) typical song of Male 2, (E) "deceptive" song uttered by Female 2.

971) suggested that this represented a "deceptive use of song selected to acquire male nest defense." In this case, as in the Black-headed Grosbeak, such "deceptive" behavior would be adaptive since both parties would ultimately benefit by the female's singing and the male's reaction to it, i.e., the bluebird nest is defended against a possible predator and the eggs or young of the grosbeak are not left unprotected when the female leaves the nest.

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HUMMINGBIRDS FEEDING FROM EXUDATES ON DISEASED SCRUB OAK

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Hummingbirds are often thought to feed almost exclusively on floral nectars and occasionally hawk insects. Nevertheless, they are known to feed on fruits, from which they may remove exuded juices (Lack 1976) and sap. For example, Ruby-throated Hummingbirds (*Archilochus colubris*) may feed from holes made by Yellow-bellied Sapsuckers (*Sphyrapicus varius*) in the trunks of paper birch trees (*Betula papyrifera*; Southwick and Southwick 1980). Edwards (1982) has pointed out that various hummingbirds use secretions of insects (coccids) living beneath the bark of trees in Mexico, Colombia, and Brazil.

In this note, we describe a previously unknown food of hummingbirds: the exudate of pathogen-induced lesions on plants. We discovered this on 16 August 1981 (about 08:00) as we watched at least six Broad-tailed Hummingbirds (*Selasphorus platycercus*) and a male and a female Rufous Hummingbird (*S. rufus*) feeding extensively on exudate dripping from swollen red lesions on the undersides of twigs of Gambel oak (*Quercus gambelii*).

STUDY AREA AND METHODS

The area where we made our observations has been used previously for studies of breeding birds (St. Helens 1981, 1982). It is an 18.4-ha quadrat in the Bear Creek Nature Center, El Paso County, Colorado Springs, Colorado. The vegetation is dominated by Gambel oak and mountain mahogany (*Cercocarpus montanus*) and is typical of the dry foothills of the Front Range of the Rocky Mountains in Colorado. Affected oaks were common throughout the study area in 1981 and 1982. This area also supported small resident populations of the above species of hummingbirds.

Both liquid and crystallized samples of exudate were collected for chemical analysis. Quantitative determinations were made on crystallized material, dissolved in distilled water, by paper or acrylamide thin layer chromatography as appropriate. Sugars were identified using the methods of Baker and Baker (1979). Free amino acids were measured by staining with ninhydrin (Yemm and Cocking 1955). The dansylation technique, described by Baker and Baker (1976) and Baker et al. (1978), was used to detect amino acids. Proteins were measured using bovine serum albumin as the standard and staining with bromphenol blue (Flores 1978). We also tested for the presence of ascorbic acid with a technique that involves the rapid bleaching of 2, 6-dichlorophenolindophenol (Nordmann and Nordmann 1969), for phenols by using p-nitraniline and Folin reagent (Baker 1977), for alkaloids and other compounds containing heterocyclic N_2 with the Dragendorff test (Harborne 1973, Baker 1977), and for lipids by staining with osmic acid and Sudan IV (Jensen 1962).

We also determined the pathogen responsible for the lesions by having a specialist examine thin sections of the diseased tissue.

RESULTS AND DISCUSSION

The lesions on the oaks were apparently produced by bacteria. They contained no arthropods or fungi. Their exudate had a high ratio (1.117) of sucrose (to glucose and fructose), which is also characteristic of nectars in flowers that are pollinated by hummingbirds (Baker and Baker, in press; Table 1). However, the level of amino acids in the exudate was higher than that of most nectars taken by hummingbirds (Baker and Baker 1975). Many such nectars contain phenols, as did the exudate (Table 1).

Having seen many honeybees (*Apis mellifera*) feeding at the lesions on other days (Kevan et al., in press), we watched closely to see whether the hummingbirds were hawking insects rather than feeding on the exudate. They were not; rather, they hovered beneath the terminal twigs of the oaks and fed directly at the fluid. The male Rufous Hummingbird drove other hummingbirds off and, although they remained in the area, their feeding bouts were