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Brightness of birds’ beaks signals strength: new study

BIOLLOGISTS SUGGEST
FEMALE COLOUR USED
FOR MORE THAN SEXUAL
ATTRACTION

By NANCY DORRANCE

Female birds with brighter bills tend to be tougher than their dull-billed competitors, according to new research by Biology postdoctoral fellow Troy Murphy.

Although most studies of bird coloration to date have focused on enhancing mate choice, “This is only part of the picture,” says Dr. Murphy. “We need to think in terms of status signals as well; how tough an individual is, its fighting ability and dominance.”

He is studying this phenomenon in American goldfinches, whose bills change colour — from dab to brown to bright orange — in both sexes during the breeding season. The bills are coloured by natural fat-soluble pigments called carotenoids, which are used in the birds’ immune systems as antioxidants and can only be acquired through their diet.

“There’s a trade-off. The more carotenoids a bird channels into the colour of its bill, the less there is for its immune system,” Dr. Murphy explains. “This makes the bill colour a great candidate for a sexual or social signal.”

Studying under Biology professor Bob Montgomery at Queen’s University Biological Field Station (QUBS), the research team, including students Malcolm Rosenthal and Ryan Kelly, uses a spectrometer to measure coloration of the birds’ bills. Artificial “lipstick” is applied to their beaks, intensifying colour to the maximum found in the natural population. Since birds can see in the ultraviolet range, these colours appear much differently to them than they do to people.

Metabolic rate of the goldfinches is then assessed by measuring the amount of oxygen they consume. The lower their metabolic rate, the less energy they require to survive. Birds with good immune systems and metabolic rates are able to divert more carotenoids into their beak colour.

Behaviour is also measured by the research group, through dominance trials in aviaries. Above each of two feeders a stuffed model female perches in a lifelike pose. The bill of one model is painted much brighter than the bill of the other. In this case, a bright beak indicates energy reserves and an ability to fight, with females choosing to feed from the feeder guarded by the less dominant stuffed bird, explains Dr. Murphy.

“The fascinating thing about beak colour is that it can change within a matter of hours, whereas plumage only molts twice a year,” he adds. “The beak provides a snapshot of the quality of the bird at that time; a dynamic signal of the bird’s condition.”

In other research that Dr. Murphy is conducting with tropical birds in Mexico, both males and females defend their territories year-round, and both sexes have colourful plumage. His work indicates that females are using their elaborate plumage to signal how tough they are when defending territories. This relates to his QUBS study, he says, where brighter beaks indicate: “Get away from this thistle patch. It’s mine!”