FOOD COLOR PREFERENCE IN THE ANNA'S HUMMINGBIRD

HEATHER J. WELKER, 190 West 8th Street, Upland, California 91786

Food color preference in hummingbirds has been of interest since the early 1900s. The suggestion that hummingbirds innately prefer red food sources has been shared by many (Graenicher 1910, Porsch 1931, McCage 1961, Peterson 1961, Dennis 1975). Yet there are those who continue to find color preference insignificant except in association with other factors, such as the position of the vial, flowers in bloom and perch location (Bene 1941, Wagner 1946, Lyerly et al. 1950, Grant 1966).

I undertook this study to investigate further the response of the Anna's Hummingbird (*Calypte anna*) to variously colored food sources. The objective of this study was to determine if there was a significant color preference.

Determination of color preference in hummingbirds may indicate which naturally-occurring flowers would be visited most frequently. This preference could in turn influence the evolution of color in those flowers which are pollinated by hummingbirds.

STUDY AREA AND METHODS

I collected data for this study in Arcata, Humboldt County, California, between 17 October and 1 December 1980.

A sugar-water solution was used as the food source. The solution contained one part white granulated sugar to three parts water. Vials, filled with sugar solution, were hung from a porch overhang in front of a second level apartment facing south. The hanging apparatus on the vials consisted of red plastic; I assembled caps for the vials from construction paper matching the color of solution being offered. The small red corks were left exposed on all vials. Any bias involving the corks was consistent for each vial and for each trial. None of the food vials were replenished with additional solution once the trials began. After each vial was hung, following trial 4, the vial nozzle was coated with vegetable oil to prevent bees and wasps from landing on the vials and feeding. Early trials indicated that hummingbirds avoided the vials when bees and wasps were present.

I used four colors of vegetable food dye: red, yellow, blue and green. Coloration of the solution did not change during the trials.

In trials 1 through 4, each color was presented alone to the hummingbirds to accustom them to feeding from variously colored vials. These trials were also used to experiment with and remove possible biases. Trials 5 through 11 presented paired choices from the four basic colors. During trial 12, all four colors were placed on the porch edge approximately 0.16 m apart. During trial 13, the feeders were placed 0.55 m from each other. For each of the four mornings during this trial, the vials were arranged in a different color order to remove any bias created by their specific locations.

Aided by 8x 30 binoculars, I observed hummingbird feeding behavior for 40 hours. Vials were suspended for a total of 42 days. "Feeding time" began as soon as the bird approached and made bill contact with the vial nozzle and

ended when the bird flew away from the vial. Time recorded as feeding included the actual hovering time, although bill-to-nozzle contact may not have been constant.

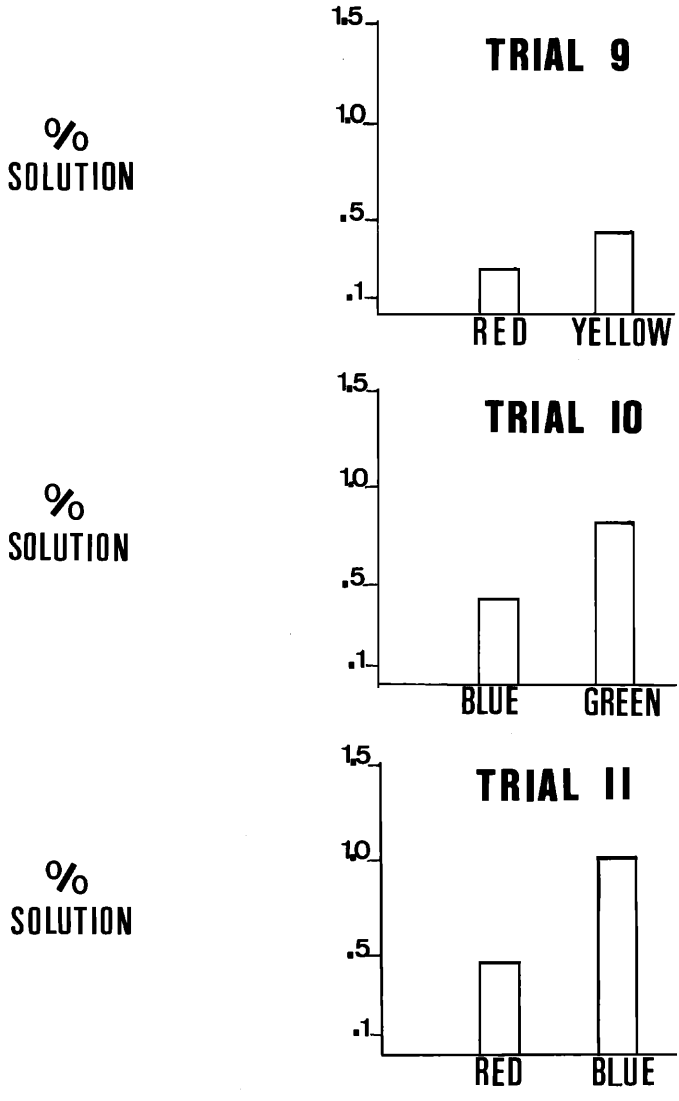


Figure 1. Percent of sugar-water solution removed per hour, in relation to color, by the Anna's Hummingbird.

In addition to color preference, I determined the frequency of visits in relation to time of day and weather conditions by observing the number of times per hour a hummingbird visited a vial.

RESULTS

COLOR PREFERENCE

Despite problems involved in trials 1 through 4 (bee and wasp disturbances, leaky vials and broken nozzles), I compared the amounts of solution removed from the individual vials over their allotted times (Table 1).

Trials 9, 10 and 11 were the only paired choice trials to indicate color preference (Figure 1). Data concerning the amount of solution removed in trial 7 (green vs. red) was rejected. One of the vials used in this trial proved faulty, causing frequent loss of sugar-water. However, the lengths of time spent feeding at particular vials in trial 13 indicated an obvious preference for green over red. Of the total observed feeding time, 78.3% was spent at the green feeder. The outcome from trials 5 and 6 was inconsistent with the results of the other 10 trials. Trial 5 showed a 0.10% preference for red over green and trial 6 showed a 0.18% preference for yellow over blue.

Trial 12 revealed a possible bias which may have occurred earlier in the study. When I presented all four colors at one time, 0.16 m apart, hummingbirds apparently preferred the end feeding positions without consideration for food color. For example, when the feeding vials were presented in the red-yellow-blue-green order, red received 76.5% of the observed attention; green received 23.5%; whereas yellow and blue apparently were not fed upon at all.

Trial 13 showed an overall preference for green food coloring. Of the total solution removed, 42.4% was green and accounted for 81.0% of the observed feeding time. The next most preferred color in trial 13 (as well as trials 8, 10 and 12) was blue, which accounted for 29.5% of the solution removed, then yellow with 23.6%. Red was apparently disfavored, contributing only 4.5% of the total amount of solution removed.

Table 1. Amounts of sugar-water solution removed by the Anna's Hummingbird from feeding vials presented alone between 17 and 28 October 1980 in Arcata, California.

Trial #	Color	Total Solution Amount Removed	Average Amount of Solution Removed Per Hour	% of Total Solution Removed Per Hour
1	Red	23.55 ml/62 hrs.	0.38 ml/hr.	0.27%
2	Yellow	50.05 ml/61.5 hrs.	0.81 ml/hr.	0.59%
3	Blue	38.45 ml/62 hrs.	0.62 ml/hr.	0.45%
4	Green	122.85 ml/73 hrs.	1.68 ml/hr.	1.22%

CIRCADIAN FEEDING CYCLE

The number of visits appeared to be inversely related to the amount of time spent feeding (Figure 2). As the number of visits decreased between 0900 and 1000 and between 1700 and 1800, the length of feeding time per visit increased.

Weather apparently did not affect the number of visits and the length of feeding time. Weather conditions were characterized as cloudy-wet days averaging 5.50 visits per hour at 19.3 seconds per visit by hummingbirds, cloudy-dry days which averaged 5.86 bird visits per hour at 17.3 seconds and sunny days which averaged 4.62 bird visits per hour at 17.2 seconds.

DISCUSSION

This study indicated that Anna's Hummingbirds prefer green food color with red being least preferred. Six trials contained color choices involving green. Each trial indicated green as the preferred color. Red food color was also presented in six trials and was least preferred in each.

These data are not consistent with previous studies; however, the season in which the studies took place could be the key to the discrepancy. Tonna J. Harris (unpubl. data) tested color preference in both Anna's and Allen's (*Selasphorus sasin*) hummingbirds in Arcata, California, during spring. Her results clearly showed a preference for red. Michael Hansen (unpubl. data) also studied food color preference in Anna's, Allen's and Rufous (*S. rufus*) hummingbirds in Humboldt County, California, during summer. All three species preferred red. Numerous flowers which bloom during spring and summer are red, which could encourage a preference for that color. In contrast, few if any red flowers bloom during the late fall and winter, perhaps eliminating the attractiveness of red and encouraging green food color

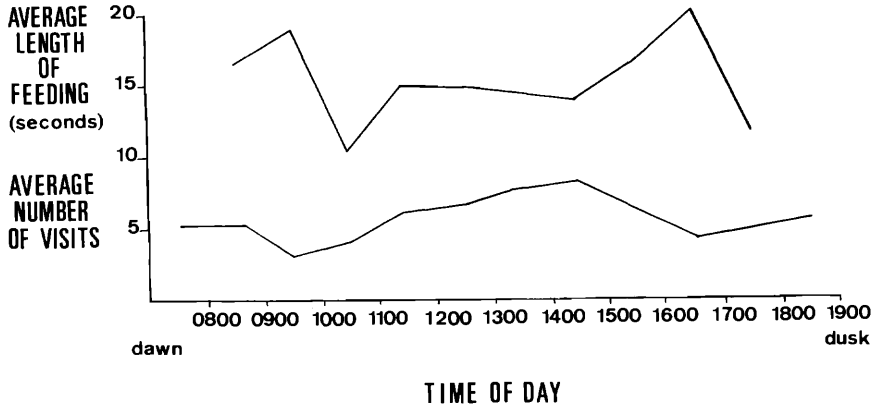


Figure 2. The average number of visits to feeding vials and average duration of feeding by Anna's Hummingbirds during 10-hour daylight periods between 17 October and 4 December 1980.

preference. I have observed hummingbirds feeding directly from water droplets on foliage, a behavior which may or may not be related to color preference.

Whereas numerous studies describe red food color preference in hummingbirds, an equal number of tests suggest no color favoritism (Bene 1941). Wagner (1946) reported that the color of flask receiving most of the attention always matched the color of the preferred flower at that particular season, matching not only the most abundant flower but the most preferred blooming flower as well. Lyerly et al. (1950) suggested that captive hummingbirds preferred the feeder positioned nearest to the bird's favorite perch, no matter what color it was. Food preference of the Anna's Hummingbird could depend on many factors in addition to color.

This study indicated that hummingbirds do not innately prefer red food sources. Their preference for green, at least during the non-flowering season, suggests that color stimuli or the lack of color stimuli may influence the food choice of the Anna's Hummingbird.

LITERATURE CITED

Bene, F. 1941. Experiments on the color preference of Black-chinned Hummingbirds. Condor 43:237-323.

Dennis, J.V. 1975. A complete guide to bird feeding. Alfred A. Knopf, New York.

Grant, K.A. 1966. A hypothesis concerning the preference of red coloration in California flowers. Am. Nat. 100:85-98.

Graenicher, S. 1911. On hummingbird flowers. Bull. Wisconsin Nat. Hist. Soc. 8:183-86.

Lylerly, S.B., B.F. Riess & S. Ross. 1950. Color preference in the Mexican Violet-eared Hummingbird, *Colibri t. thalassinus* (Swainson). Behavior 2:237-48.

McCage, R.A. 1961. The selection of colored nest boxes by House Wrens. Condor 63:322-29.

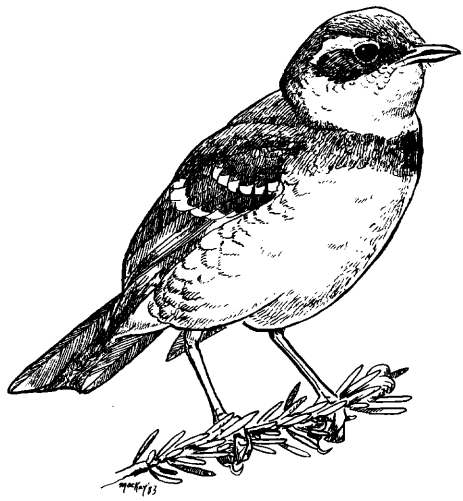
Peters, J.L. 1979. Birds of the world. 2nd edition. Cambridge, Massachusetts.

Peterson, R.T. 1961. A field guide to western birds. Houghton Mifflin, Boston.

Porsch, O. 1931. Experiments in feeding hummingbirds during seven summers. Wilson Bull. 25:153-66.

Wagner, H.O. 1946. Food and feeding habits of Mexican hummingbirds. Wilson Bull. 58:69-93.

Accepted 28 September 1983



Varied Thrush *Sketch by Barry MacKay*

BIRD RECORDS COMMITTEES

Please send detailed descriptions and photographs documenting rare bird sightings to the addresses below.

Arizona: Robert A. Witzeman, 4619 E. Arcadia Lane, Phoeniz, AZ 85018
California: B.D. Parmeter, 2500 Emerson Street, Napa, CA 94558
Colorado: CFO Records Committee, Denver Museum of Natural History, City Park, Denver, CO 80205
Oregon: Oregon Bird Records Committee, P.O. Box 10373, Eugene, OR 97440
Utah: Donald A. Hadley, 111 East 3700 South, Bountiful, Utah 84010
Vancouver, British Columbia: Wayne C. Weber, 303-9153 Saturna Drive, Burnaby, B.C. V3J 7K1
Washington: Phil Mattocks, Rt. 2, Box 200, Vashon, WA 98070

The Utah Field Ornithologists have established the Utah Bird Records Committee which solicits, reviews and classifies reports of unusual birds found in Utah. Accepted records are reported in the *Black Rosy Finch* published quarterly by UFO and will be incorporated into an updated Utah state checklist. All reports and supporting documentation are housed in the Utah Museum of Natural History at the University of Utah.

Lists of species for which reports are sought and reporting forms are available from Donald A. Hadley, 111 East 3700 South, Bountiful, Utah 84010, to whom reports should be submitted for the Committee.