FEEDING METHODS OF SOME TRINIDAQ HUMMINGBIRDS

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The hummingbird family includes hundreds of species which vary in size, bill length and bill shape. Many flowers are pollinated by hummingbirds and Grant and Grant (1968) have shown that the shapes, sizes and structures of the flowers visited are adapted to maximise the

chances of pollination. Each flower is most efficiently pollinated if it is visited by hummingbirds which regularly visit that species of flower. Measurements of the rate of calorie intake as compared to energy used during feeding by hummingbirds (Wolf et al, 1972) have shown that the optimum flower is different for different hummingbird species owing to differences in corolla length and shape and nectar concentration. Hence, while it is advantageous to the hummingbird to specialise in feeding from one flower species, such specialisation is also beneficial to the flower species since it makes successful pollination more likely.

The feeding adaptations of hummingbirds can easily be studied in Trinidad and Tobago since there is considerable variation among the 17 species which have been recorded. For scientific names and alternative names see Appendix. The feeding specialisations of the hummingbird species occurring in the forest and the cocoa and citrus-growing areas of the Northern Range of Trinidad are described in an extensive paper by Snow and Snow (1972). They found that the length, width and curvature of the corolla tube of about sixty species of flowers correspond to the shapes and sizes of the bills of hummingbirds feeding from the flowers. The same general conclusion has been reached in an earlier study by Skutch (1952). For example the two larger hermits, which have curved bills, fed most frequently at the balisier **Heliconia bihai** (see also Snow and Snow 1973). The flower of this plant is situated in a bract at such an angle that straight-billed species cannot easily feed from it. The other four flower species visited frequently by hermits have curved corollas. A further example was the ruby topaz, whose bill is short. This was the species most frequently seen to feed from flowers whose corolla tube was less than 10 mm long, and it never fed from flowers more than 19 mm long.

Snow and Snow (1972) also noted that larger hummingbirds fed for longer than did the small species. Since it seems possible that hummingbirds which specialise in particular flower species might show a characteristic feed duration when offered unlimited food, an experiment was carried out to investigate the duration of feeds at artificial feeders by seven species of hummingbirds.

Methods

A total of 117 birds were timed at feeders at Mr. Peter Rapsey's house in Aripo Valley, Trinidad. The feeders are frequently replenished with red-coloured sugar solution at a concentration of approximately 100 gm per litre (0.55 molar). When a hummingbird arrives at a feeder it drinks with intermittent short pauses of less than one second. When measuring the duration of feeding the stopwatch was stopped during the

pauses so that a "feed" was the total time that the bill tip was under the surface of the solution. In some experiments the volume of solution in the feeders was measured at the beginning and end of the experiment.

Results

Duration of Feeds

The duration of feeds was similar for five species but shorter for two others. The mean feed duration was between 8.3 and 8.9 seconds for the rufous-breasted hermit, the white-necked jacobin, the black-throated mango, the blue-chinned sapphire, and the copper-rumped hummingbird. All these were statistically longer ($p<05$) than the feed duration of the white-chested emerald with a mean of 6.7 seconds or the little hermit with a mean of only 3.2 seconds. Field observations of the little hermit showed that it took shorter feeds from flowers than did other species. Snow and Snow (1972) show that all four of the smaller species mentioned feed on smaller flowers, so it is somewhat surprising that the feed durations of a comparatively small species like the copper-rumped hummingbird was just as long as that of the three larger species. These results are discussed further by Broom (1975).

Behaviour at Feeders

The behaviour of hummingbirds approaching a feeder or a flower-bearing plant also varies from species to species. The mango and the copper-rumped, which are also found in more open country, fly directly and rapidly to the food. All three hermit species fly close to the ground and make many brief pauses in their feeds from flowers or feeders. The hermits were easily displaced from feeders by other species. Several white-chested emeralds, a small species, sat on branches within two metres of a feeder for much of the time and attempted to drive off any individual visiting one feeder. They were seldom successful unless the intruder was of their own species or a hermit. Other species did not show such defence of a feeder unless they were interrupted while feeding from it. ffrench (1973) describes the copper-rumped as an extremely aggressive species, but the black-throated mangoes were more vigorous in driving off others, at the Aripo Valley feeders.

Insect Food

Although hummingbirds are usually thought of as nectar feeders, almost all species also eat insects. In addition to the insects which must occasionally be eaten together with nectar, two different sorts of hunting methods are employed by species in Trinidad. The rufous-breasted

hermit gains much of its food by hovering by leaves and twigs and picking small insects from the surface. The other two hermits and other small species also feed in this way on occasion (Snow and Snow 1972). Some of the larger species catch insects in flight. ffrench (1973) states that the black-throated mango "commonly hunts for insects in the open" and Snow and Snow confirm this. Observations on the brown violet-ear suggest that this species may depend predominantly on insects for food. An individual watched at the Aripo Valley feeding station on several different days rested near feeders, but rarely fed from them. Instead it made frequent short flights from its perch, caught an insect and returned. ffrench also reports that this species shows fly-catching behaviour. A further fly-catcher technique has been observed by M. G. Hardy (personal communication). He watched a long-billed starthroat on many occasions at a stream in Maracas Valley hovering over the water surface in the same position for many seconds and apparently sucking in minute insects from the swarms over the water.

Responses to Salt

As a consequence of the observation by Bacon (1973) of a hummingbird in Colombia hovering over the sea and apparently drinking from it, further experiments were carried out at the Aripo Valley station to assess the responses of hummingbirds to salt. Firstly the birds were presented with a choice of water or colourless salt solution. The number of visits to each rapidly declined, but for 0.5 molar salt solution there was an indication that the visits were slightly longer than those to water (p 0.1 2-tailed binomial t-test). It thus seems possible that the hummingbird observed by Bacon might have drunk sea water for its salt content but there are other possible explanations (see Broom 1975). A further experiment was carried out in which hummingbirds were offered a choice of red-coloured sugar solution (0.27 molar) or that sugar solution with salt added. If the salt concentration was 0.07 molar or less the hummingbird did not discriminate between the two, but if it was 0.125 molar or more they drank much less from the feeders containing salt. Two human subjects presented with such colutions could not detect the presence of salt unless it was 0.25 molar.

There is much scope for further work on hummingbirds which could be carried out by any naturalist. Trinidad, with its variety of species and range of different sorts of habitats, is particularly suited to such studies.

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Appendix

English and scientific names of birds in order mentioned

rufous-breasted hermit, hairy hermit –	**Claucis hirsuta**
green hermit, Guy's white-tailed hermit –	**Phaethornis guy**
ruby topaz –	**Chrysolampis mosquitus**
white-necked jacobin, jacobin –	**Florisuga mellivora**
black-throated mango –	**Anthracothorax nigricollis**
blue-chiined sapphire, sapphire –	**Chlorestes notatus**
copper-rumped hummingbird, common emerald –	**Amazilia tobaci**
white-chested emerald, white-breasted emerald –	**Amazilia chionopectus**

little hermit, Longuemare's hermit –	Phaethornis loquemareua
brown violet-ear –	Colibri delphinae
long-billed starthroat, starthroat –	Heliomaster loqiroatria