

Aviculture of the Honeycreepers

by Ubaldo Leli, M.D.
Boston, Massachusetts



Yellow-legged Honeycreeper (Cyanerpes cyaneus). Male (from the author's collection, photo Bourque).

Photo by George D. Dodge/Dale R. Thompson



Red-legged Honeycreeper, female.



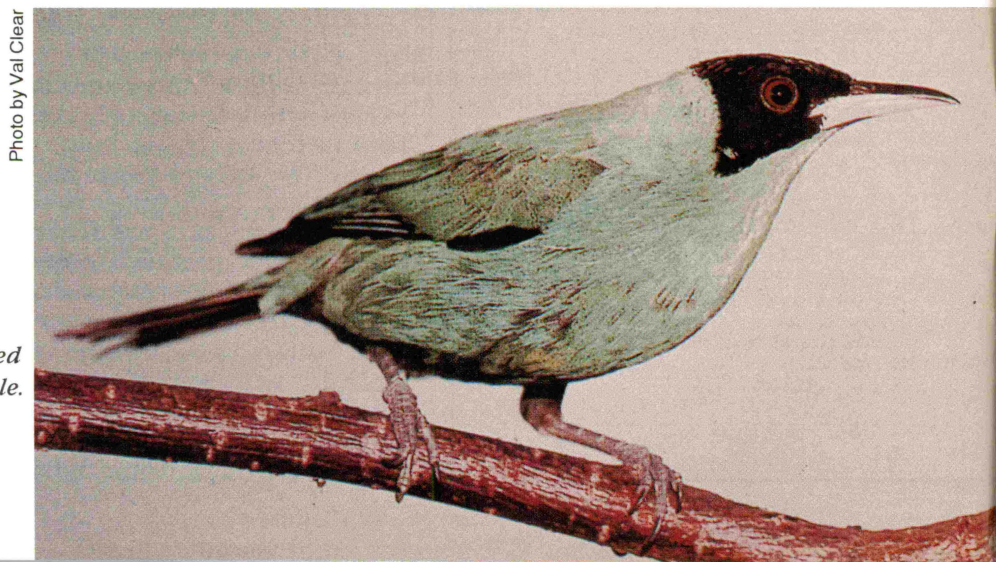
Red-legged Honeycreeper, male.

Photo by George D. Dodge/Dale R. Thompson



Red-legged Honeycreeper, male.

Photo by Val Clear



Green-legged Honeycreeper, male.

Photo by Val Clear

The honeycreepers, sometimes called sugarbirds, are a heterogeneous group of birds from South America that have been known to bird fanciers for a long time. These beautiful, gracious birds have been somewhat overlooked in the last 40 years by aviculturists. The purpose of this article is to remind the modern bird lover of the existence of these birds, and of their potential as avicultural subjects.

In this article I will not attempt to cover the very distinct aggregate of the Hawaiian honeycreepers (*Drepanididae*) that constitute a separate group. The biology of these birds, some of which are extinct, and all the living species endangered, is covered in a comprehensive article elsewhere! However, the information that I will present in this article can be of use in the management, husbandry and establishment of other small nectar-eaters with biology similar to the South American honeycreepers, namely the sunbirds from the Old World (*Nectariniidae*), the small honeyeaters from Australia (family *Meliphagidae*, genera *Myzomela* and *Certhionix*), the White-Eyes (*Zosteropidae*) and, possibly, some of the hummingbirds (*Trochilidae*). It can also be of relevance for species that are slightly more insectivorous or frugivorous than the honeycreepers, such as the Spiderhunters (genus *Arachnotera*), and the Asiatic flowerpeckers (*Dicaeidae*) and South American flower-piercers (genus *Diglossa*), respectively.

Ornithology of the South American Honeycreepers

The South American honeycreepers comprise a small group of bird families that live primarily in the rainforest. The ones important for aviculture are the *Cyanerpes*, *Chlorophanes*, *Coereba* and some of the *Dacnis*. Dunning also includes in the honeycreeper group the families *Oreomanes* and *Conirostrum* (Conebills), and *Diglossa* (Flowerpiercers)? but I will not cover these in this article. Honeycreepers belong to the *Passerinae*, and are not genealogically related to the hummingbirds, although they exhibit some of the same feeding habits. In order to understand the principles on which the management of these birds is based, it is important to take into consideration their biology and evolutionary origin.

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ized group of tanagers. Studies of comparative anatomy have demonstrated that the honeycreepers derive from the Calliste Tanager group (*Tangara*), and have specialized in feeding on nectar and small insects that they gather from flowers.³ Their diet progressed from fruit and insects first to mainly nectar. Consequently, the bills of these birds have become thinner and more specialized for probing into flowers. Figure 1 shows the derivation of three species of honeycreepers culminating in the Purple Honeycreeper, that has the most differentiated beak of the group. Thus the White-Bellied Dacnis (*Dacnis albiventris*) has evolved into the Blue Dacnis (*Dacnis cayana*) and finally into the Green Honeycreeper (*Chlorophanes spiza*); the Blue-and-black Tanager (*Tangara vassorii*) into the Red-necked Tanager (*Tangara cyanocephala*) and the Red-legged Honeycreeper (*Cyanerpes cyaneus*); and the Swallow Tanager (*Tersina*

viridis) into the Yellow-collared Honeycreeper (*Iridophanes pulcherrima*), and the Purple Honeycreeper (*Cyanerpes caeruleus*).³ Other scientific data also supporting the view that honeycreepers evolved from the tanagers include similarities of structure, color and pattern of the plumage, and similarity in the jaw muscles and horny palate between the two groups.³ We will analyze later the avicultural implications of these facts about the evolutionary derivation and family ties of the honeycreepers.

As I mentioned before, the genera of honeycreepers important in aviculture are *Cyanerpes*, *Chlorophanes* and *Dacnis*. Members of these families are now regularly available from importers, but need to be established in captivity. As I will describe later in the section of this article dealing with the aviculture of the honeycreepers, these birds are considerably simpler to deal with than hummingbirds. Considering

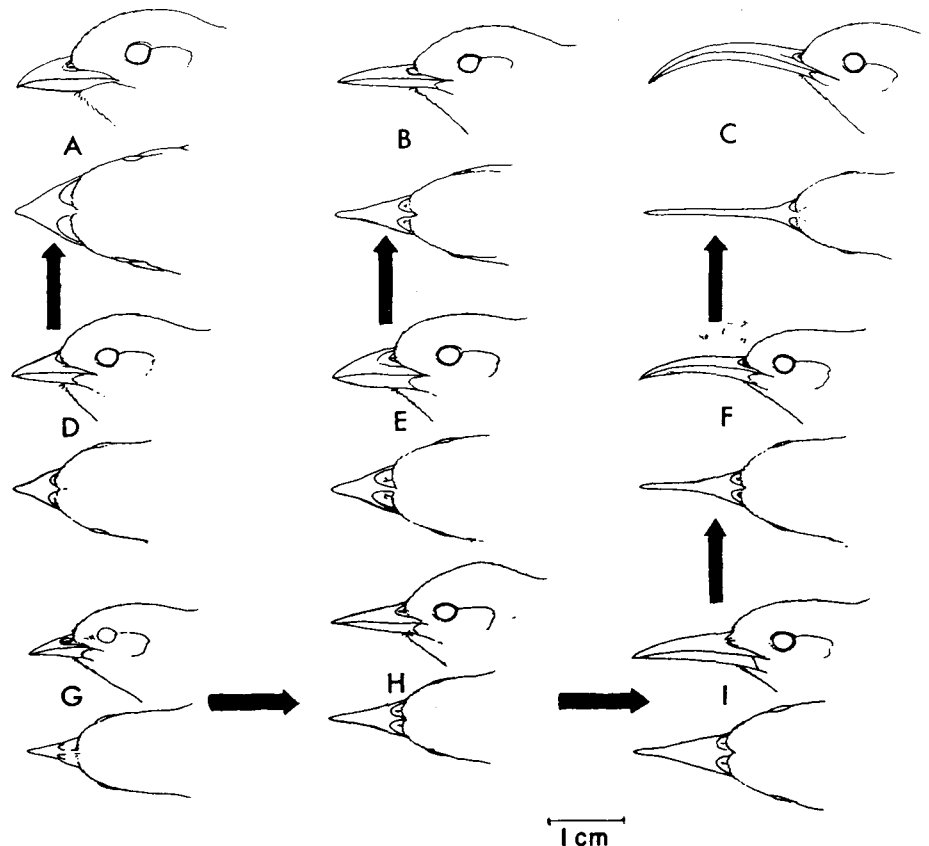


Figure 1

Derivation of Honeycreepers from Tanagers (From³). Comparison of the beaks shows a progressive specialization in feeding habits towards a more nectar-oriented diet. A: Swallow Tanager (*Tersinia viridis*); B: Yellow-collared Honeycreeper (*Iridophanes pulcherrima*); C: Yellow-legged Honeycreeper (*Cyanerpes caeruleus*); D: Blue-and-black Tanager (*Tangara vassorii*); E: Red-necked Tanager (*Tangara cyanocephala*); F: Red-legged Honeycreeper (*Cyanerpes cyaneus*); G: White-bellied Dacnis (*Dacnis albiventris*); H: Blue Dacnis (*Dacnis cayana*); I: Green Honeycreeper (*Chlorophanes spiza*).

their particular beauty, I hope that they will soon become the focus of interest of advanced bird fanciers specializing in small softbills.

A brief description of the characteristics of the 16 species of honeycreepers from South America is given in Table 1. Their diffusion and abundance determines the availability of birds for importation. The Red- and the Yellow-legged Honeycreepers (*Cyanerpes cyaneus* and *caeruleus*, respectively), the Green Honeycreeper (*Chlorophanes spiza*), the Blue, Yellow-bellied and Black-faced Dacnis (*Dacnis cayana*, *flaviventer*, and *lineata*, respectively), and the Bananaquit (*Coereba flaveola*) are widely distributed in Northern South America, ranging from Venezuela, Colombia, the Guianas and Surinam, to Ecuador, Peru, Brazil and Bolivia. The rarer Golden-collared Honeycreeper and the Tit-like Dacnis (*Iridophanes pulcherrima* and *Xenodacnis parina*) are limited to southern Colombia, Ecuador and the mountain forests of Peru. The Scarlet-thighed and the Viridian Dacnis (*Dacnis venusta* and *viguieri*, respectively) only inhabit the coastal areas of Colombia. The Scarlet-breasted Dacnis (*Dacnis berlepschi*) is limited to Ecuador. The Black-legged Dacnis (*Dacnis nigripes*) inhabits the southern coastal region of Brazil. The short-billed Honeycreeper (*Cyanerpes nitidus*) and the White-bellied Dacnis (*Dacnis albiventris*) inhabit in the highlands of Peru and an area encompassing the border regions of Ecuador, Colombia, Peru and Brazil, respectively. Finally, the Shining Honeycreeper (*Cyanerpes lucidus*), is limited to a narrow area of southern Central America from southern Mexico to Northern Colombia.

Because some of the South American countries like Brazil do not allow export of birds under any circumstances or, like Colombia, restrict export only to scientific use or, like Peru, allow export of birds only from specific geographical areas such as the lowlands, some of these honeycreepers are impossible to obtain. The most commonly imported ones are the Red-legged and the Green Honeycreepers (also called Yellow-winged Sugarbird and Black-headed Sugarbird, respectively), and the Bananaquit from Peru. However, the less common Yellow-legged Honeycreeper (also called Purple Sugarbird) and the Blue Dacnis have been

recently offered for sale more often. Although some of the species are locally rare but none of them is endangered, a renewed interest of aviculturists for the honeycreepers could result in increased availability of these birds from the importers, and would permit more focussed attempts to establish them in captivity for the benefit of future aviculturists and for the protection of the species themselves, in case of future loss of habitat — a possibility not at all

unlikely.

I will only describe in detail the Red-, the Yellow-legged and the Green Honeycreepers. A motivated aviculturist that has in hand a bird of uncertain identification should consult the Dunning's book on identification of South American Birds?


The beautiful Yellow-legged and the Red-legged Honeycreepers are very similar in size and shape. They are stocky little birds with a short tail, of about 4.5 inches in total length.

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Their beak is thin, curved and elongated, with the Yellow-legged Honeycreeper having a slightly thinner bill. The males are entirely blue with black primaries and a black mask. The Yellow-legged Honeycreeper also has a black bib, and the Red-legged, black on the nape and on the tail. However, the tone of blue is different in the two species. The Yellow-legged Honeycreeper has a deeper shade of cobalt blue, and lacks the visible hood of nearly turquoise tone that the Red-legged has. The legs are the most distinctive characteristics of the two birds. The Yellow-legged Honeycreeper has legs of a yellow varying from lemon to a light shade of greenish-yellow that tends to fade in captivity. The Red-legged Honeycreeper has vermilion legs. It has also a yellow area under the wings. The toes are black in both species. The male Yellow-legged Honeycreeper has no eclipse plumage, whereas the Red-legged male does, and in this state is identical to the female, except for its legs which remain red.

The females are very different from the males, as are the juveniles before their first molt. The female Yellow-legged Honeycreeper is slightly smaller than the male and has a green back similar in tone to the back of the Gouldian Finch. Her underparts are light brown, with many streaks of powdery yellow. The cheeks are rusty brown, sometimes with a faint blue moustache. The legs are olive green. The juveniles are like the female, but the rusty cheek spots are nearly absent, and some blue feathers are always visible mixed with the underparts. In my experience, no bird with any blue in its plumage has ever been a female. However, in the similar *Cyanerper lucidus* (Shining Honeycreeper), the female has been described to have streaks of blue on the breast. I have never seen a female of this species, therefore I cannot confirm this observation. The Red-legged hen has a more uniform color than the Yellow-legged one, and is a pale, dusty verditer aquamarine. The legs are grey, and the areas that are black in the male are grey-brownish in the hen, and lack a sharp division from the rest of the plumage. I have never seen a juvenile Red-legged Honeycreeper, so I cannot describe it. We must assume that it resembles the female.

The Green Honeycreeper is distinctly different from the two

previous birds. It is larger than the *Cyanerpes* and of a shape similar to a finch, more precisely to a European Goldfinch. The bill in this species is considerably shorter and thicker than in the other two species, with the lower mandible yellow and the upper black. In this genus (*Chlorophanes*), the derivation from the tanagers is particularly visible. *Chlorophanes spiza* male is a brilliant green-turquoise color with a jet black head, sharply divided from the rest of the plumage; the female has an all-over faded greenish tone. Feet and legs are grayish in both sexes. It is a common feature of all honeycreeper hens to lack the black head marking present in the males, and to have the colors on the body either faded, or of a different, always lighter color.

As I mentioned before, the honeycreepers are primarily low-altitude rainforest birds. Except for the Tit-like *Dacnis* that lives in highlands with trees and open shrubby areas, all the other species inhabit the thick rainforest canopy. The Bananaquit is more widespread and extends its territory to medium and high lands with trees, shrubbery and even open areas. Some authors have reported the existence of 35 sub-species of this bird⁴ However, it is not clear whether these are real sub-species or local varieties. The rainforest habitat of the honeycreepers, and the fact that all these birds come from equatorial and sub-equatorial areas have important implications for their husbandry, particularly for their breeding and acclimatization. Thus we should expect the honeycreepers to be scarcely sensitive to light and humidity stimulation to bring them into breeding cycle, due to the lack of well-defined seasons in their natural habitat. In addition, we should expect a continuing nesting behavior with small clutches. The natural food of these birds includes small insects captured in flight and on the flowers visited to gather nectar. Their rapid, precisely aimed flight requires high energy but, because these birds do not hover like hummingbirds, their requirements for simple carbohydrates in the diet is not so high as for the *Trochilidae*.

The nesting behavior of the honeycreepers in the wild is virtually unknown. One would expect that they should build a cup-shaped nest like their closest relatives — the tanagers, but authorities disagree on this (see the section on breeding).

Aviculture of the Honeycreepers

I will attempt in this section to summarize the known information on the honeycreepers in captivity, obtained from published records and from my personal experience. The subjects covered will be: sources and availability of honeycreepers, transportation and shipment, acclimatization and accommodations, diet and breeding. Before beginning I would like to note that honeycreepers are considerably less expensive than hummingbirds, and may appeal on that account to aviculturists of lesser means.

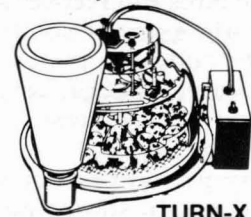
The importation of honeycreepers had a long hiatus after Federal quarantine regulations were instituted. Probably, importers felt that these birds were too fragile, and that the market was so small and limited only to those aviculturists that specialize in small nectar-eating softbills, that they were entirely ignored for the last 20 years or so. The same fate happened to other groups of birds important for aviculture, such as tanagers, hummingbirds and sunbirds. During the last ten years the pioneering efforts of Dr. Val Clear⁵ have resulted first in a steady supply of hummingbirds and bananaquits and, more recently, also of honeycreepers and tanagers. However, large commercial companies that supply zoos such as Bellbird Inc. of California and some other individual aviculturists and small importers have intermittently made available some honeycreepers to the avicultural community. Presently, several firms stock these birds regularly, and their addresses can be found in current avicultural publications. I must stress that it is imperative for the aviculturist contemplating acquisition of these birds to stipulate a guarantee of live arrival before paying for the birds. Honeycreepers are delicate and travel with difficulty, especially in winter. This may quite well cause losses. Further, the shipment bill should not be paid to the carrier until it is sure that the birds are alive in the transport crates; always bring another party as a witness.

Let us look at the specific problems of shipping and transport. Honeycreepers do not eat as often as hummingbirds, but nevertheless need a continuous supply of food. Therefore, the shipping crate must allow for light to penetrate so that the birds

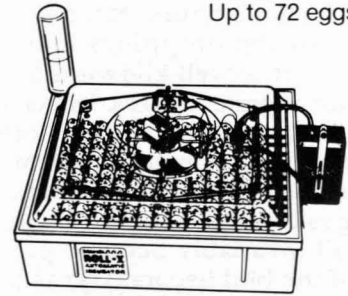
can feed. The most important feature of any shipping crate for honeycreepers and similar birds is that it must have a window and must be sturdy enough not to be accidentally crushed in cargo. Usually the birds are shipped with one or more nectar feeders and some fresh fruit such as sliced apple or pear, or halved orange or papaya. Banana is also suitable. As I will describe in more detail in the section on diet, there are many models of nectar feeders available. For transport, the most appropriate are the ones made from flat plastic bottles with a hole drilled on one of the larger sides. The opening is highlighted either with a red marker or with red nail polish. These containers are placed flat and secured in position. They do not leak unless the crate is turned upside down. Airline handlers often ignore "up" signs on the crate exterior (I have lost birds exactly for this reason), so make sure to oversize crate working labels and mark all sides of the crate. The feeders should be securely attached to the floor or the wall of the crate with wire and not with tape, which may loosen up due to the liquid nectar inevitably spilled around, or to the liquid droppings of the birds. Because honeycreepers can survive for several hours on fruit only, and this can be secured in such a way that no matter how the crate is turned it will still expose the cut area for the birds to feed, it is important to include this item in the shipment in addition to nectar. It is also important to make sure that the person receiving the birds has available the same type of nectar that the birds have been kept on, to prevent the already stressed birds from having to adjust to a new diet upon arrival. As a last caution about shipping, note that airline companies usually do not check for the weather conditions in the destination area at the time of arrival. Unloading cargo can take anywhere from 15 minutes to two hours (officially two hours). During this time the birds may very well be kept outdoors with temperatures as low as 25°F (personal experience!). Therefore, before having birds shipped or shipping them, the weather forecasts on departure and in the destination area should be checked very carefully. Pick-up from the airport must be made as soon as possible upon arrival. Honeycreepers are normally very active birds that fly rapidly and are difficult to catch. Generally,

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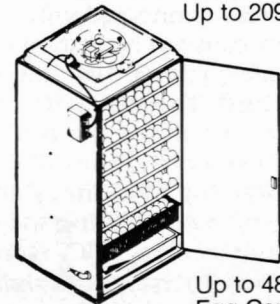
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when they come out of the shipping crate they are slow and look rather tame. This is not a sign of docility but of exhaustion.

In order of priority, the aviculturist must have the following ready: a) a small cage with lighting and heating, so that the birds can recover and eat; b) appropriate nectar solution and feeders; c) culturing plates for the detection of gram negative bacteria in the droppings; d) access to a qualified avian veterinarian.

Recovery period protocols are as follows. The light should be left on for at least 12 hours. Meanwhile a culture of the droppings must be obtained. It is well known that the presence of gram negative bacteria in the digestive system of birds other than birds of prey is abnormal. Many of these bacteria may not be harmful as long as the bird is in top condition, but will invariably become pathogenic if the bird becomes weakened for any reason. Travelling and the inevitable stress connected with it are a very likely cause of activation of non-pathogenic bacteria that could kill a shipped bird. Therefore, it is highly advisable to culture the bird upon arrival. I use Petri dishes divided in half, containing McConkey agar on one side and blood agar on the other. I incubate them at 37°C overnight. The gram negatives grow both on agar blood and on McConkey agar. The McConkey agar does not support the growth of gram positives. The gram negatives show as pink colonies (*Enterobacteriaceae*) or colorless colonies (*Salmonella*). If any growth is observed, the plates must be shipped to the closest bacteriology laboratory for identification and sensitivity test. The agar blood is important because it does allow all species of microorganisms to grow, not only the gram negatives, so you can detect the presence of gram positive bacteria (generally not harmful in birds) as well as yeasts and fungus. Although the agar blood is not the ideal medium for the growth of fungus (Soubauraud medium should be used), it is perfectly adequate for basic screening procedures. I am not advising every aviculturist to become a doctor or a Ph.D. in microbiology, but the basic screening procedures are easy to learn and carry out on one's own. Collaboration with a good avian veterinarian is, however, essential for the evaluation of the results and for an adequate therapy. Some dealers sell birds already cul-

TABLE 1
Schematic Description of the South American Honeycreepers²

SPECIES	DESCRIPTION
<i>Cyanerpes</i>	
<i>cyaneus</i>	Red-legged Honeycreeper. See text and Figure 1, 3A and 3B.
<i>caeruleus</i>	Yellow-legged Honeycreeper. See text and Figure 4.
<i>nitidus</i>	Short-billed Honeycreeper. Very similar to <i>caeruleus</i> , but the head/bill is half the length.
<i>lucidus</i>	Shining Honeycreeper. Very similar to <i>caeruleus</i> , but face light blue and black bib smaller. Female with blue streaks on breast.
<i>Dacnis</i>	
<i>cayana</i>	Blue Dacnis.
<i>venusta</i>	Scarlet-thighed Dacnis. Red eye. Head, cheeks, wing coverts and rump, light blue. Forehead, around eye and throat, wing primaries and tail, black. Green belly and red thighs. Female, no black on head (like in <i>Chlorophanes spiza</i>), all greenish blue, buffy underparts including tail.
<i>viguieri</i>	Viridian Dacnis. Eye, pale. Shining blue green, rump more bluish. Wing coverts bright green. Lores, upper back, primaries and tail, black. Female lacks black on back. Underparts, yellow-green.
<i>flaviventer</i>	Yellow-bellied Dacnis. Red eye. Crown, bluish-green. Forehead, sides of head, back, wings and tail, throat, black. Moustache, shoulder and underparts golden yellow. Female dull green above and buffy under.
<i>lineata</i>	Black-faced Dacnis. (Figure 1). Eye, golden. Forehead, face, back, wings, tail, black. Crown and underparts, light blue. Rump and belly, white. Female brownish, underparts greenish.
<i>berlepschi</i>	Scarlet-breasted Dacnis. Hood, upper breast, back, wings coverts blue. Red breast. Yellowish belly. Female brown with orange-red band across breast.
<i>nigripes</i>	Black-legged Dacnis. Very similar to <i>cayana</i> , with less black on back and throat. Female brownish above, pale below.
<i>albiventris</i>	White-bellied Dacnis. Shiny purple blue. Forehead, face, wings and tail, black. Center of underparts white. Female greenish with center of belly yellow.
<i>Iridophanes pulcherrima</i>	Golden-collared Honeycreeper. Hood and mantle black. Collar and nape golden-yellow. Rump yellow. Shoulders bright blue. Below light green. Female, no black and above olive-green.
<i>Xenodacnis parina</i>	Tit-like Dacnis. Bright blue with small beak. Female, head light blue. Back, brown. Wing coverts and rump blue. Underparts rufous with central yellow spot.
<i>Coereba flaveola</i>	Bananaquit. Short, curved bill. Long, white eyebrow. Above dark gray. Rump, belly and breast golden-yellow. Throat light grey. Monomorphic species.
<i>Chlorophanes spiza</i>	Green Honeycreeper. See text.

tured and treated. If you are lucky enough that this is the case, you will not have to go through this part of the acclimatization procedure. By culturing and treating the birds as soon as possible, you insure yourself

against an avoidable loss. I lost many birds before I instituted culturing procedures upon arrival as a matter of routine.

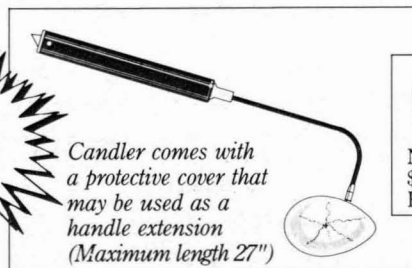
Once your bird has gone through the first night, and you know that it is

not a gram negative carrier, you are ready to move it to more permanent accommodations. If the bird cultures positive for gram negative bacteria, the veterinarian will advise you on the appropriate therapy to follow. In that case, the birds should be treated in quarantine until the cultures become negative. I would like to stress here that there are several antibiotics that are safe with honeycreepers and hummingbirds which I have used without harm. Because I do not know that any study has been published on the choice of antibiotics for these species I would like to mention the ones that have been used with my collection which were not toxic and effective. Chloramphenicol is by far the most harmless but effective antibiotic for honeycreepers and hummingbirds. I have used a dosage of *Chloramphenicol Succinate* of 1 mg in 40 ml of nectar. This is probably a slightly higher dose of antibiotic compared to the recommended dosage for *Passerinae* or *Psittacinae*, but it works well and is not toxic. Both thymethoprim/sulphamethoxazole and ciprofloxacin have not been useful in my hands, and seemed rather toxic in hummingbirds, but I cannot conclude that they are unequivocally toxic. What I mean is that I would not use them as a first choice, especially without a sensitivity test. For the treatment of fungus in hummingbirds and honeycreepers, I have used ketoconazole. However, probably because the oral adsorption of this drug is so variable and dependent on the acidity of the solution,⁶ I had to end up using as much as ten times the recommended dose in hummingbirds. This dose was effective for mouth fungus and was not toxic. I do not know whether honeycreepers would respond the same way. Final advice can only be given by a qualified avian veterinarian. Since bird fanciers may try to extend the observations reported in these notes to the management of hummingbirds, a disclaimer is in order. Warming a hummingbird to overcome stress or disease may be disastrous. Many hummingbird species do not tolerate warm and humid conditions because they come from dry and cold areas in the mountains. Therefore, try to know as much as you can about the hummingbird species you are working with before instituting any treatment. In the case of the honeycreepers, the uniform climatic conditions where they live

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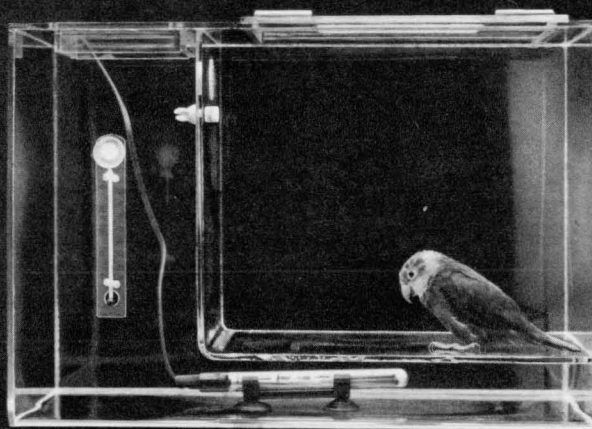
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Shipping crate, vertical plastic feeder (manufactured also in glass), and plastic bottle feeder (appropriate for transport). Note the internal bottom of the crate, made of welded wire, so the liquid droppings will fall through, the perches made of rope and the light, permeable walls that allow the birds to feed during the transport.

makes it possible to draw general conclusions about their management, which may not be appropriate for hummingbirds, coming as they do, from a much more varied array of habitats.

Concerning permanent housing of the honeycreepers, I have heard of and tried varied solutions. The ideal housing would be, of course, a planted aviary with a lot of vegetation and flowers, as well as a bounty of small insects. This is hardly possible to set up in a city apartment such as the one in which I live but zoos and aviculturists who live in better climatic areas (than New England) may consider this type of accommodation. I kept my first honeycreepers free-flying in my bird room. The birds were kept first in a cage in the bird room, and the other birds visited with them quite frequently. They did well, and did not get into as much trouble as my hummingbirds did, but I experienced problems that I will mention later in the part of this article dealing with breeding. I presently house the honeycreepers in cages of 1/2 inch x 1/2 inch x 1/2 inch welded wire 3 feet long x 2 feet wide x 2 feet deep. It is important to note that the *Cyanerpes* are not aggressive, and will live well with other small softbills and finches. However,

upon moving these birds from large to smaller accommodations, I observed the appearance of a pecking order, resulting in the bullying by the dominant male of the secondary individuals. This has caused in more than one instance extreme stress of the non-dominant male (I had two males at the time) with consequent exhaustion. Upon moving my two birds from the free-flying status (which had lasted a couple of years) into a large cage, the non-dominant male, kept away from the feeders, was found exhausted on the floor of the cage and had to be separated. Be careful about the dominance of males, especially when breeding. If you have a mixed collection containing hummingbirds, remember that the hummingbirds are much more aggressive and territorial than the honeycreepers and some species, especially the Sparkling Violet-ears, will bully the honeycreepers mercilessly. I myself prefer spacious cages holding honeycreepers individually or in pairs. Alternatively, a large, mixed aviary accommodation is possible, but I believe that it is not as conducive to breeding as the cage accommodation. It goes without saying that the cages should be as large as possible, since honeycreepers tend to become obese due to their

high-sugar diet. This prevents breeding.

Diet is equally important in the husbandry of the honeycreepers. In nature, honeycreepers feed on small insects, nectar and possibly pollen, small berries and fruit. Because these birds are so evolutionarily adapted to taking nectar I believe that some nectar in their diet is essential. However, I have seen diet recommendations for these birds that did not include nectar at all. In fact, some aviculturists believe that nectar feeding is dangerous because it may cause exclusion of all other items from the diet. This concern made perfect sense in the past, when the nectar foods were not as developed and backed up by scientific research as they are now. Of course roughage, minerals and protein from dietary items more solid than nectar are of importance for the long-term well being of these animals. In addition, these birds feed a high proportion of insects to their chicks during the first days of development. The diet for honeycreepers recommended by Bates and Busenbark includes nectar, spongecake, fresh fruit and mynah meal? The book of Kenton and Alice Lint⁸ describes a diet based on fruit, bread and milk, fruit flies and other insects, pound cake, hard-boiled egg, vionate and blossoming plants. Frank Woolham⁹ recommends fine insectile food and finely diced fruit. David Alderton⁴ recommends nectar, insectile food and soft-bodied life food. From this review of the literature it is clear that nectar is not the only food essential for these birds. My feeding routine includes nectar (see below), spongecake soaked in red Gatorade, Vionate (Squibb), fruit (primarily halved orange, papaya, pear, grapes, or banana, on a rotating basis) and finch egg-food. When the temperature is above 70°F the soft food and the nectar are changed twice daily. The birds also have always available fresh water, and bathe very willingly.

Since the nectar part of the diet is essential, I will comment on it in more detail. A nectar is a solution of nutrients in liquid, semiliquid or paste form. Flower nectar is very similar in composition to tree sap, but much more concentrated. It contains primarily simple sugars (glucose and fructose) and minerals. Therefore, it covers only the caloric requirement of the diet. The protein necessary to maintain the body organs is generally derived from pollen or insects.

Honeycreepers have a high energy consumption because of their high level of activity but, nonetheless, they require protein to maintain their body muscular and organ mass. Nectars fed in captivity differ from natural nectars in that they contain some protein so as to fulfill the requirements for this nutrient. In captivity one cannot generally rely on insects as a protein source. Unless the birds have access to a steady supply of high quality insects, and consume them regularly in enough quantity, some dietary deficiency will result. Therefore, all nectar recipes seek to create an ideal equilibrium between the amounts of protein, sugar, vitamins and minerals so that the birds will have a balanced diet, even if they eat only nectar. The problem with this approach is that the birds are much more sensitive to their need for carbohydrate energy than to their protein requirements. Therefore, the sugar contents of the nectar and the energy requirements of the bird determine the total amount of nectar consumed. This can lead to high intake of sugary nectar and, if the formulation contains too much protein, it can cause kidney damage. This is why even the best nectar formulations tend to contain too little protein. If one supplies additional protein in the form of live food, or insectile mixture, or even sponge cake, the birds should be able to fulfill their protein requirements without excessive sugar intake. However, every experienced aviculturist knows that birds eat not what they should, but what they like, making the achievement of a balanced nutrition most difficult. Dietary imbalances are particularly visible when the birds are breeding, or attempting to do so. (Later I will describe my experience with the breeding of the Yellow-legged Honeycreepers, a typical example of dietary problems not visible under normal conditions).

A last comment on the protein composition of nectar and softbill diets relates to the internal aminoacid balance in the different proteins. Of the 20 aminoacids of which proteins are made, some are essential and must be obtained from external sources, whereas others can be manufactured through biochemical transformations occurring primarily in the liver. The essential aminoacids for humans are different from those essential to birds. Since every protein contains a different proportion of

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aminoacids, we may be feeding enough protein and yet still be feeding the incorrect aminoacid balance to keep the birds in top condition. Some proteins are particularly imbalanced in aminoacids. Soybean protein for example, which is one of the most commonly used protein supplements in animal feeds, is extremely rich in acidic aminoacids and is deficient in others that are essential such as cysteine and methionine. Therefore we should try to feed our birds as varied a diet as possible, because the different imbalances of the various proteins offset one another. A typical example is that the protein from seeds, notoriously deficient in lysine, (an essential aminoacid for birds), can be balanced out by feeding cereals and beans high in lysine to species which will take these foods, such as parrots. All these considerations have been dealt with by the manufacturers of two of the most important nectar preparations commercially available. Nekton Nectar Plus (available from Nekton Products, Clearwater, FL) and Bio-Nektar (available from Bio-Tropic, Baden Baden, Germany) have been formulated based on studies of the nutri-



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TABLE 2 Recipes for Spongecake and Homemade Nectars

SPONGECAKE
3 eggs
125 g sugar
125 g flour
1 teaspoon baking powder
1 teaspoon vanilla extract

Beat the eggs. Add sugar and beat three minutes. Add vanilla and flour, mixed with baking powder. Mix well. Bake in an 8" pan, greased with butter, at 325°F for 30 minutes. Store in the refrigerator. Before serving (1" cube per bird per day), soak it in nectar or red Gatorade and sprinkle with Vionate.

NECTAR 1 (modified from Woolham⁹)

5 g purified soybean protein
5 g brewer's yeast
(available in health food stores)
5 g bee pollen
(available in health food stores)
1/4 tsp Nekton-S vitamin supplement
160 g sugar

Pound the pollen in a mortar with two teaspoons of sugar to obtain a fine powder. Add the brewer's yeast and continue pounding. Mix in the vitamins and sugar. Store in freezer. Mix 1 tablespoon of powder with 1/2 cup of water and stir well before serving.

NECTAR 2 (from Lyndsay Clack, modified by Brenda Geesey and Tom Adams)

2 cups dog or bird pellets
2 cups red Gatorade
1 cup sugar
1/3 cup soybean protein isolate
6 tablespoons Vionate (Squibb)

The original recipe employs dog food, but in the modified version Scenic Food red pellets (apple flavor) are used. Pellets, Gatorade and sugar are boiled until the pellets are dissolved. Then Vionate and soybean protein are added. This solid nectar is then stored in ice cube trays in the freezer. It can be served as is. It has been used this way, after thawing, for Hanging Parrots, and for other birds that need a nectar supplement, such as starlings. For the liquid version, one cube is dissolved in four ounces of apricot or pear nectar. These two fruit nectars maintain the other components of the mixture in suspension and are accepted by most birds. A recent modification by Brenda Geesey involves the addition of 1/2 teaspoon of Prime (Hagen) and 1 tablespoon of Nectar 1 (above) in powder form to the solution resulting from the dissolution of one cube of solid nectar in fruit nectar. This version has been accepted by many softbills that need nectar as a supplement (starlings and mynahs), and by a variety of wildlife being rehabilitated.

TABLE 3 Egg Food Recipe

4 hard boiled eggs (no shells)
2 cups high-protein baby cereal
(Gerber, golden box)
1 tablespoon Vionate
1 tablespoon Nekton Tonic K
800 units of vitamin E (two 400 unit pills)
1 250-microgram tablet of vitamin B12
1 50-microgram tablet of zinc
1/4 teaspoon of cod liver oil
1 tablespoon of finely ground cuttlefish bone

Grind the eggs with a food processor or vegetable mill. Add the baby cereal, the powdered cuttlefish bone and mix thoroughly. Pound the tablets in a mortar and add them to the mix. Pierce and squeeze the vitamin E pills and add, along with the cod liver oil. Mix until the consistency of a crumb is achieved. This food can be stored frozen. The daily amount can be scraped directly from the frozen container. It should be given in a non-metallic dish, in a very thin layer. The crumb consistency will cause the uneaten part to dry out and not spoil.

tional requirements of small nectar-eating birds by Dr. Karl Schuchmann. Nectar Plus was designed in the '70s, and is good for the maintenance of many species of hummingbirds, sunbirds and honeycreepers. The Bio-Nektar is a product designed more recently following the most recent state-of-the-art scientific advances in the field and is manufactured with laboratory grade chemicals in order to provide the ideal mixture of amino acids in the correct proportion. It has also been shown to support breeding of eight species of hummingbirds. In a conversation I had recently with Dr. Schuchmann, he commented that a correct nectar formula is essential for the breeding of hummingbirds. He himself has bred many species of *Trochilidae* in captivity under totally controlled conditions.

In Table 2 I give two recipes for homemade nectar used by various aviculturists which have worked well when commercial types were not available. I have used both for limited periods of time and my birds have done well on both mixtures. However, I do not feel that it is safe to feed these nectars to honeycreepers as the sole food for prolonged periods of time. At this point a comment on the nectar feeders is in order. Nectar can be served in many different ways. It is generally inadvisable to

serve it in open dishes or cups, because the birds may bathe in it with disastrous results. The upright, cylindrical brown feeder is appropriate for use with cages and is manufactured both in plastic (Nekton) and glass (Val Clear). Glass feeders tolerate sterilization much better than plastic ones, but are much more fragile and break easily. The flat bottle-type feeder is used exclusively for transport, and is inexpensive and easy to manufacture. I have also seen budgerigar drinkers used as nectar feeders, but I do not know how well they tolerate sterilization. No matter what type of feeder you use, it must be sterilized after *every* use. Nectars contain many insoluble components that stick to the walls of the feeders, which must be removed by brushing with a bottle brush or an old toothbrush, and liquid dish detergent. After rinsing, the feeders can be placed in a domestic dishwasher or soaked in a disinfectant solution. Antiseptic solutions are available commercially (Desi-Plus, Nekto) or can be prepared at home. The home-made solution is made of 2 quarts of water to which 1 cup of household bleach and 3 tablespoons of liquid dish detergent are added. These solutions must be prepared fresh every three or four days. Fifteen minutes of immersion are sufficient to sterilize the feeders, but longer immersions will not damage the feeders. Desi-Plus does not need to be rinsed off and should be let dry on the feeders. The manufacturer claims that feeders treated this way will allow the nectar solution to spoil more slowly. The home-made disinfectant solution must be carefully rinsed out. Sterilization of the nectar feeders is possibly the single most important operation with nectar-eating birds. It assures that lethal mouth and intestinal infections will not develop. It should be carried out religiously every day. Traditionally the tip of the feeders or the hole of the bottle-type drinkers are colored in red. However, this is not necessary and the birds will find the hole after a few trials whether it is red or not.

Finally, I recommend to aviculturists who can do so, to feed as many fruit flies as possible to their birds. This will not only improve the overall nutritional profile of the diet, but will also provide useful exercise to these swift-flying little birds while providing hours of enjoyment to the fancier, who will be able to observe the


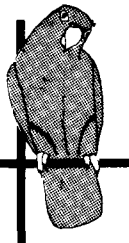
skill of the birds darting at the flies. For the aviculturists keeping caged honeycreepers, flightless strains of *Drosophyla* exist, which cannot fly and can be served with the regular food. I am, however, not aware of any commercial supplier of these mutants. To raise regular fruit flies, one can follow the very clear instructions in the book of Lint⁸.

Breeding honeycreepers in captivity has not often been achieved. As a matter of fact, I know of no recorded breeding under controlled conditions. Kenton Lint⁸ reports in his book that the Red-legged Honeycreeper breeds easily in a canary breeding cage, and uses a cup-shaped nest. The normal clutch is two eggs, - speckled at the blunt end. The same author also states that the chicks are fed insectivorous food during the first week. Alderton⁴ quotes a two week incubation period and states that live food is used to rear the chicks. My pair of Yellow-legged Honeycreepers had an unsuccessful breeding attempt. I had two males for about two years, free-flying in my bird room. After several attempts to obtain a female, regularly ending up with juvenile males which would

molt into beautiful adult cocks, I finally obtained a female. This is an important point, because obtaining a true pair of these dimorphic species in which the juveniles resemble the female is difficult. One way of making sure that one has a true female is to pluck some of the feathers from the breast of the suspected hen. If the bird has not yet had its first adult molt, the feathers will grow back the same color that they would be in the adult. In the Yellow-legged Honeycreeper, the feathers should grow back blue if the bird is a cock, but brown or yellowish if the bird is a female.

When I finally obtained a certified female, I kept her in a small cage for a few days so that I could observe the behavior of the males flying free in the room. One of my males flew on her cage within seconds, and displayed for her. The other male was kept carefully at a distance by the dominant one, although no signs of physical attack were observed. The display of the male consisted of pointing the beak to the sky, fluffing up all the body feathers and extending the wings and carrying them at a distance from the body touching the

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floor, in the same way that turkeys carry their wings during their display. Attempts at feeding the female through the cage wire were also done by the cock. After one day I released the female. The pair was always together thereafter. The single male seemed not to be bothered at all by the courtship. However, I set up an extra feeder to make sure that the non-dominant bird would not suffer any harm from being kept away by the main feeder. I provided nesting material consisting of undone rope, yarn and undone cotton balls, as well as a couple of different cup-shaped nests – one found in the woods, and a commercial one made of wicker, of the type used for finches. I do not know what kind of bird occupied the nest from the woods, but it was daintily built with fibers, with a lot of dry leaves intertwined in the outer parts. The birds undid this nest and took off all the fibers. They also carried undone rope into a dish-shaped chandelier positioned in the central part of the bird room close to the ceiling. This chandelier is not used because the room has fluorescent Vita-lites.

However, the nest construction did not proceed further, and after about three weeks I found the female honeycreeper dead on the floor of the bird room. I first thought that this was caused by some injury caused by the parrots that share the bird room with the other members of my collection but autopsy showed an egg in the oviduct, with a consolidated yolk and no shell. My conclusion was that the bird had died of egg binding, probably related to dietary deficiencies. The pair was receiving the diet described above. Therefore it seems clear from this experience that, although the diet is sufficient to keep the birds in good health and even bring them into breeding condition, it does not necessarily cover the nutritional requirements of a laying hen. Possibly the nectar food (Necton Nektar Plus, at the time) did not provide enough calcium and/or vitamin D for the hen to be able to properly process the egg. After some time, talking with Dr. Shuchmann in Germany I was told that honeycreepers build a large nest of globular shape in the rainforest, especially among the epiphytes, with various types of fibers, which is domed and has a lateral entrance. This, of course, conflicts with the published observations of Lint⁸ and others. Could this

be a species-specific difference between the Red-legged and the Yellow-legged Honeycreepers, or do these birds build different types of nests in captivity than in the wild? Certainly, it seems to me that the chandelier nest building suggests that a domed nest was being constructed, rather than a cup-shaped one. Also, my hen could perhaps have failed to lay the egg because an appropriate site was not available, rather than because of the diet. Future observations will hopefully answer these questions. Meanwhile we have learned that honeycreepers have a strong pair bond, form compatible pairs, and possibly display mate feeding. This represents an extremely pronounced difference compared to hummingbirds that do not form pairs, the hen builds the nest and raises the chicks entirely on her own, and the males are generally polygamous. Aviculturists will have to take into consideration these factors when trying to breed these species in captivity.

In conclusion, honeycreepers are beautiful birds, fortunately still available, which should be established in captivity. They are simple to keep and hopefully they will become the focus of interest of the aviculturists who have the sensitivity to appreciate and the skills to handle these beautiful creatures.

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