FOOD HABITS AND FEEDING BEHAVIOR OF THE BALTIMORE ORIOLE IN COSTA RICA

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BALTIMORE Orioles (*Icterus galbula*) are mainly insectivorous during their summer residence in North America (Bent, 1958), but little is known of their food habits while wintering in Central America and northern South America. Slud (1964) mentions that this bird has a varied behavior and diet while in Costa Rica, and A. F. Skutch is reported as saying that Baltimore Orioles subsist on a variety of animal and plant foods (Bent, 1958). However, no qualitative or quantitative data are available concerning the food habits and feeding behavior of this species. In Costa Rica the species occupies a wider range of habitat than do the native orioles and exceeds them in total numbers (Slud, 1964). This study was undertaken to obtain some data concerning the habits of this successful species during its stay in Costa Rica.

MATERIALS AND METHODS

This study was conducted at seven different sites in five of the seven Costa Rican Provinces. Collections were obtained at: Taboga, Guanacaste Province; Heredia, Heredia Province; Turrialba, Cartago Province; and San Isidro, San Jose Province. Observations of feeding behavior were obtained at the collection sites and at three other sites: San Jose, San Jose Province; San Vito, and Rincon, Puntarenas Province. Birds were collected with shotguns at different hours on several dates.

Stomachs from collected specimens were removed as quickly as possible, slit and preserved in a 70 per cent ethanol solution. The number of each item was recorded per stomach and the per cent by volume of each kind of food item was estimated.

RESULTS AND DISCUSSION

Observations of Feeding Times and Activity.—This species frequents borders and boundaries of many types of broken habitats. It is found foraging for food mainly in the canopy, but frequently is found at lower levels. Many times it is found in loose aggregations of birds such as other native and migrant icterids, tanagers, hummingbirds, etc. Associations with particular plants seem to be part of the feeding behavior of the species.

Baltimore Orioles usually become active as soon as it begins to get light in the morning. Within a few minutes of dawn, large numbers of orioles are actively foraging in the canopy layer of the habitats that they are utilizing. Active foraging generally occurs between 06:00 and 08:00. Reduced feeding activity may last until 11:00 or even later, but by 09:00 most Baltimore Orioles have finished feeding and after 11:00 virtually all are resting

TABLE 1

FOOD ITEMS OF SAMPLE 1 (21 STOMACHS) COLLECTED AT TABOGA, GUANACASTE PROVINCE, COSTA RICA—8–12 FEBRUARY 1968.

Food item	No. of stomachs with item	Mean no. of items per stomach	Mean est. per cent by vol. per stomach
Animal material			
Lepidoptera larvae	17	19	61
Coleoptera	8	1	9
Formicidae	3	2	4
Odonata	3	1	2
Orthoptera	1	0	0
Diptera and larvae	5	0	2
Hemiptera	1	0	0
Insect egg cases	3	0	1
Plant material			
Olyra seeds	2	1	8
Sideroxylon fruit	1	0	1
Unidentified material	18	—	12

somewhere in the shade. On cloudy days the entire sequence seems to be retarded and feeding activity may last later into the morning.

Later a second period of activity occurs, usually beginning about 16:00 and lasting until dark. This feeding period appears to be less intense, as fewer orioles are observed. Those that are observed seem to feed less actively than they did during the early morning period. On cloudy days this second feeding may commence and end early in the day.

Observations of Feeding and Plant Associations.—In northwestern Costa Rica during the early morning active feeding period, large numbers of Baltimore Orioles were observed visiting *Sideroxylon* trees. These trees were flowering and fruiting, but also had heavy foliage. Large numbers of bees, hummingbirds, and warblers were also visiting these trees. As many as 12 to 15 Baltimore Orioles could be observed actively feeding in the tops of these trees, but by 08:30 almost all oriole activity ceased. On one occasion a large group of orioles (8 or 10 birds) was observed foraging in a *Calycophyllum candidissimum* tree which had heavy foliage. A few orioles were observed drinking nectar from *Combretum* flowers and foraging in this vine during the early feeding period. After 08:00 and until 11:00 large numbers of orioles visited *Combretum* vines. A few were seen drinking nectar from these vines, but most were either resting or foraging for insects. The most active feeding period, however, seemed to be during the time spent in the *Sideroxylon* trees. During the afternoon period some orioles were observed

TABLE 2

FOOD ITEMS OF SAMPLE 2 (18 STOMACHS) COLLECTED AT TURRIALBA, CARTAGO PROVINCE; HEREDIA, HEREDIA PROVINCE; AND SAN ISIDRO, SAN JOSE PROVINCE—4–8 MARCH 1968.

	Sub-sample A 4–6 March Turrialba (7 stomachs)			Sub-sample B 7 March Cartago (6 stomachs)			Sub-sample C 8 March San Isidro (5 stomachs)		
Food item	No. of stomachs with item	Mean no. of items/stomach	Mean est. per cent vol./stomach	No. of stomachs with item	Mean no. of items/stomach	Mean est. per cent vol./stomach	No. of stomachs with item	Mean no. of items/stomach	Mean est. per cent vol./stomach
Animal material									
Lepidoptera larvae and pupae	5	2	26	6	6	54	3	6	30
Coleoptera & larvae	6	6	44	3	1	4	5	6	46
Hymenoptera	2	1	5	0	0	0	2	1	4
Formicidae	0	0	0	0	0	0	2	1	1
Orthoptera	2	0	10	0	0	0	2	0	2
Diptera & larvae	0	0	0	1	0	5	1	0	0
Hemiptera	1	0	1	0	0	0	2	1	3
Insect egg cases	1	1	1	2	1	7	2	2	6
Araneae	0	0	0	2	1	3	1	0	0
Plant material									
Ficus fruit	0	0	0	2	0	15	0	0	0
Unidentified material	7	–	14	5	–	12	5	–	8

feeding in *Combretum*, *Bursera simaruba*, and *Enterolobium cyclocarpum*; in one instance a few orioles were observed foraging in epiphytic bromeliads. This activity also seemed to be reduced in intensity compared with the early morning feeding in *Sideroxylon* trees.

Observations made in central Costa Rica indicated that Baltimore Orioles foraged for food in trees with bright colored flowers or in trees with heavy foliage. Most Baltimore Orioles in this region were seen during the early morning activity period foraging in *Erythrina poeppigiana* trees which had bright orange flowers and were nearly devoid of leaves. Some Baltimore Orioles were observed in other *Erythrina* spp. and in *Cassia grandis*. A few orioles were observed in *Cordia alliodora* trees which were in flower and had heavy foliage.

In southwestern Costa Rica fewer numbers of Baltimore Orioles were seen. A few orioles were observed foraging in *Cecropia* spp. and *Ficus* sp. which were in fruit. One male was seen eating from a *Cecropia* fruit but spent most

TABLE 3
SUMMARY OF IMPORTANT FOOD ITEMS FOUND IN 38 BALTIMORE ORIOLE STOMACHS COLLECTED DURING FEBRUARY AND MARCH, 1968 IN COSTA RICA.

Food items	Total number of items	Mean number of items	Mean estimated per cent by volume
Animal material			
Lepidoptera larvae & pupae	482	13	49
Coleoptera and larvae	100	3	19
Other insects and araneae	128	3	12
Plant material	36	1	7
Unidentified material	—	—	12
Total	746	20	99

of his time foraging for insects. One oriole was observed foraging high up in a large *Brosimum utile* tree which was in fruit and had heavy foliage.

Baltimore Orioles observed in the three regions either were seen actively foraging in trees with heavy foliage or were observed in vegetation with bright red or orange-colored flowers such as *Combretum* plants or *E. poeppigiana* trees. Orioles foraging or resting in these plants with brightly colored flowers seemed to be much less active and remained for longer periods of time than those orioles observed in other non-colorful vegetation. Therefore, the possibility exists that these plants not only provide food but also provide a cryptic situation for the brightly colored male Baltimore Oriole.

Stomach Contents Analysis.—Tables 1, 2, and 3 summarize the results of the analyses of stomach contents. It is readily apparent that Lepidoptera larvae and coleopterans make up the most important components of the diet of these winter residents. However, a wide variety of animal species and a few plant fruits were utilized as part of their diets. Lepidoptera larvae appear to be the most important item in the diet of this bird while it is in Costa Rica. Beetles are the next most important part of the diet. However, as sub-sample A and sub-sample C indicate, in Table 2, in some cases beetles may be the most important. This diet information is strikingly similar to the known information concerning the diet of this bird in North America during its summer residence (Martin, Zim, and Nelson, 1951), (Bent, 1958). The similarity of diet between sub-sample A and sub-sample C of sample 2 is interesting. These sub-samples were collected at different locations, on different dates, at different hours of the day and had different sex-age composition; the only equality of the sub-samples was that both sub-samples were obtained from populations of birds utilizing *E. poeppigiana* trees.

No differences in diet between sex and age groups were evident in this study. However, larger samples might show some differences because females and sub-adults seemed to feed over a longer period of time and utilized a wider variety of trees in their feeding behavior than did adult males.

SUMMARY

This study indicates that Baltimore Orioles feed early in the morning and to a lesser degree again in the late afternoon during their stay in Costa Rica. Baltimore Orioles tend to visit certain plants that are either in flower or fruit. Lepidoptera larvae are the most important fraction of this species' diet and coleopterans are the next most important part, the two accounting for about 68 per cent of the total food. A variety of other insects and spiders made up 12 per cent of the diet. Plant material accounts for only 7 per cent of the total diet; 12 percent of the total volume of stomach contents was unidentified but was composed mainly of fragmented insect remains.

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