

THE MOLTING PERIODS OF MEXICAN HUMMINGBIRDS

BY H. O. WAGNER

THE molting periods of birds of the temperate latitudes of America are fairly well known, whereas data on the inhabitants of the regions between the tropics are very widely scattered throughout the literature. Details are given only by Dickey and van Rossem (1938) in their work "The Birds of El Salvador."

I know the molting periods of 20 of the 50 species found in Mexico. The periods indicated in Figure 1 will presumably be extended as the records increase. Examination was made of freshly killed birds supplemented by skins from the Biological Institute of the University of Mexico. Only hummingbirds in adult plumage have been considered. Molting in juveniles occurs independently of the season, a few weeks after leaving the nest. Young birds which have undergone this molt shortly before the molting period characteristic of the species do not change their plumage again until the following year. Of eight male Rivoli Hummingbirds (*Eugenes fulgens*) taken at Tepepan, D. F., between April 2 and 25, only the five adults were molting. Seven adult male White-eared Hummingbirds (*Hylocharis leucotis*) collected in Santa Rosa, D. F., October 2 and 5 were molting, whereas five young raised that summer and taken at the same time as the adults showed no blood quills.

The season of annual replacement of the plumage in the hummingbird family is highly variable. Every month, at least one species is in molt (Figure 1). In some species the time of molt of individual populations may not be the same. It thus is tempting to trace the causes that condition them.

Position of the molting period in the annual cycle.—Irregularity in the molting time can be understood only in relation to breeding behavior. As long as a bird is in breeding condition, no shedding of feathers occurs. This makes it necessary to examine more closely the factors which determine the reproductive period. In hummingbirds favorable environmental conditions stimulate the breeding urge at all seasons but unfavorable ones suppress it. No inherited reproductive rhythm can be discovered. The molting period is fitted into pauses between breeding periods conditioned by environmental factors. If, during one of these periods, living conditions deteriorate beyond a certain point, the birds look for areas where conditions are more favorable. Migration and molting may then coincide. If conditions for reproduction are fulfilled in the new site, migration and breeding may occur up to three times in the course of a year

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<u>Complypterus hemileucurus</u>												
Chiapas												
<u>Colibri thalassinus</u>												
Chiapas, Michoacan												
<u>Abeillia abeillet</u>												
Chiapas												
<u>Chlorostilbon canivetii</u>												
Morelia Guerrero												
<u>Cynanthus latirostris</u>												
Queretaro												
<u>Nylocharis leucotis</u>												
D.F. and Mexico, Male D.F. and Mexico, Female Cerro Tancitaro, Mich., Male												
<u>Amazilia candida</u>												
Yucatan, Chiapas												
<u>Amazilia cyanocephala</u>												
Chiapas Tequisquitengo												
<u>Amazilia beryllina</u>												
Morelia and D. F. Ornitome Gro. Agua del Obispo, Gro.												
<u>Amazilia tzacatl</u>												
Chiapas												
<u>Lampornis clemenciae</u>												
Michoacan												
<u>Lampornis amethystinus</u>												
Chiapas D.F. (on migration)												
<u>Lampornis viridi-pallens</u>												
Chiapas												
<u>Hellomaster constantii</u>												
Sinaloa												
<u>Lamprolaima rhami</u>												
Chiapas												
<u>Eugenes fulgens</u>												
Tepepan, D.F. (on migration) Chiapas												
<u>Tilmature dupontii</u>												
Guerrero Chiapas												
<u>Calothorax lucifer</u>												
Tepepan, D.F.												
<u>Stellula calliope</u>												
Mexico												
<u>Selasphorus platycercus</u>												
Hidalgo												
	3	8	15	16	13	8	6	2	3	4	5	4

FIGURE 1. Molting periods of Mexican Hummingbirds.

(Wagner, 1943, 1948), although molting occurs only in a pause between nestings.

The more or less fixed regularity of the seasons with their different climates, and therefore of living conditions, can create the illusion that the breeding, and therefore molting rhythm also, is determined by heredity, whereas in fact it is conditioned by the climatic rhythm. This is clearly shown by the irregular distribution of the breeding time within a species throughout the year according to the local weather conditions. Here it is not only the conditions for feeding which are decisive but often the nature of the nesting material at the time as well. Thus moss, a material used frequently in building, is too brittle and dry in the dry season to work on, and so makes nest building and reproduction impossible then.

The White-eared Hummingbirds in the mountains near Mexico City have proved to me on many occasions to what extent local conditions can determine differential behavior even within a population of one species. Those that live in the oak-pine forest—a biological community which is withered and dead in the winter—migrate in November, while those in the neighboring damper fir forest at a higher elevation are permanent residents. Even though blossoms and insects are rare here between December and May, those that remain always manage to find enough spiders and other small creatures in bark cracks, rock walls, and similar places to rear young successfully in spite of the winter cold (below freezing point) and occasional snow up to March when the full effect of the dry season is felt. All the males of this community molt in the autumn, the females do not molt until spring, while according to all indications those that migrate molt in the late autumn.

Females which have started a new brood shortly before the molting period omit the molt if, after the nestlings have become independent, conditions which induce molting no longer obtain. The omission of a single molt is not detrimental to the bird. Its plumage is hardly worn after one year. Freshly molted and adjacent old feathers can often be distinguished only by the intensity of the coloring. The omission of one molt can be recognized later by the increasing abrasion and pronounced fading of the plumage. Exceptional attrition of the pinions and rectrices of individual females of the White-eared (*Hylocharis leucotis*) and Lucifer hummingbirds (*Calothorax lucifer*) captured after the local molting period, can be explained only by the omission of a molting period.

Once molting has commenced, it is completed. If living conditions improve in the meantime, the reproductive instinct can assert itself

again before the completion of molting. One Lucifer Hummingbird whose outermost primaries were still in blood quills was found breeding (Wagner, 1946). Molting males can also be capable of breeding. The diameter of the testes of singing White-eared Hummingbirds in molt was up to 1.8 mm. The corresponding minimum and maximum sizes are 0.2 mm. and 4.2 mm.

In view of the fact that the time of breeding depends so considerably on external factors, it is not surprising that general renewal of plumage of the hummingbirds of the more or less arid plant communities of Mexico usually occurs in the rainless spring months. At this time species like the Lucifer Hummingbird (*Calothorax lucifer*) and the Fork-tailed Emerald (*Chlorostilbon canivetii*) are found looking for food in the flowering trees. On the other hand, the molting period of hummingbirds of the tropical moist and rain forests is in the humid rainy season (summer and autumn) if the reproductive instinct is suppressed.

Hummingbirds generally build bulky nests of plant fibre or moss. Where the humidity is great these materials cannot be worked, as they suck up water like a sponge. It is therefore natural that some species of the moist virgin forest, such as the Emerald-chinned Hummingbird (*Abeillia abeillei*), molt in the rainy period of the summer. This also applies in Chiapas to Rieffer's Hummingbird (*Amazilia tzacatl*) which lives in the same climatic range at the forest edge and in uncultivated clearings, and to the White-bellied Emerald (*Amazilia candida*) which in Yucatan molts in September and October when there is heavy rain.

Frequently, as for example with the Violet Sabre-wing (*Campylopterus hemileucurus*) causal relations are understood only when details of the biology and local weather conditions are known exactly. In the mist forest of the mountains of southern Mexico individuals of this species molt during the coldest season, between October and January. In this biological community it is always moist and rainy, and a condition for its colonization by the Violet Sabre-wing is undoubtedly connected with the type of nest construction. The thinness of the walls of the nest and the type of plant fibres used as building material make it possible for this species to nest in more humid areas and seasons than other hummingbirds. Because they can thus nest in the rainy season, they molt in the inhospitable mist forest, not in the rainiest but in the coldest months when continuous light drizzle is typical.

Molting periods of a species varying with locality.—As the molting period depends so considerably on the reproductive period and hence

on environmental influences, it is not surprising that the behavior of populations of a species in areas where the rainy and dry seasons are not similarly distributed throughout the year, should be correspondingly different. Figure 2 presents data from El Salvador (Dickey and van Rossem, 1938) in addition to those which I obtained from Mexico. Of ten species from Mexico and El Salvador the molting periods of which are known, only three molt in the same months—*Eugenes fulgens*, *Lampornis viridi-pallens*, and *Lamprolaima rhami*. Dickey and van Rossem noticed in a country as small as El Salvador

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<u>Compylapterus hemileucurus</u>												
Chiapas												
El Salvador												
Costa Rica												
<u>Colibri thalassinus</u>												
Michoacan, Chiapas												
El Salvador												
<u>Hylocharis leucotis</u>												
D.F. and Mexico, Male												
D.F. and Mexico, Female												
Michoacan, Male												
El Salvador												
<u>Amazilia cyanocephala</u>												
Chiapas												
El Salvador												
<u>Amazilia beryllina</u>												
Morelia and D. F.												
Omitlano, Guerrero												
Agua del Obispo, Gro.												
El Salvador												
<u>Lampornis amethystinus</u>												
Chiapas												
El Salvador												
<u>Hellomaster constantii</u>												
Sinaloa												
El Salvador												

FIGURE 2. Different molting periods of the same species of hummingbirds in Mexico, Costa Rica, and El Salvador.

that there was a difference in the time of molting between the northern and southern race of the Violet Sabre-wing, and also a localized molting period in November or March for the Red-billed Azure-crown (*Amazilia cyanocephala*). Molting twice a year, which was assumed with reservations by these authors, is unlikely.

Different molting times of the sexes.—I have already referred to the surprising discovery that the sexes of the White-eared Hummingbird molt at different times in the vicinity of Mexico City. The males renew their plumage between August and October when living conditions are as favorable as possible. The exact time is not fixed, however, as is shown by three male White-eared Hummingbirds which I collected on 25 June 1947, near Apun, Michoacan, two of which

were molting their primaries. Their molt had begun at the beginning of May before the start of the rainy season. On the other hand, the females, in so far as they are permanent residents, molt in the spring. They are not able to do this in the autumn, as they are fully occupied with breeding. Molting in the females is postponed until unfavorable living conditions cause the breeding instinct to subside. A similar case occurs with the Mallard Duck (*Anas platyrhynchos*) where the onset of the molt of the primaries in the females is dependent upon the state of development of the young, i.e. late brooding females molt later. The time of molt of the drakes, however, depends upon the season (Stresemann, 1934). That this situation does not apply to all populations of the White-eared Hummingbird is shown by the race living in El Salvador, *Hylocharis leucotis pygmaea*, in which both sexes renew their plumage between December and February.

The molting of the male White-eared Hummingbirds of Santa Rosa, D. F., Mexico, which begins when living conditions are at their best during the reproductive period, leads one to think that this is the operation of a hereditarily determined molting rhythm which is counterbalanced elsewhere and in the case of the females by environmental factors. It is not known whether differences in the strength of the internal rhythm or variation in the effects of environmental influences cause different behavior of individual populations.

Summary.—The molting periods of 20 species of Mexican hummingbirds are distributed throughout the entire year (Figures 1 and 2). A comprehensive survey was made to discover the causes of the differential molting time of some species. As long as a bird is breeding, molting is inhibited. The breeding season of humming birds is not controlled by an internal rhythm, as they always proceed to breed every year when living conditions permit. Where living conditions prevent breeding, molting occurs. The effect of fairly regular climatic rhythm can give the illusion of an internal molting rhythm. Populations of a species in adjacent areas do not always molt at the same time. Males and females of at least one species (*Hylocharis leucotis*) can molt at different seasons. In this event the males presumably follow an internal rhythm whereas the females postpone molting to the end of the breeding season.

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Übersee-Museum, Bremen, Germany.