THE MOLT OF HUMMINGBIRDS

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FEW details are available about the molts of hummingbirds. When collecting in Mexico, I was struck by characteristic variations in the sequence of shedding the rectrices, and this led me to take notes on the sequence of the molt in birds which had been killed. It was possible only in the case of a few species to obtain the number required to describe the whole process in detail. Only freshly killed birds were examined; skins are useless, as the feathers have often dried up in blood quills and are no longer recognizable as such, and it is frequently difficult to find where feathers are missing. Old feathers fade considerably, and by this means they can be distinguished during the molt from new ones. The figures show symbolically the age of each feather: those which have been molted are represented by a trabecula, and those freshly replaced by the whole feather and blood quill show the actual proportion of the enclosed and open parts.

A complete annual molt is the rule with hummingbirds. Exceptions can occur with females which have just begun a new brood at the onset of the molting period and then wear their plumage for two years.

Renewal of the feathers takes place approximately within 60 to 70 days. It is not possible to make more precise statements with killed birds, as within a population there is considerable variation among individuals in the time of onset of the molt. The wings may show remarkably large gaps for birds which depend on their ability to fly as much as hummingbirds do. This, however, does not seem to be very detrimental to those which are molting, as at least some species undertake distant migrations when the primaries are still in blood quills, for example the Rivoli Hummingbird (*Eugenes fulgens*) and the Calliope Hummingbird (*Stellula calliope*). Replacement of individual feather groups takes place in a definite sequence, but the molt of one group merges with that of adjacent groups. Molting of the flight feathers begins with the primaries. Shedding of the rectrices generally follows when the wing molt is nearly concluded. Examination of a fairly large series of White-eared Hummingbirds (*Hylocharis leucotis*) from the same population showed a considerable range of variation in stage of molt of the primaries at the time the first rectrices were shed. I know of only two exceptions to the general rule, two Red-billed Azure-crowns (*Amazilia cyanocephala*) in which the two center rectrices were shed before any of the remiges. The Lucifer Hummingbird (*Calothorax lucifer*) molts both portions of its flight

feathers at more or less the same time. The molt of the contour feathers usually begins towards the end of the molting of the remiges. The corresponding flight feathers and rectrices on each side are replaced at the same time (figure 1). Shedding of the rectrices can be progressive (figure 2), in groups (figure 2), or practically simultaneous (figure 4).

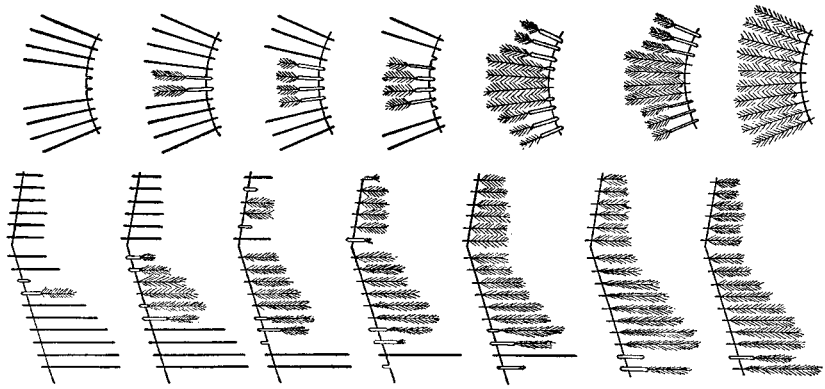

FIGURE 1. The shedding of pinions and rectrices of the Lucifer Hummingbird.

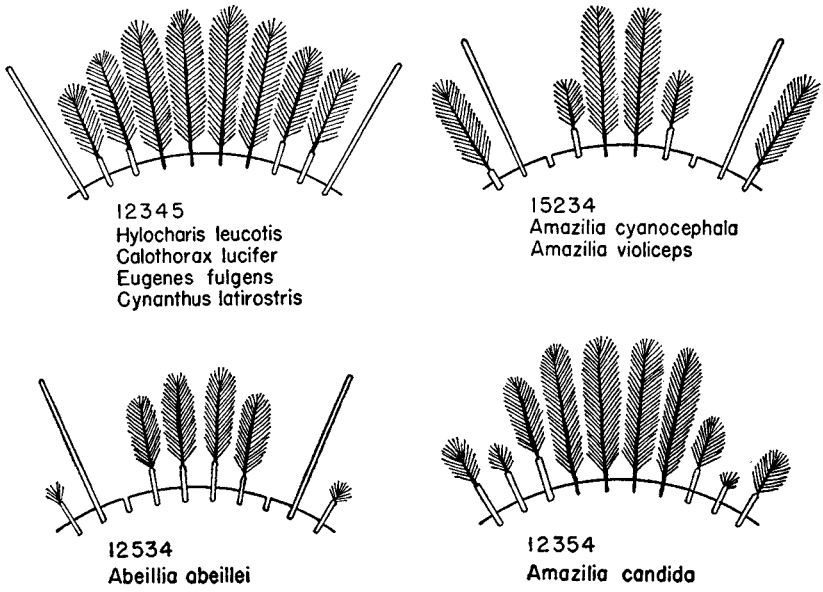

FIGURE 2. Various patterns in the sequence of shedding rectrices. The rectrices are numbered from the central pair (1) to the outer pair (5).

In view of specific differences in the sequence of the molt, it seems advisable to discuss the molting areas individually.

Primaries.—The molting center of the ten primaries in the Lucifer Hummingbird is situated between the seventh and eighth pinions and hence is not central (figure 1). Owing to this, the outermost pinions, charged with the main effort of flight, are renewed after the remainder has already been replaced. Shedding of the first primary before the second should be noted; this is a characteristic of all the species I investigated. However, this does not occur as one might expect by the second falling out after the first one has hardened;

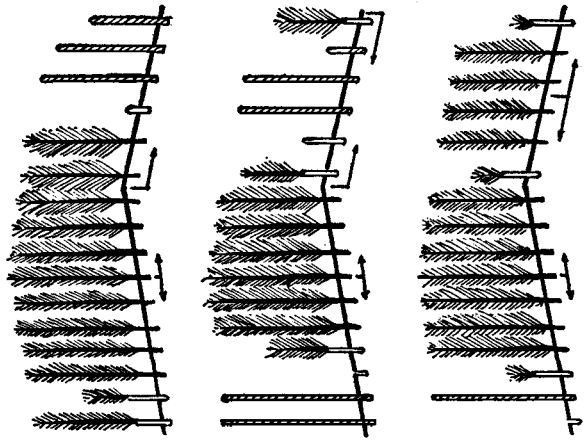

FIGURE 3. Variously situated molting centers of secondaries. Left. *Eugenes fulgens;* middle, *Hylocharis leucotis;* right, *Calothorax lucifer.*

quite frequently the third assumes for a short time the function of the first.

Secondaries.—In contrast with the primaries, the molting process of the secondaries is not uniform. At present three possibilities are known. The simplest process is seen in the Rivoli Hummingbird, in which replacement runs proximally beginning with the outermost secondary. My impression is that in this case, shedding passes abruptly from the innermost primary to the neighboring secondary (figure 3). Rivoli Hummingbirds would then have one molting center for all pinions, which so far has not been known to occur in birds. Quite a different pattern is followed by the White-eared Hummingbird, in which shedding begins successively with the innermost and outermost secondaries (figure 3). Replacement of the six feathers in this way is more rapid than in the Rivoli Humming-

bird. The same applies to the third sequence exemplified by the Lucifer Hummingbird, in which shedding begins between the third and fourth primaries and progresses proximally and distally in a regular manner (figure 3).

Rectrices.—The rectrices may be replaced in one of four different patterns (figure 2). I am not aware of the occurrence of further methods. From the point of view of development, the oldest is probably the centrifugal process which is found with the Lucifer, White-eared, Broad-billed (*Cynanthus latirostris*), and Rivoli hummingbirds. The other types are derived from this basic pattern, except that shedding of the outermost rectrices occurs first. The fifth may be shed immediately after the first, as with the Red-billed Azure-crown and Black-billed Azure-crown (*Amazilia verticalis*) or as the

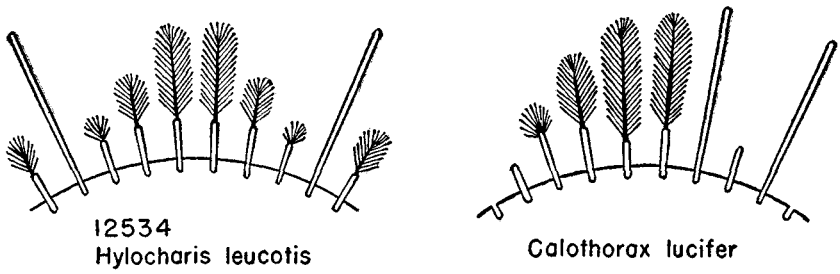

FIGURE 4. Exceptional patterns of shedding the rectrices in the White-eared and Lucifer hummingbirds.

third in sequence after the second, of which the Green Violet-ear (*Colibri thalassinus*) and the Emerald-chinned Hummingbird (*Abeillia abeillei*) are examples. The fourth possibility, the shedding of the outermost before the fourth, occurs with the White-bellied Emerald (*Amazilia candida*).

As already mentioned, replacement of the corresponding feathers occurs on both sides simultaneously. An exception was shown by a Lucifer Hummingbird which had lost its rectrices asymmetrically (figure 4). On one side the normal, centrifugal process occurred, while on the other side the second and fourth feathers remained. These, which had been left over for some unknown reason, had presumably been replaced only recently and therefore had not been shed again.

The fact that a sequence is not maintained unconditionally within a species or even a population is shown by a White-eared Hummingbird from Santa Rosa, D. F., which did not molt centrifugally as

is normal, but on both sides replaced the fifth (outermost) rectrix after the second (figure 4). It is not known whether this pattern, which deviates from the centrifugal type and which is apparently older from a developmental point of view, can be attributed to the appearance of a fresh mutation. I cannot see that either method has any increased value for the preservation of the species.

Plumage other than rectrices and remiges.—Change of the contour feathers, which starts towards the end of the molt of the rectrices and remiges, begins in the tail region, continues over the rump, and ends in the head tract. Occasionally there is considerable shedding at the same time on several parts of the body. As an extreme case, on 10 June 1941, in Siltepec, Chiapas, I took a male Rivoli Hummingbird with a whitish-gray instead of iridescent blue cap to be a species

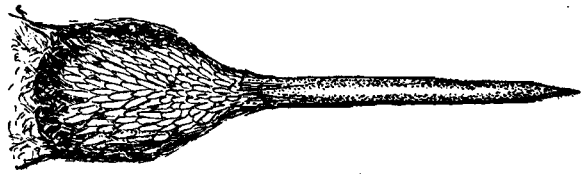

FIGURE 5. Simultaneous shedding of all cap feathers (in the figure, in blood quills) in the Rivoli Hummingbird.

I did not know. It was only when I held the dead bird in my hand that I realized that the whitish-gray cap owed its coloring to blood quills of uniform length which were about to open (figure 5).

Owing to insufficient material, no rules could be established for the time of replacement of the wing coverts. Although generally this was more or less simultaneous with that of the pinions, in a White-eared Hummingbird they were replaced only at the time of the head molt. The same applies to the tail coverts. No dependable ratio between the upper and lower was discovered.

Our present knowledge of the molting of hummingbirds permits only a few rules to be established along general lines. To be noted are the different numbers and positions of the molting centers of the pinions and the variable sequence in the shedding of the rectrices. We are inclined to explain these peculiarities, and also the renewal of the first before the second primary, by teleological considerations. A glance at the figures of feathers at very different growth stages shows that these efforts would be purely speculative in character.

No causal explanation is known for the various patterns characteristic of the species. Only the future can show to what extent an increase in our knowledge of the molting characteristics of the individual species can be applied to their arrangement into a natural system.

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