

MAINTENANCE ACTIVITIES OF THE ROSE-BREASTED GROSBEEK

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THE Rose-breasted Grosbeak (*Pheucticus ludovicianus*) is usually placed in the New World subfamily Richmondinae of the family Fringillidae. Although the behavior of most "finch" groups has been studied, at least superficially, no richmondine finch has yet been studied ethologically.

This first of several papers on *P. ludovicianus* treats maintenance activities, which are of interest in themselves, and are also of importance in understanding sexual and agonistic behavior. It is among these activities that we find the nonritualized precursors of reproductive and agonistic displays, and therefore an understanding of maintenance activities is basic to any study of the evolution of a communication system, or the causal motivation of its displays.

(The term grosbeak refers to the Rose-breasted Grosbeak throughout this paper unless stated otherwise.)

METHODS

Grosbeaks were studied in the wild through three breeding seasons, 1961–63. Captive birds were also studied during the breeding seasons of 1962 and 1963 in $13.1 \times 26.2 \times 32.8$ dm outdoor planted flight cages of wood and 16 mm hexagonal mesh wire, and during the winters of 1961–63, the first year in individual wood, wire, and glass cages and the last two in $13.1 \times 26.2 \times 26.2$ dm welded wire cages of 8×16 mm rectangular mesh.

The laboratory diet was a mixture of sunflower seeds and various grains. Cuttlebone and grit were available. Mealworm (*Tenebrio molitor*) larvae, pupae, and adults were fed, as well as fresh fruit of many kinds. Birds in outdoor cages had access to wild insects and some individuals ate a mixture for insectivorous birds (Ficken and Dilger, 1961). Commercial liquid vitamins (e.g., Zymadrops) were given every week or two during the winter in the drinking water.

The field studies were made primarily in a tract of wet woodland at the head of Cayuga Lake, Ithaca, Tompkins County, New York. Field observations were concentrated in the period from the arrival of the first males until the young had fledged, and were made without an observation blind. Notes in the field and in captivity were recorded on a small tape recorder for later transcription. Still and motion pictures were made in the field and laboratory.

RESULTS

Feeding.—Flying insects, and the buds, flowers, fruits, and/or young leaves of various trees and shrubs were eaten. Fine gravel and seeds were consumed

in ground foraging. In captivity this species will eat almost any seeds or other fruits offered, although there are individual preferences, as Kear (1962) noted in British carduelines.

McAtee (1908) reports that the Rose-breasted Grosbeak consumes an average of 52 per cent animal matter and 48 per cent vegetable matter on its breeding grounds.

Foraging is most commonly done at the periphery of the tree canopy (at all levels) where there is maximum leaf cover (see Table 1). Foraging in the understory is less common in the spring than later when certain understory plants are in fruit (e.g., *Rubus* spp.). The male and female of a foraging pair may feed at the same level in a tree or at different levels in a tree or in nearby trees. There is no consistent difference in foraging level between the sexes as there is in some species.

When on the extreme ends of fine branches, the grosbeak sometimes hangs upside down, somewhat like foraging tits (Paridae). At other times it flies out or up and grabs food in the bill, tearing it off as the bird returns to the starting perch or one nearby. Flying insects are captured on the wing and are eaten on the original perch or one nearby (Selby, 1912, and pers. obs.), but regular perches are not used for this purpose as they are by tyrannids. If a moth or other flying insect enters a cage containing a grosbeak the bird fixates the insect and follows its movements by head movements of its own. It may fly out and capture the insect in midair, but normally it waits until the insect comes within range, snapping it up with a rapid thrust of the head and neck. Insects flying outside of a cage are also fixated and their movements followed. Young were first seen to capture flying insects at 47 days after hatching.

Progress on the ground is by hopping and no specialized feeding movements such as scratching the substrate or overturning objects were noted. Food items on the ground or on the cage floor are fixated briefly, then seized and eaten or carried to a perch and eaten there. Mealworms presented in a dish are usually seized only after a period of monocular fixation. A hand-reared bird, however, will seize a mealworm immediately if offered from the hand. Young were first seen to follow forceps with the eyes at 7 days, to peck at forceps at 8 days, and to seize and consume mealworms and nonlive food from the forceps at 11 days.

Food is never held with the foot as it is in some species.

With the possible exception of soft-bodied larvae, insects brought to the nest were thoroughly crushed in the bill before they were fed to the young (Ivor, 1943, 1944b; pers. obs.). In captivity grosbeaks seize a mealworm and move it back and forth crosswise between mandible and maxilla with the aid of the tongue, breaking the heavily sclerotized body of the larva. Soft, white

TABLE 1
FORAGING LEVELS OF THE ROSE-BREADED GROSBEAK IN ITHACA, TOMPKINS COUNTY,
NEW YORK, MAY-JUNE 1961-1963

Stratum	Observations	Per cent
Ground	5	2.6
Shrubs	17	8.7
Trees	173	88.3
Vines	1	0.4
Totals	196	100.0

mealworms which have recently molted are often eaten without crushing, as are other mealworms if the bird has been recently deprived of insects. Occasionally the larva is crushed in the bill for 10 to 20 seconds, the gut squeezed out and eaten, and the remaining flat exoskeleton dropped. The grosbeak was never seen to strike an insect against a branch or perch as does for example the Chaffinch (*Fringilla coelebs*) (Marler, 1956). However, Ivor (1944*b*) reports "hammering" of large moth larvae before feeding the young. Mealworm beetles were broken up before swallowed; the elytra were sometimes removed by this action, but usually were not.

Sunflower seeds are seized in the bill, oriented with the longitudinal axis parallel to that of the bill, and then the pericarp is cut down the center or to one side of center. I have never seen grosbeaks (or Black-headed Grosbeaks (*P. melanocephalus*) or Cardinals (*Richmondena cardinalis*)) split a sunflower *edgewise*, as Kear (1962) describes for the Hawfinch (*Coccothraustes coccothraustes*) and Evening Grosbeak (*Hesperiphona vespertina*). Sunflower seeds were first given to young at 26 days and at that time they were opened efficiently without practice. Small seeds were first consumed at 17 days of age but husking was not seen before 27 days. Ivor (1944*a*) reports young first taking seed at 28 days.

Drinking.—The head is dipped down so that the bill is immersed in water, and the bill is opened slightly; there are throat movements. The bill is closed and the head is tipped back with throat movements as the water is swallowed. Throat movements while the bill is actually immersed are not found in the Chaffinch (Marler, 1956).

Defecation.—Young in the nest defecate 2 to 3 seconds after being fed. If fed twice in a visit, a second smaller fecal sac may be voided. Defecation of young is dependent upon food in the throat or upon actual ingestion, since placing of empty forceps in the mouth does not result in defecation. Backing toward the nest rim prior to defecation was first noted at 6 days of age. The

fecal sac is lost on the 12th day, corresponding to the approximate date the young leave the nest (Chase, 1899; Ivor, 1944a; pers. obs.).

Bill-wiping.—This is one of five methods used to clean the bill, and is seen commonly after bathing, drinking, and feeding. The head and anterior part of the body are lowered and the bill is wiped across the perch from base to tip. The bill is commonly wiped once on each side of the perch, but a series of wipes may follow in rapid succession. The bill may either be closed or slightly open, and sometimes a stropping noise is produced. Bill-wiping is a common displacement activity.

Incomplete bill-wiping terminates short of contact with the perch. This was first seen at 7 days of age. At 10 days the alternate wipes of the bill were evident but no contact was made. At 11 days both complete and incomplete bill-wiping was seen, and on the 13th day bill-wiping with the mouth open was first seen.

Licking the tomium.—The mouth is opened and the tongue licks the tomium. Such licking was seen following, or associated with, bill-wiping after feeding. This was first seen in 11-day-old young.

Head-shaking.—The head may be shaken repeatedly from side to side after feeding if the bill is very dirty; the bill may be open or closed. This was seen when Vermiculite from the cage floor adhered to the bill. Head-shaking as a food rejection movement was first seen at 6 days of age. This serves to dislodge food which is improperly placed in the throat or is otherwise unacceptable.

Scratching.—The head and adjacent regions are scratched with the foot, often producing a whirring sound. In adults the foot is brought over the trailed wing (sensu Andrew, 1956a); this was first seen in young 9 days old. In one individual of this age, 8 to 10 attempts were made to scratch the head over the wing; each resulted in the bird losing its balance. It then scratched the head twice by bringing the foot under the wing. At 10 days of age attempts were seen to bring the foot up to the head, and then to bring the head down to the foot, before the foot was brought over the wing and balance maintained. The wing is trailed and the foot is concomitantly brought behind and over the top of the wing. The foot itself is compressed laterally such that the two outer front toes lie alongside the longer middle toe, and the hind toe is oriented parallel to the tarsometatarsus. As determined by analysis of motion pictures, actual contact is made by the middle toe. The foot is moved very rapidly during scratching, and the mouth may be opened (first seen at 14 days of age). The area scratched may be ruffled or not.

Twenty-five areas scratched with the foot are listed in Table 2. Scratching may shift from one area to another without interruption, and in such cases the head is moved relative to the foot rather than the converse. *Head-rolling* is

movement of the head while the foot is in contact with it, resulting in scratching some part of the head not initially contacted by the foot. In a sample of 67 scratches (from three females and one male in captivity), 25 per cent involved head-rolling. Intention movements occur here, as in bill-wiping, and scratching is also a displacement activity.

Rubbing the head.—The feathers of the head are ruffled, the head and anterior part of the body are lowered, the bill is closed or is opened wider than in bill-wiping, and the base of the bill and/or the whole side of the head is rubbed against the perch. The rubbing movement may progress from the front of the head toward the back, or, as in bill-wiping, from the back toward the front, or may begin from front to back but continue as a circular motion. Several rubs may follow in succession, but normally only one side of the head is rubbed in any one bout. This behavior is often associated with bill-wiping, and one can see a bird wipe the bill with a single stroke on one side of the perch and rub the head with a single movement on the other. Rubbing the head is common after bathing. It was first seen in 9-day-old young. Hailman (1959) has seen "perch-scratching" in emberizines and wonders if it might be characteristic of that subfamily. His description resembles rubbing the head and this movement is found in at least one richmondene finch.

Preening.—Preening often occurs in bouts including scratching and fluffing. It also occurs after bathing, but not always, and is seen in birds moving through wet vegetation (as noted by Heinroth, 1912, 1938). Dislodged feathers were dropped and were not seen to be eaten. At 7 days of age the wings were first preened (Van Sant, 1901; pers. obs.) on both dorsal and ventral surfaces, although the quills had not yet broken open. The breast and shoulders were also preened. Tail-preening and touching the uropygial gland were not seen until the 11th day.

Cleaning the feet.—Grosbeaks peck at the feet to clean them. The foot was never raised from the perch for cleaning. The toes were first seen to be cleaned on the 16th day. The tarsometatarsus is cleaned by small nibbling movements as the bill moves along its length, from the tibiotarsus to the foot. Metal bands used for identification were always picked at for the first day after application. Bands that fitted loosely were pried with the bill by inserting the tip of the mandible between the band and the tarsometatarsus. Such bands were eventually removed in this manner.

Yawning.—Yawning, or stretching the jaw muscles, is common in the Rose-breasted Grosbeak and was first seen in young 6 days old. Several birds caged together tend to yawn, stretch, preen, bathe, feed, rest, etc., in bouts (Van Sant, 1901; pers. obs.), suggesting possible social facilitation of these activities. In yawning the mouth is opened wide and then closed; the tongue may be lifted.

TABLE 2
AREAS SCRATCHED WITH THE FOOT IN CAPTIVE ROSE-BREASTED GROSBEAKS (THREE MALES
AND ONE FEMALE)

Areas and Scratching Frequencies			Percentage
Top of head	5	(1 right) (4 left)	3
Side of head	46	(24 right) (22 left)	31
Back of head	16	(11 right) (1 center) (4 left)	11
Forehead	1		1
Neck	13	(5 right) (8 left)	9
Over the eye	3	(2 right) (1 left)	2
Throat	38	(15 right) (13 center) (10 left)	25
Shoulder	8	(4 right) (4 left)	5
Bill	10	(8 right) (2 left)	7
Base of bill	10	(1 top right) (0 top left) (2 side right) (1 side left) (4 under right) (2 under left)	7
Totals	150		101

Stretching.—The wings are either stretched together above the back, or down along the side separately; both patterns were first noted in 6-day-old young. In the first instance the wings are raised together above the back until they almost touch, about half-open, and then returned to the side. In 7-day-old young the wings are stretched downward together before replacement at the sides. This is rarely seen in adults as is the case in *Emberiza* (Andrew, 1956a). In separate stretching the wing is stretched downward and held out slightly to the side so that it extends below the perch, then opened fully, and finally returned closed to the side. In adults such a wing stretch usually involves a concomitant stretch downward of the leg on the same side and this results in the spread toes touching the spread wing. This pattern was first seen at 7 days of age, but differed from the adult patterns in that the leg was

moved laterally along the perch, not lifted and stretched downward. The latter was first seen at 12 days of age. The tail is frequently spread and swung toward the side of the wing and leg stretch. When the wing is stretched downward without the leg stretch, the tail may be spread and swung toward the opposite side from the stretched wing. Downward stretching of one wing is often followed by stretching of the other wing and also by stretching of the wings over the back. When both legs are stretched together (first noted at 7 days of age), it is the body which is raised relative to the perch, causing an arching of the back. Stretching the legs without wing stretching is common in the Rose-breasted Grosbeak but apparently absent in some emberizines (Andrew, 1956a; Nice, 1943), although Sutton (1943) notes it in the Vesper Sparrow (*Poocetes gramineus*). In 8-day-old young a single wing stretch is combined with stretching both legs together.

Fluffing the plumage.—The plumage is fluffed (sensu Morris, 1956) in bouts of preening, scratching, and other maintenance activities, when the temperature drops, when sleeping, sometimes when brooding or incubating, and often before ruffling. The fluffed breast feathers cover the anterior edge of the closed wing. As Morris indicates, fluffing places the body plumage in a position for maximal insulation. Certain areas of the body are fluffed in displays, resulting in a larger appearance of these areas relative to the rest of the body.

Ruffling and shaking the plumage.—Ruffling and shaking the body plumage occurs by itself or in bouts of other activities and is sometimes accompanied by tail-flicking. It is very frequent during and after bathing, and is also seen after sunning. Females ruffle and shake after copulation, and males sometimes after chasing. Ruffling alone occurs during sunning and during incubation or brooding in hot weather, often with the bill held open, and places the plumage in a posture for minimal insulation. Ruffling occurs in agonistic displays. Ruffling and shaking permit thorough wetting or irradiating the body in bathing and sunning, respectively, and may also remove foreign particles from the plumage. Shaking was first seen at 6 days of age, a day before any quills began to open.

Bathing.—Drinking usually precedes bathing. Carpal flicks, then crouching and other hopping intention movements, and head flicks to the side, result in a final hop into the water. As soon as the lowered head and breast touch the water the wings beat, throwing water over a wide area and thoroughly wetting the bird. No pecking into the water occurs, as it does in *Emberiza* (Andrew, 1956a), where a sidewise bill movement is used in bathing and in feeding. The absence of such a movement in the grosbeak indirectly supports Andrew's hypothesis that this bill movement of *Emberiza* in bathing and a very similar one in feeding might be homologous. The wing movements involve partly

opening and then closing the wing with concomitant raising and lowering the wing into and out of the water. Strong head flicks to the side (as in *Emberiza*) and vertical movements of the spread tail aid the wings in wetting the now ruffled plumage during frequent immersions. Some preening takes place during bathing. The "alternate wing movement, motion 3" of Nice (1943) was not seen.

In captivity the Rose-breasted Grosbeak bathes at least daily and invariably bathes when given fresh water.

An adult will brood young while still wet from bathing, and this results in wet natal down. Depending on the ambient temperature this could be advantageous or deleterious. Twenty-four-day-old young were subjected to light rain for several minutes but showed no bathing movements. Two days later they were given water in a dish for the first time and bathed immediately. The head and bill were *not* dipped in the water. The breast was depressed in the water with ruffling and wing-fluttering which was sporadic compared to adult bathing; the movements gave the impression of incompleteness.

After bathing.—After bathing the plumage is shaken, and bill-wiping, preening, scratching, and head-rubbing are common. The uropygial gland is touched with the bill and sometimes the bill is scratched immediately thereafter, doubtless transferring some of the oil to the foot and allowing oil transfer to those parts that cannot be preened with the bill but only scratched (see Table 2). In some cases the head is then immediately scratched (Nice, 1943; pers. obs.). The head was not seen to be rubbed on the shoulders after oiling as it is in *Emberiza* (Andrew, 1956a). Young 26 days old drying after bathing for the first time used sporadic movements and remained wet longer than an adult.

Grosbeaks were not seen to bathe in dust. Although Sutton (1943) saw dust-bathing in young Field and Vesper sparrows, he did not see it in Cardinal or Indigo Bunting (*Passerina cyanea*) young.

Sunning.—In sunning, the plumage is ruffled, the wings drooped—the one toward the sun may be partly spread, and the head is usually turned so that one side faces the sun or a lamp above the cage in the laboratory. The body is held at an angle such that one side receives maximal radiation, and the tail is turned toward the illumination source and may be spread but not drooped as in *Emberiza* (Andrew, 1956a). The bill is held open and the eyes are often open; this agrees with Hauser's (1957) Level III except that the plumage here is ruffled, not fluffed. This attitude is held for several minutes, with interruptions for scratching, ruffling, shaking, and looking around.

Sleeping.—The young sleep at first in a prone position. Later the sleeping posture is that of a resting adult. At 11 days the head is turned to rest on the carpals, and later in the same day the bill is tucked beneath the scapulars,

completing the transition to the adult sleeping posture. Van Sant (1901) noted a similar change in sleeping posture over a 3-day period.

Locomotion.—Locomotion from branch to branch or tree to tree is by flight. Hopping is done along a branch, from one branch to another, on the ground, or from the ground to a low shrub or sapling (jumping). Young can hop and jump at 7 days of age, and can fly short distances at 9 days although they do not always leave the nest at this age in the wild. When hopping, the body is often pivoted from side to side, probably aiding the bird in spotting food and predators. The grosbeak appears to move through a 90- to 120-degree arc. Pivoting in place also occurs in certain conflict situations. Grosbeaks do not walk or step, except in a reproductive display. Hopping on the ground is straight ahead and hopping on a perch is sidewise progression. Hopping may be slow or very rapid. A second method of sidewise movement on a branch is sidling, where one foot is moved before the other in a shuffling manner. A sidling bird moves slowly and sidling is common when a bird is feeding at the ends of branches.

Tail-flicking is not a conspicuous feature of grosbeak locomotion. The tail is flicked horizontally in the sense that the tail appears to change orientation after the body has done so, and the resultant time lag gives the impression of a short flick. This is usually so slight as to be very difficult to see. Small movements in the vertical plane also occur (Types Up-Down and Down-Up of Andrew, 1956*b*), but usually in combination with lateral movements, giving the impression of a tiny arc being described. Strong vertical flicking was seen only in displays and even then it is not common.

Flight intention movements consist of crouching on the perch with sleeked plumage, head held up and oriented in a presumed direction of flight, and often wing-flicks.

SUMMARY

The maintenance activities of the Rose-breasted Grosbeak were studied in the wild and in captivity.

This species forages mostly in the forest canopy, but also in shrubs and occasionally on the ground. Insects are gleaned from the foliage or, less commonly, caught in the air. Seeds, buds, fleshy fruits, and young leaves comprise the bulk of the vegetable matter eaten.

Locomotion during feeding is by hopping, sidling, and flight. Seizing vegetable matter in flight is an adaptation for feeding at the ends of branches. Insects are caught in flight, but regular perches are not used for this purpose.

Insects are crushed in the bill but not struck against a perch before eating. Food is not held with the foot.

The bill is cleaned by wiping on the perch, licking with the tongue, shaking the head, scratching, or rubbing against the perch. The foot is not raised from the perch for cleaning.

Downward stretching of both wings in the young persists as an occasional activity in the adult. Leg-stretching develops from a lateral movement of the leg in the young. Leg-stretching without wing-stretching is common. In young a single wing stretch may accompany stretching both legs.

Bathing does not begin with pecks into the water. Alternate wing movements do not occur in bathing.

The head is not rubbed on the shoulders after oiling.

Sidewise switching during hopping describes a 90- to 120-degree arc.

Tail-flicking during locomotion is inconspicuous, and is Up-Down or Down-Up with small lateral movements.

Head-rubbing is not restricted to the Emberizinae among the fringillids, but occurs in at least this one richmondene finch.

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