

## NESTING AND PARENTAL BEHAVIOR IN DOMESTIC COMMON QUAIL

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WHILE laboratory investigations of reproductive behavior of the Common Quail (*Coturnix coturnix japonica*) are numerous, comparable data in wild populations are scarce. Most such studies emphasize aspects of the birds' natural history, such as nest size and form, clutch size, migratory movements, and population dynamics (e.g. Schwartz and Schwartz 1949, Austin and Kuroda 1953, Stanford 1957, Labisky 1961, Stevens 1961, Wetherbee 1961, Taka-Tsukasa 1967). References to actual breeding behavior are infrequent, largely because of the difficulty in observing this species in the wild. Collective reports suggest that territoriality in males, pair bonding, polygyny, and multiple broods occur in at least some breeders.

Domestic strains of the Common Quail are usually reluctant to nest and rarely demonstrate any reproductive behavior past courtship, copulation, and occasional attempts at nest building. To our knowledge only one other investigator besides Stevens (1961) has succeeded in inducing Common Quail to undertake complete reproductive cycles in captivity (E. Hess pers. comm.). For this reason and because of the difficulties of studying quail in the field, the behaviors involved in nest site selection, nest construction, incubation, and hatching have not been described. Although broodiness has been induced hormonally in laboratory stocks of Common Quail (McCollam and Schein 1974), the details of parent-young interactions also remain to be described.

This report is based on two successful nestings studied in captivity in Ithaca, New York. Our main purpose here is to describe the methods used and to illustrate the kind of observations one can make with captive quail in the hope of encouraging other investigators to attempt similar studies.

### MATERIALS AND METHODS

Our original stock of quail was obtained from the Cornell University Poultry Science Department from their random-bred line. The birds were maintained in large colony pens until they reached breeding age. The pens were constructed with wire mesh walls and concrete floors and usually had dried sugar cane litter (Zorbit or Serval). The only contact the stock birds had with humans was in the course of normal stock management: daily feeding, egg collecting, banding, etc. The stock was expanded by hatching eggs collected from colony pens in incubators and rearing the chicks in wire-floored chick brooders until they could be put in a colony pen at 3 to 4 weeks of age. The chicks were fed chick or turkey starter mash and the adults Purina Game Bird Startena crumbles.

Birds were separated into pairs, one male and female per pen, for breeding observations. Each pair could hear, see, and have limited physical contact through a common wire mesh wall with another pair, but were not within sight or hearing of the colony pen. Food and water dishes and dusting grounds of adjacent pens were arranged in close proximity to encourage interactions between the pairs. The two breeding pens were  $3.7 \times 4.9 \times 2.4$  m tall with a dirt floor planted with field grasses and shrubs. The quail received water, grit, and feed mixtures *ad lib*. Food consisted of a mixture of grains (milo, millet, canary, wheat, and cracked corn) and a mixture of turkey starter mash, dog food mash, and oil. Live food (mealworms and beetles and fresh greens) was fed by hand often, primarily to maintain tameness. The breeding pairs found additional live food in their seminaturally planted pens.

The birds were exposed to natural daylength. The first successful pair nested in April, the second in June of another year.

### RESULTS

*Pair relations before nesting.*—Birds that bred successfully apparently formed pair bonds. Males courted only their own female; no attempts to court females in adjacent pens were observed. Females responded overtly only to the calls of their mate; calling by adjacent males induced no more than an increased alertness in females. Both members of a pair usually loafed and performed maintenance activities together but paid little attention to those of the birds in the adjacent pen. Mated pairs made no attempts to enter the adjacent pen nor to fight with adjacent birds.

Tidbitting and copulation were frequent activities as the laying period began. Tidbitting rapidly declined and was not seen again as the clutch neared completion.

*Nest construction.*—In the two successful pairs the nest was made entirely by the female with neither help nor hindrance by the male. In some unsuccessful pairs, males showed great interest in the nest site, and two males performed nest building movements on several occasions. The female chose a somewhat secluded site in a grass clump or tussock as reported in the wild (Taka-Tsukasa 1967), or at least with dried grass within her reach as she sat on the nest site. Nest materials consisted entirely of pieces of dried grass, generally plucked by the female, as she sat on the nest. The female first made a scrape within the grass clump and hollowed it out to a shallow cup by the time she laid the last egg of the clutch. She worked on the nest for the short time around laying each day, but she seemed essentially to ignore the nest otherwise and spent very little time on it until she finished laying. At the onset of incubation she showed a tremendous increase in nest-building activity, and virtually completed the nest rim shortly after the start of incubation. This observation is in contrast with a previous report of no building during incubation (Edwards MS, cited by Wetherbee

1961). She plucked most of the dried grass within reach of the nest and placed it around the nest rim, gathering most of the material as it lay on the ground or grew around the scrape. She generally snipped the grass stems near the base and placed them one at a time directly in front of her or at her side on the rim. Occasionally she pulled down grass overhanging the scrape, either living or dead, and added it to the rim. Frequent turning on the nest during this building activity resulted in even growth of the rim. Nest-building movements could be seen at any time throughout incubation but were concentrated toward the beginning of incubation with some rearrangement of materials around the time of hatching. The finished nest cups were approximately 2.5–3.9 cm deep, 7.0–9.0 cm inside diameter, and 14.0 cm outside diameter. These dimensions agree well with previous reports (e.g. Stevens 1961, Wetherbee 1961).

*Laying and incubation.*—Before starting the nest, both females laid eggs scattered throughout their pens. Female 1 began laying in her nest within 2 days, and female 2 16 days after being released into the breeding pen. Thereafter each female laid one egg per day, always in the nest, until her clutch was complete (female 1: 10 eggs; female 2: 8 eggs) and then started to incubate. The exact time for onset of incubation was difficult to determine, but female 2 apparently began the day before she laid the last egg. This observation is particularly noteworthy in view of Vince's (1966) findings that hatching in Common Quail can be accelerated by artificial sound or vibrational stimulation and that hatching in Bobwhites (*Colinus virginianus*) can be accelerated as much as 24 h when the embryo is in contact with more advanced embryos (Vince 1964). Thus, if the same conditions and time span hold true for *Coturnix*, beginning incubation of one egg a day later than the others would still allow the entire clutch to hatch synchronously. Incubation lasted 16½–17 days and was entirely by the female, with neither assistance nor interference by the male. This situation contrasts with Stanford's (1957) observation that males were never seen near nests in free-ranging birds, but in pens containing individual pairs males so harrassed the females that all attempts to incubate were abandoned within 3 to 4 days.

Both females appeared to develop incubation patches, with some loss of feathers and increased vascularization on the central lower breast. Female 1 rolled two eggs into her nest, the first from 30 cm away on the day after incubation started, the second from 60 cm away the day before the hatch was due. Neither of these eggs showed any development.

After starting incubation, the females adopted a characteristic attitude

whenever approaching or leaving the nest. They crouched, with the feathers slimmed, and skulked through dense cover directly to the nest. When disturbed on the nest, they did not flush; they crouched with feathers slimmed and sometimes ran quietly away from the nest.

Early in the incubation period, the females were very active on the nest, plucking and placing grass stems around the rim of the nest and turning frequently. After the nest rim was completed, the birds spent long periods dozing on the nest; they preened on the nest but left to defecate. An incubating female may leave the nest for 7–20 min periods several times per day for feeding and maintenance activities. Toward the end of incubation, the females again became more active; they frequently stood and turned on the nest, then squatted on the eggs again with a distinctive shaking of the body side-to-side while settling on the eggs. This “shake-settle” movement was often vigorous enough to cause a rattling sound that carried a few meters, from the eggs striking each other. The females also waddled with a slower side-to-side motion than in the “shake-settle” and often raised the breast to poke the eggs with the bill.

*Pair relations during incubation.*—Frequent copulation continued until the clutch was complete. Crowing and tidbitting were rare late in the egg-laying period, and all courtship ceased when incubation began. The male showed little direct interest in the nest site although he often preferred being in the company of the female. Characteristically the male was inactive while the female was incubating, but he joined her when she left for short periods of feeding and maintenance. After eating, drinking, and dusting together, he followed her back to the nest and loafed near the nest—often within 30 cm—while she continued incubating.

During incubation both members of a pair were very subdued and quiet and were more secretive than earlier, especially in the first days of incubation. Even the formerly frequent cricket calls were rare.

In pair 1 the female became aggressive toward the male near the end of incubation. As early as the 5th day of incubation, feathers were missing from the male's head. From now on the male became increasingly agitated and showed greater interest in leaving his pen and entering the adjacent pen. He began cricket calling to the adjacent nonbreeding pair and spent more and more of his time loafing near them. After the chicks hatched, the female attacked him several times per day. His only response to these attacks was to try to escape. Four days after hatching, he crowed for the first time since before incubating began. Because the male was being so harrassed, he was removed from the pen this same day. These observations agree with Stevens' (1961) report

that pairs remain together throughout egg-laying and the early part of incubation and with Moreau's (1951) suggestion that males paired with incubating females do not crow.

*Parent-young interactions.*—Some eggs pipped as much as 30 h before hatching, but these remained at this stage until all eggs were pipped on the morning of the day of hatching. Shortly before the first eggs pipped, the female became much more active and vocalized frequently on the nest (mostly peeps and trills). This activity increased until all chicks hatched. Her various movements included shifting position, raising the breast and gently poking at eggs and chicks, raising the entire body, waddling while standing, turning, shake-settling, and occasional nest-building behaviors. Thus her behavior on the nest for the last day and a half was in marked contrast to her previously quiet incubation.

Both clutches hatched in late afternoon and spent the following night in the nest. Hatchability was 100% for eggs laid in the nest (excluding the two eggs rolled in by female 1 after incubation had begun). Both families left the nest early the morning after hatching. After leaving the birds treated the nest site just as any other part of the pen; it was never again used as a specific site for gathering or shelter.

The male remained at the far side of the pen during most of the hatching period. After the chicks left the nest, the male seemed to ignore them and acted apprehensively whenever he was near the female. The female usually ignored the male except when feeding or moving the young; then she often chased the male.

The female spent much of her time brooding the young by completely covering them with her breast, flank, and wing feathers. Heads of chicks often appeared from under her at any point or up between her wing and body. Brooding took place anywhere in the pen but most often in places that afforded at least some cover.

The hen and chicks kept in almost constant vocal communication. Four main calls of the hen were recognizable: (1) brooding trill—given only when chicks were under the female and distinct from the more warblelike call given on the nest before hatching. (2) "Pweet"—given singly or repeated arrhythmically. The hen gave this call only when disturbed, and it caused the chicks to scatter or to crouch and freeze. (3) Hoarse peep—may be given along with the "pweet," in which case it may be a location or contact call between the female and young, or it may be given prior to brooding or feeding, in which case it tends to attract the chicks. (4) "Kuh-kuh-kuh-kuh..."—given in the same context as the similar call in tidbitting, but sounds hoarser. The hen gives this call only when both live food and a chick are near her, and it is usually interspersed with more numerous hoarse peeps.

The chicks used two main vocalizations: (1) twitter—soft when being brooded; loud when mildly disturbed; and (2) shrill call—given when isolated from the others.

The chicks ate live food (mealworms and beetles) as early as 1 day after hatching. The hen gave the "kuh-kuh-kuh-kuh..." and hoarse peeps while picking and dropping the food item several times. A chick quickly approached, picked up the food from the ground, and beat and shook it on the ground while holding one end. Without letting go the chick repeated the shaking several times, interspersed with short bursts of running before swallowing. When the observer threw out insects for the quail, the hen often ate several first before leaving others for the chicks.

By the 4th day after hatching, the chicks did not follow the female so closely; in order to gather the chicks, the hen had to hoarse peep very insistently. By the 11th day the chicks ranged freely in the pen and ate independently. However, they and the hen still maintained frequent vocal contact by shrill calls and hoarse peeps.

#### CONCLUSIONS

Nesting and parental behavior of Common Quail can be studied successfully under partially controlled conditions in captivity. Many questions remain unanswered, particularly those concerning the factors necessary to initiate and direct a successful reproductive cycle. If these can be determined, the breeding biology of this species can be investigated far more thoroughly.

#### SUMMARY

Data on nesting in wild Common Quail are scarce, and domestic forms rarely demonstrate any reproductive behavior past courtship and copulation. We have observed complete, successful reproductive cycles in captive quail maintained in a seminatural habitat. This report describes successful nestings in two quail pairs. Interactions between male and female and with birds in adjacent cages suggest pair bonds were formed. Crowing, courtship, and copulation continued through egg-laying but ceased with the onset of incubation. Nest building reached a peak shortly after incubation began. Eggs were laid daily until the clutch was complete (8-10 eggs); one hen began incubating 1 day before laying her last egg. The apparent pair bond was maintained during the initial days of incubation, but the female became aggressive to the male late in incubation and more so following hatching. During hatching the hen was very active on the nest. Following hatching the hen and chicks vocalized frequently—brooding trills, "pweets," hoarse peeps, and "kuh-

kuh-kuh-kuh. . ." from the hen and twitters and shrill calls from the chicks. The hen showed live food to the chicks by a series of behaviors very similar to the tidbitting display of a courting male.

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