

PARENTAL AND COURTSHIP FEEDING IN RED JUNGLE FOWL

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THIS paper describes parental and courtship feeding in a free-living, semidomesticated population of Red Jungle Fowl, *Gallus gallus*, and discusses their functions and possible origin. Published behavioral studies of unconfined jungle fowl include those of Beebe (1918–1922), Johnson (1963), Collias et al. (1966), and Collias and Collias (1967). Kruijt (1964) and Lill (1966) studied captive Red Jungle Fowl. Wood-Gush (1955) and Guhl (1962) review the behavior of domestic fowl. These authors say little about parental or courtship feeding.

The young of gallinaceous birds are precocial, but they need help from one or both parents to obtain food during their first few weeks. Typically the parent locates food and behaves in such a way that the young will get it. The parent may let the chick take the morsel from its beak, drop the food in front of the chick, or use specific calls to alert the chick to the presence of the food. All these behavior patterns I include under the term parental feeding.

In many galliforms (Stokes and Williams, MS) the male may perform somewhat similar feeding behavior toward the hen as part of his courtship. This is commonly called "tidbitting" (Domm, 1927) from the fact that the cock often displays with choice morsels.

The Red Jungle Fowl in the 40-hectare San Diego Zoo are unconfined, but each bird belongs to a small social unit and remains within a territory the entire year (Collias et al., 1966). The birds obtain some natural food, but rely primarily upon food provided for other exhibit animals by the zoo keepers and the general public. I made intensive studies largely on the birds of the Monkey Mesa from April through June 1969. I could recognize individually 16 cocks and 22 hens that used this area by means of comb configuration, scars, brood size, and other characteristics. They formed three separate flocks, each dominated by a single adult cock, with little overlapping of home range. The birds were so tame I could feed them at close range.

The zoo jungle fowl are normally single brooded with a peak of hatching in April. In 1964 and 1965 the midwinter population ranged between 125 and 142, with cocks making up 56 per cent of the total (Collias et al., 1966). In 1969 I estimated the population at 222 birds, almost double that of 1964 and 1965. In a single afternoon's census on 21 May of almost all the available habitat I counted 124 cocks. These fell into two distinct age classes

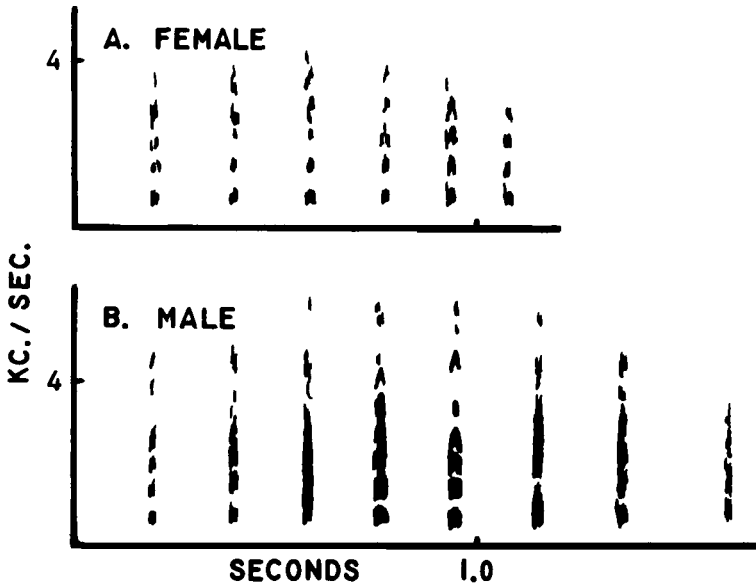


Figure 1. Food call of Red Jungle Fowl. A, the female; B, the male.

on the basis of spur length and curvature. The 48 cocks with long, curved spurs I judged to be at least 2 years old; 76 with shorter, blunt spurs I called yearlings.

In their study of Red Jungle Fowl in northern India Collias and Collias (1967) found the breeding season and sex ratio almost identical with those at the San Diego Zoo, but the density of jungle fowl in good habitat was only 6 birds/100 hectares compared to the 555 birds/100 hectares at the zoo in 1969.

Feeding behavior of the hen to her chicks.—During their first few days after hatching jungle fowl chicks remained within a meter of the hen. When foraging the hen was ever on the move. She shifted the litter with a side-ways sweep of her beak and scratched with her feet. When she found a suitable piece of food during these first days she picked it up, held it above or in front of the chick, and waited until it took the morsel from her beak. In good foraging areas she found food every few seconds. This movement of the beak near the chicks attracted their attention, and they soon became alert to her motions. At this stage the chicks were so close to the hen she needed to move only her head to give them the food.

In a week the chicks started to forage farther from the hen. Then when she located food she sometimes carried the morsel a few steps to the chick and let it take the food from her beak or dropped it in front of the chick.

TABLE 1
INVENTORY OF RED JUNGLE FOWL AT SAN DIEGO ZOO, 1969

	27 April-1 May	21 May	Total
Adult cock: With single hen	16	16	32
With hen and chicks	5	2	7
Alone	19	?	?
Yearling cock: With single hen	9	5	14
With hen and chicks	23	6	29
Alone	31	?	?
Hen and chicks: With cock	28	8	36
Alone	26	13	39
Single hens: Alone	3	?	?
Total cocks observed: Adults	31	48	79
Yearlings	48	76	124
Per cent adult cocks	39	39	39
Cocks/100 hens (from Collias et al., 1966: 551)	137		
Hens/adult cock	2:1		

More commonly she gave a food call (Figure 1A) which alerted the chicks and brought them on the run to her. By this time she usually dropped the morsel before the chick, but often she merely pointed her beak at the morsel without picking it up.

As the chicks continued to develop and to forage still farther from her, the hen's behavior changed still more. Her food call became louder, faster, and longer. In addition she sometimes dabbled at the food with exaggerated up and down head movements, two or three times per second. Chicks responded to these auditory and visual signals when as far as 10 m from the hen. The hen stopped signaling as soon as the chicks arrived. When the brood foraged where food was plentiful, the hen neither called nor dabbled, but let the chicks feed for themselves while she also fed. Mealworms proved highly attractive, and hens with young chicks never failed to tidbit with them. At 8 to 10 weeks the chicks became fairly independent of the hen and vice versa; when given a worm the hen at this stage merely ate it, without calls or head movements.

The food call has the physical properties of sounds easy to locate: abrupt start and stop, brevity, and wide frequency range. Food calls of other galliforms have the same characteristics and may be almost identical in form (Stokes and Williams, MS).

Parental feeding by the cock.—About half of the hens with broods acquired a consort cock (Table 1, Figure 2) that helped her feed the chicks. When such a group foraged, the cock was usually farther than the hen from the chicks. When he found food he gave the same food call as the

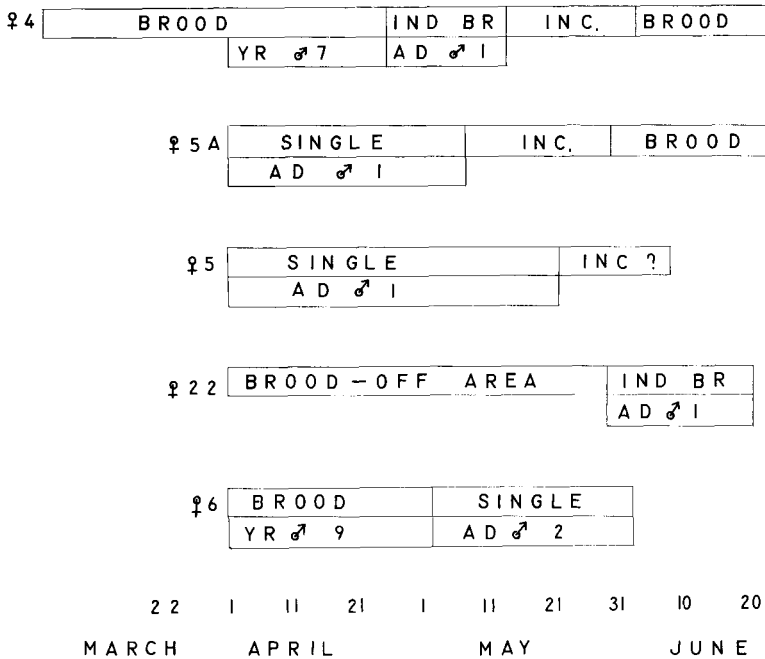


Figure 2. Association of male Red Jungle Fowl with females in relation to reproductive state of the female.

hen (Figure 1B) and the same exaggerated head movements, at which the chicks and hen ran to him. I have seen a cock freeze with his beak a few cm above the ground until the chick came and took the morsel, but more commonly the hen ran up to him. As she came to within 0.5 m of him he usually turned away from her, and she then in turn repeated the call over the food until her chicks arrived.

Courtship feeding.—Male jungle fowls commonly tidbitted to hens at the zoo. They did this to half-grown pullets, to hens ready to lay, and to hens with chicks. The display movements and call were virtually identical to those both cock and hen used while feeding chicks as described above, but the tidbitting cock usually picked up a greater variety of items: the tiniest of morsels, whole peanut shells, palm nuts, wood chips, leaves, and leafy twigs up to 0.5 m long. Hence the feeding was sometimes symbolic. Mealworms released strong tidbitting, but any novel or uncommon food also served. If a hen did not run to the cock immediately, he usually intensified his calling and motions. At times he carried the item a few steps toward the hen, especially if he found it partly or well-hidden, but only rarely would he go right up to her. Occasionally he let the hen take food from

TABLE 2
SEXUAL BONDS IN RED JUNGLE FOWL IN RELATION TO AGE OF COCKS

	Monkey Mesa			Remainder of zoo	
	Adult males	Yearling males	No males	Adult males	Yearling males
Single hens	8	1	0	38	14
Hens with brood	2	8	6	6	35

his beak. He would repeatedly pick up the food and drop it, dabble with it on the ground, or more rarely freeze with his beak over it. A cock might continue such behavior for well over a minute, and then if no hen arrived, eat the morsel. The displaying cock partially flexed his legs, kept the wings close to the body with primary wing tips concealed, and held the long tail feathers high off the ground, but the only essential components of the display seemed to be the call, the head movements, and the actual dabbling with the morsel.

The sight or sound of a tidbitting cock was a powerful stimulant to nearby cocks to begin tidbitting. If the latter were not near food, they picked up whatever was at hand, often large leaves and small branches. The conspicuous movements and associated loud calling often attracted the hen and her chicks to the second cock, and she and her brood might then run back and forth between the two cocks standing perhaps 6–10 m apart. These rival cocks rarely fought, but often low-intensity display and chasing ensued that made the subordinate cock withdraw temporarily a meter or so and stop tidbitting. Sometimes after such sessions of rival tidbitting the hen shifted her attachment from one cock to the other and let him stand close to her while she was feeding or resting.

The sight of a mealworm must be a strong stimulus for the cock to eat it, but he rarely did so while a hen was within about 10 m of him. Exceptions were when a cock had been dominated recently by another cock standing nearby, after some general disturbance in the vicinity, or when the hen and chicks were actively feeding where food was plentiful.

A cock's association with hens depends upon his age and social status (Table 2). Adult cocks tend to escort single hens; yearlings to escort hens with broods. The data for Monkey Mesa are more accurate because they are based on repeated observations of known individuals. On Monkey Mesa only one yearling acquired a single hen as mate, and his intermediate length spurs suggested he hatched very early the preceding year. The two hens with broods that had adult cocks as consorts had broods that were virtually independent; as both hens nested again shortly, in effect they

were physiologically identical with single hens. Thus apparently adult cocks normally court only single hens; when this resource runs out the adult cock may court a hen with well-grown chicks who might yet renest the same season. Likewise yearling cocks rarely acquire a single hen, although they may court them when the adult cock is temporarily preoccupied; instead they court hens with chicks so their only competitors are other yearlings.

Permanence of the social bonds.—In April the relationships between cocks and hens were already well-established. Bonds between an adult cock and single hens normally formed well before egg laying (See Figure 2, Hens 5 and 5A). But an adult cock might form a bond with a hen almost immediately following loss of her brood (as with Hen 6), or at the time her brood reached independence at about 8–10 weeks of age (Hens 4 and 22). An adult cock never stayed with a hen after she had started nesting, nor did he resume the bond after her chicks hatched. Although I have no evidence, I suspect that a hen about to renest, after either loss or independence of her chicks, will be courted again by her original consort.

Bonds between yearling cocks and hens with chicks at first also seemed stable. I often found the same cock and hen together hour after hour and from day to day, although one or more other yearling cocks often tidbitted and waltzed up to this same hen. Over a 2-month period a hen might have a succession of two or three different consorts as one cock gradually dominated his predecessor. Thus Cock 9, a yearling, escorted Hen 6 and her chicks from 17 April through 2 May, when she lost all her brood. She then left her usual range and began going with an adult cock. Cock 9 then started courting Hen 18 whose chicks hatched on 2 May; by 7 May he was being challenged and was gradually displaced by yearling Cock 12; Cock 9 still stayed in Hen 18's vicinity, but only rarely did he court her. Such changes in attachment between cock and hen were accompanied by an increase in the area where the new consort held dominance over his rival. Sometimes a cock maintained his consort role with the same hen successfully for at least 6 weeks.

Thus the yearling cocks on Monkey Mesa had three possible roles during the breeding season. One cock was able to acquire a single hen and presumably breed with her; several stayed close to an adult cock and courted his single hens when the adult momentarily strayed from them; by far the most attached themselves to a hen with chicks, either as consort or as a subordinate to the consort. In contrast all three adult cocks on Monkey Mesa acquired one or more single hens, and rarely paid any attention to hens with broods unless the chicks were reaching independence.

The roles of juvenile cocks.—I was fortunate to find one juvenile cock as he began to consort with a hen. This cock was about 3 months old in

early April when I first noted him with a brother, both already independent of their mother and sister. I periodically threw mealworms to this cock over the next 2 months. At first he ate them silently without sharing them with nearby chicks or hens. By late May he was spending more and more time near Hen 15 and her young chicks. On 3 June he was not tidbitting to her even when within 3 m of her. On 5 June he made a few half-hearted food calls, but got no response. On 10 June he tidbitted and called much more vigorously and this time Hen 15 came up and took the worm. Thereafter he tidbitted to her regularly. In addition he largely severed his ties with his brother. When he started courting this cock was about 5 months old, and his comb was about the size of a yearling's, but he had no spur.

DISCUSSION

The function of courtship feeding.—It is clear that tidbitting and calling serve as powerful stimuli for a hen to approach the displaying male. The hen's approach permits the cock to proceed with other courtship displays such as waltzing and actual mounting. Furthermore the repetition of this display week after week may create so strong a bond between cock and hen that the cock may wander away from her for brief periods without danger of her straying to another cock. Thus the display in adult cocks as given toward single hens seems to enhance their chances of fostering progeny.

The value of courtship feeding to yearling cocks is less clear. I first thought the display could lead to a bond that would give the cock an advantage should that hen lose her brood and reneest. However adult cocks quickly identified such hens, and supplanted the yearling cocks. It now seems more probable that the association of yearling cocks with hens that had chicks provides a training ground where they can match their strength and experience against other yearlings. Such yearlings may then be more successful in acquiring one or more mates the following year. Analogous behavior occurs in turkeys and various lek species of grouse in which the yearling males display toward the hens and to each other, but are rarely successful in mating (Patterson, 1952: 152–154; Watts, 1968).

The origin of courtship feeding.—In monogamous galliforms the male commonly plays an important role in feeding the young (Hume and Marshall, 1878–1881; Beebe, 1918–1922; and numerous references in the *Avicultural Magazine*). But even in polygynous species the male may assume parental duties should the hen be killed (*ibid.*). This evidence suggests that males of polygynous as well as monogamous galliform species have some motivation to feed chicks. In the Red Jungle Fowl the form of tidbitting and calling by the male is virtually identical to that of the female, whether he be courting a single hen or attracting a hen and chicks to food.

I believe, therefore, that the courtship feeding of Red Jungle Fowl originated as functional parental feeding when the species or its progenitor was monogamous. Polygyny in the Red Jungle Fowl presumably evolved when seasonally abundant food enabled the hen to rear a brood with little or no assistance from her mate. A dominant cock could then pass on more progeny to the next generation by acquiring two or more hens, even though this meant foregoing his role of providing food for the chicks. Yet the parental role still persists in yearling cocks, but even here feeding has become largely a device to attract hens and to gain experience against rival cocks. At times it can even be entirely symbolic feeding.

Courtship feeding in Red Jungle Fowl has not moved far along the evolutionary path from functional parental feeding. With the exception of the cock's somewhat exaggerated head movements, his turning aside as the hen approaches, and his use of symbolic food, the behavior is identical in male and female. This is in contrast to certain other galliforms where courtship feeding has become inseparable from primary courtship display, as in the peacock pheasants, *Polyplectron* spp. (Beebe, 1918-1922).

This study has revealed the possibility of misclassifying breeding patterns of birds from field observations. A hen seen in company with a cock, both before and after she has hatched a brood, has been used as evidence that a species is monogamous. I observed essentially this relationship among the Red Jungle Fowl at the San Diego Zoo, but the cock that associated with a hen after she hatched her brood was always different from her previous one, a fact determined only by being able to identify individual birds. The Red Jungle Fowl at the San Diego Zoo must be largely polygynous, for yearling cocks seemed rarely able to acquire a mate; the population had about two adult hens per adult cock (Table 1), and many adult cocks were seen in close association with two or more hens.

The zoo population, even though free-living, may not be typical of jungle fowl elsewhere. The jungle fowl begin to breed in spring, when the warmer weather also brings a greater zoo attendance and thus more food for the birds. This seasonally rich source of food could be conducive to polygyny and perhaps also to a higher occurrence of second broods than occurs in the species' native habitat.

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SUMMARY

An unconfined population of Red Jungle Fowl was studied at the San

Diego Zoo from April through June 1969. The male's courtship feeding serves to appease and attract the female to him and in this way leads to a pair bond and eventual copulation. Usually only adult males succeed in attracting breeding females through courtship feeding. Yearling males, in contrast, courtship feed hens with chicks. Consorting with hens that are rearing chicks seems to function as a means of gaining experience against rival yearling cocks and with potential breeding hens that could enhance their chances of acquiring a mate the following year. Yearling jungle fowl cocks regularly feed the chicks of the hens they are courting. In addition cocks may take over the entire role of raising chicks. Perhaps because of this retention of the parental role in jungle fowl cocks, courtship feeding has become only slightly ritualized as a form of display in contrast to its greater ritualization in some other galliforms.

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