COURTSHIP AND SEXUAL SELECTION OF THE FLICKER (*COLAPTES AURATUS LUTEUS*).

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Plates XV–XVI.

THE Flicker has the distinction of being especially singled out by Darwin (1871) as supporting his theory of sexual selection. He states that Audubon "does not doubt that the female deliberately chooses her mate; . . . the hen is followed by half a dozen gay suitors, who continue performing strange antics, 'until a marked preference is shewn for one'." The Flicker is further distinguished among local Woodpeckers by the brilliant yellow tones to the undersurface of wings and tail. Darwin did not refer to these bright colors as having been especially evolved by sexual selection. The fact that they are equally developed in both sexes he would probably attribute, as he did with other birds, to their transference to the female after they had been acquired in the male through female choice.

Huxley (1916, 1923) has shown, however, that in many cases where both sexes are adorned there may be a mutual performance and mutual selection of the more attractive partners. Moffat (1903), Guenther (1909) and Hingston (1933) on the other hand have stressed that sexual selection may be an illusion, the conspicuous colors having arisen as intimidating and not attracting devices. In some lower vertebrates it seems certain that the bright colors of the male have only this function (Noble 1934). Much has been written on the courtship of the Flicker since Audubon's day, but no agreement has been reached as to the functional significance of the bright colors.

PREVIOUS WORK.

It has long been known that the courtship of the Flicker differs from that of other local Woodpeckers in that two or more females may gather about a single male and apparently compete with one another for his attention. Baskett (1897), Burns (1900), Sherman (1910), Patton (1926) and Johnson (1934) cite particular instances and various other writers such as Forbush (1927) speak of the habit as a general procedure. On the other hand few observers have been able to give first hand information which would support Audubon's contention (1832) that half a dozen "gay suitors" may be attracted to a single female. To be sure some writers such as Burns (1900) speak of such a habit as a common occurrence but they do not cite cases and it seems probable that they are basing their assumption on Audubon. All observers have been impressed by the apparent good nature of the courtship displays. When females were competing among themselves,

"there were the same struttings . . . and bowing that is practiced by the males in a similar situation" (Sherman 1910). "The heads are tilted back at times and the bills pointed up at an angle of sixty degrees with the necks outstretched. The bills, heads and necks are kept in constant motion, reminding one of a musical director's baton" (Skinner 1928). It is not surprising that many writers have described these movements as a dance and the question arises: May there not be after all some mutual selection in this performance which bears a certain resemblance to the mutual ceremonies of Grebes and Herons?

Recently Johnson (1934) has given a very detailed account of the courtship of a particular male Flicker:

". . . the acquisition of a mate by this Flicker was an undertaking that required practically an entire month. As early as the fourth day he had, by effective broadcasting, succeeded in attracting no less than three good 'prospects'. One of these entrants in the elimination contest, so to speak, withdrew early. Each of the remaining two was the determined kind, apparently; neither would yield, and a deadlock threatened. The male, meanwhile, from all appearances, assumed a neutral, wholly impartial attitude toward the two rivals. He even went so far as to continue to broadcast his advertisements, as if serving notice that he felt under no obligation to restrict his choice—if he really had any choice—to these two. But no further candidates responded . . ."

Johnson, however, found no evidence that the dance was stimulating to the male. "The two remaining females chased each other about in a mildly belligerent fashion, spreading their tails and erecting their crown feathers, and at the same time uttering a weak 'weechu-weechu'. They followed each other about thus, along the larger limbs of the nest-hole tree as well as on another tree a few yards away. Jealousy was evident."

METHOD OF STUDY.

I have been interested to repeat Johnson's observations on another Flicker throughout the courting season. Thanks to the coöperation of the Department of Education of the American Museum I was able to introduce mounted birds of both sexes at critical moments in the cycle. This procedure has yielded new evidence as to the significance of the display. I have also found it possible to glue a "moustache" on the face of a living female bird with the result that an accepted mate was transformed into a "rival male." Control experiments were made with the same female after the moustache had been removed. The results have shed light on the significance of the moustache in the life of the bird.

OBSERVATIONS AND EXPERIMENTS.

During the last week of April, 1935, a male Flicker was giving his long "Flicker call"[1] at frequent intervals from a bare limb near the top of an elm in my yard at Englewood, N. J. On May 1, apparently the same male began a hole on a willow 96 feet from the elm. On May 2, he was joined by a female but continued to work well within the orifice while she showed her interest by pecking at intervals around the entrance.

In order to test the ability of these two birds to recognize sex I placed a pair of mounted Flickers on the same limb as the hole but from 12 to 16 feet away. The mounted birds were posed in a resting position with heads turned at very nearly the same angle and they were placed at various distances from one another, sometimes the male nearer the hole and again the female. The test was first made on May 2 and repeated every morning until May 9. The test period was approximately two hours between 6.30 and 8.30 A.M.

The Flickers distinguished between the sexes of the two mounted birds on every occasion. The female would attack the female mount and the male the male mount. A second mounted female added to the pair brought forth the same response as the other female mount. The female Flicker was far more aggressive than the male and once she had knocked a female mount to the ground she would dive at the male mount. If her mate was close at hand she would also peck at him. On rare occasions the male Flicker would attack the female mount after knocking down the male one. The female Flicker alone would follow the mounts to the ground and peck viciously at them.

Both birds when attacking gave only the familiar we-cup call of the breeding season. The bill was directed forward and upward, the head bobbed, the tail flitted in the so-called "dance." The whole performance was obviously intimidatory. Both birds added to it a movement which I am not aware has been previously described. As an attacking bird approached the particular object of its indignation, the tail would be lifted from the limb and spread. Then with a sudden movement it would be tilted at an angle of 45° or more to the limb exposing the brilliant undersurface. The male tilted his tail more than the female did but in both the object was to flash suddenly the yellow fan in the face of the apparent adversary. A record of one trial will illustrate:

"May 3, 8 A.M. Male mount placed sixteen feet from hole and female mount three feet nearer it. Male Flicker, first to return to tree, moves down limb giving loud we-cup calls with usual head movements. He circles

[1] Saunders (1935) describes this call as wick-wick-wick. It is not to be confused with another call Saunders describes as ooweeka but Roberts (1932) as flick-ah, flick-ah. I follow Burns 1900 in writing the latter as "we-cup."

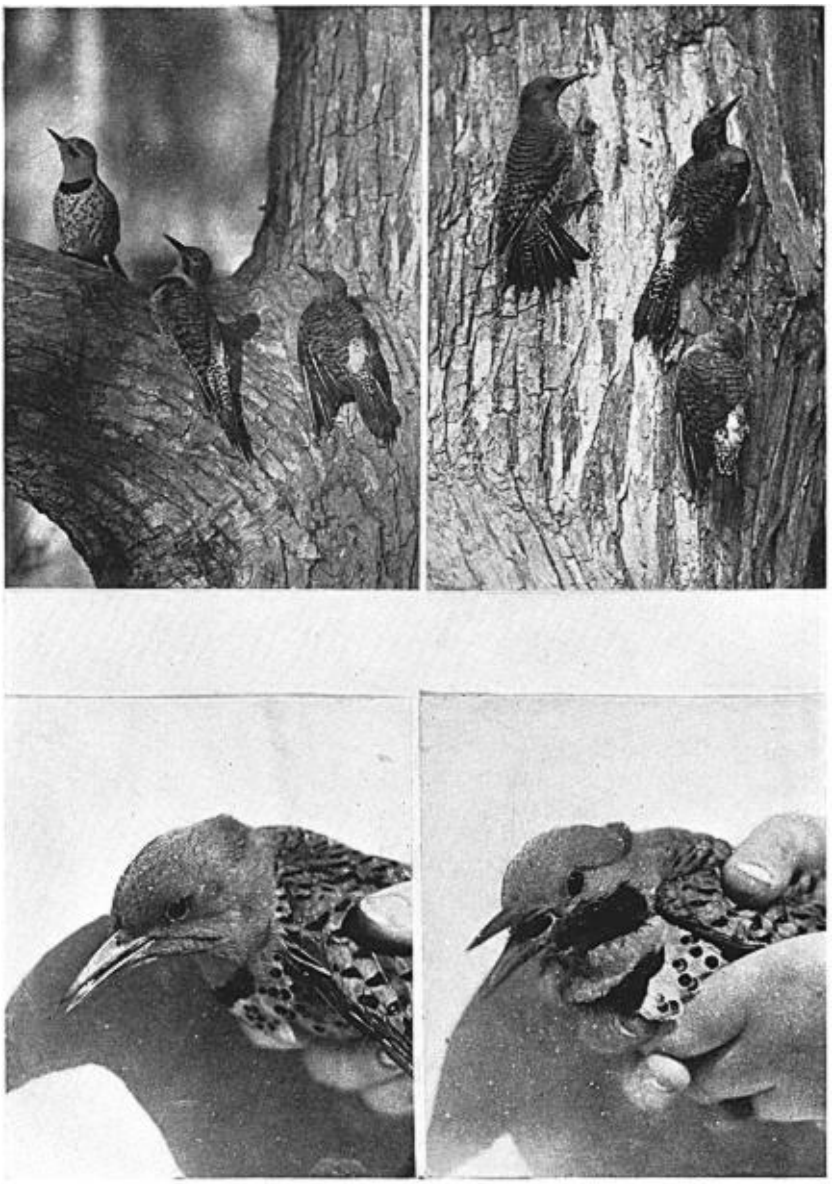
female mount and when one foot from male mount tilts his widely spread tail nearly to a vertical position, fully exposing its bright underside. Moving nearer, the Flicker pecks at mount, spreads and displays tail as before then pecks again several times until the mount falls. Then the Flicker turns to female mount, spreads tail but tilts it only slightly. He pecks at mount and knocks it to the ground."

The female Flicker would also move around the mount of the opposite sex in order to attack the mount of her own sex first. On May 4, for example she attacked the female mount seven times in succession. The female's persistence in following up her attack frequently resulted in her ignoring the male mount entirely. Thus on May 5, the female knocked the female mount down ten times during a period she knocked the male mount down only three times. Both were attached to the limb in such a manner that a vigorous thrust would disengage either one and hence these figures are a fair indication of the relative frequency the female ignored the male mount.

The limb on which the mounts were placed slanted upward at a gentle incline. Obviously the greater the incline the greater the difficulty a Woodpecker would have in displaying the under surface of its tail. An opportunity to test the Flickers on a vertical surface was given by the birds themselves. On May 3 the male, possibly disturbed by the tests of the previous day, began a second hole in a red oak 46 feet from the willow and 100 feet from the elm which had served as a calling station. The hole was begun in the trunk, approximately thirty feet from the ground. The pair of mounted birds placed twenty-four feet from the hole and only six feet from the ground brought forth the same we-cup calls, head bobbing and attacks but the tail while fully spread and slightly tilted showed very little of its undersurface.

When a single mounted bird was placed on either the willow or the oak the response differed in accordance with the sex of the mounted bird. The male would approach a mounted female and sit near it for long periods usually bobbing its head and we-cupping softly at intervals. If the female Flicker returned alone she would soon begin a vigorous attack upon the mounted female.

When the male mount alone was exposed the female Flicker would we-cup loudly and fly to the vicinity but she would never take up a position a few inches away and we-cup softly. There was therefore a markedly different attitude of the two Flickers towards mounted birds of opposite sex (Pl. XV, upper). The male would approach and without displaying give the same cry and head movements utilized in an attack but all scaled down to a very gentle performance. Moreover there would be long periods when the male would remain quiescent near the female mount.



UPPER LEFT.—MALE FLICKER (LEFT) PROTESTING TO MOUNTED MALE (CENTER).
RIGHT.—FEMALE (LEFT) READY TO ATTACK MOUNTED FEMALE (BELOW).
LOWER.—FEMALE FLICKER BEFORE AND AFTER "MOUSTACHE" WAS ATTACHED.

The female's failure to perform the same way towards the male mount may have been due to her lack of interest in a silent male but there was another factor to consider. This particular female may have been mated to the male, the resulting bond modifying the response to the visual image of a bird of the opposite sex. When two or more mounted birds were placed on either tree she would frequently direct her we-cup calls at her mate. On at least one occasion when a male mount was present she went behind the male Flicker and attempted to drive him toward the male mount. As a rule when two or more mounts were exposed the female would we-cup loudly until the male flew into the same tree and then she would immediately begin her attack on the female mount. It was clear that the attack of the female was greatly enhanced by the presence of the male in the vicinity. His we-cup calling, his movements urged her on to single handed attacks which she apparently dared not perform alone. If the male was present the female would knock the male mount down, a feat she never accomplished alone. A record from one of the tests made May 7 will illustrate:

"Male mount placed along six feet from ground on trunk of oak. The female approaches calling and takes up position a few feet away but will not attack. Five minutes later the male flies in and alights on trunk. The female immediately attacks male mount and knocks it down.

"Male mount placed on the willow 12 feet from the hole. The female flies to limb we-cupping loudly and moves from four feet to eight inches of the mount but will not attack. She remains for 25 minutes in this position we-cupping loudly every 20 to 60 seconds. Male mount is then moved back to the oak. Male Flicker settles down ten inches from mount behind and slightly to the right. Every 45 seconds he we-cups loudly. Several minutes later the female arrives and he immediately attacks. Female seems to strike the blow which knocks the male mount down."

It might seem from this observation that the male was passing out of cycle and that the female was the more vigorous in defending territory. But a copulation was observed the preceding day and also on many later occasions. Hence it would seem more probable that the male's response always less vigorous than the female's had merely been dulled to such an extent that he required the presence of the female in order to complete an attack on the quiescent form of a mounted male bird. On the following day the male drove a Starling from the hole in the willow and displayed the underside of his tail at a male mount placed between two female mounts 12 feet from this hole. Hence the male, although still sufficiently motivated to attempt intimidation of a "rival" by his tail display, would not direct an attack on the quiet form.

Under normal conditions a rival Flicker would obviously not remain quiet but would answer the challenge of we-cups with a similar cry. It

seemed very desirable to secure further information by the introduction of live birds into the situation. Any new male released near the trees would, of course, soon fly away. Hence it was decided to masquerade the female as a male for she obviously was interested in his territory. I am not aware that such masquerading has been previously attempted but in the Flicker it does not present great difficulties in that the male differs from the female chiefly in his black "moustache." Catching the particular female also was not difficult since her jealousy would invariably cause her to knock a mounted female to the ground. A string was attached to the neck of the mount and after it was struck down it was pulled closely followed by the viciously pecking female into a drop trap. The feathers were then cut from the area the moustache occupies in the male and a series of short black feathers secured from the neck of a dried skin of a Pileated Woodpecker was attached to the cut ends with ambroid cement. The resulting transformation was a fair likeness of a male Flicker (Pl. XV, lower). With time the feathers became rubbed the wrong way and failed to lie smoothly. But certainly the first test was made with a bird that resembled a male Flicker closely.

The female was caught the morning of May 11, and after the moustache had been attached the bird was released at 11 A.M. fifty yards from the oak. She flew straight towards the hole and alighted on its edge. The male was not there and she remained for ten seconds alternately peering into the hole and looking about outside. A moment later the male flew in and dropped down beside her. As soon as he alighted he spread his tail and tilted it slightly. The female hopped to a branch a foot and a half away and stopped with head directed away from the male. Immediately the male leaped on her back and brought his tail down in a typical copulatory manner. A moment later he stepped from her back and at the same instant the female turned her head. With a start he drew back and recovering his balance, lunged viciously forward. Then began a long drive which lasted nearly two hours and a half. Along the branches, back to the trunk, up to the nest hole and again out on the branches the male mercilessly pursued the moustached female. As he drew near his tail was spread and tilted displaying the bright under surfaces to their maximum. The male at first made no sound but within a few minutes the female began to we-cup softly. Frequently the female lifted her wings in defense as the male pecked at her head. At no time did she fight back although our previous experiments had shown her to be a more valiant defender of territory than the male. Again and again she returned to the hole only to receive such an onslaught that she lost her balance and fell several feet before catching hold of a branch. After ten minutes of rough treatment the female led the male away from the oak and five minutes later the male returned alone. Two

minutes later the female returned and again we-cupped softly as the male drove her out on a limb. A moment later she dove to the ground, the male following and holding his tilted tail nearly vertical he gave an extraordinary display before lunging at her again. Once more she flew away and this time it was possible to follow the pair as they scrambled over a burnt field a hundred yards beyond the elm which had seemed to be on the edge of the male's territory.

It might be assumed that the male was not confusing the moustached female with a rival but was merely annoyed by the "foreign objects" on the person of his mate. Obviously a control was required at this point and this again was fortunately supplied by the same birds. At 1.30 the male drove the female into a culvert where she was captured. Since both birds were tired from the strenuous chase, it was decided to run the control the next morning.

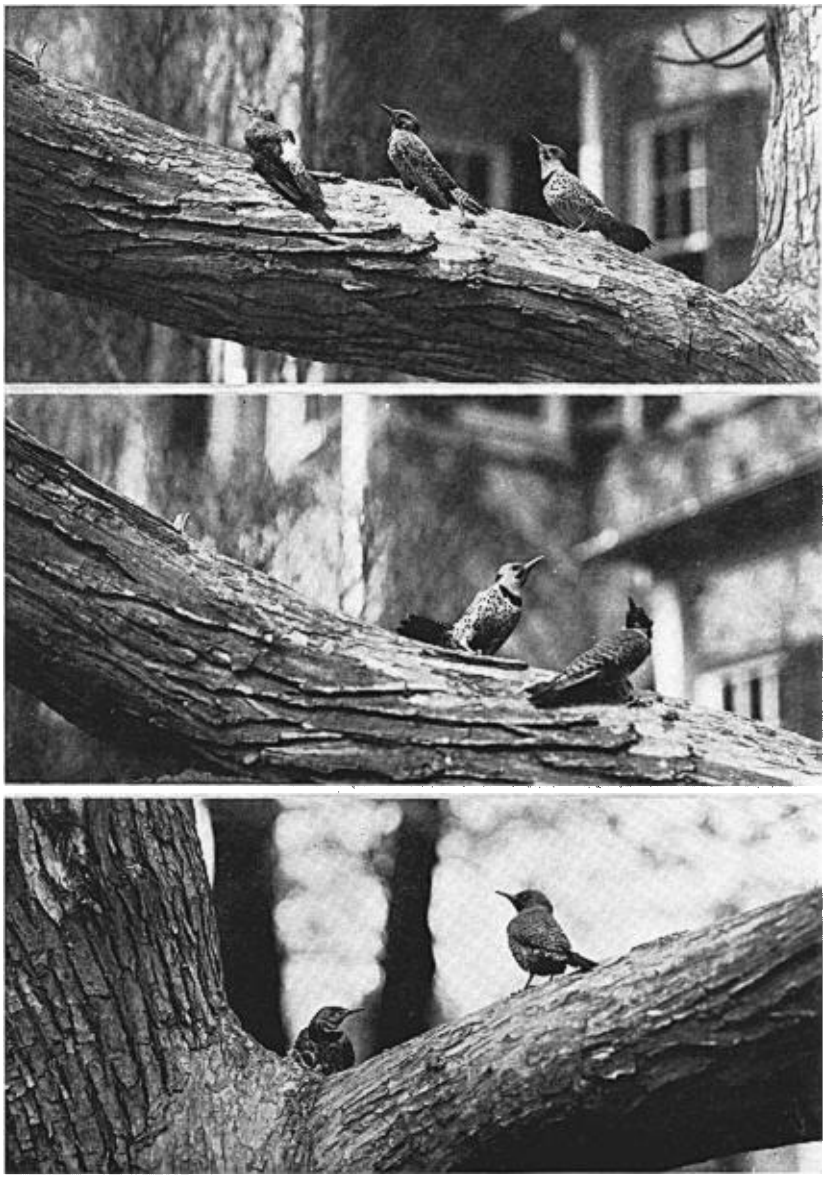
At 6.30 the next morning the male was back on the elm, his original calling station, and giving loud Flicker calls. These were interspersed with loud drummings on the same dead limb he had used before the female arrived. At odd intervals explosive *clapes* were ejaculated. The moustached female was staked out in exactly the same position on the willow that the mounted male had been and a mounted female was placed six feet nearer the nesting hole. The calling male came at once and walked around the mounted female to tail display and then lunge at the moustached female. In order to keep the female in good health the male was frightened away every time he pecked at the live bird. When approached the female usually we-cupped softly, the male loudly, while spreading his tail. When he was out of sight the female occasionally gave a short Flicker call and this was answered in the same manner but with more volume by the male who usually flew back at once. It was obvious that both the we-cup call and the Flicker call of the female attracted the male. During twenty-eight trials with the mounted female in the usual path of approach the male showed not the slightest interest in this quiescent form but directed efforts towards displaying before and then attacking the moustached female (Pl. XVI, uppre).

Since the male was frightened away at each of these twenty-eight trials his attacks at last began to become less vicious. At the same time his we-cupping became louder and more sustained. Previously it was found that the male when attacking a mounted male we-cupped more than he fought. When driving the moustached female he was at first very vicious and at the same time he called very little. Hence there appears to be an inverse ratio between the degree of vigor in the attack and the amount of we-cupping given. As the drive became less intense, there appeared to be no difference between the male's attack on a mounted male and moustached female.

It might be argued that in spite of this resemblance the male was, nevertheless, not attacking an apparent rival but merely an abnormally marked female. As the tests continued the artificial moustache became rumpled and as shown in the photograph (Pl. XVI, center) actually darkened more of the throat than when freshly attached. In order to test the importance of this rumpling factor, the black moustache was cut away and a series of feathers from the throat of a female Flicker skin were roughly stuck to the same areas with ambroid cement. Three hours after this new transformation the female was placed again where she had been tied before but now a mounted male Flicker was placed six feet nearer the nesting hole. The female gave the short and subdued Flicker call and the male came at once to display the underside of his spread tail at the male mount. Receiving no reply the male moved on to the redecorated female who lunged at him savagely as he drew close. The quiet approach of the male encouraged the female to attack him in a way she had not done before. Although she pecked at the male he did not peck back. He was content to walk about her while displaying the under surface of his spread tail. Three minutes later he flew to the elm and drummed. Two minutes later he was back on the willow tail-displaying and we-cupping at the male mount. As he approached the female she struggled and he we-cupped and tail-displayed. Again he flew away without striking the female and drummed on the elm. Again a long Flicker call was given from the elm and four minutes later the male returned to the willow. This time he remained we-cupping, head-bobbing and tail-displaying before the male mount without moving nearer the live female.

At 5 P.M., two hours and a half after beginning these tests with the redecorated female the latter was moved to a crotch twenty feet from the nesting hole. The male soon flew directly to her and sat quietly a few inches from her for several minutes (Pl. XVI, lower). When the female was then staked out on the ground at the foot of the oak the male flew to her and after displaying the underside of his tail settled down a few inches away we-cupping softly. From all appearances the redecorated female had again been accepted as a mate.

Although the normal courtship of the Flicker might be reconstructed from the responses of these two birds to one another and to the mounted birds, the question remained: Would the presence of several live individuals of one sex modify the picture? Opportunity to test this question came the next morning. The redecorated female although apparently remated was returned for the night to a cage. At 6.20 A.M. the next day two new females were fighting on the edge of the nesting hole in the oak. Their loud we-cups were identical to the cries given by the original female when attacking the mounted bird of her own sex. At 6.28 the male arrived and one of the



UPPER.—MALE FLICKER (RIGHT) WITH SPREAD TAIL. BIRD ON LEFT IS A MOUNTED FEMALE.

CENTER.—MALE DISPLAYING UNDER SURFACE OF TAIL TO HIS MATE NOW TRANSFORMED INTO A RIVAL.

LOWER.—SAME FEMALE WITH "MOUSTACHE" REMOVED. THE MALE IS NOW ATTRACTED BY HER AND DOES NOT DISPLAY NOR ATTEMPT TO INTIMIDATE HER.

females who for the moment had driven off the other female turned away from the hole giving a nasal *we-we-we,* like the first syllable of the we-cup but more plaintive and repeated without the *cup.* She moved along a limb and squatted cross-wise the male following and coition occurred. Here was a distinct call-to-mate which has apparently not been described previously for the Flicker. Observations on the following days showed that this was the normal procedure for this female at least. Two previous coitions had been witnessed in the case of the first female and neither time was a distinctive mating cry heard. But in both these cases the female moved off and suddenly stopped, this movement alone apparently inducing the mating response in the male. From 6.30 to 7.15 A.M. (daylight saving time) the two females contended for a place near the entrance to the nesting hole in the oak. They we-cupped loudly, spread their tails and tilted them to expose the under surfaces fully. When the females called the male thrust his head out of the orifice or flew near the contending females but he never displayed to them. When one female was driven off the other approached the male and we-cupped gently. The head was bobbed and the tail flitted in the usual way but with much less vigor than when driving a female.

At 7.15 A.M. one of the females gave the plaintive we-we call and hopped along a branch, crouched cross-wise and coition occurred. Five minutes later the male was again attracted by the same call and he hopped almost automatically after the female until she stopped when coition again took place. During this period of mating as during the previous one only one female was present in the oak with the male. Neither he nor she displayed nor stimulated one another by a dance. At a moment of quiet the female merely gave a distinctive call and the male followed until the female stopped when copulation followed.

At 7.20 another severe epidemic of we-cupping broke out as the second female alighted on the oak. The male who was within the hole immediately left and flew to the females but again did not enter into their displays. The female who had mated soon drove the second female off and immediately returned to the lower edge of the nesting hole. At 7.40 she entered the hole while the male rested twenty feet away on a limb.

The next morning, May 14, copulation occurred again at 7.03 and it was preceded by exactly the same call and movements by the female. At 7.05 another female alighted on a tree fifty yards from the oak. Both birds flew to the new-comer but only the female displayed her tail or lunged at the new bird. The male was content to sit on a limb and we-cup softly. When the male moved the female dove at the new bird, obviously encouraged by the presence of the male. At 7.08 the first female returned to the oak and engaged the new female in another squabble. At 7.12 all three were in the elm where the male who took no part in the fight began to drum.

Immediately a female flew to within three feet of him and we-cupped rapidly. The male drummed again and the female bowed and we-cupped. A minute later the male repeated the drumming with the result that the second female appeared. The first female flew at her and drove her off. But she returned at 7.40 and the females displayed. At 7.41 the male flew away, leaving the females who in his absence sat three feet apart and we-cupped at one another without changing their positions. At 7.47 the male returned and this action caused the females to approach immediately and tail-display while we-cupping loudly. A moment later the male gave a short Flicker call and one of the females flew to him and gave a plaintive invitation-to-mate while hopping away from him along one of the limbs. Immediately the other female flew at her and we-cupped excitedly with the result that she was driven off.

From 7.58 until 9.30 the three birds were kept under continuous observation. The dominant female when at rest held her head more extended than the other. It was the dominant female which settled at frequent intervals on the edge of the nesting hole in the oak. If the male left the oak both females would quiet down but his return would start another bout of tail displays and we-cupping. Rarely did one female strike the other but the tail displays were more frequent and conspicuous than those which had been directed toward the mounted birds. If the male entered the nesting hole, the dominant female would at once fly to her position immediately below the orifice. With the male out of sight the we-cups of the females would weaken. Once the two females rested only ten inches apart and immediately below the orifice through which the male had passed. There was no doubt that the presence of the male was essential for the females to continue their battle of we-cups and displays at the maximum pitch. On one occasion the dominant female entered the hole but immediately left it when the male appeared.

Although the male was attracted by a we-cupping bout between the females he made no attempt to keep nearer one than the other. It was the dominant female who entered the hole and in securing this favorable position she was nearer his center of activity. Whether she alone had actually copulated with the male was uncertain because the females could be distinguished only by their head carriage and this for only a comparatively short time.

By the next morning one of the females had driven off the other. On this day copulation occurred at 6.25 A.M. and again at 6.50 P.M. Both acts were preceded by the nasal invitation-to-mate of the female. The first mating was near the nesting hole in the oak and the female moved away in the usual way. The second occurred in the elm and the female moved towards the male and turned transversely to the axis of the limb when she

was two feet from him. The male hopped across her depressed body but as the female continued to give the call he turned and stepped on her back. As he brought his tail down he lost balance and tilted over until his left side was against the branch. These two matings were again preceded by no display, dance or sound other than the nasal invitation-to-mate of the female.

By May 16 the pair seemed to be definitely established in the nesting hole in the oak and the second female driven away. The original female with her artificial cheek feathers still very bristly was therefore placed on the willow to see if the male would still respond to her presence. Within ten seconds the male had flown to the limb and began to give the short Flicker call. Then he moved down the limb and stood beside her while she lunged at him. The male we-cupped softly but the female obviously annoyed by the cords which held her feet firmly to the middle of the limb made no reply. After remaining near the female for three minutes he suddenly pecked at her. She fenced with him and then there was another wait of several minutes. Apparently the male recognized her as a female but was annoyed by her struggles and failure to reply to his we-cups.

The following morning the test was repeated with the same result. The male came again and stood close to the female. But this time as the female lunged she broke loose from the cords which held her feet and flew away closely followed by the male. An hour later the male had returned to the nesting hole in the oak and the second female met him with feeble we-cups. The original female never returned to the territory and the second female was allowed to rear a brood without further disturbance.

These observations and experiments had showed that the "dance" of the Flickers was in no sense a method of attracting or stimulating individuals of the opposite sex, but rather a means of defending territory and driving off rivals. After the young were reared it seemed desirable to test the responses of the pair again to mounted birds of the same and opposite sex. Since a male, presumably the same male, retained the nesting hole in the oak as a retreat, the pair of mounted Flickers employed in the previous tests was attached to the trunk of the tree twenty-five feet below the hole. The male mount was placed directly above the female mount and 14 inches from it. Soon the male returned and with the usual head bobbing he we-cupped as he approached the mounts. Then followed a long period of waiting broken from time to time by short we-cup calls, head bobbing and feeble tail displays. As he called he edged nearer and 31 minutes later he gave the female mount a poke which knocked it down. He then moved on to the male mount and called, craned his neck and flitted his tail exactly as he had done to the female mount. Eventually he knocked the male mount down, and later the female mount again. But the performance was

chiefly characterized by long periods of waiting near one mount or the other. In the course of the morning he was within six inches of the female mount for 42 minutes, the male mount for 37 minutes and half way between the two for 26 minutes. There was obviously at this late date no differential response to the sex of a mounted bird. The male was intent on driving the mounts from his old nesting and present roosting tree. To accomplish this end he utilized the we-cup calls, head bobbing, tail flitting and display he had employed earlier in the season. But the whole performance was less intense and only once was the tail spread and tilted to the full extent. This was directed towards the male mount which the Flicker did not attack but only addressed his feeble we-cups while settling down six inches away.

DISCUSSION.

It is clear from the above observations and experiments that the "dance" of the Flicker has been usually misinterpreted. The male gives his long Flicker call and his drumming performance from some high point of vantage. Females are attracted to the site, late in the season at least, with great rapidity. When two or more females arrive there is great competition between them. They employ the head bobbing with up-tilted bill, the loud we-cup calls, the tail and wing flitting as means of intimidating the rival. The most dramatic gesture is a wide spreading of the tail and tilting of it until the bright under surface is fully exposed to the opponent. The male employs exactly the same methods of intimidation when a rival male appears. He is attracted by the we-cupping of two females and they require his presence in order to battle to their fullest extent. Each female endeavors to secure a place near the male or near his nesting hole but they do not stimulate him by special displays or by movements. The fact that a female often we-cups when only a male is present must be attributed to excessive excitement. Once she is alone with a male whose sex she recognizes there is no display and only a mild form of we-cupping.

When a female is ready to breed and has driven off her rival she gives a distinctive call while moving along a limb. This invariably causes the male to follow and mate. Coition may occur without this invitation-to-mate but in this case the female moves away and stops as in the first case. A male is willing to fly near any female which appears in his territory. Although he may we-cup and spread his tail towards her this is more a test of her intention to stay than an effort to attract her. If she remains, his we-cupping like hers becomes feebler and eventually dies away entirely.

A quiescent female form is not a sexual object to a male Flicker. Unlike many other birds which will mate with mounted birds (Noble and Vogt 1935) he requires a distinctive cry from the female to release his copulatory behavior. Various other birds are known to have a similar invitation call.

In the Song Sparrow Nice (1933) has described this as a nasal *eeeeee*. During 1935 I made many attempts to induce unmated and calling male Song Sparrows to mate with mounted individuals of their own species. Occasionally the male would sit for long periods near the mount, more usually he would attack it, but he never mated with it.

While in the Song Sparrow and Pigeon, sex is recognized by voice and behavior, mature Flickers apparently have learned to recognize the moustache as a badge of maleness. The response to a female bearing an artificial moustache was much more vigorous than that to a mounted male. This, however, was to be explained by the greater stimulation of a moving object.

Unfortunately only one live male was available for these observations and experiments. His behavior was apparently identical to the male described by Johnson (1934). It may be assumed that not rarely more than one female is attracted to a single male. At these times her hidden colors are flashed out to intimidate her rivals. The male's gladiatorial vestment is also reserved primarily for impressing a rival. It follows that sexual selection in the Darwinian sense, that of female choice, has played no rôle in enhancing the color of the Flicker. Natural selection alone is adequate to account for the bright yellow colors.

CONCLUSIONS.

The we-cup call, the head bobbing with uptilted bill, the wing and tail flitting are means that Flickers of both sexes employ to intimidate rivals. The extreme display is a wide-spreading of the tail and a tilting at an angle of 45 degrees or more exposing its bright yellow under surfaces to the rival.

When two females come to a calling male there is keen rivalry between them. The male is attracted by their calls and they are stimulated by his presence but he takes no active part in aiding one or the other in the contest.

When a female has driven off her rivals she may induce the male to mate by giving a nasal call heard on no other occasion. This invitation-to-mate is given while the female moves along a limb and then crouches. Coition may proceed without the call provided the female moves and stops in the same way. It is not immediately preceded by any displays or dances on the part of either bird.

The "moustache" of the male is a badge of maleness and will call forth an attack by a territory guarding male even when artificially attached to a female apparently mated with him. Males readily distinguish the sex of mounted birds placed within their territory. Early in the season before the nesting holes have been fully constructed the female is more vigorous in attacking a mounted female than a male is a mounted male. In the excitement of the attack she may strike her mate or the mounted bird of the opposite sex but in general she distinguishes between the sexes.

After the young have left the nest the male may still defend the nesting hole but he treats both sexes of mounted birds the same way.

The bright yellow colors of the concealed surfaces of Flickers have not evolved through Darwinian sexual selection, that is through female choice, nor through mutual selection as defined by Huxley. Their chief function is to intimidate and hence natural selection alone is adequate to account for their genesis.

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