THE BELLIGERENCY OF THE KINGBIRD [1]

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ANALYSIS of the aggressive, belligerent behavior of the Eastern Kingbird (*Tyrannus tyrannus*) should assist in the understanding of the psychology of territorialism. Territory in bird life as first conceived pertained solely to intraspecific fighting. The careful study of other species has clarified and in certain respects altered the concept. It is now becoming clear that, while there is a general pattern of behavior, each species manifests territorialism in a manner peculiar to that species. This paper describes and analyzes the manner in which the Kingbird shows territorialism and discusses this behavior in relation to the territorialism of other species.

The Kingbird is notorious for its habit of driving away other species and of pursuing predators. This behavior is interspecific; the behavior usually considered in papers on territory is intraspecific. A comparative study of many species indicates that fighting has at least two important motivations (Davis, 1940a). The defense of the sex-partner is one cause and the defense of the piece of land (nest site) is another. A third type of fighting which comes into prominence in the Kingbirds (Tyranninae) is the pursuit of predators. Other types of fighting are present in certain other species of birds. This classification of motivations holds for fish and lizards as well as for birds.

Belligerency is a widespread characteristic of this group of flycatchers. My observations in Cuba on *Tyrannus dominicensis* and *Tolmarchus caudifasciatus*, in British Guiana on *Pitangus sulphuratus*, and in Argentina on *Tyrannus melancholicus* indicate that the fighting of the Eastern Kingbird is typical of the whole group. An analysis of the behavior of *Tyrannus tyrannus* is probably valid for the whole subfamily (Tyranninae) and perhaps even other subfamilies.

This study was made by the usual field observational technics. It was not found necessary to use colored bands for individual birds although certain observations, incidental to the major problem investigated, could have been made had colored bands been used. No blind was used since the birds were sufficiently tame for observation. The sexes may be easily distinguished by the behavior as described below or by the presence, only in the female, of the brood patch. This area is noticeable as a dark line down the middle of the abdomen where the contour feathers of each side fail to meet. Sometimes in a strong wind the feathers are blown aside so that the patch is plainly visible. The red spot in the crest of the male is reputed to be larger than that

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of the female. But this difference, if it exists, is of no value for the determination of sex in the field.

The observations were made on the Edmund Niles Huyck Preserve at Rensselaerville, New York, during the summer of 1940. The preserve is a tract of land in the Helderberg Mountains just north of the Catskills. The altitude is about 1,500 feet, resulting in slightly cooler weather than in the nearby lowlands. Most of the land is, or has been, under cultivation. There are several small streams and two ponds, providing ideal habitat for the Kingbirds.

A perusal of the literature concerning the species produces a mass of incidental notes, little of which is pertinent to the problem under consideration.

Belligerency

The fighting of the Kingbird may be divided into three types. (1) The fighting against the members of the same species (intraspecific) is the most fierce and conspicuous. (2) The battles with other species (interspecific) occur frequently but lack the violence of intraspecific fighting. (3) The fights with predators show distinct behavioristic differences from the types above mentioned.

The fighting against members of the same species (intraspecific) occurs in nature only when there is an intrusion onto the territory by a strange bird. During the beginning of the breeding season such encounters are frequent. The method of acquiring territory in this species is as follows. Single birds fly about searching for mates. After these single birds find mates, then the pairs wander around for several days looking for a suitable territory and nest site. This acquisition of the territory after pairing differs from the method used by many other species and permits frequent encounters between birds which have a territory and those which are still wandering about. When a single bird enters the territory of a pair it is driven out at once. The pair which has already acquired a territory defends the area in violent fights. A most important point is that both sexes cooperate to drive out the intruder. The female fights as vigorously as the male. Another important point is that the territory defended decreases in size as the season progresses. Towards the middle of the incubation period the territory is relatively small and the encounters with strangers are infrequent, in part due to the small territory and in part due to the fact that there are few birds wandering around looking for mates. At the end of the breeding season, more single birds are traveling about and more skirmishes occur.

The fighting consists of air battles, conducted with a great chattering and display. A note *b-zee* is used in addition to the *tik* note. A great tumbling display occurs when the intruder is some distance away. This display has many of the characteristics of the song-display of certain

passerine birds. The male certainly uses this display and, although at no time was the female certainly identified performing the display, it is possible that at times she also displays. The bird flies high in the air chattering with wings quivering and then, after tumbling, climbs high again and repeats the tumble several times. This tumbling performance was on several occasions performed simultaneously by birds of adjoining territories. On one occasion in the evening, the male sat in a tall tree, called and then performed just before going to his favorite place to sleep. No other male was known to be present at that time. This tumbling display, as used in fighting, serves the same ends as the territory song in many passerine birds.

In order to examine further the behavior involved in the defense of the territory against the strangers, experiments were performed with stuffed dummies. These dummies were museum skins arranged to resemble more or less a live bird and attached to a stick. Three species, *Tyrannus tyrannus, T. dominicensis,* and *T. verticalis* were used. The dummy was placed near the nest and in one case put directly on the nest. As was the case with live birds, both the male and the female fought against the dummy. The reaction of individual birds against the same dummy varies greatly but usually consists of a startled hovering at first, followed by direct attacks. If the dummy remains for an hour or more the birds get accustomed to it and resume the normal behavior. There was no observable difference in reactions towards the three species of dummies used. The following field notes describe some of the encounters in detail. On June 23, I put the dummy about a foot from the nest of the Pond pair. "The female went to the nest, hovered above the dummy. She then touched it with the bill, sat beside it and went on the nest, twittering. The male came in and sat near (6 inches) and looked around. He then went back on the wire. At 9:18 the female went off the nest and the male came and hovered over the dummy. She came back at 9:24 and sat on a twig before flying to the dummy. She called, peered at the dummy and then went onto the nest twittering." This incident is much milder than the following with the Dam pair of birds. The dummy was put near the nest. "At 7:15 A.M. the male (as proved by later identification) sat on a twig, and hovered over the dummy, snapping the bill and using the territorial *b-zee* call." Once it chased away a Grasshopper Sparrow (*Ammodramus savannarum*). The male went away for a short time but soon came back. At 8:00 the female carried in nest material and hovered over the decoy, this being the first time she had seen it. "She attacked it, snapping her bill and knocked it over. The male hovered over it and snapped his bill. At 8:20 both birds left." It should be noted that while the female actually hit the dummy, the male did not do so, a sex difference which occurred with other pairs. These observations are typical of many experiments and show that while the male does

at times actually dive at the dummy, the female is far more aggressive. The behavior of the two sexes in reference to the intruder differs in other small details of perching and use of the notes. These details are indescribable, but after experience may be used to distinguish the sexes of the birds.

Some observations on the defense of the territory when an enemy (human) is present are of interest. On June 28, while I was putting up the dummy, the female dove at it and hit it violently. This indicates that she was more concerned about the presence of a Kingbird stranger than of a human predator. At other times this particular bird was greatly concerned over my presence and attacked me violently. On another occasion at another nest when I approached, the adults were greatly concerned because the young had just left the nest. A bird from a nearby territory came near to investigate the situation and sat calling in a tree about 40 feet away. In this case the parents ignored the intruder although it is certain that under normal circumstances it would have been attacked and driven out in a moment. In both cases the birds attacked the object which was closest to the object defended, that is, nest or young. These observations on intraspecific fighting show clearly that the Kingbirds defend a territory against other members of the species; this fighting will be analyzed in the discussion below after the data concerning the interspecific fighting are mentioned.

The term "interspecific fighting" refers to battles between Kingbirds and all other species except obvious predators such as Crows and hawks. This fighting occurs only in the immediate vicinity of the nest. With one exception no interspecific fighting was observed more than 30 feet from the nest. In this one case a male attacked a young Barn Swallow (*Hirundo erythrogaster*) about 50 yards from the nest without any obvious cause. Witmer Stone (1937:671) has remarked that Kingbirds are "valiant defenders of their nest" and attack "nearly every bird that passes near." The important characteristic of this interspecific fighting is that only the male fights. On no occasion was the female seen to fight. The following observations emphasize this fact. "June 18. When a warbler came into the nest tree the incubating female paid no attention to it. A Song Sparrow (*Melospiza melodia*) sang in the tree for 10 minutes but the female paid no attention to it. The male was some distance away. A Magnolia Warbler (*Dendroica magnolia*) came into the tree, just as the male came onto the wire. It fiercely drove the warbler out at once." "June 25. At one time the female sat within two yards of a Song Sparrow which the male drove away when he came." Olive Thorne Miller (1892) records one case in which the female joined the male in attacking an intruder. But the behavior of the female is not described in detail; possibly the female flew off the nest at the same time the male attacked the intruder. Another characteristic of interspecific fighting is that the

male does not raise the crest when attacking another species. When fighting with another Kingbird both male and female erect the crest.

In order to incite the wrath of the male Kingbird, the intruder must satisfy certain conditions. As a rule a bird merely passing over the nest tree is not disturbed; swallows swooped by unharmed, and on one occasion a Flicker (*Colaptes auratus*) flew over unmolested. Another condition is that the bird must be moving into, about, or from the nest tree. The male seldom attacks a perched bird, although sometimes when the bird is singing in the nest tree the male drives it out. A last condition is that the bird must be above the ground to incite molestation. Robins (*Turdus migratorius*) and Catbirds (*Dumetella carolinensis*) feeding on the ground under the nest tree are left alone. This horizontal stratification of the defense area is of great interest. The male does not come from a distance to drive out intruders even though the bird satisfies these conditions. These three conditions seem to be necessary to stimulate the male to attack. On some occasions, especially after a wandering Kingbird has been driven away, the male attacks birds at a greater distance from the nest site. The battle with an invader seems to excite the male. A further point of interest is that in the evening shortly after sunset the male loses the desire to defend the territory, even against strangers and will permit any bird to come into the nest tree.

The interspecific fighting wanes very noticeably during the progress of the breeding period. In order to give some quantitative idea of the diminution of the fighting impulse the following data indicate the number of times an intruding bird was driven out. These data are crude observations; in many cases it is not certain that all the conditions were fulfilled; furthermore not all the encounters but only those witnessed are enumerated. Nevertheless these rough data show a definite trend. During the nest building period the intruding bird (various species) was driven away 8 out of 17 possible times; during incubation the intruder was attacked 3 out of 10 times. In the feeding period the invader was driven away only twice out of 16 times. The diminution of the attacks is more noticeable to the observer than these quantitative data can indicate. Gilbert H. Trafton (1908) observed a nest in a gutter of a house and states that "this pair showed none of the reputed pugnacity of the Kingbird toward other birds." However, his observations refer primarily to the feeding period and he does not state how near the other species came to the nest.

The Kingbird is usually the victor in the skirmishes with other species but on some occasions the intruder emerged victorious. In two encounters Robins won and in one other battle a Baltimore Oriole (*Icterus galbula*) repelled the attacks. Both species resisted the attacks by using the bill and fluttering the wings.

Many other species drive intruders away from the nest area. The

behavior of Hummingbirds and Song Sparrows (Nice, 1937) are examples. The latter species drives away most other species, unless they are too large or indifferent. House Sparrows (*Passer domesticus*) and Goldfinches (*Spinus tristis*) ignore the threats of the Song Sparrows. Field Sparrows (*Spizella pusilla*), although attacked, succeeded in nesting among the Song Sparrows. Although Nice does not state under what circumstances an intruder is driven off, apparently the Song Sparrow differs from the Kingbird. The latter drives off all birds which satisfy certain characteristics of behavior. The former does not attempt, or at least is unable, to drive certain species away.

Interspecific fighting has different behavior characteristics from that of defense against a predator. Both sexes attack predators and, it is most important to note, go far away from the nest and outside the territory. The male is the more aggressive and goes the farther away from the nest site. Crows and Red-tailed Hawks (*Buteo borealis*) are pursued and attacked from above. It is not uncommon to see the little bird clinging to the back of the larger and pecking out feathers. A Cooper's Hawk (*Accipiter cooperi*) is, however, treated with the respect due his superior ability. The Kingbirds fly up to the hawk but never get within more than a couple of yards and hesitatingly follow it till the danger is past. Cats are pursued with the usual *tik* note and sometimes attacked from above. When a person approaches very near to the nest or handles the contents, the birds may dive at him and frequently click the bill.

Life History

During the investigation of the belligerency of the Kingbird many observations were obtained on the habits of the species. During the summer seven nests were followed in detail, two of which were observed from the very start of courtship to the dispersion of the young. It is not the purpose of this section to record every observation of the birds but only those which seem significant or add information about the relation of the behavior of Kingbirds to the habits of other species.

The pairing of this species differs from that of many other birds. Single birds wander around until a mate is found. Under these circumstances it is impossible to see the exact mechanism of pairing for the investigator is seldom so fortunate as to be on the spot when pairing takes place. The unpaired birds of both sexes give a call which is different from that of a mated bird. This call is the *b-zee* note but does not descend in pitch and is slightly shorter in duration. It is very difficult to distinguish the two calls but it can be done with practice. After pairing has occurred, the birds settle down in a suitable place. Frequently the pair searches for a location, going sometimes a great distance.

After pairing the birds select a territory around the nest site. The

observations on the Dam pair showed without doubt that the nest location is selected first and then the territory acquired around it. This pair built two nests and each time obtained the territory around the nest site. Other observations of the Myosotis pair show that the nest site is the first object acquired. This pair built three nests in different locations and each time acquired the territory around the nest site. Several days are required for the pair to outline the territory around the nest site and during this period the birds wander over a large area. After the boundaries are defined the birds restrict their activities to the territory.

The nest is located typically out near the end of a limb in a small shrubby tree. All the nests under observation were located in apple trees. This tree seems to provide the ideal site for the birds; the tree is bushy out to the end of the limbs and the small branches provide adequate support for the nest. One nest was started in an oak tree but was soon abandoned. The pair then built in an apple tree. The birds have a decided preference for water, building near a stream or pond in nearly all cases. A. W. Schorger (1920) observed this characteristic in Wisconsin and quoted R. W. Chaney's similar notes from Michigan.

The female selects the site for the nest, hopping about a tree and trying various forks by revolving about in them. The male is an interested follower but has no choice in the final selection. The construction of the nest is also done entirely by the female. She picks the grasses, twigs, and rootlets from the ground. In no case was the male seen to carry material or assist in any way in the building. The male, however, is a zealous guardian of the nest site while the female works and greets her every time she returns with material. He often accompanies her for a short distance out from the nest while she works and then returns to guard the nest while she is absent. Towards the middle of the day when the female stops working he relaxes his vigilance and feeds.

The eggs are laid at intervals of one day, usually in the morning before 10 A.M. Two of the nests studied had four eggs and three nests had three eggs. The incubation period in two cases was 16 days. The female begins to incubate when the penultimate egg is laid and gradually increases the time spent on the nest until she is incubating regularly the day after the last egg is laid. She remains on the nest for about 15 to 20 minutes and then goes off to feed for 5 to 10 minutes. During the time the female is on the nest the male is away feeding, usually within 300 yards. After she leaves the nest he returns to his favorite perch and guards till she returns. Her return is greeted with chattering and a quivering wing display. She usually feeds in a place different from his feeding area. In one case she fed across the lake in a section where he never went.

The eggs are pipped two days before hatching. The female carries away the broken shell. The young are blind and nearly naked. Some white down covers the head, the dorsal, and the ventral tracts. Brooding continues for some time but gradually gives way to feeding. The amount of time occupied in brooding decreases as the young grow. In rainy or cold weather the young are brooded nearly continuously. The behavior of the male changes radically when the young hatch, for he now for the first time takes interest in the contents of the nest. He feeds the young, although on the whole not as frequently as the female. However, only the female shields the young from the rain and sunlight. After feeding, the adults usually wait for the young to defecate and then carry away the sac containing the feces. The young remain in the nest for 16 to 17 days. The day before leaving the nest the young start to give the *tik* call of the adults and after one day's practice give it so perfectly that it is indistinguishable to the observer. They exercise the wings frequently at this time. The first day out of the nest the young stay within a few yards of the site; in one case the young came out late in the afternoon and went back into the nest for the night. The second day out of the nest the young leave the nest tree and begin to wander around. The family group now moves about, usually staying near the territory but by no means stays within the territory. The birds do not use the territory as food reserves in any way.

In this region the birds raise only one brood. The fledging success was high, 79 per cent in the nests studied, for 15 young were fledged from 19 eggs laid. During the progress of the nesting cycle the anxiety of the adults increases. After the young have hatched the parents are greatly alarmed by the investigator. There is an interesting difference in behavior between the sexes. When approaching the nest for feeding the young birds, the male, at the nests under observation, alighted on his favorite perch before giving the insect to the young. The female, on the other hand, flew directly to the nest. This difference in habits is probably consequent upon the difference in behavior during the incubation period.

The notes of the species are all loud and harsh. The note *b-zee* is used in the territory by the adults. An unmated bird has a slight difference in this note as described above. A loud harsh *tik* is the most common note and is used on many occasions. The young use it and the adults use it when greeting each other. It seems to be a social note used to keep the birds together and aware of the location of the other member of the pair. This *tik* is used in the tumbling display. A chatter consisting of a series of rapidly repeated *tiks* is used in the greeting ceremony when the female comes back to the nest. When the female goes onto the nest she frequently twitters quietly for a few moments. L. A. Hausmann (1925) comprehensively discusses the

notes of the species, calling attention to the matin song, used early in the morning, and the use of the *kitter* for alarm, chase, and victory.

A peculiar behavior was observed at one nest. The apple tree was infested with tent caterpillars. Frequently the male and sometimes the female swooped down, seized a caterpillar and carried it to a boat which was tied on the edge of the pond about 50 feet away. One day I found 33 caterpillars in the boat. When the boat was not there the birds placed the insects on the dock. No explanation can be suggested for this behavior.

Another observation of interest is that the male in one case slept in the same tree from June 10 until August 16 when observations were discontinued. He frequently called from the top of a nearby tree before diving down to his sleeping place.

Discussion

This study of the Kingbird was undertaken for the purpose of analyzing the relation of the notorious belligerency of the species to the general concept of territorialism. The evidence obtained indicates to the author that the excessive fighting of the *male* is merely exaggerated territorialism. (For the moment we are not concerned with fighting against predators). For an adequate understanding of this interpretation it is desirable to review certain ideas concerning territorialism. For reasons stated elsewhere (Davis, 1940a) it seems necessary to separate the fighting observed into two psychological entities; the fighting over the piece of land (the nest site) and the fighting over the sex-partner. While there are other causes of fighting these are the two which have been grouped under the term of territorialism. Further strength is added to this provisional division by the observations on the Kingbirds. According to this scheme the male defends the territory and also, naturally, the sex-partner. When a male Kingbird is fighting with another Kingbird within his own territory he is simultaneously defending territory and sex-partner. The female defends the sex-partner only. (The phrase "defend the sex-partner" refers to those actions of the male or female which prevent a rival from obtaining the mate. Thus the female drives away other females which might attract the male away). This interpretation explains why the female never drives away other species from the nest; why the behavior of the male is different in intra- and interspecific fighting; why territorial defense (as shown by interspecific fighting) diminishes during the breeding cycle while the defense of the sex-partner is as vigorous after the young are out of the nest as during the building of the nest. It is further in accord with this hypothesis that the territory is secondary to the nest. After the young have fledged, the family group may leave the territory but in spite of this fact, the adults defend the sex-partner with great vigor. This discussion suggests that the interpretation outlined will fit the facts more

closely than an interpretation which combines the fighting for the piece of land and the sex-partner under one psychologic motivation. In summary, this hypothesis suggests that territorialism should be limited to the fighting in defense of the nest site, while sex-partner fighting refers to the defense of the sex-partner.

This scheme differs radically from that of Tinbergen (1939). In my opinion even Tinbergen's data on the Snow Bunting agree with the separation of fighting into territorial and sex-partner categories. Tinbergen considers territorialism as a type of sexual fighting. His definition would exclude defense of territory in the fall but include that which occurs shortly before the formation of the sexual bond. It seems impossible to include the defense of a piece of land as a type of sexual fighting without confusing the distinctly different motivations.

A point of interest concerning the defense of the territory is that the male loses his impulse to fight at evening. About sundown he ceases to patrol the nest site and prepares for retiring. This is in accord with the observations on another Tyrannid, *Muscivora tyrannus*, in Argentina (Davis, 1940b). This species is violently territorial during the day but retires at evening to roosting sites where hundreds of males sleep in harmony; shortly after dawn they have returned to their territories and are defending the nest site.

A problem which assumes great importance in the studies of breeding success and of game management is the occurrence of abortive nests. These nests are built and then for no patent reason deserted. Sometimes the nest is completed and other times only the foundation is started. These studies on the Kingbirds added more data on the occurrence of abortive nests but little information for the analysis of the factors causing abortion. One pair of birds (Dam site) started a nest in an oak tree, worked on it during one morning and then deserted it. In this case it seems likely that the nest site was unsuitable; the tree was high, not near water, and thinly foliaged. The extreme case of abortions was provided by the Myosotis pair. These birds built three nests and deserted each one after completion. The first nest was built in an apple tree which was severely attacked by tent caterpillars and nearly defoliated. This possibly was the reason for desertion. However, it is important to note that two other nests were built in apparently ideal locations and deserted. These facts suggest the importance of some observations on the actions of the female at the first nest. Four days after the first nest was completed she started to "incubate" the empty nest. About four days is the normal interval between the completion of the nest and the start of incubation. The behavior of the female was identical with that of a female incubating eggs. She "incubated" for 15 to 25 minutes; the male guarded in her absence and greeted her in the typical manner when she returned. The incubating rhythm was normal. A possible explanation of these abortions is that no eggs were laid. Which sex was responsible for the deficiency

could not be determined without microscopic examination of the gonads.

The experiences with the dummy birds, although designed to clarify the territorial fighting, also shed light on the problem of discrimination of sex. It will be remembered that both sexes were hostile to the dummy and that the male did not try to copulate with it as occurs in some species (Noble and Vogt, 1935). These facts suggest two interpretations. The less probable is that after pairing the fidelity of the birds is such that no other individual of either sex is attractive to a member of the pair. The more likely interpretation is that the behavior of the other bird must conform to certain patterns in order that the birds may recognize the sex.

Summary

The belligerency of the Kingbird (*Tyrannus tyrannus*) was studied during the summer of 1940 in New York State for the purpose of analyzing the relation of this fighting to the concept of territorialism. Other species of Tyrannidae also are belligerent.

Three types of fighting occur: intraspecific, interspecific, and predator defense.

The intraspecific type occurs between Kingbirds when a stranger intrudes upon the territory of a pair. Both sexes participate and fight throughout the breeding cycle. Experiments with dummy birds showed that both sexes fight against specimens of three species of Kingbirds.

Interspecific fighting occurs between Kingbirds and other species. Only the male fights. He drives away intruders from the nest site under certain specified conditions.

The fighting against a predator differs greatly from the other two types of belligerency. Both sexes go far from the territory to drive away a hawk or Crow.

Observations on the life history show that single birds wander around looking for a mate and, after pairing, select a nest site and territory. The female selects the site, builds the nest, and incubates the eggs. The male assists in feeding the young. The territory is not used for food reserves. Fledging success was 79 per cent for 6 nests. In the two nests observed from laying to fledging, the incubation period was 16 days and the fledgling 16 and 17 days. One pair of birds built three nests, and deserted each in turn, without obvious reason.

Analysis of the belligerency suggests the interpretation that the male defends the territory (nest site) and the sex-partner and the female defends the sex-partner only. The defense of the territory and the defense of the sex-partner are different psychological entities.

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