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## The Courtship Behavior of Sanford's Bowerbird (*Archboldia sanfordi*)

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The present paper is preliminary to a general report on the Ptilonorhynchidae (Gilliard, MS) in which the systematics of the bowerbird family will be discussed. Presented herein are detailed field observations of *Archboldia sanfordi* made by the writer in 1956 (July 13 to 17) at 8500 feet on the south watershed of Mt. Hagen, New Guinea, together with remarks on the biological significance of a hitherto unknown pattern of courtship in birds.

### HISTORY

Near Tomba on Mt. Hagen on July 12, 1950, the author discovered *Archboldia sanfordi* (Mayr and Gilliard, 1950, pp. 1-3) and what he took to be its bower, which was a mat of sticks and ferns (Mayr and Gilliard, 1954, p. 362). In 1952 (May 11 to 18) he searched the northern slopes of Mt. Hagen to an altitude of 9000 feet in an unsuccessful attempt at finding another bower and at observing the unknown courtship behavior of this new species. Other collectors and ornithologists also journeyed to Mt. Hagen in quest of further information concerning this bowerbird. Some obtained skins, and Fred Shaw-Mayer and Loke Wan Tho, who were traveling together, discovered an unoccupied bower (Loke, 1957, p. 108). Mr. Norman J. Camps of the Australian Museum spent two days beside a bower (verbal communication). However, none of these men succeeded in observing the living bird. Therefore, when in 1956 the present writer found three bowers that appeared to be in use, and at one of these observed a male and a

female as they performed the lengthy, involved courtship dance reported herein, his observations constituted the first concrete evidence that the mat of ferns, together with their various ornaments, was definitely built by *Archboldia sanfordi*, as well as the first notes of the use to which they were put. Previously, evidence of courtship had been purely circumstantial: the writer had observed and photographed tail feathers of *A. sanfordi* in one of three snare traps (see photograph in Mayr and Gilliard, 1954, pl. 32) that had been installed at the edge of the bower discovered in 1950. All 11 specimens brought to him in 1950 by native hunters were said to have been taken in these three traps at the edge of this bower. Although this evidence seemed irrefutable at the time, there was need for visual proof based on observations of the new species in the bower, particularly because the circumstantial evidence constituted the first indication of bower-building behavior in the little-known genus *Archboldia*. The genus contains one other species, *A. papuensis*, of the Snow Mountains of Netherlands New Guinea which was discovered by the Archbold Expedition of 1939 (see Rand, 1940, pp. 9-10).

Also there was another problem: the 11 specimens said to have been trapped at the 1950 bower consisted of a mixed group of males and females (seven adult males, one subadult male, two females, and one possibly a female). Such a mixture was most unusual, because with all the other species of bowerbirds the bower is always the territory of a single male and not a meeting place used by a group of socially displaying males.

On July 13, 1956, the writer discovered his second bower of *Archboldia sanfordi*. It was within 200 feet of the site of the original bower discovered six years earlier and in precisely the same habitat. The following notes cover the most significant observations that were made during a period of five days at this bower.

Studies were undertaken shortly after dawn. Field notes were supplemented by rapid ink sketches, and every entry was timed. Efforts were made to record the total auditory and visual interactions as they developed through each day. On the second day the climax occurred. A female visited the bower and remained for more than 22 minutes, during the whole time acting extremely aggressive and always occupying dominating positions in the bower. On the other hand, during this long period a male, which had been previously observed many times at the bower, assumed an attitude that closely resembled the food-begging actions of a nestling bird. He did this while crawling on the surface of his bower with an ornament in his mouth. The male visited



FIG. 1. Upper tier of mixed second growth and original garden forest where bower no. 2 was found.

the bower many times both before and after this performance, which seems to be unique in birds. At such times he always appeared perfectly adult in his actions.

Judging from the observations made in 1956, it is likely that *Archboldia sanfordi* employs a solitary form of display, with each male constructing his own bower and defending it as do other bowerbirds. It is probable that the high bounty I placed on *Archboldia sanfordi* in 1950 induced the natives to claim that all the specimens they brought in came from the one bower I had already visited and photographed, probably because the hunters feared that my desire to examine and measure additional bowers would drive away birds which they hoped to catch and sell to me. After making the discovery that the behavior was probably solitary and that there was virtually no likelihood of trapping as many birds at one bower as claimed by my hunters in 1950, I called in the men who had hunted for me in that year and told them I disbelieved their stories. They therefore divulged that at least some of the 11 birds had come from other bowers, some of them quite a few miles from the site of the initial one, but all in the same general area.

#### ARCHBOLDIA SANFORDI

The following observations are of one male and one female interacting on a bower stage, July 14, 1956, at 8520 feet on Mt. Hagen. The scene was a semi-flat garden forest consisting of a mixture of original second growth and some introduced pandanus trees (figs. 1, 2).

Observations were carried out at this bower during the mornings of July 13 to 17. On July 17 the male was photographed on the bower (fig. 3). Five poor shots were made with a 200-mm. telephoto lens set at its widest opening,  $f/4.5$ . Tri-X film was used. The indicated exposure was  $f/2$ . By "forcing" the film during development an identifiable image was obtained. Cameras were not taken to the blind until the observations had been completed. Also on July 17 close-up photographs of the bower were made, and then all the ornaments and bower materials were collected. The birds were not collected.

#### A.M.

- 6.32: Enter blind. Begin second day of observations of bower no. 2 (fig. 4).  
6.37: Large pigeon (*Balus*)<sup>1</sup> cooing in distance. Counted three series of coos numbering 16, 14, and 14 separate calls. These were delivered as rapidly as I could count. Pauses of five to 30 seconds occurred between each series.

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<sup>1</sup> Native names given to me by my guide.



FIG. 2. Lower tier and base of forest (shown in fig. 1) with bower no. 2 encompassing the central half of the photograph. Picture was made from top of log shown at left foreground of figure 4.

- 6.40: Cry of female *Astrapia mayeri* (Togi): a single "cri" or "kre."
- 6.44: Flight of little parrots over canopy. Wings whirr. Much chattering in flight.
- 6.47: Group of birds (*Tegelmu*) working through forest. Perhaps eight to 10 birds. Calls short, plaintive, and not very loud.
- 6.48: *Epimachus mayeri* (Tomba). Male. A short burst like raps from an air hammer. About one and one-half seconds long.
- 6.51: The whistle of an *Oropuoy*. Unhurried. Rather like a boy whistling "oh hey lo."
- 6.52: The slow cry of the *Iminke*: "Kaa" (long pause) "kaa." Two are "talking." One has a much higher-pitched voice. They alternate calls for a while, then one stops calling.
- 6.55: Much whirring of wings in crown. Very little calling and virtually no real song.
- 6.55: *Epimachus mayeri*: A short burst.
- 6.55: The same pigeon continues calling from the same perch in distance. It sometimes stops for a minute or more. The coos are deep, hollow, and rapidly repeated.
- 6.57: Yellow-faced meliphagid (*Mongulip*): an intermittent rasping cry, short and not at all loud.
- 6.58: A *Rhipidura* (*Tongk*) delivers a sharp, pleasant, twittering whistle of about one and one-half seconds' duration. Many syllables.
- 7.00: No flies yet. No cicadas have been heard at Camp No. 6.
- 7.01: "Kii kii" 20 feet away. David (my Tomba guide) acts as though *Archboldia* is in vicinity.
- 7.04: Male *Archboldia* suddenly appears 9 feet up over bower. Is flipping wings up and down. With each motion moves head sharply.
- 7.05: *Archboldia* flies to horizontal perch 2 feet over bower (at edge of fern stage), moves upward on moss-covered perch. In matter of seconds climbs 14 feet in tree over bower. Alternately thrashes wings, pauses, thrashes wings. Then in noisy thrashing flight darts to another perch 20 feet east of bower and 20 feet up. Sits silently and would have been lost to my vision except for periodic thrashing of wings on perch.
- 7.09: *Epimachus mayeri*: Two bursts of about one second's duration each.
- 7.10: *Archboldia* continues occasional wing thrashing. Has now moved to perch close over my head.
- 7.10.10: *Epimachus mayeri*: Two bursts. Very loud and wooden.
- 7.11: *Archboldia* flies to perch about 40 feet to east of bower.
- 7.11.10: *Epimachus*: Two bursts.
- 7.11.30: A mighty whistle from *Archboldia*. The loudest noise yet heard in this forest: a long-drawn-out "pheeuw." Two sets of two notes each with about eight seconds of silence between the pairs and three seconds between the two notes.
- 7.14: A powerful, crow-like call, "kraaaaa," about 15 feet over my blind. This again is *Archboldia*. This is a very harsh call.
- 7.14.30: The creaking of David's bark belt as he breathes sounds like exploding grenades, so tense am I. We stand like frozen images. David holds the notebook. I stand, binoculars in left hand, pen in right.

We look through a hole 5 inches in diameter. The thick blind is nearly black inside. It resembles a mound overgrown with ferns. Many long fronds hang out as they would from a trunk. The port-hole is in shadows under one of these. We are about 28-30 feet from the bower.

- 7.19: Forest is now rather silent. Morning song period is over.
- 7.20: *Archboldia* wing thrashing heard about 30 feet west of bower.
- 7.22: The cooing of that persistent pigeon continues. This note is the predominant low-range note of these forests.
- 7.23: *Archboldia*: A sharp, crow-like cry: "kraa kreee." Called twice in tree 40 feet south.
- 7.27: *Archboldia* wings thrash air as bird flies to limb over bower.
- 7.27.10: *Epimachus*: Two bursts.
- 7.30: *Archboldia* sits 4 feet over bower on sloping limb. Moves slowly with head down. May have worked on something with bill. Is silent.
- 7.31: Loud wing thrashing from *Archboldia*. Flies 5 feet to perch, then moves to perch 10 feet up and 10 feet east of bower. Still only one *Archboldia* seen.
- 7.32: *Epimachus*: Two bursts.
- 7.33: A sharp "kree" and a snap. Dropped pen to scan area with binoculars. Much commotion 6 feet over bower. Cries.
- 7.35: Much sound like insects buzzing. Much "kree"-ing and "kraa"-ing. Also notes like "kriii" and "kreeee." Periodic, usually every three to five seconds. Perhaps two individuals of *Archboldia* are in tree.
- 7.37: A sharp "kraww" from *Archboldia*, followed immediately by two bursts from *Epimachus*.
- 7.38: *Archboldia*'s harsh "krawww" just to the east of bower.
- 7.40: Sun now striking floor of bower in one small spot.
- 7.42 to 7.45: This period was action-packed. First the male *Archboldia* moved to a position 6 feet over bower. There it "kriii'd" and cawed and vented a deep, hollow growl. It sat with the wings drooped and the tail drawn slightly forward under the body like a trogon. Next it disappeared for a few seconds and then reappeared on the floor of the bower itself. There it assumed a crouching position over snail shells. With the tail and back nearly horizontal to the ground it moved snail shells with bill. Next it carried a shell to one heap, put it down, picked it up again, then carried it back to original pile. A large gray shell was then picked up and moved a few inches. For perhaps a minute the golden-crested bird dandled the shells. At times the bird moved over the bower mat in a kind of glide or scurry, its head held low. Once it flew up to a low perch beside the bower and delivered a number of "keee's." These were of a ventriloquistic nature. Although the bird sat in plain sight not more than 35 feet from my binoculars, I at first could not be sure that the notes were being emitted by the bird I watched. Then I noticed that with each far-sounding "keee" the mouth opened and the tail moved. These ventriloquistic notes were frequent and gave me the impression that three or four indi-

- viduals of *Archboldia* were in the vicinity. Still, only one male, probably the same individual, has been seen at the bower.
- 7.58: *Archboldia* descended to the bower stage to move snail shells again. The bird so far has not remained on the ground more than 20 to 40 seconds.
- 7.59: A low "kraa" followed by a sharp "kraa" from *Archboldia* which is now in a tree over the bower again. Sun now is lighting bower quite well and has been doing so for some minutes.
- 8.00: It seems certain that there is only one *Archboldia* in the vicinity, although his noises and movements make it seem at times that there are several.
- 8.01: *Archboldia* arrives at perch 8 feet over bower carrying a long tendril of vine (at least 6 inches long) or strip of other vegetation. It



FIG. 3. Male *Archboldia sanfordi* arranging ornaments on matted fern floor of bower.

- paused for several seconds, then dropped steeply and directly onto the bower mat. There it went directly to the heap of blackish snail shells with the strip. It worked quietly close to the ground for some time.
- 8.05: The male has been on the bower for quite a few minutes. Most of the time it is nearly or completely out of sight in the "cave" portion of the bower which I cannot see.
- 8.06: The male is now on a perch some 8 feet east of the bower.
- 8.07: Extremely sharp "kra-kraaa" followed by a snap and a kind of hiss. These notes seem almost deafening. Sun now lights bower stage very brightly.
- 8.08: A short churr 20 feet to west of bower.
- 8.09: Many wings are to be heard around my blind.



- 8.15: *Epimachus*: Two series of very loud, hammer-like notes from middle tier of forest about 80 feet south of bower. These notes were deeper than usual and sounded like an air hammer at work on the floor of an apartment several stories overhead.
- 8.15.30: Two more bursts from *Epimachus*.
- 8.18: *Epimachus*: Two bursts.
- 8.18.40: *Epimachus*: Two bursts.
- 8.19.20: Wing beats. Loud. From direction of *Epimachus* bursts. Bird may have departed.
- 8.20: More wing beats from direction of *Epimachus* bursts.
- 8.20.10: *Epimachus*: Two bursts 200 feet south. A little later, wing beats in *Epimachus* direction.
- 8.22: *Melidectes belfordi* (*Arua*) crying loudly nearby.
- 8.23: *Epimachus*: Two bursts 250 feet distant.
- 8.26: *Archboldia*: Thrashing flight heard as male approaches and lands in bower area. A click is heard from bower area.
- 8.29: *Archboldia*: A high "kreec"-snap some 10 feet up and 10 feet east of bower.
- 8.20.10: A loud "kraaaa" over bower.
- 8.31: The low "kraaa" of *Archboldia* 100 feet to west.
- 8.34: The curious, insect-like buzzing of *Archboldia* (two series), followed by a sharp "keei keiii," rather like the cry of *Paradisaea*.
- 8.34.30: *Archboldia*'s loud "kraaa." This and the insect-like buzzing were emitted from the "singing" area 8-15 feet east of the bower and 8-15 feet up.
- 8.35: A tiny thrush-like bird is at blind. It has a tiny bill which is thin and sharp. It is black, with a white rump, and is smaller than *Saxicola*. Its habitat seems to be low vines and forest-floor vegetation.
- 8.35.30: *Archboldia*: Thrashing flight heard as bird shifted perch.
- 8.38: After a silence of about a minute, a series of loud "keee's," each followed by a tearing and snapping sound, was begun. These were repeated with some variety about every five seconds (timed). Also heard were noises which sounded like a variety of small birds approaching noisily. Much activity suddenly developed. *Archboldia* emitted several calls which were catbird-like.
- 8.40: Small birds suddenly flutter about blind and bower. They are excited, and there is much chipping.
- 8.41: *Archboldia* is quiet, but small birds continue to be excited.
- 8.41.30: A trill—almost a melodious whistle—from *Archboldia*.
- 8.42: A large brown *Sericornis* on vine close to ground 4 feet from behind. Twitters, flutters wings. A wave of small birds can be seen darting about in the lowest tier of the forest.
- 8.44: Low churrs are emitted by *Archboldia*. East singing area. Small birds dart about entrance of blind.
- 8.45: *Epimachus*: Two bursts.
- 8.46: Wing thrashing: *Archboldia*.
- 8.46.3: *Epimachus*: Two bursts 200 feet west.
- 8.46.7: *Epimachus*: Two bursts 200 feet west.

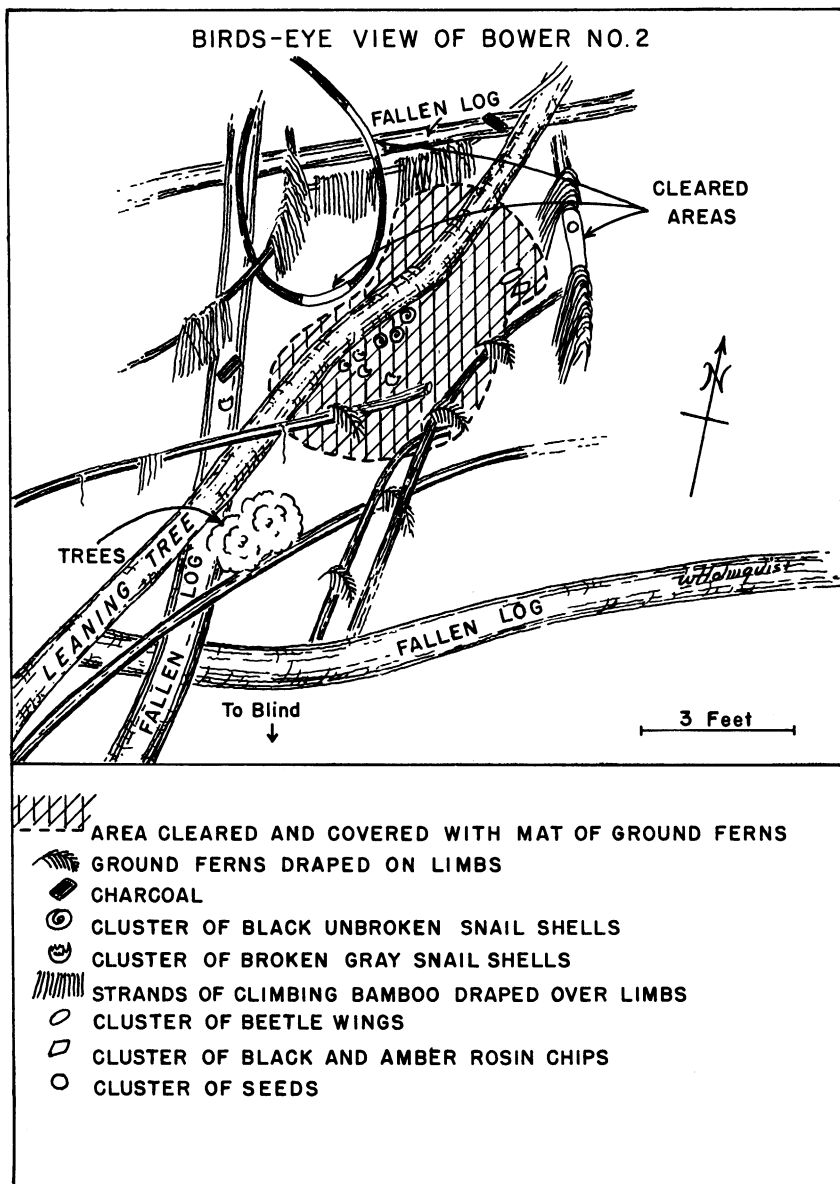


FIG. 4. Bird's-eye view of bower no. 2 of *Archboldia sanfordi*.

- 8.50: *Archboldia* sits on horizontal vine at side of bower 2 feet up. This vine was marked with areas which were suspiciously free of moss and vines. The male sits on one of these in sharp bend of vine shown in sketch (fig. 4). Is silent. Sat for some 25 seconds, then flew off.
- 8.53: *Epimachus*: Two bursts. Many little birds around vine. Seem to be concentrated. Many are fluttering.
- 8.54: *Epimachus*: Two bursts. Also much insect-like "deee-deee"-ing and "chu-wee"-ing from small birds.
- 8.54: *Archboldia*: Sharp "kraaa" from east perch area.
- 8.56: *Archboldia*: Sharp "kraaa" from east perch area.
- 8.57: *Epimachus*: Two bursts 100 feet west. Much chipping, "dee"-ing. A small thrush's song and noises of other small birds around bower and blind.
- 8.59: *Archboldia*: An unusually high-pitched "kraaa" from east singing area.
- 9.01: Not much going on.
- 9.08: "Queen" heard 200 feet west, then continues closer and closer around bower to west singing perch. (This oft-repeated call was a little different from the usual notes of *Archboldia*. It had not been heard away from the bower before. This call may have been emitted by the male as he escorted the female to the bower area.)
- 9.10: *Archboldia* in vicinity of bower, "kee"-ing.
- 9.12: Male descends to bower stage and begins a low churr purr, purr churr, churr. (Later this churring continued incessantly as the male displayed on the ground.) The female flew into the bower area—a completely black bird which appeared suspicious of everything. It eyed my blind, flew towards it, then back to the bower area, landing on a low horizontal perch. There it fluttered the wings excitedly, looked down at the male which now lay churring on the fern mat. Often the female thrashed its wings loudly. It snapped the head around, bent over with the head dipping to the level of its feet. It raised the tail to the level of the back as it stooped. Often the mouth of the female opened, and I believe it emitted a low, growl-like churr. Frequently it changed perches, flying from one edge of the bower to the other. The perches that the female used were about 1 to 3 feet above the fern stage on which the male lay displaying. There were at least three such perches. Each was draped with golden bamboo strands and with dried ferns. On one I had seen about five pieces of charcoal, the largest about the size of a golf ball. When the female changed perches, which occurred about every minute or two, she frequently flew within a foot of the male. At such times when she passed over the displaying male, she whipped her wings with such rapidity that they sounded as though they would be torn. This ripping, tearing sound, like stiff cardboard being torn, was delivered over the male and gave the appearance of whipping (fig. 5). This was the extent of the display of the female. She was never seen to descend to the ground or to touch any ornaments.

She never was more than 5 feet from the male. At least once the female leaned well over her horizontal perch so that her head was perhaps 2 inches below the level of her feet. Her mouth was open, her back bent, and her tail hung down steeply behind. Her head was almost always pointed at the male. This action occurred late in the long display period. It brought the heads of the male and the female within a foot of each other.

The display of the male appeared submissive and begging in the extreme. A glance at the time annotations shows that it continued unbroken from 9.12 to shortly after 9.35. During this period of

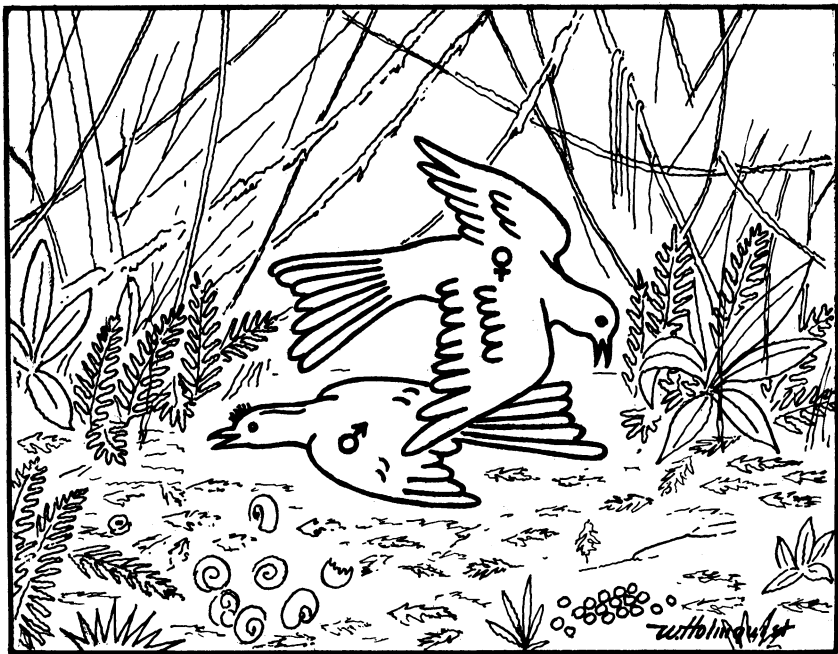


FIG. 5. Female flying over prostrate male as she changes perches bordering bower mat.

more than 22 minutes, the male spent all but about one minute lying flat on the fern stage. There it crawled like a wounded animal (fig. 6), body pressed to the ferns, wings half open, their under surfaces against the ferns. The tail was also partly open and pressed to the ferns. So flattened was the bird that it resembled a reptile more than a bird. Only when the bird rose to hop (see below) were the legs momentarily visible. The crown was folded flat against the head. The tip lay tightly on the plumage of the neck and upper back. Only the yellow tuft at the forehead stuck up. The only part of the bird that was elevated was the

head and neck. The bill was almost continuously open, and it was usually open wide. The mandibles were continually flexed as though the bird were gasping. At least half of the time a strand of fern shaft or thin bamboo was held crosswise in the mouth. The movements of the mouth parts gave the appearance of chewing. The direction of the crawl (which resembled a "whipped dog" crawling towards its master) was always towards the female. Progress was slow. With open, elevated bill the bird crawled perhaps a foot in one or two minutes. The female sat on nearly horizontal perches around the edge of the fern stage, its head usually directed towards the approaching male. Sometimes the male crawled to within a foot of the female before she flew over him, often hovering to whip her wings over his back, then to fly 3 to 5 feet across the bower to another low perch. Immediately she flew, the male would turn and slowly crawl towards her again. But every so often (I saw this perhaps 10 times) the male would shorten the distance by rising to its feet and hopping from about 3 inches to about 10 inches in the direction of the female. This hop was executed quickly. It was unusual because the bird seemed to execute it from a prostrate position flat on the ground. Except during these jumping periods, the male kept up an incessant churring. In landing on the mat at the end of a jump, the bird slid in on its belly and immediately assumed the "whipped dog" attitude. It would lie still with the head groveling for a second or two, then raise the head, open the mouth, and rapidly begin its chewing of the small vine. The male made a complete circuit of the fern stage in about five minutes, following the female as she moved irregularly around its edge. Never did the male touch any of the many shell, insect, or resin ornaments which were in its path. Frequently it crawled among and even over the ornaments. Its only ornament used was the strand of vine held in the mouth. This vine was slender and about the length of a match stick. During the crawling display the head was sometimes directed almost straight up.

- 9.30: Male still crawling towards moving female. Male is completely "lost" in display. Female still appears suspicious. Sounds of "whipping" very loud.
- 9.35: Display continues. Male still on ground, where it has been since the female arrived!
- 9.37: Looks like it is over. Both birds flew off silently.
- 9.39: Deep growl of male? at west singing perch: "kraaa kraaa." Notes in groups of two or three.
- 9.43: Male *Archboldia* flies in. Goes first to horizontal perch at edge of bower (2 feet up) used by female. This perch is a cleared area on the top of a horizontal vine. Earlier I had observed it to be deeply scored with claw marks. The cleared area is about 8 inches wide. The remaining portion of the vine (about 4 feet in horizontal length) is thickly covered with a natural covering of moss. A curtain of thin yellowish bamboo shafts and a few dark brown

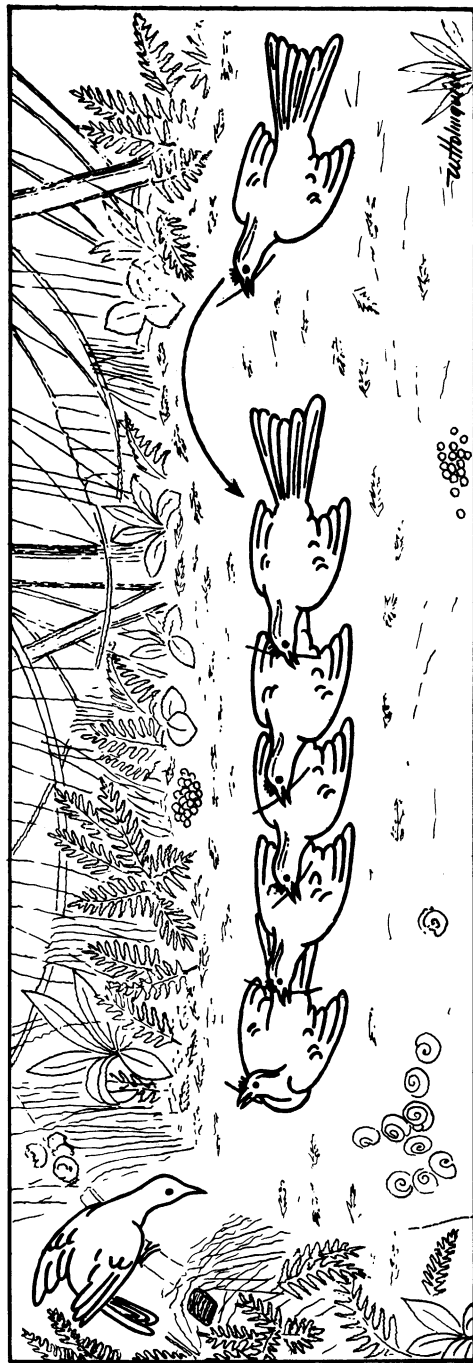


FIG. 6. Male sometimes executes a short hop to shorten distance to female. The usual approach attitude consists of slow crawling, infantile begging, and stick chewing as shown.

dead ferns are added decorations placed there by the bower owner. The male then jumped to the bower floor. There it stood for a long time, slowly moving its head as it picked at a cluster of grayish and blackish snail shells. Often it raised the head to peer out of the bower. At such times its head resembled that of a lapwing, the fore crest rising steeply, the golden crest lying flat on the crown and extending backward to a sharp tip which protruded at least half an inch behind the nearly vertical neck. This I would call the "sentry" position. Aside from these periods when the head bobbed up, the body was held low over the fern mat and ornaments, and the actions were slow and deliberate. The male was absolutely silent during this period.

- 9.48: The male is still in the bower. It carried a 16-inch stalk of some kind of plant into the middle of the fern stage. Next it jumped to another of the perches used by the female, this one 2½ feet up. There it draped the stalk over the perch, stood silently for about 10 seconds. Next it jumped to the middle of the bower, picked up a dead fern frond, moved it about 3 inches, then dropped it.
- 9.50: The male *Archboldia* continues working in the bower. Frequently as it works, it holds the tail up at a steep angle. This is in contrast to the display position when the tail is always dragged.
- 9.51: The male works on top of log at the edge of the bower, arranging ferns and moss. As it stands on the edge, its tail hangs nearly straight down. The male is still silent. The male again goes to bower stage, then back to the top of another log—a long log north of the bower. The actions are methodical and deliberate in contrast to the frantic movements seen during the display.
- 9.53: I can no longer see the male. It may have departed.
- 10.05: Observations close.  
Altimeter reading at blind 10.06 A.M., 8520 feet.

### REMARKS

The biological significance of this form of display is obscure. Apparently, with the reversal of the usual roles of courtship between male and female, the male regressed by incorporating a phase of infantile display in his assumed pattern of female courtship behavior. Noteworthy is the fact that, although as in phalaropes and others the roles of courtship are reversed, sexual dimorphism is not reversed.

The carrying of a vine in the mouth of the male, like the acts of bower building, could have arisen as a displacement activity for nest building. An insight concerning the "afferent" stimulation derived from such activities is given by Lorenz (*in* Schaffner, 1955, p. 185) who wrote: "One of the most universal instinctive movements . . . in the class of birds is the nest building movement. The bird takes a bit of nesting material, a twig or a blade of grass between its mandibles and, exe-

cuting all the while a strong trembling movement, shoves it sideways against the substratum." This movement, which Lorenz found in birds as widely different as crows, herons, pigeons, and eagles, he labeled the "tremble-shove."

The nervous actions and cries of *A. sanfordi* as it crawled in its bower among its ornaments with a vine in its mouth seem but a long step beyond the situation noted by Lorenz in his famous Jackdaws: "In jackdaws, the material to use in tremble-shoving must be learned by trial and error. Inexperienced birds, when getting into breeding conditions and beginning to build, use the most impossible materials, such as cakes of ice, brass settings of electric bulbs, etc., and only after much experimentation arrive at using twigs and branches of adequate length."

It is noteworthy that the crest of the displaying male *A. sanfordi* is little used in courtship. It is carried pressed to the back and is apparently never raised. The length and amount of black in the crest are very variable, suggesting that the crest is not vital to the display. In this connection it is pertinent to recall that in *A. papuensis* of Netherlands New Guinea the crest is apparently lacking, with the result that both the male and the female are similarly colored, whereas in *A. sanfordi* the male has a yellow crest while the female has the head grayish black.

In an earlier paper (1956, pp. 450-451) the present writer postulated that the absence of sexual coloration in the males of certain bowerbirds in which complex bowers are built may be due to the transferral of signals from sexual plumage to sexual objects. The minor role played by the yellow crest in *A. sanfordi*, together with the variability found in its crest, suggests that the threshold of transfer has been passed and the crest has been released from the rigid control of selection. If this is true, the crest will ultimately be lost, for the reason that bright sexual plumage is more of a liability to a ground-displaying bird than are bright ornaments. The reasoning leading to this hypothesis is as follows: bower building is generally believed to be a terrestrial refinement of the arboreal displaying practiced by most birds. In other words, bower building and its effects represent a step beyond arboreal display, and the bower must be considered a psychological organ important to the structure of the bird. Therefore, just as when a peculiar body organ is found, the observer must search for the functions that the organ performs and try to unmask the selective pressures that brought it into being. Whatever these pressures were and are, the writer postulates that the bower is a relatively late arrival in the pattern of avian display, and as such, when it is successfully incorporated, it tends to have a modifying



effect on structure, particularly the structure of the plumage used in display. This effect tends to camouflage birds that are really highly organized, so that they appear more primitive than the species that retain their bright crests, and this has an important bearing on current methods of classification.

### SUMMARY

Sanford's Bowerbird (*Archboldia sanfordi*) was discovered in 1950 in the forests of Mt. Hagen, New Guinea. This species, together with the closely related Archbold's Bowerbird (*A. papuensis*) of western New Guinea, for which a new genus was erected in 1940, differs sharply from all other bowerbirds. Nothing was known of the bower-building behavior of either species except for some circumstantial evidence that the bower took the form of a fern mat in *A. sanfordi*. In that species the male is sooty black, with a golden crown, whereas in the western species the male is blackish gray, with no trace of color on the head. The females of the two species are so similar they might easily be taken as belonging to the same species. It is this phenomenon that led to the development of the hypothesis that in certain closely related species of bowerbirds the transfer of sexual signals to objects has brought about the secondary loss of sexual plumage in the males. The loss of sexual plumage is postulated to be responsible for the lack of a crest in *A. papuensis*, although the bower and bower behavior of that species remain to be discovered and analyzed.

The male of *A. sanfordi* builds a bower that is a mat of ferns and vines adorned with snail shells, resin, and strands of gold-colored bamboo. It spends much time arranging these ornaments and the fern stage which appears to be the territory of a single male. The male is adept at making ventriloquistic notes, in crying harshly, and in making noises like the tearing of cardboard. The display is unique. When the female comes to the bower, the male immediately assumes an infantile attitude in which it flattens its body on the fern mat, chews, with its bill mostly open, on a slender vine, and flutters its wings as does a young bird waiting to be fed. The female does not land on the ferns but remains on low perches encircling the bower. The female appears to dominate the male. When she changes perches she hovers noisily over the prostrate male who continues to "crawl" in her direction for as long as 22 minutes at a time. Copulation was not observed. The biological advantage of this form of display was not determined.

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