A RADIO TRANSMITTER ATTACHMENT FOR SMALL PASSERINE BIRDS

By Arlo Raim

Transmitter attachments used on large birds (Brander, 1968; Nicholls and Warner, 1968; Dunstan, 1972) have generally not been successful on small birds. Harness attachments have been tested and occasionally used on small birds (Graber and Wunderle, 1966; Godfrey, 1970; Bray and Corner, 1972; Cochran, 1972), and a feather attachment technique described by Bray and Corner (1972) has been used on some medium-sized passerines (Bray et al., 1975). Various methods of gluing transmitters to small birds have been tried or used (Graber, 1965; Graber and Wunderle, 1966; Cochran et al., 1967; Kjos and Cochran, 1970; Bray and Corner, 1972; Langman, 1973; Jackson et al., 1977). These adhesive transmitter attachments seemed to have little effect on the behavior of the birds but usually remained attached for only two to three days. This report describes a more durable adhesive technique that I have successfully used for several years on Brown-headed Cowbirds (*Molothrus ater*) and that has recently been used on the Red-cockaded Woodpecker (*Picoides borealis*) by Nesbitt et al. (1978).

METHODS

The weight of the transmitter, battery, antenna, and attachment used on cowbirds was 1.7–1.8 g, approximately 3–5% of the body weight. A 15-cm guitar string antenna 0.23–0.28 mm in diameter was used before and during the breeding season, when 90% of the detailed behavioral observations were made. A 23-cm dual antenna, made up of a 13-cm guitar string and an overlapping 23-cm gold-plated steel wire 0.15 mm in diameter, was used after the breeding season.

The basic attachment technique involves three steps. The transmitter is attached by two threads to a piece of cloth (primary), a second piece of cloth (secondary) is attached with a skin adhesive to the skin and the bases of the cut feathers on the bird's back, and the pieces of cloth are then glued together. (Only one piece of cloth can be attached both to the bird and the transmitter.)

Before performing the above steps, holes (Fig. 1A) or grooves (Fig. 1B) are made in the transmitter between the battery and transmitter and at the posterior end of the transmitter. The holes or grooves can be made when the transmitter is potted. The holes must be large enough to allow passage of the needle used to attach the transmitter to the cloth.

The transmitter is attached to a firm, light cotton blend (0.20–0.25 mm thick) primary cloth by two threads passing through the holes in the potted transmitter (Fig. 1C, D) or around the transmitter if grooves are used. The threads connecting the primary cloth and transmitter are then pulled tight and tied. The threads should be aligned with the holes or grooves in the transmitter so that the cloth remains flat and does not buckle. The exposed knot and threads are glued with

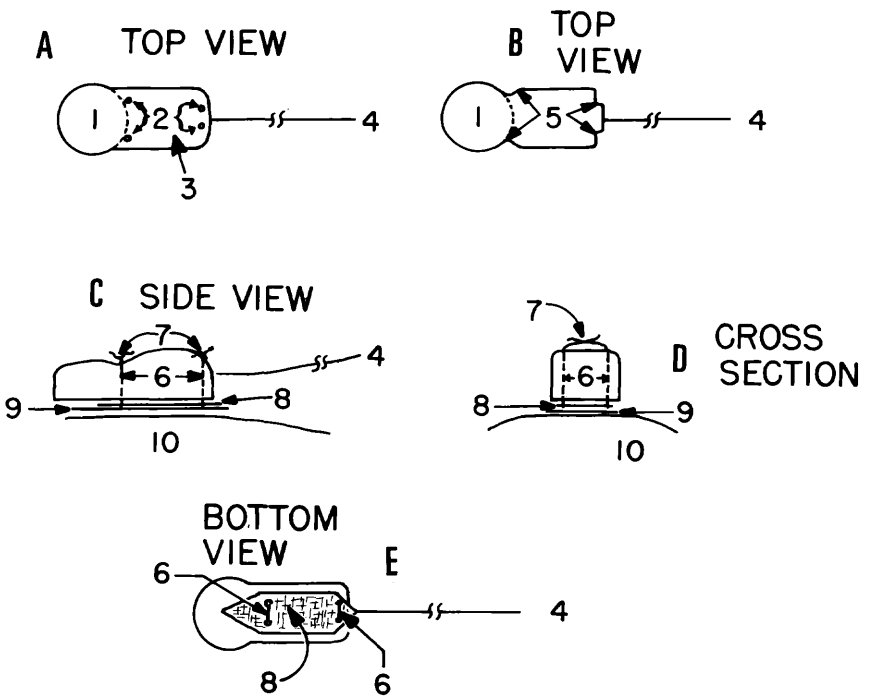

FIGURE 1. Transmitter: A (1) Battery, (2) holes, (3) transmitter proper, (4) antenna. B (5) Grooves. C, D, E, (6) Threads, (7) knots, (8) primary cloth, (9) secondary cloth, (10) bird. X 1.1.

a quick-drying adhesive such as Duco cement. The primary cloth is trimmed to the minimum size required to hold the threads to the cloth (Fig. 1E).

In the field, about 90% of the feathers and down of part of the bird's interscapular region of the spinal tract (Fig. 2A) are trimmed away in preparation for attachment of the secondary cloth. This area should be determined by placing the prepared transmitter on the bird's back as far forward as possible without restricting the bird's head movement. Sufficient back feathers should be left in front of the transmitter to cover the transmitter after it is attached. To remove feathers when working alone, I held the bird on my lap with my left hand (Fig. 2B). The bird's head was placed under my palm with my thumb and forefinger holding the sides of the bird. Feathers to be left uncut were pushed forward and to the side, under the hand. Each feather is usually cut twice. The first cut removes most of the feather and improves visibility for the removal of all but about 1.5 mm of the exposed feather shaft in the attachment area. Most down in the attachment area should also be cut. Care must be taken when trimming feathers and down not to cut the skin or to trim more feathers or down than is absolutely necessary.

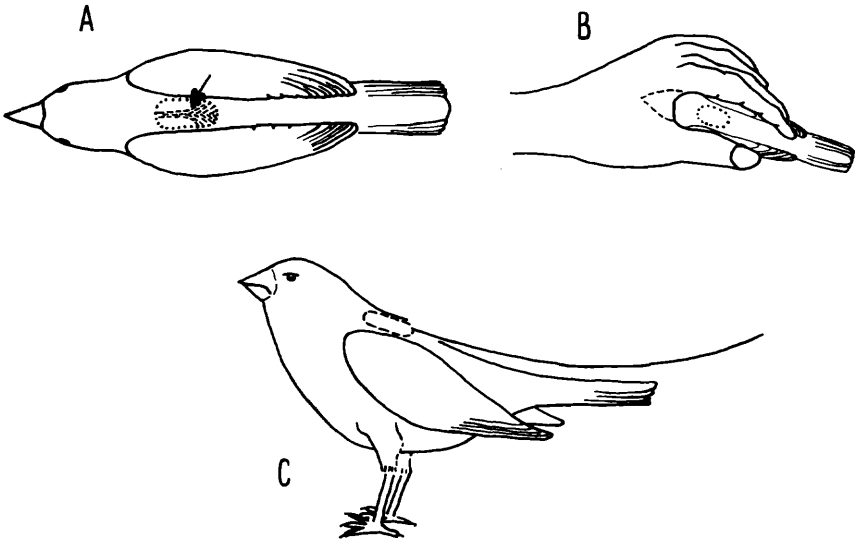

FIGURE 2. Attachment: A. Area of feather and down removal (dotted lines) and cut ends of spinal feather shafts (arrow). B. Method of holding bird with back and tail exposed. C. Transmitter (dashed lines) covered by feathers after attachment.

A thin, chiffon (0.17-mm) secondary cloth the size of the transmitter is then attached to the prepared area with an adhesive specified for use on skin; most other adhesives contain skin irritants. Revlon and Andrea eyelash adhesives were the best of the six adhesives tried. Care must be taken to keep adhesive away from feathers. Forceps are helpful in placing the secondary cloth (with a minimum amount of adhesive) in the proper place and adjusting its location before pressing it firmly to the bird's back. The cloth must be spread smoothly. Drying of the adhesive (10–20 min) can be accelerated by using a small hand-held low-heat hair dryer or gun-type auto windshield defroster (plugs into cigarette lighter). Do not overheat the bird. When the cloth is dry enough to prevent the surrounding feathers from sticking to it, the bird may be put into a holding cage, with ample ventilation, until the cloth is completely dry. If the cloth is not completely attached to the bird, additional adhesive can be put under the edges with the tip of a narrow spatula.

When the above steps are completed, a thin coat of skin adhesive is spread on the primary cloth. While keeping the surrounding feathers out of the way, the primary cloth is placed in contact with the secondary cloth on the bird's back. A thin spatula is inserted between the transmitter and the primary cloth to press it firmly to the secondary cloth. Correct alignment is important because the two pieces of cloth adhere almost immediately unless excess glue is applied. If any of the back feathers become glued together, they are clipped out. The transmitter,

when firmly attached, resists movement or twisting except for movement of the bird's skin.

If properly placed, the axis of the transmitter is parallel to the anterior-posterior axis of the bird, and the antenna extends along and projects 3–5 cm beyond the tail of the bird (Fig. 2C). A slight upward curve in the antenna minimizes its contact with the tail and with the substrate on which the bird is perched. Any sideward antenna angle is remedied by bending the antenna, where it exits the transmitter, to make it parallel with the bird's tail.

I abandoned three variations of the above technique because, though sometimes faster, they did not result in as neat or as durable attachments when working alone. All three variations used only one piece of cloth the size of the exposed area on the bird's back. This cloth and threads, with the transmitter tied down (variation 1), with the transmitter loosely attached by the threads (variation 2), or without the transmitter but with the threads attached (variation 3), were glued to the bird's skin. In variations 2 and 3, the transmitter was tied down later.

The first variation was discontinued because it was difficult to achieve good contact with the skin and good drying of the adhesive when the transmitter was already attached to the cloth. The second and third variations were eliminated because, working alone, it was difficult to tie the transmitter to the cloth that was already attached to the bird without the bird attempting to escape, thereby resulting in poor attachments.

The edges of the secondary cloth adhere directly to the skin, whereas the center is attached mainly to the remainder of the cut feather shafts. The edges of the cloth (attached to the bird's skin) release within the first few days, but the cloth attached to the ends of the feathers holds until the transmitter falls off. Most attachments were terminated by recatching the birds and removing the transmitters by cutting the threads and then trimming the loose edges of the cloth, which remained on the bird.

Successive transmitters with fresh batteries are attached by removing the transmitter and primary cloth (when using two pieces), regluing the loose edges of the secondary cloth to the skin, and gluing another primary cloth with attached transmitter to the secondary cloth. Up to six successive transmitters over a period of six weeks were attached successfully by this method (the female cowbird involved appeared to ignore the transmitter).

BEHAVIOR OF INSTRUMENTED BIRDS

About 60 transmitters were attached between 1971 and 1975 by using the four variations described. Approximately the last 10 were attached by the major technique (using two pieces of cloth). Because the basic technique was the same, comments on behavior and on duration of attachment are based on the total sample of about 40 birds for which detailed behavioral observations were made. Detailed visual observations of behavior were made for up to seven days after attachment. Less

detailed observations were made for periods up to 17 days. Particular care was taken to note any behavior attributable to the transmitter.

Nearly all cowbirds accepted transmitters within a few hours. About 30% appeared to ignore their transmitters from the beginning and, upon release, fed, preened, or perched quietly for a few minutes to occasionally an hour or more (probably because of handling fatigue). Other cowbirds pulled or pecked at their transmitters, a few vigorously, during the first minutes and possibly hours after release. Most vigorous behavior directed at the transmitter occurred during preening and was much less marked than that toward leg bands in the cases when transmitters and leg bands were applied simultaneously. The precise period of adjustment generally could not be determined because, after recovery from handling and preening, most birds radio-tagged in late morning, flew about 1.5 km to afternoon flock-feeding areas where detailed observations were difficult or impossible. By the following mornings the transmitters generally seemed to be ignored.

The transmitter appeared to have little effect on behavior after it was accepted. Within the first hours or days, the feathers generally were preened over and around the transmitter. Copulation did not appear to be affected in the observed birds. The one female with a transmitter attached for almost six weeks laid fertile eggs during that time. Flight did not seem affected, although the wingbeats of a few birds appeared more labored than usual when the birds were released; this might have been an escape reaction. Birds wearing transmitters appeared to take flight as quickly and fly as fast as noninstrumented birds. The transmitter seemed to be noticed only if the antenna became caught (rarely observed) in thick vegetation while the bird was turning around or when the transmitter became very loose just before falling off. If slight movement did not release a caught antenna, the bird would pull on the antenna with its bill until the antenna was freed. If the transmitter was loose and lying or twisting to one side, the bird would occasionally pull at the transmitter, hastening attachment separation.

At least one cowbird never accepted a transmitter. She had two transmitters, attached several days apart, which came off within 1 and 36 hours, respectively. In the latter case, she pulled vigorously at the transmitter at least two or three times every hour. One male also quickly removed two transmitters. The first was removed in an hour, and two days later a second was removed in a few minutes. This male subsequently carried a transmitter for several days. The reason for intolerance was believed to be caused by improper centering or attachment (cloth not glued flat or incompletely glued to the skin) and possibly to individual reaction. Some birds appeared docile during handling whereas others were bellicose.

After initial acceptance none of the more than 60 cowbirds to which transmitters were attached appeared to be adversely affected. None of those for which pre- and post-attachment weights were available (20) showed any unusual daily fluctuation in weight.

DURATION OF ATTACHMENT

Because most transmitters were removed while still attached to the bird (3–18 days) and because of variations in procedures, it was difficult to determine the average duration of attachment. Only the transmitters attached after the breeding season were left on until they came off of their own accord. Because of the far-ranging activities of these birds (15 km) at that time, it was difficult to determine attachment failure unless the tagged bird happened to be observed or the transmitter was found. On this basis, at least 33% of the transmitters were known to remain attached at least 17 days, with some apparently remaining attached as long as 24 days. Considering all variations used and the probable attachment life of those transmitters intentionally removed, average life was estimated to be 10 to 14 days (range 3–24).

The greater success of this glued attachment over those tried previously is probably related to the retention of skin flexibility. This flexibility at the point of attachment allows relatively unrestrained bird movement, makes the transmitter less noticeable to the bird, and reduces the stress placed on the attachment when the skin flexes during normal activities.

SUMMARY

An adhesive radio transmitter attachment used successfully on small birds is described in detail. The attachment involves the gluing of cloth to the back of the bird and the attachment of a transmitter to the cloth. Transmitters attached in this manner were accepted by cowbirds of both sexes within a few hours and remained attached up to 24 days.

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