any interpretation of the isolated observation reported here is premature. Clearly, a long-term study of marked individuals is essential before we can fully understand the social milieu of this and other breeding displays.

I thank R. Cartar, S. T. Emlen, R. T. Holmes, J. P. Myers, F. A. Pitelka, and an anonymous reviewer for their comments on earlier drafts of the manuscript. The observations reported herein were made during a long-term study of shorebird habitat use patterns on Alaska's North Slope by J. P. Myers and F. A. Pitelka; the funding was provided by the United States Department of Energy.

Literature Cited

Ashkenazie, S., & U. N. Safriel. 1979. Breeding cycle and behavior of the Semipalmated Sandpiper at Barrow, Alaska. Auk 96: 56–67.

Drury, W. H., Jr. 1961. The breeding biology of shorebirds on Bylot Island, Northwest Territories, Canada. Auk 78: 176–219.

Holmes, R. T. 1966. Breeding ecology and annual cycle adaptations of the Red-backed Sandpiper (*Calidris alpina*) in northern Alaska. Condor 68: 3–46.

———. 1973. Social behavior of breeding western sandpipers *Calidris mauri*. Ibis 115: 107–123.

———, & F. A. Pitelka. 1964. Breeding behavior and taxonomic relationships of the Curlew Sandpiper. Auk 81: 362–379.

Kessel, B., & D. D. Gibson. 1978. Status and distribution of Alaska birds. Studies Avian Biol. 1: 1–100.

Myers, J. P. 1979. Leks, sex, and Buff-breasted Sandpipers. Amer. Birds 33: 823–825.

———, & F. A. Pitelka. 1975. Wet coastal plain tundra II. Amer. Birds 29: 1136.

Parmelee, D. F. 1970. Breeding behavior of the Sanderling in the Canadian high Arctic. Living Bird 9: 97–146.

———, D. W. Greiner, & W. D. Graul. 1968. Summer schedule and breeding biology of the White-rumped Sandpiper in the central Canadian Arctic. Wilson Bull. 80: 5–29.

Pitelka, F. A. 1959. Numbers, breeding schedule, and territoriality in Pectoral Sandpipers of northern Alaska. Condor 61: 233–264.

———. 1974. An avifaunal review for the Barrow region and north slope of arctic Alaska. Arctic Alpine Res. 6: 161–184.

———, R. T. Holmes, & S. F. MacLean, Jr. 1974. Ecology and evolution of social organization in arctic sandpipers. Amer. Zool. 14: 185–204.

Received 2 August 1982, accepted 26 October 1982.

Myology and Histology of the Phalloid Organ of the Buffalo Weaver (*Bubalornis albirostris*)

Gregory Dean Bentz
Mount Vernon College, Washington, D.C. 20007 USA

Bubalornis is a monotypic genus of the family Ploceidae that together with its closest relative, *Dinemellia*, constitutes the subfamily Bubalornithinae (Moreau and Greenway 1962, Bentz 1979). In the Buffalo Weaver (*B. albirostris*) the phalloid organ is a blunt conical appendage of the cranial cloacal wall. It was first mentioned in the literature by Lesson (1831), who did not illustrate it but briefly described it. Sushkin (1927: 30), in a supplement to a larger paper, described and illustrated the phalloid organ and informally described and poorly illustrated the muscles that contributed to its formation. Sushkin's general description of the phalloid organ is basically correct and need not be repeated here. The purposes of this paper are to illustrate the structure more clearly, to describe formally and illustrate more clearly the associated musculature, and to examine the phalloid organ from a histological standpoint. Sushkin (1927: 32) noted the need for microscopical sectioning of the phalloid organ to determine whether or not the core consisted of erectile tissue. King (1981: 140) incorrectly paraphrased Sushkin's comments by stating that the phalloid organ was nonerectile.

The phalloid organ is a stiff, slightly bent, feathered structure (Fig. 1). It is not perforated, possesses no discernable ducts, and is covered by a continuation of abdominal skin. Its size in males may approach 25 mm in length (Hartert 1917). Male phalloid organs viewed in this study were 13–15 mm in length. It is not a true penis and is in no way homologous with the internal cloacal penes of Struthionidae, Rheidae, or Anatidae. It is a unique structure among birds. Females of the species, however, do possess a rudimentary phalloid organ (Fig. 1b). Its size in females averages 4 mm in length (Hoesch 1952).

Myology.—Sushkin's anatomical illustration (1927: 32) is somewhat confusing and perhaps understandably so. In the present study, muscles were stained with an iodine stain (Bock and Shear 1972). This greatly enhances the visibility of individual muscles as well as muscle-fiber direction. Dissection was carried out under a dissection microscope, and illustra-

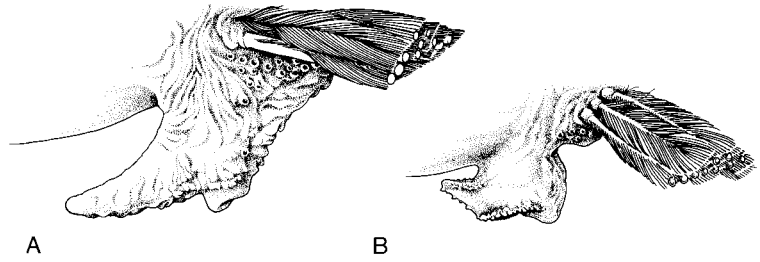

Fig. 1. Left lateral views of male (A) and female (B) phalloid organs. Feathers removed; papillae and knobby structures on edges of phalloid organs indicate their former positions.

tions were made with the aid of a camera lucida. Only one muscle, M. sphincter cloacae, helps to form the phalloid organ and together with two others, M. transversus cloacae and M. levator cloacae, can affect its movement (Fig. 2).

M. sphincter cloacae is particularly hypertrophied in *Bubalornis* and is the major contributor to the formation of the phalloid organ. It is a thick circular band of muscle that completely encircles the cloaca. The belly lies caudal to the belly of M. transversus cloacae. The craniodorsal portion of the belly has attachments to the distal edge of the main tendon of origin of M. transversus cloacae. Much of the muscle is overlain by a thick investing fascia that connects to the pygostyle between the bellies of M. pubocaudalis externus and M. pubocaudalis internus. This fascial connection obscures most of the belly of M. levator cloacae. Contraction of M. sphincter cloacae would not only constrict the vent but also might serve to hold the phalloid organ in a fixed position.

M. transversus cloacae of *Bubalornis* is considerably different from that of most passerines. In passerines the dorsal fibers of this muscle insert on the lateral surface of the cloaca, while the ventral fibers form a sling under the abdomen cranial to the cloaca. In *Bubalornis* all the fibers are directed to the base of the phalloid organ. The muscle contributes only slightly to the formation of the phalloid organ, but it is capable of moving it. The muscle has both fleshy and tendinous origins. Fleshy fibers arise from the ventralmost portion of the ischium just caudal to the ischiopubic fenestra and from the lateral surface of the distal end of the pubis. The main origin is by a tendinous sheet that extends between the transverse processes of the second and third free caudal vertebrae. This tendon passes laterally and ventrally between the bellies of M. flexor cruris lateralis and M. lateralis caudae, widens slightly, and gives rise to fleshy fibers that join those that arise from the ischium and pubis. The caudalmost fibers of M. flexor cruris lateralis arise from the cranial edge of this tendon. This tendon continues ventrally and serves as

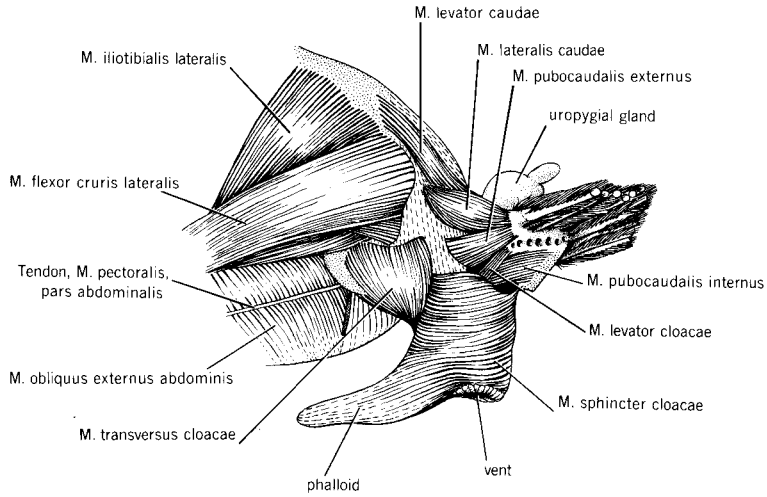

Fig. 2. Left lateral view of the superficial musculature associated with the phalloid organ. Cross-hatched area is the cut edge of M. transversus abdominis.

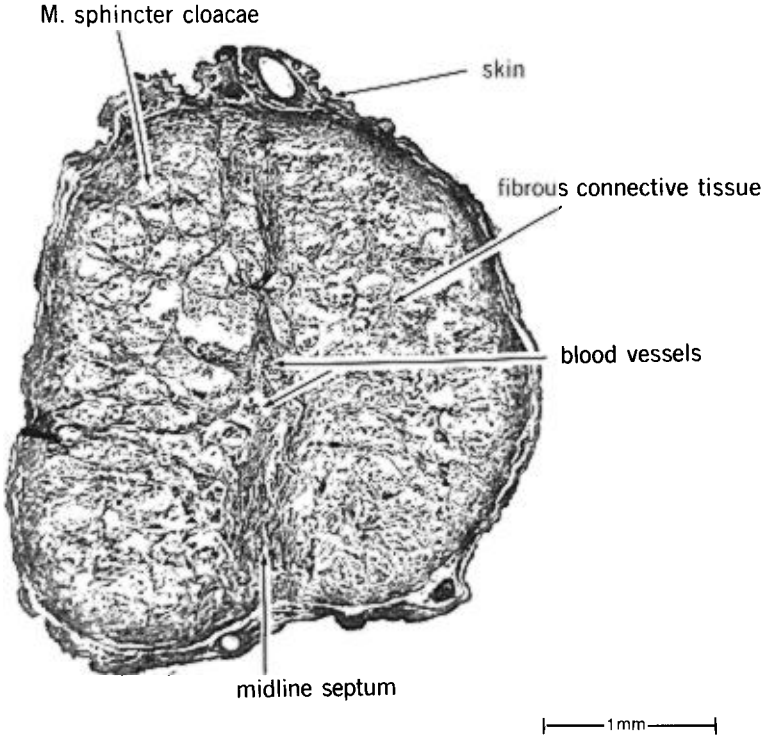

Fig. 3. Photograph of a histological section from the middle of the phalloid organ. Bundles of M. sphincter cloacae are normally filled with muscle fibers. Circular structures in skin are feather follicles.

an area of attachment for the craniodorsal fibers of M. sphincter cloacae. A second tendon arises from the deep surface of the main tendon of origin at the point where the fleshy fibers of M. flexor cruris lateralis arise. This tendon passes distally deep to M. caudofemoralis and rejoins the main tendon at the level of the proximal portion of the belly of M. transversus cloacae, thus forming a loop through which M. caudofemoralis passes. The fibers of the belly of M. transversus cloacae converge ventrally and medially and end on a tendinous raphe, shared with its counterpart from the other side, on the dorsal surface of the proximal end of the phalloid. The caudal edge of the ventral half of the belly is contiguous with the belly of M. sphincter cloacae. Bilateral contraction of M. transversus cloacae would cause the phalloid organ to be drawn up against the abdominal musculature. Unilateral contraction would allow the phalloid to be inclined to one side or the other.

M. levator cloacae, a small, strap-shaped muscle, arises by a thin tendon from the rectricial bulb between the insertions of M. pubocaudalis externus and M. pubocaudalis internus. The parallel-fibered belly passes ventrally to insert on the dorsal edge of the belly of M. sphincter cloacae. Because the function of this muscle is to elevate the cloaca and because the phalloid organ is attached to the cranial border of the cloaca, it follows that this muscle may be capable of retracting the phalloid organ. In most birds the vent is directed more caudally, and the insertion of M. levator cloacae is on the cloacal wall cranial to M. sphincter cloacae.

Histology.—The phalloid organ of an adult male specimen (CM 2164) was removed and dehydrated through increasing concentrations of alcohol. After clearing with xylene, it was embedded in Paraplast and sectioned at 6 μ on an AO Rotary Microtome. Some sections were stained with hematoxylin and eosin and some with Milligan's trichrome, which makes fibrous connective tissue appear blue and muscle red. Some sections were mounted in the unstained condition. Basically, the phalloid organ consists of dense fibrous connective tissue with bundles of muscle fibers passing through it (Fig. 3). These fibers of M. sphincter cloacae pass lengthwise through the phalloid organ parallel to an internal, tendinous septum on the midline. Some fibers insert on fibrous connective tissue at various points along the phalloid organ. A few fibers continue all the way to the tip of the organ, where the amount of fibrous connective tissue increases at the expense of muscle. Perhaps most interesting is the lack of extensive vasculari-

zation. Only a few very small blood vessels could be demonstrated. This is in marked contrast to the well-vascularized true penis found in ducks (for example, see Komarek and Marvan 1969).

Discussion.—For years speculation as to the function of this structure has abounded. Originally, it was referred to as a copulatory organ, because it was assumed that the phalloid organ was introduced into the cloaca of the female (Lesson 1831). Crook (1958) observed much of the behavior of *Bubalornis* but did not observe copulation. Consequently, no new information was gained about the phalloid organ. The only observation of copulation was made by an entomologist, F. Gaerdes, cited by Hoesch (1952). According to Hoesch, the angle formed by the axes of the bodies of two copulating birds fluctuates between 75 and 105°. He assumed than that this position was brought about by the male fastening or hooking the curved distal end of the phalloid organ around the shorter phalloid organ of the female. Regrettably, the function of the phalloid organ remains in doubt. Presumably, close observation of captive birds will provide the answer. An observer could then look for evidence of clasping or of stimulation of the female by the male. Also, little is known about the development of this structure in the transition from juvenile to adult birds. Its larger size in breeding birds (Sushkin 1927) is most likely attributable to age. At any rate, lack of extensive vascularization indicates that the phalloid organ does not consist of erectile tissue.

I am grateful to Richard L. Zusi and Storrs L. Olson for their comments on this manuscript and to Peg Melville Barber for sectioning and staining the phalloid organ. Specimens were provided by Carnegie Museum of Natural History and The American Museum of Natural History. The drawings were made by Jacqui Schulz. Victor Krantz prepared the photograph. Portions of this study were supported by a Faculty Development grant from Mount Vernon College to the author.

Literature Cited

Bentz, G. D. 1979. The appendicular myology and phylogenetic relationships of the Ploceidae and Estrildidae (Aves: Passeriformes). Bull. Carnegie Mus. Nat. Hist. No. 15.

Bock, W., & R. Shear. 1972. A staining method for gross dissection of vertebrate muscle. Anat. Anz. 130: 222–227.

Crook, J. H. 1958. Études sur le comportement social de *Bubalornis a. albirostris* (Vieillot). Alauda. 26: 161–195.

Hartert, E. 1917. Minutes of the 218th meeting of the club. Bull. British Ornithol. Club 37: 51–53.

Hoesch, W. 1952. Über die funktion des phalloiden organs biem Buffelweber (*Bubalornis albirostris niger*). J. Ornithol. 93: 362–363.

King, A. S. 1981. Phallus. Pp. 107–147 *in* Form and function in birds, Vol. 2. (A. S. King and J. McLelland, Eds.). New York, Academic Press, Inc.

Komarek, V., & F. Marvan. 1969. Beitrag zur mikrokopischen Anatomie des Kopulationsorganes der Entenvogel. Anat. Anz. 124: 467–476.

Lesson, R. P. 1831. Traité d'ornithologie. Paris, F. G. Levrault.

Moreau, R. E., & J. C. Greenway, Jr. 1962. Family Ploceidae. Pp 3–74 *in* Check-list of birds of the world (E. Mayr and J. C. Greenway, Jr., Eds.). Cambridge, Massachusetts, Mus. Comp. Zool.

Sushkin, P. P. 1927. On the anatomy and classification of the weaver-birds. Bull. Amer. Mus. Nat. Hist. 57: 1–32.

Received 2 August 1982, accepted 11 November 1982.

A New Subspecies of Henslow's Sparrow (*Ammodramus henslowii*)

Keith A. Arnold
Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843 USA

Paynter (*in* Peters 1970) recognizes two subspecies of Henslow's Sparrow: *Ammodramus* [= *Passerherbulus*] *h. henslowii*, the western form, and *A. h. susurrans*, the eastern form. The A.O.U. Check-list (1957) gives the breeding range of the western form as including ". . . northeastern Texas . . ."; this probably refers to the discovery by F. G. Watson of singing males on 27 May 1952 on a prairie near Deer Park, Harris County (Oberholser 1974). On 8 April 1973, M. Braun discovered singing males in a field in south central Houston, Harris County; on 31 July, N. Pettingell observed an immature bird; and a census on 12 August resulted in a count of 62 adults and 9 immatures. Harris County is situated over 1,200 km from the southernmost known breeding records for *henslowii* (in Missouri). Oberholser (1974), lacking specimens, arbitrarily allocated this population to the western subspecies.

On 12 July 1975, two specimens (both males) were secured while the sparrows were being banded in