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Modifications and Improvements in the Formax Method of Preparing Small Avian Study Specimens

Martin A. Floyd
University of Arkansas at Little Rock

Gary A. Heidt
University of Arkansas at Little Rock

This survey resulted in the finding of three specimens. Two specimens were captured in May on a 65-acre prairie in Boone County (Marsh, 1978), and the other specimen was captured in July on a 40-acre prairie in Franklin County, representing the first record for this county. Thus from 1909 to 1978 there are reports of the ornate box turtle in ten Arkansas counties: Benton, Boone, Fulton, Washington, Franklin, Perry, Garland, Prairie, Lafayette, and Columbia (Figure I). Being a species which is restricted by habitat availability, the ornate box turtle has been greatly affected by the changes in land use practices occurring in Arkansas, and has been considered a rare species (Reagen, 1974). Conversion to more productive agricultural use has reduced the amount of native prairie and undisturbed grassland available to the ornate box turtle, and this may be the most important factor limiting the ornate box turtle, and this may be the most important factor limiting the ornate box turtle's range in Arkansas. In addition, the Arkansas highway system has taken a toll because the turtle seems to exhibit a certain affinity for roadways and a great number are killed by motor vehicles (Legler, 1960 and Reagan, 1974). To properly assess the status of the ornate box turtle *(Terrapene ornata ornata)* and to eliminate confusion concerning its distribution in Arkansas a detailed study is obviously needed.

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LAWANA ENGLAND. Arkansas Natural Heritage Commission, Suite 500, Continental Building, Main and Markham, Little Rock, Arkansas 72201.

MODIFICATIONS AND IMPROVEMENTS IN THE FORMAX METHOD OF PREPARING SMALL AVIAN STUDY SPECIMENS

Traditional methods of preparing study skins of small avian specimens are often not feasible due to time and expertise required. This may be especially true when large numbers of specimens, as in the case of tower kills, need to be prepared. Sheridan (Am. Biol. Teacher, January, 1978) reported a method of preparing small avian specimens which entailed injecting formaldehyde saturated with sodium borate (Formax) into the specimen. However, he did not present the proportions of the mixture, pinning procedure, or injection amounts in the different areas of the specimens. This paper describes improvements and standardization of Sheridan's technique.

The Formax used in our laboratory consists of 1 gram of sodium borate to 125 ml of standard (37%) formaldehyde. This mixture is easily injected into the muscles and internal organs where it diffuses throughout the tissues, drying and preserving them in place. Materials needed for preserving the specimen are minimal, requiring only syringe, needles, pins, pinning board, ruler and specimen tags. Thus, the preparation of specimens is as easy in the field as in the laboratory.

Prior to injection, standard measurements of the specimen should be taken (e.g. see Pettingill, Ornithology in laboratory and field, p. 447, 1970). Formax is then injected into the flight muscles on each side of the keel, into the abdominal cavity, and into the cranial cavity next to the eye. Larger birds require additional injections in the nape, feet, wings, and/or other parts of the body depending upon specimen size. Table 1 summarizes the amounts of Formax injected into various areas for birds of representative sizes. For additional support of the head, an elongated S-shaped wire hook is inserted down the mouth and throat (Fig. 1). The use of this wire and the drying factor of Formax increases the usefulness of the teaching specimen as it is not as fragile as one prepared by the traditional skinning method. To prevent seepage of Formax from the mouth, with matted feathers as a result, a small piece of cotton is inserted in the mouth. The cotton is usually placed in the mouth prior to injection of the cranial cavity and then replaced by a fresh piece after injection.

Figure 1 illustrates proper positioning and pinning of the specimen for drying. In some cases, additional support for the wings may be necessary. During the pinning process, feathers, especially on the dorsal side, may be moved out of place. This can be corrected by pushing a pin under the specimen from the anterior to posterior, several times. By modifying the pinning procedure, mounted specimens may also be prepared using this method.

Formax-prepared specimens have been particularly useful for teaching purposes. Birds dissected after a one year period still retain excellent preservation properties, and the Formax-prepared specimens appear to be much more durable than traditional bird skins. This last factor is particularly important in the classroom where the specimen is handled a great deal by a large number of students.

General Notes

Table 1. Approximate Amounts of Formax Required for Birds of Various Sizes

Species	Cranial Cavity	Each Pectoral Muscle	Abdominal Cavity
Short-billed Marsh Wren	0.05cc	0.15cc	0.25cc
Purple Finch	0.10	0.40	0.60
Sharp-shinned Hawk	0.30	1.30	1.60
Bobwhite Quail	0.30	1.40	1.90
Roadrunner	0.50	2.00	3.50

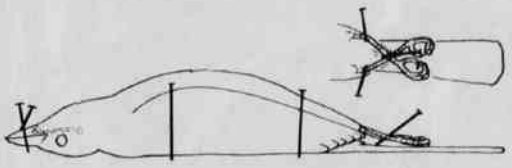

Figure 1. Positioning and pinning of a Formax preserved specimen. Note position of S-shaped support in mouth and throat.

MARTIN D. FLOYD and GARY A. HEIDT, Dept. of Biology, University of Arkansas at Little Rock, Little Rock, AR 72204.

TRICHOMES OF SOME MEMBERS OF THE LOASACEAE, A SCANNING ELECTRON MICROSCOPE STUDY

The plant family Loasaceae contains herbs, shrubs, and some woody vines. The leaves are alternate or opposite, entire or variously divided, and generally covered with rough bristly or barbed hairs. Fifteen genera of about 250 species are native to the Americas, and one species to Southwest Africa.

Metcalfe and Chaulk (1950) have presented a summary of the known trichome types; however, most of this seems to have been from the work of Solereder (1908). Thurston and Lersten (1969) and Thurston (1969, 1974) provided data on the stinging emergences of *Loasa tricolor*. Thompson (1963) and his co-workers (Davis and Thompson, 1967; Ernst and Thompson, 1963; Thompson and Roberts, 1971; and Thompson and Zavortink, 1968) have supplied taxonomic data on species of *Loasa* of the United States; they have done only limited work with trichome morphology. They worked with trichomes on all parts of the plant, and provided an illustration of the dendritic or candelabra type as described by Payne (1978). Hill (1975, 1976, 1977) worked with the seeds, and Jensen et al (1978) have recently worked with protein chemistry and chromosome numbers of the group.

This report provides some new morphological data concerning the types of trichomes, employing the scanning electron microscope.

One species of *Mentzelia* was examined from live material, four species of *Mentzelia* and one of *Loasa* were rehydrated from herbarium material, and all other specimens were from pressed herbarium materials. The living leaf samples were fixed in CRAF V solution, dehydrated with acidified DMP, and critical point dried from CO_2. The rehydrated specimens were prepared by placing them in water which was then heated until the sample dropped to the bottom of the container. After soaking there for one week, they were dehydrated with DMP and critical point dried from CO_2. All specimens were then mounted onto stubs and coated with approximately 50 Å of carbon and 50 Å of 40/60 gold palladium by vacuum evaporation. They were then examined and photographed in a Cambridge S-600 using Polaroid 665 P/N film.

The trichomes observed during this study which appear to be different from those described in the literature are numerically listed below along with the genus from which they were observed:

1. An anchor trichome with elongated, downwardly directed barbs alternately arranged on the stalk. *Eucnide*. Fig. 1.
2. Very elongated, pointed trichome covered with small, oppositely or whorled upwardly directed spines. *Mentzelia*. Fig. 2.
3. Short conical-shaped with straight barbs in whorls, and anchor-like cap, and a raised, apparently multicellular base. *Mentzelia*. Fig. 3.
4. Long tapering trichome with spines pointing straight out and seemingly randomly arranged. *Petalonyx*. Fig. 4. There may be two different sizes within this group.
5. Long tapering trichome with elongated horizontal protuberances randomly arranged. *Loasa*. Fig. 5.
6. Thin tapering trichome with outward pointing spines which do not extend to the apical end. This type is attached to a large, flat basal or accessory cell. *Mentzelia*. Fig. 6.

These types give only a partial presentation of the data gathered. Figures 7-10 illustrate apical portions of trichomes seen on otherwise similar trichomes. Further investigation must be completed before a clear understanding of these observations can be achieved.

Although Loasaceae trichome morphology has been organized into groups of six unicellular forms and one multicellular form, this examination using the scanning electron microscope has revealed trichome morphology that does not satisfy previous criterion.

Several other modifications not presented here also have been observed, but it is not yet known whether these are developmental stages or distinct forms. A study utilizing living specimens is in progress from which it is anticipated that the developmental stages of some of these trichomes can be determined. From current morphological data, it appears that a classification system dividing Loasaceae trichomes into at least the following four (4) major categories would be more appropriate:

1. Stinging emergences
2. Simple acerate to attenuate, of variable length, with or without tuberous swelling
3. Branching or candelabra type
4. Attenuate anchor hairs, with categorization based upon:
   a. Apex form
   b. Barb type and arrangement on shaft
   c. Length of shaft
   d. Base type

