Journal of the Arkansas Academy of Science

Volume 47 Article 44

1993

Enlarged Posterior Maxillary Teeth in the Scarlet Snake, Cemophora coccinea (Serpentes: Colubridae), Using Scanning Electron Microscopy

Stanley E. Trauth
Arkansas State University

Enlarged Posterior Maxillary Teeth in the Scarlet Snake, *Cemophora coccinea* (Serpentes: Colubridae), Using Scanning Electron Microscopy

Stanley E. Trauth
Department of Biological Sciences
Arkansas State University
State University, AR 72467

The scarlet snake, *Cemophora coccinea*, is a small-to-medium sized colubrid species that is distributed throughout Arkansas and the southeastern United States (Conant and Collins, 1991). The species is noted for its coloration (a red, black, and yellow-to-cream banding pattern), fossorial-to-semi-fossorial habits, and distinctively pointed snout. The scarlet snake is also infrequently encountered, and little is known about its biology in Arkansas other than its habitat preference for the sandy and red clay soils (Sutton and McDaniel, 1979; Trauth, 1982) in which it lays eggs and possibly searches for food in the form of the nesting eggs of other reptiles. Many authors have described the egg-eating habits of captive scarlet snakes (Minton and Bechtel, 1958; Palmer and Tregembo, 1970; Ernst and Barbour, 1989). Minton and Bechtel provided scarlet snakes with snake eggs and reported the presence of slits encircling the eggs following feeding episodes. The manner in which scarlet snakes pierce eggshells can be summarized as follows: 1) the jaws are extended forward over the end of an egg until enlarged maxillary teeth (EMT) are engaged into the eggshell, and 2) the egg is then chewed while, at the same time, the snake's body is wrapped over the egg to apply pressure to force out the egg contents. In the present study, the EMT (a morphological characteristic in this species; see Williams and Wilson, 1967) of *C. coccinea* were investigated using scanning electron microscopy to reveal the nature of dental ridges or other structural dental features of the teeth which enable these snakes to penetrate reptilian eggshells.

The left maxilla of six museum specimens (four adult and two juveniles) of *C. coccinea* collected from Arkansas was prepared for scanning electrom microscopy (SEM). Maxillae were excised from jaws using jewelers forceps and microscissors with the aid of a dissecting microscope. After extraneous tissues were removed from the bone, the samples were placed into 70% ethanol. Standard laboratory techniques were then employed to prepare bones for SEM. Maxillae were dehydrated in a graded series of ethanol and amyl acetate, dried in a critical point dryer, mounted onto copper specimen holders, coated with gold/palladium, and viewed with a JEOL 100 CXII TEMSCAN electron microscope at an accelerating voltage of 40 kV. Intact snakes and prepared tissues are deposited in the Arkansas State University Museum of Zoology and in the Electron Microscope Facility, respectively, at Arkansas State University.

Examination of the maxillary bones of *C. coccinea* by SEM revealed striking differences between anterior maxillary teeth and the EMT not only in size but also in dental ridge configuration (Figs. 1 and 2). There were no obvious differences in dental morphology between the sexes or between adults and juveniles. The anterior maxillary teeth exhibit labial dental ridges (Fig. 2B). Similar labial (as well as lingual) ridges have been observed in other colubrids, such as *Thamnophis elegans* (Wright et al., 1979) and *Tantilla gracilis* (Trauth, 1991). However, the EMT of *C. coccinea* appear to lack labial/lingual dental ridges (Fig. 1B). Instead, a very broad distal surface has a blade-like, slicing edge lying posteriad (and looking much like a teardrop in cross-sectional view) along the curvature of the tooth (Fig. 1B; 2C). A corresponding but less conspicuous dental ridge is found near the tooth tip on the mesial surface of EMT (Fig. 1C). This latter condition has also been noted on EMT of *Thamnophis elegans* (Wright et al., 1979) and various other colubrids (Vaeth et al., 1985) as viewed by SEM. On the other hand, *Tantilla gracilis* exhibits labial grooves on the EMT which constitute a rear-fanged or opisthoglyphous condition, and there are no mesial or distal dental ridges on these posterior maxillary teeth (Trauth, 1991).

The shifting of the labial/lingual dental ridges 90° to form a posterior blade and a short anterior ridge on the ETM has been reported in other snakes (Vaeth et al., 1985). No fluting patterns or striations were observed in the maxillary teeth of *C. coccinea* as compared to some colubrid species, whereas the EMT of some colubrids in the subfamily Natricinae possess blade-like posterior ridges (Vaeth et al., 1985).

During the seizing of reptilian eggs, the jaws of *C. coccinea* open widely to allow all maxillary teeth to contact the eggshell surface. In this process, the EMT extend forward; the mesial cutting edge (anterior tooth face) of EMT undoubtedly assists in the initial penetration of the

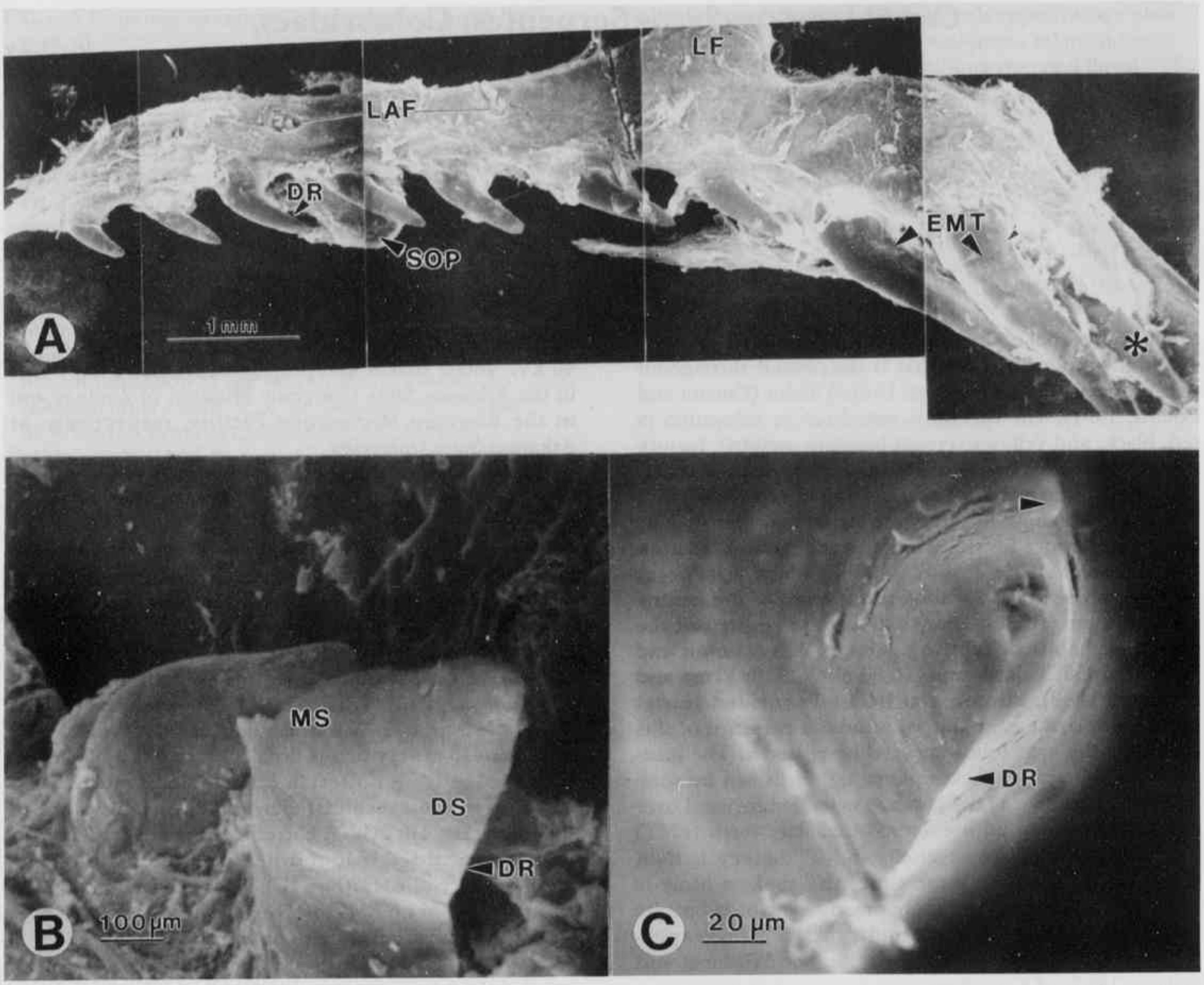

Fig. 1. Scanning electron micrographs of the left maxillary bone and enlarged maxillary teeth of an adult male *Cemophora coccinea*. A. Composite micrograph of entire maxillary bone showing two enlarged maxillary teeth (EMT) preceded by seven anterior teeth. A replacement EMT is identified by an asterisk. LAF = lateral anterior foramina; LF = lateral flange; SOP = suborbital process: DR = dental ridge on an anterior maxillary tooth. B. Magnification of two EMT illustrating the expanded distal surface (DS) which projects a prominent dental ridge (DR); MS = mesial surface. C. Ventral, end-on view of an enlarged maxillary tooth showing the cutting surface of the posterior dental ridge (DR) and a much smaller mesial dental ridge (pointer).

eggshell possibly by creating a trench or slight groove. As the mouth closes and the action of chewing begins, the EMT would follow the groove paths until the posterior surfaces of EMT are forced through the shell and could provide the maximal slitting capability by these teeth.

Literature Cited

Conant, R. and **J.T. Collins**. 1991. A field guide to reptiles and amphibians of eastern and central North America. Houghton Mifflin Co., Boston, 450 pp.

Ernst, C.H. and **R.W. Barbour**. 1989. Snakes of eastern

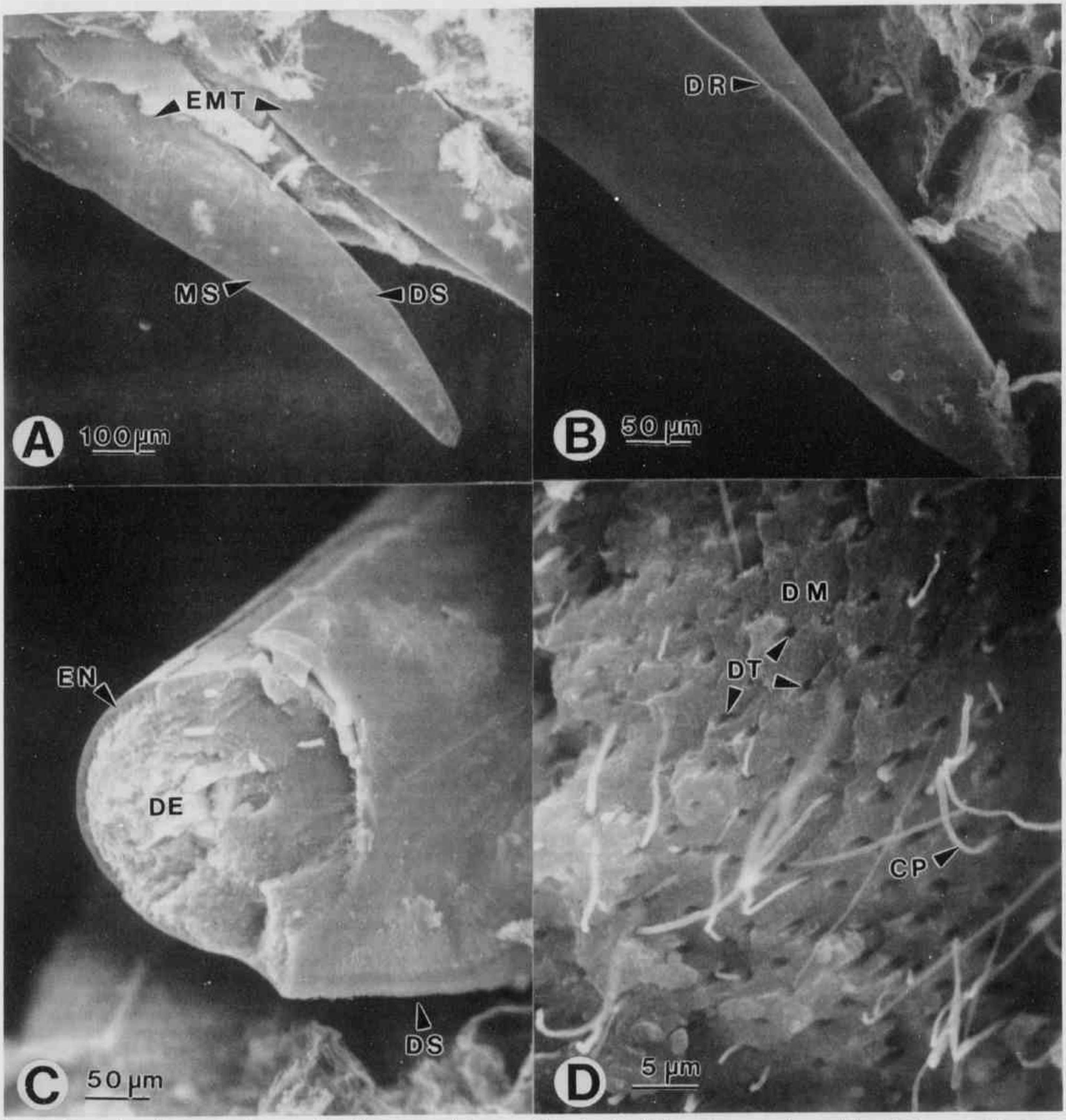

Fig. 2. Scanning electron micrographs of aspects of the maxillary teeth of *Cemophora coccinea*; abbreviations are the same as in Fig.1. A. Labial view of two EMT; note the lack of a labial dental ridge. B. Anterior maxillary tooth illustrating a conspicuous labial dental ridge. C. Ventrolateral view of a broken EMT revealing a thin outer enamel layer and a pulp of dentine. The prominent posterior dental ridge on the distal surface (DS) creates a tear-drop shape in transverse section. D. Magnification of C showing dentinal tubules (DT) interspersed within the dentine matrix (DM); CP = cytoplasmic process of odontoblast cell.

North America. George Mason Univ. Press, Fairfax, Virginia, 282 pp.

Minton, S.A., Jr. and **H.B. Betchel**. 1958. Another Indiana record of *Cemophora coccinea* and a note on egg-eating. Copeia 1958:47.

Palmer, W.M. and **G. Tregembo**. 1970. Notes on the natural history of the scarlet snake *Cemophora coccinea copei* Jan in North Carolina. Herpetologica 26:300-302.

Sutton, K.B. and **V.R. McDaniel**. 1979. Unusual concentration of scarlet snakes (*Cemophora coccinea*) in Village Creek State Park, Arkansas. Proc. Arkansas Acad. Sci. 33:92.

Trauth, S.E. 1982. *Cemophora coccinea* (Scarlet Snake). Reproduction. Herpetol. Rev. 13:126.

Trauth, S.E. 1991. Posterior maxillary fangs of the flathead snake, *Tantilla gracilis* (Serpentes: Colubridae), using scanning electron microscopy. Proc. Arkansas Acad. Sci. 45:133-136.

Vaeth, R.H., D.A. Rossman, and **W. Shoop**. 1985. Observations of tooth surface morphology in snakes. J. Herpetol. 19:20-36.

Williams, D.L. and **L.D. Wilson**. 1967. A review of the colubrid snake genus *Cemophora* Cope. Tulane Stud. Zool. 13:103-124.

Wright, D.L., K.V. Kardong and **K.L. Bentley**. 1979. The functional anatomy of the teeth of the western terrestrial garter snake, *Thamnophis elegans*. Herpetologica 35:223-228.