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MANDIBULAR DENTITION IN SIX SPECIES OF SALAMANDERS, GENUS *PLETHODON* (CAUDATA: PLETHODONTIDAE), FROM ARKANSAS USING SCANNING ELECTRON MICROSCOPY

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ABSTRACT

The mandibular (dentary) dentition of six species of *Plethodon (P. caddoensis, P. dorsalis, P. fourchensis, P. glutinosus, P. ouachitae,* and *P. serratus)* from Arkansas was studied using scanning electron microscopy. In all species, the mandibular teeth were bicuspid, and each tooth possessed a prominent labial cusp and a well-developed, inward-curving lingual cusp. All species showed similar tooth crown features, except *P. caddoensis* which exhibited a reduced tooth height and a reduced lingual cusp (only slightly larger than the labial cusp). We compared our data with other studies on premaxillary, maxillary, and palatal teeth in *Plethodon* and found overall similarities in tooth types. Tooth morphology does not appear to be an effective tool for taxonomic purposes in our *Plethodon* species because of the range of morphological variation in tooth structure.

INTRODUCTION

Amphibian teeth are divided into two parts, a basal pedestal and a distal crown or apex (Lawson, 1965; Moury *et al.*, 1987). Teeth can be either monocuspid or bicuspid with the bicuspid condition being considered primitive and can be either monostichous, in a single row, or polystichous, in multiple rows (Wake, 1963; 1966; 1976). Within the family Plethodontidae, Coss (1974) found that the shape of the premaxillary and maxillary teeth of *Plethodon ouachitae* and *P. glutinosus* were bicuspid with a well-developed labial cusp. He also noted that these teeth in *P. dorsalis* were bicuspid and uniform in size with the labial cusp being more reduced in males (an indication of sexual dimorphism). Stewart (1958) stated that the maxillary and dentary teeth were similar in morphology in *Eurycea bislineata* with the exception of a gradual decrease in size and height posteriorly. Moury *et al.* (1987) studied the ultrastructural and histochemical features of monostichous teeth of the jawbones in *P. cinereus* and compared then to the palatal (polystichous) teeth. They found that the apices, or crowns, were similar in both kinds of teeth with the basal pedestals being heterogenous. Coss (1974) also found that the crowns were similar in external morphology with the Yonahlossee group, the Glutinosus group, and the Wehrlei group in *Plethodon.* He stated that in the Yonahlossee group, the species *P. yonahlossee, P. ouachitae,* and *P. caddoensis* had similar tooth morphologies as were *P. glutinosus* and *P. jordani* of the Glutinosus group. Highton and Larson (1979), using electrophoretic analysis of protein variation, revised the grouping of *Plethodon* and placed *P. ouachitae, P. caddoensis, P. glutinosus,* and *P. fourchensis* into the Glutinosus group, *P. wehreli* and *P. punctatus* in the Wehreli Group, *P. serratus* in the Cinereus group, and *P. dorsalis* in the Welleri group.

Although several studies have compared the morphology of premaxillary, maxillary, and vomerine (palatal) teeth in *Plethodon,* few have mentioned anything other than general morphology of the mandibular or dentary teeth (see Moury *et al.*, 1987). No study using scanning electron microscopy (SEM) has been performed on the mandibular dentition of *Plethodon* species from Arkansas. Herein, we describe the mandibular teeth of six species of *Plethodon (P. caddoensis, P. dorsalis, P. fourchensis, P. glutinosus, P. ouachitae,* and *P. serratus)* from Arkansas using SEM. We also wished to determine interspecific differences and whether mandibular tooth morphology could be used as a reliable taxonomic tool. Lastly, we compare our observations with the current knowledge pertaining to premaxillary and maxillary teeth in *Plethodon.*

MATERIALS AND METHODS

The mandibular teeth of six species of *Plethodon* (N = 29) were examined (*P. caddoensis*—1 female, 3 males; *P. dorsalis*—1 female, 4 males; *P. fourchensis*—3 females, 2 males; *P. glutinosus*—2 females, 3 males; *P. ouachitae*—3 females, 2 males; *P. serratus*—3 females, 2 males). All specimens were collected in Montgomery, Polk, and Stone counties. Animals were sacrificed using a dilute chloretone solution, fixed within 24 hr of collection in 10% formalin, and stored in 70% ethanol. Specimens were then measured and sexed. Lower jaws were excised and placed into vials of 70% ethanol. For SEM, mandibles were dehydrated in a graded series of ethanol and amyl acetate, dried in a critical point dryer, coated with gold/palladium, and viewed with a JEOL 100 CXII TEM/SCAN electron microscope at an accelerating oltage of 40 kV. Jaw teeth were counted after preparation for SEM using a dissecting microscope at 30X. All specimens and preparations are deposited in the Arkansas State University Museum of Zoology. When means are given, they are accompanied by ± two standard errors.

RESULTS

All mandibular teeth examined during this study were bicuspid and exhibited an elongate lingual cusp (except *P. caddoensis*) and a prominent, well-developed labial cusp. Teeth showed basic similarities among all species, and some degree of intraspecific variation was evident.

In *P. dorsalis* and *P. serratus,* teeth showed a well-developed labial cusp with a long inward-curving lingual cusp (Fig. 1A & B). Each tooth also exhibited a posterior curvature as seen in dorsal view (Fig. 2A).

In *P. ouachitae* and *P. glutinosus,* the teeth exhibited a prominent labial cusp with the lingual cusp being curved sharply inward (Fig. 2D-F). The labial cusp was almost vertical (anterior-to-posterior), or slightly curved posteriorly as observed in labial view (Fig. 1F).

Plethodon fourchensis exhibited a reduced labial cusp and a slightly incurving lingual cusp (Fig. 1D; 2B). The labial cusp was either vertical or slightly curved posteriorly.

In *P. caddoensis,* the teeth showed slightly-developed lingual and labial cusps with the lingual cusp being greatly reduced to such a degree that the lingual cusp was only slightly larger than the labial cusp (Fig. 1C; 2C). The teeth exhibited no inward curvature and were nearly vertical in anterior-to-posterior position. Although some variation was evident, both cusps showed a blunt to moderately tapering crest.

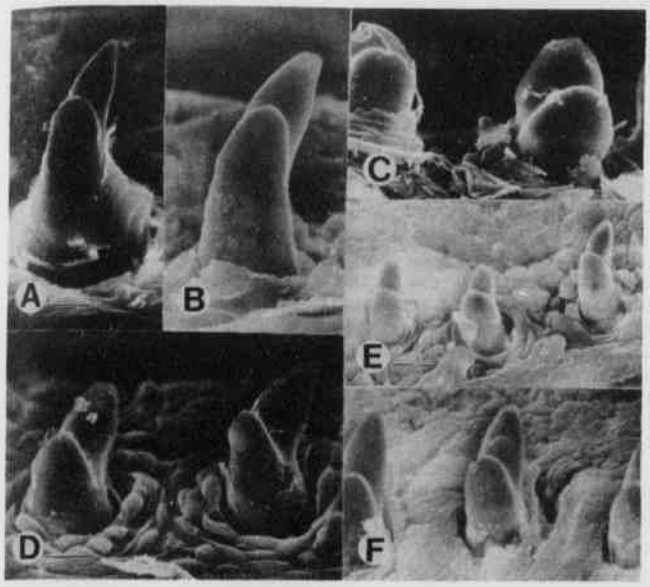

Figure 1. Scanning electron micrographs of mandibular teeth in species of *Plethodon* from Arkansas. All observation are labial views. A. *P. serratus,* 500X; line = 20 μm for A - C. B. *P. dorsalis.* C. *P. caddoensis.* D. *P. fourchensis,* 300X; line = 35 μm. E. *P. dorsalis,* 200X; line = 50 μm for E & F. F. *P. glutinosus.*

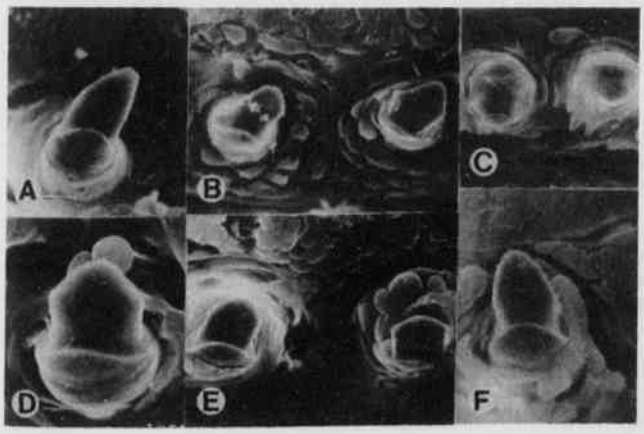

Figure 2. Scanning electron micrographs of mandibular teeth in species of *Plethodon* from Arkansas. All observations are dorsal views. A. *P. serratus,* 300X; line = 35 μm for A - C, E & F. B. *P. fourchensis.* C. *P. caddoensis.* D. *P. ouachitae,* 500X; line = 20 μm. E. *P. ouachitae.* F. *P. glutinosus.*

Within the tribe Plethodontini, tooth number may either increase as body length increases (a primitive condition), or decrease as body length increases (an advanced or specialized condition). In our study, the highest average mandibular tooth counts (including empty sockets) were found in the larger species (*P. caddoensis,* 74.8 ± 4.6; *P. fourchensis,* 77.4 ± 3.9; *P. glutinosus,* 77.6 ± 3.7; *P. ouachitae,* 77.6 ± 3.3). The two smaller species, *P. dorsalis* and *P. serratus,* averaged 46.6 ± 2.7 and 41.6 ± 3.7, respectively.

DISCUSSION

Our results confirm that mandibular tooth morphology in *Plethodon* is basically similar in structure to premaxillary and maxillary teeth as reported by Coss (1974) and Wake (1963, 1966). The teeth were bicuspid with the cusps showing varying degrees of development. The mandibular teeth of *P. glutinosus* and *P. ouachitae* possess the same morphological characteristics as their premaxillary and maxillary teeth. The only visible difference between these teeth was the width of the base of the tooth (widest in *P. ouachitae*). *Plethodon fourchensis* (not studied by Coss, 1974) was similar to *P. glutinosus* and *P. ouachitae,* except for the lingual cusp being sharply curved posteriorly. Although within the same phylogenetic grouping as *P. fourchensis, P. glutinosus,* and *P. ouachitae* (Duncan and Highton, 1979; Highton and Larson, 1979), *P. caddoensis* exhibited a distinctive mandibular tooth morphology with the lingual cusp being greatly reduced. This reduction in size of the lingual cusp would be a specialization for the Glutinosus group.

The tooth counts for the mandibular teeth in *P. glutinosus* and *P. ouachitae* were similar to the maxillary tooth numbers reported by Coss (1974). The mandibular tooth number in *P. dorsalis* and *P. serratus* were also very similar to the premaxillary/maxillary combined counts (Coss, 1974). Although *P. glutinosus* is considered a primitive species while *P. dorsalis* represents an advanced form (see Coss, 1974), the significance of mandibular tooth number and the correlation between body size and tooth number was not assessed during the present study.

Because of the range of variation, mandibular tooth morphology does not appear to be an effective taxonomic tool in *Plethodon* salamanders. The only species that possesses a distinctive cusp morphology is *P. caddoensis.* Otherwise, *Plethodon* species generally exhibit similar tooth structure among the various sets of teeth.

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