Dental Anomalies in Three Species of Shrews from Indiana

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Introduction

Dental anomalies in shrews are not common. Hall (1940) found no cases of missing or extra teeth in 1,837 specimens of North American shrews and Jackson (1928) reported only 5 specimens (0.05%) with dental anomalies out of 10,431 *Sorex* and *Microsorex* examined. Information on dental anomalies in shrews has been best summarized by Choate (1968). Most reported dental anomalies result from a reduction in the number of upper, and to a lesser extent, lower unicuspid teeth (I2, I3, C, P2, P3, 13, and c of Choate 1968). No case of genetically deleted molariforms or first incisors has been reported in shrews. Subnumerary dentitions have been reported from *Sorex araneus* (Reinwaldt 1961), *S. cinereus ohionensis* (Bole and Moulthrop 1942), *S. minutus* (Reinwaldt 1961), *S. obscurus longicauda* (Jackson 1928), *S. tundrensis* (Pruitt 1957), *Blarina brevicauda* and *B. b. carolinensis* (= *B. carolinensis*) (Choate 1968), *B. adamsi* (from the upper Pliocene—Hibbard 1953), *Cryptotis goodwini, C. mexicana, C. nigrescens,* and *C. parva* (Choate 1970), and *Microsorex hoyi* (Jackson 1928).

Supernumerary dental formulas have resulted most often from extra upper unicuspids and have been reported from 1 *Sorex o. obscurus* (Jackson 1928), 1 *S. s. saussurei* (Hooper 1946), 3 *Blarina carolinensis* (Choate 1968), 1 *Crocidura cyanea*, 2 *C. hirta* (Meester 1953), and 3 *C. marquensis* (Dippenaar 1978). Extra unicuspids in the lower jaw have been reported only from *Blarina brevicauda* (Hibbard 1953).

Supernumerary molariform teeth in shrews are especially scarce. Small molariform teeth located behind the lower third molar have been described from 3 (1 unilateral, 1 bilateral) of 514 (0.4%) *Crocidura marquensis* (Dippenaar 1978), 1 (unilateral) of 145 (0.7%) *Blarina b. brevicauda* (Choate 1968) and 1 (unilateral) of 111 (0.9%) *B. b. kirklandi* (Choate 1968). Small extra molariforms posterior to the third upper molars are known from the white-toothed shrews *Crocidura olivieri* (1 unilateral) (Setzer 1957) and *C. hirta* (1 unilateral) (Meester 1959). Choate (1968) indicated that T.E. Lawlor would discuss an instance of supernumerary molars in *Blarina brevicauda* from specimens now housed in the Cleveland Museum. This data, however, has never been reported (T.E. Lawlor, personal communication).

Knowledge of dental variation in Soricidae is important because cranial and dental morphological features are considered the most useful key characters (Junge and Hoffman 1981). Both types of characters preserve well and are considered to be rather dependable although few few data are available to suggest just how dependable. This paper gives an assessment of rates of occurrence of rather pronounced morphological variations within populations. These as well as more subtle variations, if genetically based, are presumably part of the raw material upon which natural selection may act and may help elucidate evolutionary trends in the Soricidae.

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Materials and Methods

During a study of the Southeastern Shrew (*Sorex l. longirostris*) and the Masked Shrew (*S. cinereus lesueurii*) in Vigo County, Indiana (French 1980), skulls of 125 Southeastern Shrews and 214 Masked Shrews were examined for dental anomalies. In addition, skulls of 4 Southeastern Shrews and 115 Masked Shrews were examined from other areas of Indiana and 95 Southeastern Shrews were examined from Alabama.

From Vigo and adjacent Clay counties, Indiana 385 Short-tailed Shrews, *Blarina brevicauda* were examined for dental anomalies, along with 37 from Alabama, 20 from Georgia, 5 from Maine, and 3 from Massachusetts.

Results

Six of 125 (4.8%) Southeastern Shrews from Vigo County exhibited subnumerary dental formulas. In four cases the upper fifth unicuspid was missing (3 unilateral, 1 bilateral) and in two cases the upper fourth unicuspid was missing (both bilateral). Four of these specimens include an adult female and her three nearly weaned offspring which were trapped in a pitfall as a family unit. The tooth missing in the mother is the left upper fifth unicuspid and in the offspring include a right upper fifth unicuspid, the upper fifth unicuspids bilaterally, and what appears to be the upper fourth unicuspids bilaterally. This is the first case in which a family of *S. longirostris* have been captured together away from a nest and the first evidence that dental anomalies in shrews may be inherited and not the result of spontaneous mutation. Specimens in this study also represent the first reported examples of dental anomales in *S. longirostris.*

In Parke County, Indiana two of four Southeastern Shrews had upper unicuspids missing bilaterally, the fourth unicuspids in one and the fifth in the other case. Of ninety-five specimens of *S. longirostris* from Alabama examined, one (1.1%) had the left upper fourth unicuspid missing and two others had missing teeth that appeared to be the result of injury. In one case the right upper fourth unicuspid was missing and in the other the right upper third, fourth and fifth unicuspids were missing. In both of these latter cases the teeth were not crowded and large gaps were present where the teeth should have been located.

In *S. cinereus* two of 214 (0.9%) from Vigo County had subnumerary dental formulas. In one, the upper fifth unicuspids were missing bilaterally and in the other specimen this tooth was missing on the right and was peg-like on the left. One of 15 specimens from Wabash County, Indiana was missing the upper fifth unicuspids on both sides. No cases were found in either species which involved molariform teeth.

The only case of supernumerary dentition in *Sorex* was a Southeastern Shrew from Vigo County in which there were six upper unicuspids on the left side. This is a 0.8% occurrence. The extra tooth appeared to be between the third and fourth unicuspid (see Figure 1).

Palmer (1937) noted a greater incidence of subnumerary dentitions in smaller subspecies of the broad-footed mole, *Scapanus latimanus*, than in larger subspecies, a relationship that he considered due to crowding of the teeth in the smaller skulls. Choate (1968) found the same relationship between two forms of *Blarina* that are now considered closely related species, *B. brevicauda* and the much smaller *B. carolinensis* and in his study only two of 145 (1.4%) specimens of *B. b. brevicauda* had subnumerary complements of unicuspids, displaced unicuspids, or diminutive unicuspids; abnormalities that Choate also considers related to tooth crowding.

The same relationship seems to exist between *S. cinereus* and *S. longirostris.* In Vigo County 4.8% of the *S. longirostris* and 0.9% of the *S. cinereus* displayed subnumerary dental complements. As Miller (1895) noted, the palate of *S. longirostris*

FIGURE 1. Dental patterns of *Sorex longirostris* and *S. cinereus*. Patterns of *S. longirostris* are on the left and include specimens with the fifth unicuspid missing and the fourth smaller than the third (A), the fifth unicuspid missing and the third and fourth about the same size (B), a sixth unicuspid between the third and fourth (C), and the typical dental pattern (D). Patterns of *S. cinereus* are on the right and include specimens with the fifth unicuspid missing and the other unicuspids of typical proportions (E), the fifth unicuspid displaced and unusually large (F), the typical dental pattern of *S. cinereus ohioensis* with the third unicuspid smaller than the fourth (G), and the typical dental pattern of other races of *S. cinereus* (H).

is "remarkably broad and short," a character which results in crowding and thus an increased frequency of related tooth abnormalities.

Seventeen of 384 (4.4%) Vigo and Clay County *Blarina* had reduced, displaced, or missing unicuspid teeth. Thirteen (3.4%) specimens had anomalies in the upper and 4 (1.0%) in the lower unicuspid tooth rows. In at least 6 of the 14 skulls with missing teeth these teeth appeared to have been lost due to injury. In the remaining eight cases (2.1%) the teeth apparently were genetically deleted, in five cases the fifth upper unicuspids were missing (3 unilateral, 2 bilateral), and in one case each, the third and fourth upper unicuspids and first lower unicuspid were missing unilaterally. Choate (1968) reported subnumerary complements of unicuspids, displaced unicuspids, or diminutive unicuspids in two of 145 (1.4%) of the Short-tailed Shrews *B. brevicauda* from the University of Kansas Museum of Natural History collection.

Two especially unusual cases of supernumerary dentitions were found in Vigo County *Blarina*. On 8 April 1977 an adult pregnant specimen (ISU#5315) with heavily worn teeth was trapped at Coal Creek and Indiana Highway 63. This specimen has two extra molariform teeth positioned bilaterally and posterior to the upper third molars (Figure 2A). On 14 October 1978 a juvenile female (ISU#5316) from this locality was

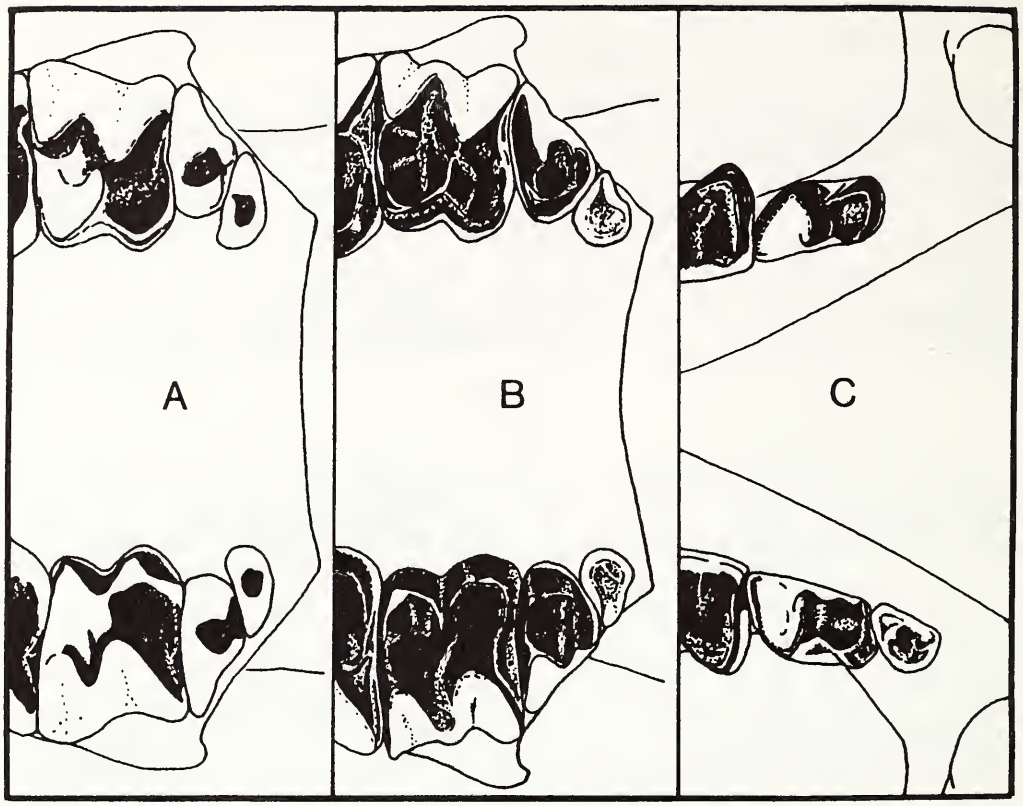

FIGURE 2. A—Posterior end of *Blarina brevicauda* (ISU#5315) palate showing two extra molariform teeth positioned bilaterally and posterior to the upper third molars.
B—Same condition as in 1A in a younger specimen (ISU#5316).
C—Posterior end of *B. brevicauda* (ISU#5316) lower tooth rows showing one extra molar posterior to the left lower third molar.

discovered with the same condition of bilateral extra molariforms posterior to the upper third molars (Figure 2B) and also with an extra tooth posterior to the left lower third molar (Figure 2C). The ages and length of time between captures of these two specimens eliminates the possibility that the second specimen was the offspring of the first but they well may have been closely related individuals. These two *Blarina* appear to represent the first reported cases of bilateral supernumerary upper molariform teeth in shrews. Seventy-two *Blarina* specimens were collected at this locality between 1977 and 1979 but no other supernumerary dentitions were discovered.

Of 65 *Blarina* examined from outside Indiana no additional anomalies involving molariform teeth were found but one specimen from Massachusetts (ISU#5317) had six upper right unicuspids. The extra unicuspid in this specimen is lingual to the fourth unicuspid (P2 of Choate 1968).

Several other abnormalities probably not directly related to crowding also were found. Two Southeastern Shrews, one from Vigo County and one from Alabama had asymmetrical rostrums. The rostrums were curved to the left and displayed a noticeable reduction in the size of several of the unicuspid teeth on the shorter side. One Masked Shrew from Wabash County, Indiana had a steeply sloping rostrum resulting in very uneven wear of the teeth. Another from Vigo County had an abnormally large upper left fifth unicuspid which was separated from the fourth by a noticeable gap. This normally diminutive tooth was as large as the fourth unicuspid and just as well pigmented

(see Figure 1). It is not known if this abnormality was present on both sides because the skull was crushed and part of the right maxilla was missing.

Normally the upper fifth unicuspid is not pigmented, even in very young individuals, but 10 Masked and one Southeastern Shrew from Indiana had this tooth pigmented. Four Southeastern Shrews from Alabama also had pigment on this tooth. In young specimens the upper third unicuspid is usually pigmented but two young Southeastern Shrews from Indiana lacked pigment on this tooth. Two of the 214 Vigo County *S. cinereus* displayed unusually light colored dental pigment but no complete absence of pigment was found. Bole and Moulthrop (1942) reported a series of *S. c. ohioensis* from Cuyahoga County, Ohio that "show practically no pigmentation in the teeth, 2 specimens from this locality being absolutely without dental pigment."

Hall (1940) had no instances of diseased teeth in 1837 *Sorex* but in this study four of 132 (3.0%) Southeastern Shrews and five of 260 (1.9%) Masked Shrews from Indiana had decayed teeth. Two of 95 (2.1%) Southeastern Shrews from Alabama also had decayed teeth. All but one specimen with decayed teeth (a Vigo County *S. longirostris*) were old shrews with heavy tooth wear.

Discussion

Within the Soricidae the basic dental formula consists of 32 teeth (i 3/1, c 1/1, pm 3/1, m 3/3 x 2 = 32), including 5 upper unicuspids and 2 lower unicuspids. In North America this full dental complement is found in the genera *Sorex, Microsorex,* and *Blarina* although 2, rather than the usual 1 unicuspids are vestigial in *Microsorex*. Reduced dentitions are typical of *Cryptotis* (30 teeth) and *Notiosorex* (28 teeth), each the result of losses of upper unicuspids. In this study, reductions in upper unicuspid numbers was the most frequent anomaly encountered and appears to be a genetically inherited character and increases in frequency in species with shorter, more crowded toothrows.

The only variation in the normal mandibular dentitions of recent Soricidae is an extra unicuspid between the second and third tooth (c and p 4) in the African genus *Myosorex* and rarely in its geographically and phylogenetically near relative *Surdisorex norae*. No anomalies resembling this condition were found in this study but one case has previously been reported from *Blarina* (Hibbard 1953). No examples of variations in molariform teeth in recent species of Soricidae normally occur although other members of the order Insectivora, such as moles, golden moles, elephant shrews, and tenrecs, do possess greater molariform complements.

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