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AGE DETERMINATION OF EUROPEAN WILD BOAR

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Populations of European wild boars (*Sus scrofa*) have increased recently in Spain (Tellería and Sáez-Royuela 1985) and in other parts of Europe (Sáez-Royuela and Tellería 1986), leading to studies on wild boar biology and management (Dietrich 1984, Spitz and Pepin 1984). Most studies have used aging procedures based on tooth eruption and replacement (Habermehl 1961, Matschke 1967), but few have considered alternative methods to age boars.

We compare ages obtained by counting incremental lines in tooth cementum (Morris 1972, Spinage 1973, Grue and Jensen 1979, Fancy 1980) with 2 other methods: width of pulp cavity (e.g., Graf and Wandeler 1984) and analysis of eruption patterns of teeth (Habermehl 1961).

METHODS

During 1983–1985 we collected 84 skulls (44 M, 40 F) at Burgos Province (Central Spain). Teeth and jaws were studied according to incremental lines in tooth cementum, pulp cavity, and dentition.

The root of the first permanent incisor (I_1) was decalcified in nitric acid (3%) for 48–96 hours, sectioned (30μ) on a freezing microtome, immersed in Ehrlich's hematoxylin for 24 hours, and mounted on a slide for microscopic examination (Klevezal' and Kleinenberg 1967). Incremental lines on the lingual face of the tooth were counted according to Quere and Pascal (1984). We simultaneously evaluated all incisor teeth (I_1, I_2, and I_3) from 20 skulls to evaluate how deposition of incremental lines affected age assessments.

To examine pulp cavity, we radiographed incisor teeth (I_1 and I_2) using a medical x-ray machine of 120 Kv and 400 mA. The width of each incisor tooth (T) and its pulp cavity (P) was measured at the point of widest pulpar cavity (Fig. 1) to obtain the ratio R(I) = P/T. This method has been used for carnivores (Graf

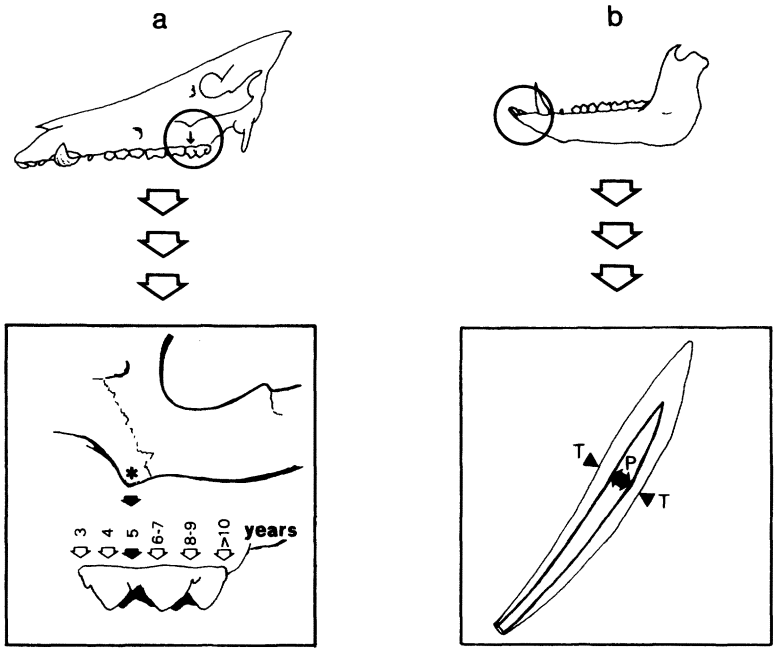

Fig. 1. Two methods of aging European wild boar. a. Dub's method (Habermehl 1961) is calculated by observing juxtaposition of spina ristae facialis (*) relative to the position of upper molar (M^3). b. Pulp cavity method uses measurements on radiographed teeth, P = width of tooth.

and Wandeler 1982, Kuehn and Berg 1983, Jenks et al. 1984), but not for wild boar.

The order of tooth eruption allows a correct age determination of wild boars during the first 26 months of life (Habermehl 1961, Matschke 1967). Ages of older animals are often determined by studying the position of the spina ristae facialis with regard to the third upper molar (Dub's method [Habermehl 1961]). Age is calculated by observing juxtaposition of spina ristae facialis relative to position of the upper molar (M^3) cusps (Fig. 1).

RESULTS

A dark staining cementum line can be detected first in October, but most line deposition occurs in the winter. During March–September, none of the 12 skulls we studied had staining cementum line at I_1, but 47 of 71 (66.2%) had this line during October–February and 28 of 30 (93.3%) during January–February. The first cementum line appears on I_1 in months 21–23. Parturition in wild boars in the study area occurs in March (Sáez-Royuela and Tellería 1987).

Results obtained by comparing paired I_1 and I_2 incisor teeth from each of 20 selected skulls were similar: 1 pair showed 1 line, 7 pairs showed 2, 4 pairs showed 3, 2 pairs showed 4, 1 pair showed 5, and 1 pair showed 8. Only 4 skulls exhibited differences between I_1 and I_2 (3–2, 4–3, 5–4, and 5–4 lines for I_1–I_2, respectively). However, I_3 showed 1 line more than the rest of incisor teeth in all skulls, except 4 skulls in which I_3 had 2 lines more than I_2. These differences between patterns of line deposition agree with chronological order of eruption of these teeth: I_1 appears during the twelfth month of life, I_2 during the twentieth month, and I_3 around the twelfth month (Habermehl 1961).

We measured pulp cavity ratios in 50 I_1 (27 M, 23 F) and 49 I_2 (28 M, 21 F) incisors. There were no differences ($P > 0.05$) in ratio of pulp cavity (R[I_1] and R[I_2]) between males and females (Mann-Whitney *U*-test comparisons between males and females grouped in 5 inter-

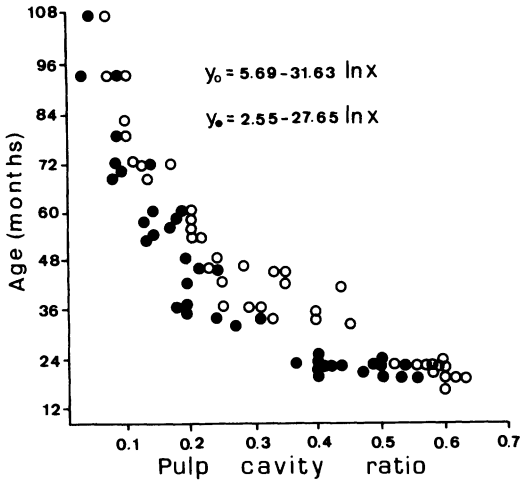

Fig. 2. Relationship between pulp cavity ratio (R) and age of European wild boar obtained by means of cementum layers in incisors. ○ = I_2, ● = I_1.

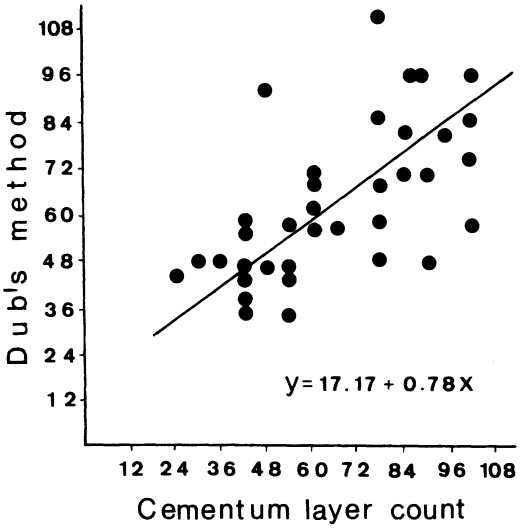

Fig. 3. Relationship between ages of European wild boar obtained by Dub's method and cementum layers count.

vals: 2, 2–3, 3–4, 4–5, and >5 yrs). Therefore, all samples were pooled. Results showed a strong correlation ($r^2 = 0.92$, $n = 50$, $P < 0.001$; $r^2 = 0.94$, $n = 49$, $P < 0.001$) between pulp cavity ratio and the age obtained by counting incisor cementum layers (Fig. 2).

The relationship between ages obtained by Dub's method and ages obtained by means of incremental layers was poor ($r^2 = 0.35$, $n = 36$, $P < 0.01$) (Fig. 3). The predictive value of Dub's method is lower than that obtained using pulp cavity analysis. This result can be attributed to variability of the M^3 used in this method (Cabon 1959). There was little agreement between results of the 2 methods of absolute age determination (T[36] = 180, $P < 0.01$, Wilcoxon test between ages obtained by means of Dub's and count of incremental lines methods).

DISCUSSION AND MANAGEMENT RECOMMENDATIONS

European wild boars in Spain deposit incremental lines in incisor tooth cementum seasonally. If lines were not deposited annually, this pattern of cementum banding would not be evident (Garshelis 1984). Counting incremental lines in tooth cementum appears to provide accurate age assessments, but it is important to consider problems related to this method, including differences among results from some incisors and interpreter bias (Klevezal' and Kleinenberg 1967, Morris 1972, Grue and Jensen 1979, Larson and Taber 1980). However, counting cementum lines is time consuming. Therefore, it may be useful to try alternative approaches. Dub's method is easier and requires less time, but results disagree with those obtained by counting incremental lines in tooth cementum.

Our results show that the pulp cavity ratio seems to be a less variable age index and can be used in absolute age estimates by analyzing its relationships with results obtained by counting incremental lines in tooth cementum. However, the consistency of this relationship should be tested in managed populations of wild boars and with known-aged animals before being used for absolute age estimates. In short, the pulp cavity ratio method may be a valuable approach to age determination of wild boars in current management practices because it is easy and inexpensive to apply (e.g.,

only 1 tooth/individual is needed; many teeth can be radiographed and measured in a few hours). In addition, this method works on old wild boars (see Fig. 2), unlike other relative aging methods (e.g., crystalline weights and epiphysis fusion) that fail to age animals 2–3 years old (Sweeney et al. 1970, Wijngaarden-Baker and Maliepard 1982).

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