ANOMALIES IN THE DENTITION OF THE FOX, *VULPES VULPES* (LINNAEUS, 1758), FROM CONTINENTAL WESTERN EUROPE

by

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While studying skulls of Foxes from western Europe for taxonomical purposes, the authors were struck by the high percentage of skulls not showing the normal tooth-formula. However, after a literature survey, it became clear this phenomenon is not rare in Canidae (Colyer, 1936; Hall, 1940; Reinwaldt, 1963, and Fleischer, 1967). But the occurrence of anomalies in the dentition may vary geographically and as such may have taxonomical significance (e.g., in *Talpa europaea*; see Stein, 1963). Thus it was thought useful to publish our data.

Our notes concern samples from three different populations, viz., from the Netherlands, from western France (roughly the area between Rennes and Bordeaux) and from southern France (southeastern slopes of the Cevennes). For the loan and/or the acquisition of Fox skulls from the mentioned regions we are grateful to Prof. J. A. Rioux (Montpellier), Monsieur F. Chanudet (La Rochelle), Madame J. Baudouin-Bodin (Nantes), Dr. A. M. Husson (Leiden) and to the staff, in particular to Dr. J. L. van Haaften, of the Institute of Biological Field Research (ITBON) at Arnhem.

The most common anomaly encountered is the absence of certain teeth (see tables I to III). As we found no significant statistical difference between the left and the right side of the skull in relation to the absence of teeth, missing teeth from both sides were counted together. Obviously, no striking differences exist between the three samples, perhaps with the exception of the rather high percentage of missing first and second lower premolars in males in the sample from western France.

It is evident that sometimes it is impossible to state whether a certain premolar or a last lower molar were never present or whether these peg-like teeth have been lost early in life. This uncertainty may influence the values we obtained by calculating the percentages of teeth missing.

Taking all the skulls together and expressing the absence of elements in percentages (table IV), it is more apparent which teeth tend to be absent. In view of the rather high percentages of missing first premolars and third molars in the mandibles, one is almost forced to believe, that an evolutionary trend is working in *Vulpes vulpes* towards a reduction of the dentition. As compared to the archaic dental formula in the Bat-eared Fox, *Otocyon megalotis* (Desmarest, 1822), with four premolars and four molars in both upper and lower jaws, the normal dental formula of *Vulpes vulpes* shows already a reduction. However, some authors, e.g., Weber (1904), consider the high number of teeth in *Otocyon* a secondary character.

Reinwaldt (1963), in his studies on dental anomalies of Foxes from southern Sweden, notes also the absence of the last lower molar in 10% of the skulls. However, Reinwaldt does *not* mention the absence of the first lower premolar or other premolars. Hall (1940), on the other hand, found that in 5.7% of the skulls of American Foxes he studied, premolars (all the premolars from both jaws taken together) are lacking; the percentage of missing last lower molars is 10.7%, about the same value as found by Reinwaldt and by us.

Comparing the males of all three samples with the females of all three samples (table V), we come to the conclusion that in males the tendency to lack one or two lower first premolars is greater than in females. Also the absence of the first lower incisor occurs more often in males than in females.

Other anomalies in the dentition, or related to it, are much rarer. Striking is one skull, which shows protusion of the mandibular incisors (fig. 1, above) and another skull which shows protusion of the maxillary incisors (fig. 1, below; a normal skull is figured between the two abnormal ones). We use here the terminology of Colyer (1936), who describes similar

Table I-III. Missing teeth in skulls of Foxes from the Netherlands, from western France and from southern France.

Table I. Sample from the Netherlands; n = 145

63 ♂♂				65 ♀♀				17 sex ?			
I^1		I_1	–	I^1	–	I_1	1	I^1	–	I_1	–
I^2	–	I_2	–	I^2	–	I_2	–	I^2	–	I_2	–
I^3	–	I_3	–	I^3	–	I_3	–	I^3	–	I_3	–
C	–	C	–	C	1	C	–	C	–	C	–
P^1	–	P_1	–	P^1	1	P_1	1	P^1	–	P_1	3
P^2	–	P_2	–	P^2	–	P_2	1	P^2	–	P_2	–
P^3	–	P_3	–	P^3	–	P_3	–	P^3		P_3	–
P^4	–	P_4	–	P^4	–	P_4	–	P^4	–	P_4	–
M^1	1	M_1	–	M^1	–	M_1	–	M^1	–	M_1	–
M^2	–	M_2	–	M^2	–	M_2	1	M^2	–	M_2	–
		M_3	3			M_3	5			M_3	3

Table II. Sample from western France ; n = 78

37 ♂♂				13 ♀♀				28 sex ?			
I^1	3	I_1	–	I^1	–	I_1	–	I^1	2	I_1	2
I^2	–	I_2	–	I^2	–	I_2	–	I^2	1	I_2	–
I^3	–	I_3	–	I^3	–	I_3	–	I^3	–	I_3	–
C	–	C	–	C	–	C	–	C	–	C	–
P^1	–	P_1	8	P^1	–	P_1	–	P^1	3	P_1	2
P^2	1	P_2	3	P^2	–	P_2	–	P^2	–	P_2	–
P^3	–	P_3	1	P^3	–	P_3	–	P^3	–	P_3	–
P^4	–	P_4	–	P^4	–	P_4	–	P^4	–	P_4	–
M^1	–	M_1	–	M^1	–	M_1	–	M^1	–	M_1	–
M^2	–	M_2	–	M^2	–	M_2	–	M^2	–	M_2	–
		M_3	4			M_3	1			M_3	3

Table III. Sample from southern France ; n = 70

26 ♂♂				22 ♀♀				22 sex ?			
I^1	1	I_1	–	I^1	–	I_1	–	I^1	–	I_1	–
I^2	–	I_2	1	I^2	–	I_2	–	I^2	–	I_2	–
I^3	–	I_3	–	I^3	–	I_3	–	I^3	–	I_3	–
C	–	C	–	C	–	C	–	C	–	C	–
P^1	–	P_1	3	P^1	–	P_1	3	P^1	–	P_1	–
P^2	–	P_2	–	P^2	2	P_2	2	P^2	–	P_2	3
P^3	–	P_3	–	P^3	–	P_3	–	P^3	–	P_3	–
P^4	–	P_4	–	P^4	–	P_4	–	P^4	–	P_4	–
M^1	–	M_1	–	M^1	–	M_1	–	M^1	–	M_1	–
M^2	–	M_2	–	M^2	–	M_2	–	M^2	–	M_2	–
		M_3	5			M_3	5			M_3	3

cases in the Fox, as in that way we avoid the necessity of stating whether the mandibles are too short or too long or whether the rostral parts of the skulls are abnormal. Both skulls are from Foxes shot in the Netherlands in January 1968. Reinwaldt mentions one Fox, a male, from southern Sweden, with too short a rostrum. According to Colyer, these anomalies may be hereditary.

In our material we noted several cases of supernumerary teeth. In a female Fox from the Netherlands we found an extra tooth at the inner side of the left lower first molar (fig. 2, right). A fourth lower molar we noted in the mandibles of an animal (sex unknown) from western France (fig. 2, middle). In a male Fox from the Netherlands a M_4 (right side) is also present, together with on both sides an extra root on the second lower premolar. These externally placed extra roots (and tubercles) were also found in a Fox (sex unknown) from southern France (fig. 2, left).

Doubling of teeth has been noted in an animal from the Netherlands (sex unknown); this pertains

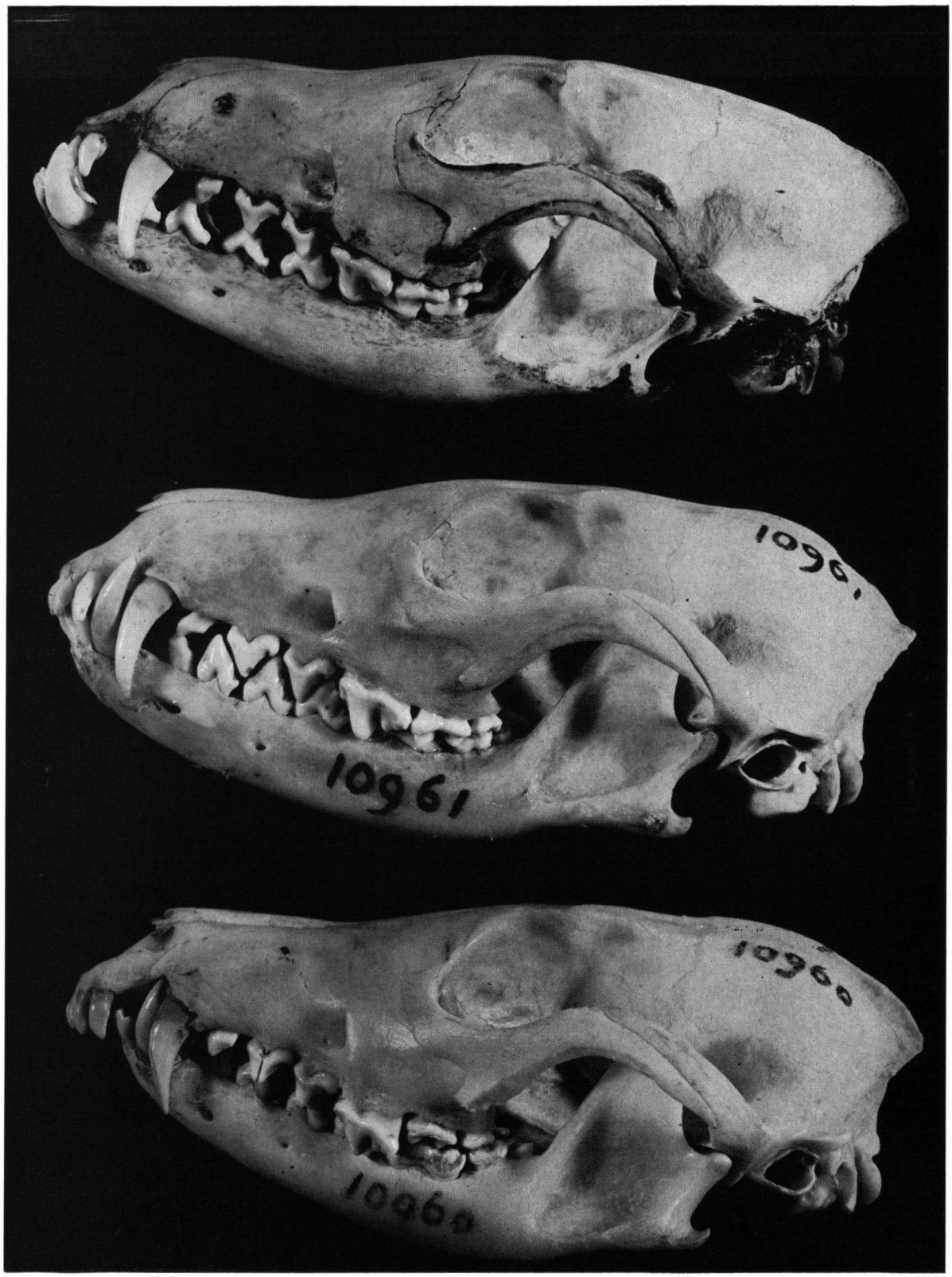

Fig. 1. Skull of *Vulpes vulpes* showing protusion of the mandibular incisors (above), a normal skull of a Fox (middle) and a Fox skull showing protusion of the maxillary incisors (below).

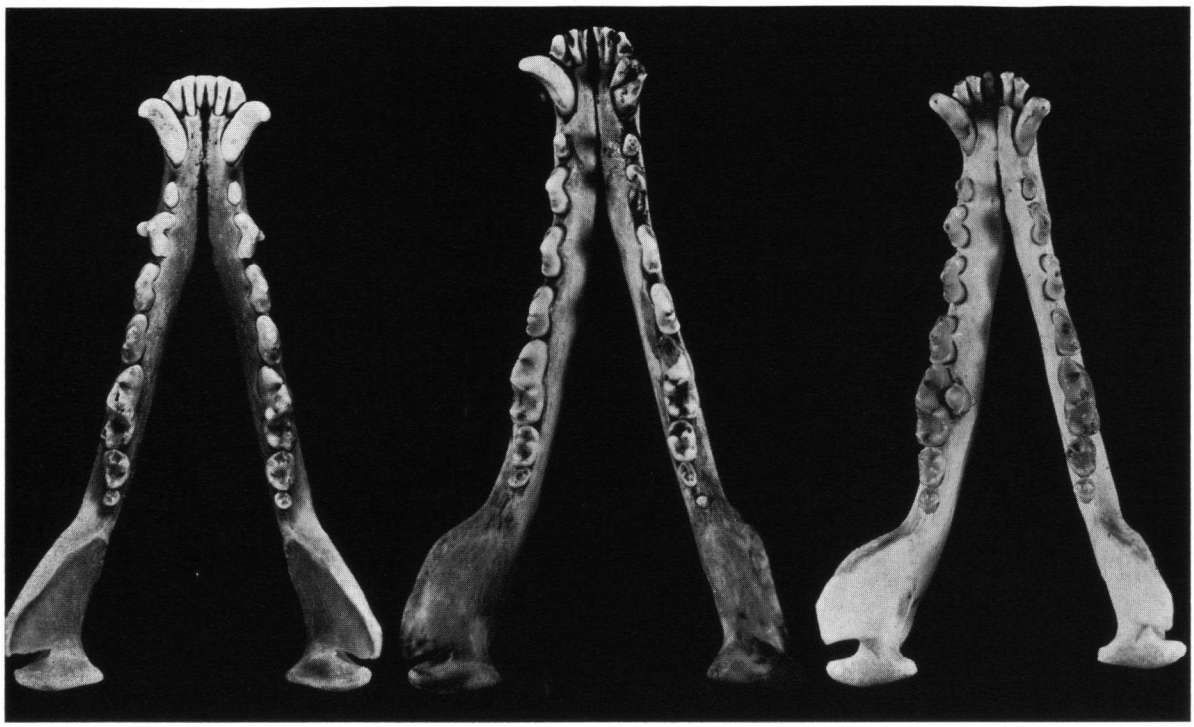

Fig. 2. Mandibles of Foxes showing anomalies in the dentition. At left, abnormal second premolars; in the middle a supernumerary fourth molar at the right side; at right a supernumerary tooth at the inner side of the first molar at the left side.

to the first upper premolars. On the right side there are two separate teeth, each with its own root; on the left side the elements are not completely separated. Doubling of the first upper premolar, only on one side, we found in two skulls (sex unknown) from southern France. In one of these two specimens this phenomenon was coupled with the loss of both last lower molars. In table VI all these supernumerary teeth are enumerated again.

Table IV. Percentages of teeth missing in 293 skulls of Foxes from continental western Europe.

I^1	6 = 2.0%	I_1	3 = 1.0%
I^2	-	I_2	1 = 0.3%
I^3	-	I_3	-
C	1 = 0.3%	C	-
P^1	4 = 1.4%	P_1	19 = 6.5%
P^2	3 = 1.0%	P_2	9 = 3.1%
P^3	-	P_3	1 = 0.3%
P^4	-	P_4	-
M^1	1 = 0.3%	M_1	-
M^2	-	M_2	1 = 0.3%
		M_3	32 = 10.9%

Table V. Sexual differences in percentages of teeth missing in skulls of Foxes from continental western Europe.

126 ♂♂				100 ♀♀			
I^1	3.2%	I_1	—	I^1	—	I_1	1%
I^2	—	I_2	0.8%	I^2	—	I_2	—
I^3	—	I_3	—	I^3	—	I_3	—
C	—	C	—	C	1%	C	—
P^1	—	P_1	8.7%	P^1	1%	P_1	4%
P^2	0.8%	P_2	2.4%	P^2	2%	P_2	3%
P^3	—	P_3	0.8%	P^3	—	P_3	—
P^4	—	P_4	—	P^4	—	P_4	—
M^1	0.8%	M_1	—	M^1	—	M_1	—
M^2	—	M_2	—	M^2	—	M_2	1%
		M_3	9.5%			M_3	11%

In the classical study by Colyer (1936) all the above mentioned aberrations have been treated except for the lower second premolars with extra tubercle and root (fig. 2, right). Since we found this aberration in a sample from the Netherlands as well as among the Fox skulls from southern France, this is an indication that the aberration is not the result of a mutation restricted to one locality only.

Table VI. Supernumerary teeth in 293 skulls of *Vulpes vulpes* from continental western Europe.

Reg. nr.	sex	supernumerary teeth	sample
ZMA 8797	?	P^1 dex.	S. France
ZMA 8765	?	P^1 sin. (M_3 sin. + dex. missing)	S. France
ZMA 8798	?	P_2 sin. + dex. with extra root	S. France
ZMA 9020	?	P^1 sin. + dex.	S. France
ZMA 11,141	♀	M_1 sin.	Netherlands
RMNH 11,430	♂	P_2 sin. + dex. with extra root + M_4 dex.	Netherlands
RMNH 11,229	?	P^1 dex. (P_1 dex. missing)	Netherlands
ZMA 10,628	?	M_4 dex.	W. France

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