

Ancestral characters in the dentition of the weasel *Mustela nivalis* L. (Carnivora, Mustelidae)

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Four dental structures, characteristic of ancestral mustelines, found in 3 out of 254 specimens of recent *Mustela nivalis* L. from Poland are described. They are an additional cusp posterior to the protoconid on P₄, two small second upper molars, and a large elongate two-rooted M₂ with three distinct cusps. These structures have been compared with similar ones described earlier in other members of the genus *Mustela*.

The structures are considered to be the results of the expression of genes that occurred much more frequently in the ancestors, and which are now rare but still present in the gene pools of the living species of *Mustela*.

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1. Introduction

The general trend in the evolution of the cheek dentition in the Carnivora is the enlargement of the upper and lower carnassials, and simultaneous reduction of the remaining teeth, including loss of the peripheral teeth of the tooth row. The living carnivores occasionally show the presence of an extra anteriormost premolar (e.g. Hensel 1879, Hall 1940, Van Gelder 1959, Manville 1963, Hell 1966, Hochstrasser 1970, Kratochvíl 1971) and posteriormost molars (e.g. Vereshchagin 1959, Kurtén 1963, Hell 1966, 1968, Neuenschwander & Lüps 1975, Glas 1977, Ruprecht 1978), usually lost in the course of evolution. Ancestral tooth patterns also occur (e.g. Kurtén 1963, Mazák 1964, Pavlinov 1974, Hoekstra 1975).

Examination of such 'throw-backs' to the ancestral conditions may help elucidate the origin of the living species. In this paper the author describes three such cases found when inspecting the permanent dentitions of recent *Mustela nivalis*

L. in the Mammals Research Institute, Polish Academy of Sciences, Białowieża (no. 112384 and 51404), the Museum of Natural History, Wrocław University, Wrocław (no. 43), and the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, Cracow (a total of 254 skulls).

2. Description

Data on the three weasels with ancestral characters are shown in Table 1.

In weasel no. 43 the left P₄ has a distinct additional cusp situated just behind the protoconid (Fig. 1). This tooth also differs in size from its right counterpart, which is characteristic of this species.

Weasels no. 51404 and no. 112384 have one additional upper molar each, in the right (Fig. 4a) and the left (Fig. 4b) jaw, respectively. These are non-occluding, one-rooted teeth, which slant

Table 1. Characteristics and measurements (mm) of three weasels with ancestral characters. CB = condylobasal skull length, L = greatest tooth length, W = greatest tooth width, D = greatest tooth crown diameter, l = left, r = right.

Spec. no.	Age and sex	Locality	CB	LP ₄	WP ₄	DM ¹	DM ²	DM ¹ /DM ²
43	Adult male	Unknown	40.8	l 2.53 r 2.34	l 1.40 r 1.38			
51404	Adult female	Barcice near Sztum (Poland)	Skull damaged			r 2.78	0.96	2.90
112384	Juvenile male	Czerwone Bagno near Rajgród (Poland)	38.6			l 3.23	0.85	3.80

Table 2. Measurements (mm) of the lower molars in weasel no. 112384, in the Norwegian specimen of this species (no. M-1443 Zoological Museum of the University of Oslo) (data from Mazák 1964) and in the Dutch specimen of *Mustela putorius* L. (No. 1114 B. Hoekstra's private collection) (data from Hoekstra 1975). Abbreviations as in Table 1.

Spec. no.	Sex	CB		LM ₁	LM ₂	WM ₂	LM ₁ /LM ₂
112384	Male	38.6	l	4.43	1.07	0.99	4.14
			r	4.44	1.72	1.36	2.58
M-1443	Male	32.7	l	3.35	1.80	0.95	1.86
			r	3.35	2.00	1.00	1.67
1114	?	±64.3	l	7.30	4.80	-	1.52
			r	7.25	2.25	-	3.22

backwards behind the internal part of M¹. In the occlusal view the outlines of the crowns resemble a triangle with rounded vertices (Fig. 4a) and an ellipse (Fig. 4b), respectively. In no. 51404 the additional tooth is relatively much larger and the pattern more complicated than in no. 112384; the crown has a bucco-lingual ridge which culminates in the centre (Fig. 4a), whereas in no. 112384 there is only a conical cusp (Fig. 4b).

In addition to the extra upper molar, weasel no. 112384 has an atypically developed right M₂. This tooth is elongated and distinctly larger than its left counterpart (see Table 2 and Fig. 5). It has two roots, of which the anterior is larger than the posterior (Figs. 3a and 3b), and three noticeable cusps of the crown, of which the middle one is the highest (Figs. 2, 3a and 3b). All the cusps are situated along the long axis of the tooth, which is oblique in relation to the mandibular branch (Figs. 5 and 2).

3. Discussion

None of the structures described above is characteristic of the genus *Mustela*. Nevertheless, they occur from time to time in large series of dentitions of living members of this genus. The additional, unilateral cusp on P₄ in no. 43 (Fig. 1) is, as far as I know, the first occurrence described in recent *Mustela*, but structures similar to the other ones described here have been recorded before.

Additional upper molars were observed in *Mustela putorius* L., in 3 out of 385 specimens from the Netherlands (Glas 1977) and in 3 out of 801 specimens from Poland (Ruprecht 1978), as well as in *Mustela nivalis* in 4 out of 93 specimens from Hessen (Neuenschwander & Lüps 1975). In two weasels they occurred on both sides, whereas in the other cases they were found (as in the specimens described by me) either in the left or in



Fig. 1. Lateral view of the cheek tooth row in the left mandibular branch of weasel no. 43.

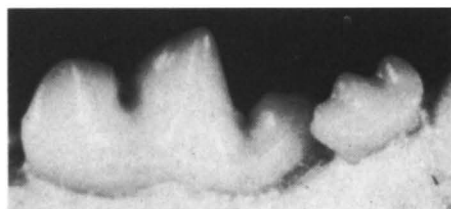


Fig. 2. Medial view of the right lower molars in weasel no. 112384.

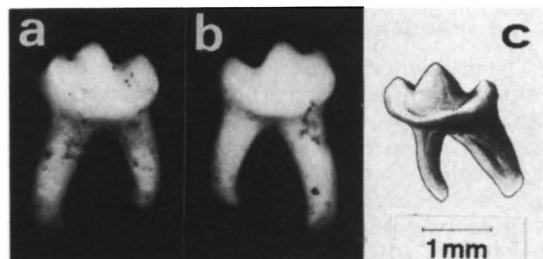


Fig. 3. Medial (a) and lateral (b) views of the right second lower molar in weasel no. 112384 and (c) lateral view of the left one in the Norwegian specimen of this species (no. M-1443, Zoological Museum of the University of Oslo) (drawing after Mazák 1964).

the right jaw. They occurred both in females and in males. The additional molars were small, one-rooted teeth with a subcircular crown outline, resembling M₂ in specimen no. 112384 (Fig. 4b) rather than no. 51404 (Fig. 4a).

Large second lower molars, similar to the right M₂ in no. 112384 (Figs. 2, 3a and 3b, 5) have been observed in recent members of the genus *Mustela*. Hoekstra (1975) described such a large left M₂ in a specimen of *Mustela putorius* from the Netherlands, and Mazák (1964) found a large M₂ in both mandibular branches of a specimen of *Mustela nivalis* from Norway. In both cases M₂ had two roots and three distinct crown cusps placed along the antero-posterior line. Unlike the atypical M₂ described in the present paper, these

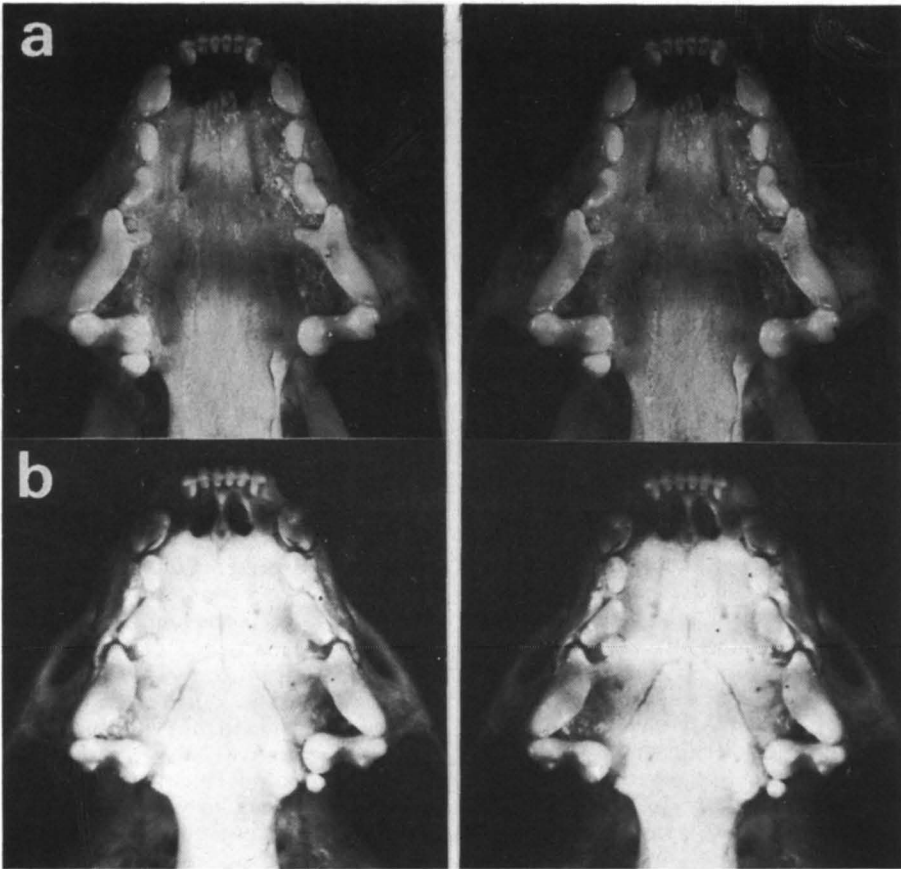


Fig. 4. Stereophotographs of the upper dentition in weasels (a) no. 51404 and (b) no. 112384, occlusal view.

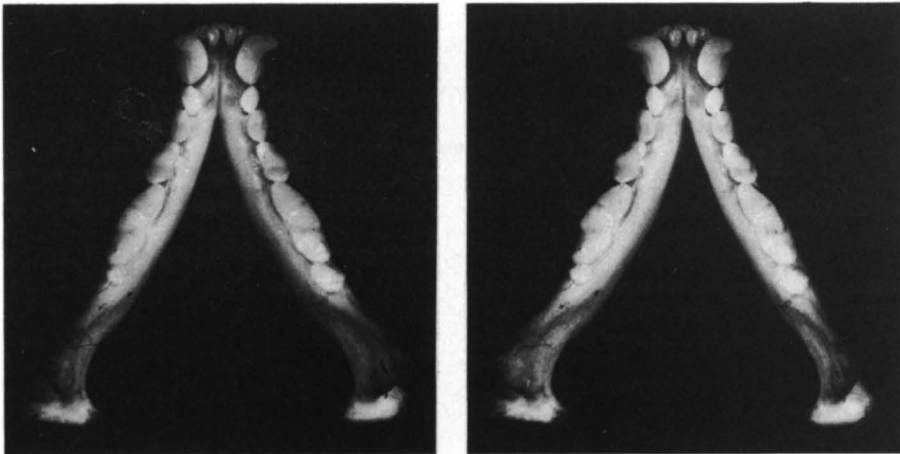


Fig. 5. A stereophotograph of the lower dentition in weasel no. 112384, occlusal view.

teeth were more elongate and relatively larger (cf. data in Table 2) and the cusps were better developed. The anterior root of the teeth found by Mazák (1964) was smaller than the posterior, whereas in the specimen described here, exactly the opposite situation prevails (see Fig. 3). In the genus *Mustela* M_2 is characteristically distinctly smaller than these teeth and has only one root. On the occlusal surface there is very often a poorly marked ridge, sometimes (e.g. in *Mustela nivalis*) or rather frequently (e.g. in *Mustela putorius*) with three small elevations, which probably correspond to the three cusps on the two-rooted teeth discussed above.

Of the structures described in the present paper, only the additional cusp placed posteriorly to the protoconid on P_4 occurs in the living Mustelinae as a specifically characteristic feature; it is very often present in members of the genus *Martes*. All these structures are, however, known in many extinct genera of this subfamily. For instance, M^2 and the above-mentioned additional cusp on P_4 are present in *Brachypsalis* (Upper Miocene — Upper Pliocene, after Romer 1966: 384) (Hall 1930a, Galbreath 1955). The additional cusp on P_4 is also present in *Ischyrictis* (Lower — Upper Miocene, after Romer 1966) (Schmidt-Kittler 1976), *Miomustela* (Upper Miocene, after Romer 1966) (Hall 1930b), *Baranogale* (Upper Pliocene — Lower Pleistocene, after Romer 1966) (Kormos 1934, Kowalski 1959, Stach 1961), and other genera. It is worth emphasizing that in the genus *Palaeogale* [= *Bunaelurus*] (Lower Oligocene — Lower Miocene, after Romer 1966), regarded by many authors (e.g. Schlosser 1924:111, Thenius 1969: 366) as ancestral to the genus *Mustela*, both the additional cusp on P_4 (Scott & Jepsen 1936: Pl. XIV, fig. 3, Simpson 1946: fig. 4a¹), a small vestigial M^2 (Matthew 1902, Loomis 1932, Scott

& Jepsen 1936, Simpson 1946, Gromova et al. 1962, Müller 1970), and an elongate, two-rooted M_2 (Schlosser 1924:16, Dehm 1950, Müller 1970: 153) with three indistinct cusps along its long axis (Simpson 1946, Gromova et al. 1962:207), have been found.

Neuenschwander & Lüps (1975), Glas (1977) and Ruprecht (1978) regard the second upper molars noted by them (see above) as atavisms. Mazák (1964:28) thinks that the case described by him "...cannot be interpreted as an atavism". He cites G. G. Simpson (unpubl.), who believes that "...it cannot be considered truly atavistic" and "...the most probable interpretation of this specimen is that it is a mutation or a developmental anomaly in which the field of growth in the molar teeth has extended farther posteriorly than is normal in the species..."

In my opinion, the structures described both by Mazák (1964), Hoekstra (1975), Neuenschwander & Lüps (1975), Glas (1977), Ruprecht (1978) and by me in the present paper, are the results of expression of genes which are rare but still present in the gene pools of the living species of the genus *Mustela*, and which occurred much more frequently in the ancestors of this genus. I believe that if we had at our disposal representative samples of the links in the evolutionary chain from the most primitive Mustelinae to the living *Mustela*, we would be able to trace a gradual decrease in the frequency of these structures in the samples from successive geological layers up to the present time.

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