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Excessive and missing premolars and molars in dentition of male roe deer (*Capreolus capreolus* L.)

Nadliczbowe i brakujące przedtrzonowe i trzonowce w uzębieniu samców saren (*Capreolus capreolus* L.)

Summary. The aim of the present study was to determine the reasons for anomalies in male roe deer dentition during the last 5 years and obtained from 101 hunting circles managed by the Regional Board of Polish Hunting Association in Lublin. Within the studied period, the number of anomalies was low and ranged from 1 to 3 cases per hunting season. This volume relative to the amount of harvested roe deer in different seasons was from 0.11 to 0.35% of the total volume of raising animals in the hunting season. In the majority of cases, the anomalies referred to the lack of some teeth in the lower jaw, both on the left and the right sides. No clear directional asymmetry of the defects, nor the regions the animals with these types of anomalies originated from were observed, thus the environmental conditions had to influence the described abnormalities, including inbreeding as one of the possible reasons for their occurrence.

Key words: roe deer, dental pattern, dentition anomalies

INTRODUCTION

In order to describe an animal of a particular species, elements of its conformation or performance, or both, are taken into considerations. At the same time, regardless of the description form that is used, the term *"feature"* is the most often applied. Due to a fact that all features of living organisms are genetically determined, hence undergo the heredity principles, there is a biological similarity of progeny and parents. For wild animals,

also variable environmental conditions, under which particular individuals live performing basic functions of life, are factors modifying specific features. Animal's dentition, like any feature of living organisms, is genetically determined as well. For herbivorous mammals from ruminant suborder, dentition is characterized by so-called *"diphyodontism"*, which means that some species animals possess deciduous teeth until specified age and then they are replaced by permanent dentition till the end of their life [Akajewski 1970]. Moreover, dentition of herbivores from ruminant suborder is characterized by so-called *"heterodontism"*, i.e. teeth distinction between incisors (*incisivi*), canines (*canini*), premolars (*premolares*), and molars (*molares*), while dental pattern of a complete dentition should be of a form [Akajewski 1970]:

I	C	P	M
3	1	4	3
3	1	4	3

For roe deer and other representatives of *Cervidae* family, it can be observed the phenomenon of regress and disappearance of upper incisors and canines along with formation of thick slats of fibrous connective tissue being in contact with lower incisors and canines during the occlusion [Bobek *et al.* 1992, Dzięciołowski and Pielowski 1993, Dzięciołowski 1994, Pielowski 1999]. Furthermore, upper canines (so-called *"grandles"*) can be found at particular species with various frequency [Flis 2004a, 2010, 2012]. They are taken in brackets in a description of dental pattern. Upper canines are common at red deer, whereas sporadic at other *Cervidae* animals [Bobek *et al.* 1992, Dzięciołowski and Pielowski 1993, Dzięciołowski 1994, Pielowski 1999]. In addition, the first premolars are regressed and missing at all representatives of domestic deer. However, it is very common hunting practice that other premolars are counted from 1 to 3. Therefore, typical dental pattern of wild ungulate mammals from *Cervidae* family is most often as follows:

I	C	P	M
0	0(1)	3	3
3	1	3	3

Structure of particular tooth types depends mainly on the lifestyle of a given animal species and associated feed specificity. In the case of ruminants, the chiseled incisors and canines are for catching, holding, and tearing the food apart, while premolars and molars for preliminary crumbling and for crushing and grinding the feed during rumination. Therefore, premolars and molars are characterized by short roots and massive crowns, which is related to as hypsodontism. In addition, characteristic curved slats formed from nodules of crowns with a cavity ("register") between, and hence due to anatomy, these mammal's suborder has been once named *"semilunartoothed"* and specific changes of tooth rubbed off during rumination, thus characteristic alterations in the shape and depth of "registers" are used in hunting practice for determining the age of particular individuals [Akajewski 1973, Przybylski 2008].

Because of the fact that dentition of deer is counted to qualitative features with straight heredity, it is almost certain that number of teeth for a given species, regardless

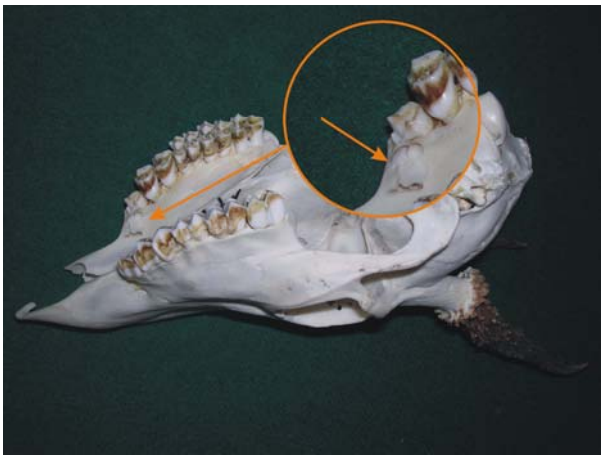
of age and region, is constant, unless above mentioned dental pattern resulting from evolution of that group of animals is taken into account. For roe deer, despite of described dental pattern, cases of additional premolars and molars or their lack can be observed in practice [Markowski and Markowska 1990, Flis 2004a, 2006, 2008].

MATERIAL AND METHODS

Material for study comprised of skulls and jaws of male roe deer obtained within Lublin region in 2007–2011. Premolars and molars were counted during annual evaluation of the correctness of male roe deer shooting, when age of individuals obtained in a given hunting season and estimation of the correctness between shootings and individual selection criteria for the species, was performed. During that evaluation made by means of organoleptic technique and based on characteristic changes in registers of premolars and molars [Przybylski 2008], individuals with anomalies of upper and lower jaw teeth number, were distinguished. Achieved results were presented in a form of macroscopic photos of dentition, as well as radiological images of selected anomalous cases. In total, material for study originated from 101 hunting inspectorates localized in Lublin Upland, where from 557 up to 923 male roe deer were obtained in particular years during hunting season.

RESULTS

In the first year of study, atypical dental pattern was found for two cases of 557 male roe deer being a subject to evaluation. The first one was recorded at 2-year-old buck, at which additional premolar (*premolares*) during the growth phase was present in upper jaw on the left side (Phot. 1). The tooth was situated not in the dental line of the jaw, but more medially and in part it overlapped the adjacent premolar that was shorter, hence deformed. Number of teeth in lower jaw was typical.



Phot. 1. Macroscopic view of male roe deer's skull with additional premolar
Fot. 1. Makroskopowy widok czerepu kozła z dodatkowym zębem przedtrzonowym

Phot. 2. Macroscopic view of male roe deer's lower jaw with lacking premolars of the second pair
Fot. 2. Makroskopowy widok żuchwy kozła z brakującymi zębami przedtrzonowymi 2. pary

Phot. 2a. Radiological picture of lower jaw with lacking premolars
Fot. 2a. Obraz radiologiczny żuchwy z brakującymi zębami przedtrzonowymi

Phot. 3. Macroscopic view of male roe deer's lower jaw with lacking premolars of the first pair
Fot. 3. Makroskopowy widok żuchwy kozła z brakującymi zębami przedtrzonowymi 1. pary

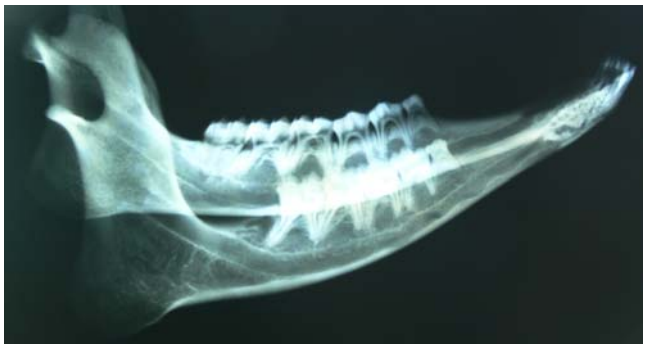
Phot. 4. Macroscopic view of male roe deer's lower jaw with lacking premolars of the first pair
Fot. 4. Makroskopowy widok żuchwy kozła z brakującymi zębami przedtrzonowymi 1. pary

Phot. 5. Macroscopic view of stag's lower jaw with lacking premolar of the second pair on the right side
Fot. 5. Makroskopowy widok żuchwy rogacza z brakującym zębem przedtrzonowym 2. pary po stronie prawej

Phot. 6. Macroscopic view of male roe deer's lower jaw with lacking premolars of the third pair
Fot. 6. Makroskopowy widok żuchwy kozła z brakującymi zębami przedtrzonowymi 3. pary

Phot. 7. Macroscopic view of stag's lower jaw with lacking premolar of the first pair on the left side
Fot. 7. Makroskopowy widok żuchwy rogacza z brakującym zębem przedtrzonowym 1. pary po stronie lewej

Phot. 8. Macroscopic view of stag's lower jaw with lacking molar of the third pair on the right side
Fot. 8. Makroskopowy widok żuchwy rogacza z brakującym zębem trzonowym 3. pary po stronie prawej



Phot. 8a. Radiological picture of lower jaw with lacking molar on the right side
Fot. 8a. Obraz radiologiczny żuchwy z brakującym zębem trzonowym po stronie prawej

Phot. 9. Macroscopic view of male roe deer's lower jaw with lacking molars of the first pair
Fot. 9. Makroskopowy widok żuchwy kozła z brakującymi zębami trzonowymi 1. pary

Phot. 9a. Radiological picture of lower jaw with lacking molars
Fot. 9a. Obraz radiologiczny żuchwy z brakującymi zębami trzonowymi

Another case referred to the buck obtained near Świdnik. Its mandible was characterized by lack of premolars of the second pair, both on the left and right side (Phot. 2). Upper jaw did not reveal any dentition anomalies. It is difficult to univocally conclude on the animal's age due to the anomaly present, but analysis of the wear marks on remaining teeth indicated that the male roe deer could be 4-year-old. Achieved radiological picture of dentition revealed that no prominent mechanical injuries or other visible deformations of bone structure were present where these teeth should be found, thus they could not be lost nor they even were mechanically knocked out (Phot. 2a). Where teeth should be found, there were no symptoms of alveolus; in addition, uniform structure of cortical and cancellous bone visible on radiological picture can be a confirmation that these teeth were absent or did not grow during replacement of deciduous into permanent dentition, and lower jaw bone resorbed the alveoli during its growth process.

The following year, a buck with the lack of premolars of the first pair on the left and right sides, was obtained (Phot. 3). Organoleptic assessment of morphological structure of mandible bone indicated that these teeth were not formed during the deciduous into permanent dentition replacement. Taking into account the fact that the process of deciduous into permanent premolars replacement is completed at the age of 13–14 month of life at roe deer, as well as complete shaping the permanent molars that are not present as deciduous ones at similar age (15), the lack of the first pair of premolars in lower jaw at 2-year-old male roe deer in combination with fully formed lower jaw bone, should be counted to the individual developmental defect, most probably determined by genetics, because environmental factors in that case (age of the animal) could not play such important role.

Male roe deer with lack of premolars of the first pair on both sides of lower jaw was obtained the same year near Kraśnik (Phot. 4). Like in previous case, organoleptic evaluation of the lower jaw of 2-year-old male roe deer indicated that these teeth never grew during the dentition change, thus it can be supposed that genetic conditions could be the reason for such situation.

Dentition anomaly was reported for only a single case of total number of 853 buck skulls subject to assessment during study carried out in 2009. It referred to the lack of premolar of the second pair on the right side of mandible. Organoleptic evaluation of lower jaw indicated that the tooth could be knocked out during the individual life of animal, which was confirmed by the presence of the dental canal remains visible in macroscopic picture, as well as during organoleptic assessment (Phot. 5). The age of that male roe deer was estimated for 4 years.

Subsequent year, of 913 buck skulls subject to evaluation, only a single case showed the numerical defects of dentition. Lack of premolars of the third pair on both sides was found in lower jaw of 3-year-old buck (Phot. 6). Organoleptic evaluation of the mandible made by means of macroscopic imaging indicated that these teeth were not formed during the replacement of deciduous into permanent dentition. It can be confirmed by facts associated with excessive development of teeth adjacent to the lacking ones and their considerable inclination in a direction of the empty (toothless) space of the lower jaw. Moreover, it can be proved by elements associated with the wear of the back chewing surface of premolars of the second pair in the lower jaw to their half of height. This type of wear is confirmed by the excessive development of premolars of the third pair in upper jaw determined the lack of their equivalents in lower jaw, which taking into account the animal's age, allows for concluding that these teeth were not formed during the dentition replacement.

During the last studied hunting season, two bucks with dentition of lower jaw indicating atypical traits associated with the lack of some teeth. The first case (estimated for 7-year-old) was characterized by the lack of the first pair premolar on the left side of lower jaw (Phot. 7). Number of teeth in the dental arch on the right side of mandible was consistent with dental pattern typical for the animal species. Furthermore, other premolars and molars were formed in a correct way. Organoleptic analysis of the toothless space in lower jaw indicated that the lack of the tooth did not result from mechanical injury, which is a consequence of the fact that the elevation of the toothless space in lower jaw on the side of lacking tooth, was slightly shifted back and began just near the second premolar, which in turn confirms that the tooth was absent in lower jaw both as a permanent and deciduous one.

Lower jaw of the other individual, the age of which was estimated for 5 years, was characterized by the lack of the third pair molar on the right side (Phot. 8). Like in the previous case, morphological structure of the lower jaw indicates that the tooth was never present at this animal, which was confirmed by anatomical structure of the bone visible in radiological picture (Phot. 8a).

Also in 2011, a buck with no molars (*molares*) of the first pair both on the left and right side, was obtained in one of the hunting circles of Lublin province (Phot. 9). The premolars and molars wear was so remarkable that the animal's age was estimated for about 10 years. Organoleptic evaluation, along with dentition look in radiological picture (Phot. 9a) allowed for supposing that lacking teeth were most probably removed due to mechanical injury. It could be confirmed by residual crown and root of lacking tooth on the right side of lower jaw, as well as non-uniform structure of the cortical and cancellous bone on the left side where the lacking tooth should be. At the same time, the injury could occur at younger age of the animal and specific filling of dental canals by bone-forming cells could have happened till the animal has been obtained.

DISCUSSION

No case of lower jaw incisors nor canines anomalies were reported at roe deer during the study. Comparison of recorded anomalous cases with the number of obtained animals indicate that the percentage was rather low; it ranged from 0.11 to 0.35% within years of the research and referred mainly to anomalies associated with the lack of some premolars and molars in the lower jaw, and only in a single case additional tooth in the upper jaw was recorded. When comparing with literature data, such proportion of the cases during the 5 years of study can be considered as very low. This type of anomalies at roe deer are in general sporadic and it is difficult to point out both the reason and a clear directional tendency referring both to the tooth groups and lower and upper jaw dentition on their both sides [Flis 2006, 2008, 2012].

Studies upon reindeer (*Rangifer tarandus*) revealed 3.5% dentition anomalies, although majority of them referred to the lack of teeth [Miller and Tessier 1971]. In south-eastern population of red deer from Spain, both excessive and lacking teeth in a dental pattern were reported. At the same time, upper jaw molars were the most susceptible to anomalies [Azorit *et al.* 2002]. Occurrence of lacking and excessive teeth was also found within Japanese population of Japanese serow (*Naemorhedus crispus*). At this animal species, lower jaw anomalies dominated [Natsume *et al.* 2005]. Cases of excessive premolars and molars were earlier reported at buck dentition. Moreover, presence of additional canines (*"grandles"*), including double ones in the upper jaw, which is extremely rare at the species [Markowski and Markowska 1990, Flis 2004a, 2004b, 2006, 2008, 2010, 2012].

CONCLUSIONS

Results of presented developmental dentition anomalies at male roe deer indicate that they are not very common and refer exclusively to premolars and molars. It can be

confirmed by the fact that their recorded quantity corresponded with the number of obtained animals makes up quite small percentage not exceeding 0.35% in studied hunting circles. In majority, presented anomalies, that referred both to upper and lower jaw on both sides, allow for suggesting that every single case was the individual feature of a given animal. Therefore, it can be concluded that they are probably genetic anomalies manifesting in phenotypic form. It is difficult to point out the background of such type of anomalies; mutations should be rejected, because it is characterized by permanent changes of hereditary substance that recreates its altered form during replication and is carried over to the progeny, hence within particular regions, the frequency of obtaining the animals with similar anomalies would be much higher. No doubt, in some cases, out-of-population factors in a form of mechanical injuries or other environmental influences, can be the stimuli affecting this type of phenomena.

However, for this type of anomalies, the inbreeding phenomenon, i.e. mating within close relationship, seems not to be excluded, and it is very likely in the case of roe deer due to small living areas, thus local isolation of particular populations and even particular individuals. It can be confirmed by observations made upon pets, including incorrectness of mammal dentition. Therefore, it can be concluded that no doubt genetic background is the reason of described anomalies, although environmental elements associated with functioning of particular local populations of roe deer, can be modifying factors. This hypothesis seems to be very probable.

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Streszczenie. Celem badań było określenie i ustalenie przyczyn anomalii w uzębieniu samców saren w okresie ostatnich 5 lat, pozyskanych na terenie 101 obwodów łowieckich administrowanych przez Zarząd Okręgowy Polskiego Związku Łowieckiego w Lublinie.

W ocenianym okresie liczba stwierdzonych przypadków anomalii była niewielka i zawierała się w przedziale od 1 do 3 przypadków w ciągu sezonu łowieckiego. Wielkość ta odniesiona do liczby pozyskiwanych rogaczy w poszczególnych sezonach stanowiła od 0,11 do 0,35% ogólnej liczby zwierząt pozyskanych w sezonie łowieckim. W większości przypadków anomalie dotyczyły braku niektórych zębów w żuchwie, zarówno po stronie lewej, jak i prawej. Nie stwierdzono wyraźnej asymetrii kierunkowej występujących nieprawidłowości, nie zlokalizowano również rejonów pochodzenia zwierząt z tendencją do występowania tego rodzaju anomalii, stąd wniosek o wpływach środowiska ze wskazaniem chowu wsobnego jako jednej z możliwych przyczyn opisywanych nieprawidłowości.

Słowa kluczowe: sarna, wzór zębowy, anomalie uzębienia