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INSTRUCTIONS FOR CONTRIBUTORS

The Minufiya Veterinary Journal is published half-yearly and covers subjects in the veterinary and allied sciences . It is in offset print size of 21 x 29.7 cm. It has a Volume number on yearly basis and Number on issues per volume basis (in exceptional cases there can be more than two issues in a volume).

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The text must be typed on white bond paper (A 4 , 21x29.7cm.) with 4 cm. on the right side, 3 cm.
On the left side, top and bottom , and double spacing. Each English manuscript must be accompanied by an Arabic summary. Summaries must not exceed in length 20 lines of typescript or, in case of short communication 10 lines. A line comprises 60 type characters. British English, spellings and generic names of drugs should be used. International Code of Zoological Nomenclature, Nomina Anatomica Veterinaria, International Code of Botanical Nomenclature and International Standards should be strictly followed. All terms should be identified by their scientific names and for easy comprehension common terms/names can be used.

The abstract should begin with title of the article, and have brief procedures, salient results and conclusions not more than 225 words, in one paragraph. Proprietary names and abbreviations should be avoided. Provide four or six key words below the abstract for indexing services. Abstract is not necessary for short communications, case reports, news items, etc.
The proper text of the paper should begin with title of the article. The text should be divided into sections with headings; introduction, materials & methods, result, discussion, tables/illustrations and references.

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The list of references should be in an alphabetical order of the names of the authors. Each reference should be written as the following Example:

Saber A.S. and Weyrauch K.D. (1998): Scanning electron microscopy of the papillary body of the rumen and reticulum of the one- humped camel (Camelus dromedarius). JCPR, Vol. 5, No. 1, p 51-55.

Five reprints of the article will be provided after publication to the author in correspondence with the editor. Extra reprints can be had on order before publication of the journal. Minimum of 10 reprints would coast 30 L.E (Egypt) or 15 US$ (Abroad).

B- Morphology and pattern of cusps:

The results of the present study revealed that the carnassial or sectorial teeth of both fox and dog as well as the molars of all examined animal species were made up of outer and inner elements. The latter structures appeared as buccal and lingual tooth columns, with an intervening septum (Fig. 15/5). However, the presence of this septum indicated the dual nature of the concresence of the future two tooth units as well as the complicated fashion of the enamel folding.

I- In canine species:

In the upper jaw the fourth premolar of both fox and dog was the specialized carnnassial tooth (Fig. 3A/P4). This tooth was characterized by the elongation of the distolingual surface to form a more efficient shearing blade. This blade element was made up of two large buccal cusps- paracone and metacone. (Fig. 3A/2, 3) as well as a reduced lingual one; protocone (Fig. 3A/1). The former two cusps were carried on the outer tooth column, while the latter cusp was oriented upon the inner tooth column. Interesting that, each cusp pointed into an interdental space of the opposite jaw, and the inner surface of the blade; behind the protocone; was observed to slice down the outer surface of the lower carnassial- first molar- tooth (plate 1-A&B) and (Figs. 4&5). Moreover, the previously mentioned three cusps were carried upon three separate roots; two buccal and a lingual one.

Concerning the morphological pattern of the cusps in the upper molars of canines, large first and a small second one. It was demonstrated that each tooth was provided with a triangular shaped crushing crown. The latter appeared low medially and carried a small lingual cusp- protocone (Fig. 3A/1) and two laterally compressed buccal ones; a mesial paracone (Fig. 3A/2) and a distal metacone (Fig. 3A/3). Moreover, the cusps were surrounded at the base of the crown by a well-developed cingulum from which two subsidiary cusps were projected; a hypocone (Fig. 3A/4) and an intermediate metaconule (Fig. 3A/5).

Regarding the cusps in the molars of the lower jaw in both fox and dog, it was observed that the first molar was a massive carnassial tooth. It consisted of two elements; a mesial blade element and a distal grinding one, the former possessed three main cusps arranged to form nearly symmetrical triangle. The central cusp, protoconid (Fig. 3B/1) was the sharper and largest of the three cusps, being suited for shearing action while the paraconid and the distal metaconid were quite small (Fig.3B/2, 3). The caudal grinding element- talonid- which contacted the upper first molar carried two major cuspid an outer-hypoconid (Fig. 3B/5) and an inner one-entoconid (Fig. 3B/4) with a minor hypoconulid (Fig. 3B/6). In addition, the cusps of the trigonid blade element and that of the grinding talonid one were carried on a mesial and a distal root respectively. The second lower molar with its three cusps was much smaller tooth and in contact with the upper first molars, while the third lower molar of no functional significance,

Further analysis of the teeth of this type in canine from radiographic interpretation (plate I- A&B) indicated that the cusps in both upper and lower jaw shear against each other with probably anisognathous zigzagged line of shearing in the following manner; the upper carnassial fourth premolar bite outside the lower carnassial, the two upper

molars occluded with the talonid of the lower carnassial and with the second lower molar (Fig. 4) & (plate 1A& B). Despite the fact that the pattern of distribution and the number of the cusps in the teeth of the fox were essentially the same as those of the dog, the sharp and pointed cusps of the teeth in the fox resulted in a close fitting interdigitation between the upper and lower dentitions which could be expressed as side- to –side occlusion (Fig- 5 and plate 1A).

II- Herbivorous species:

Specialization of the herbivorous habit in chewing was marked by the alternation of the upper and lower molars to isognathous quadrate form, as they acquired new cusps in addition to the three main cusps described in the tricuspid form of canine species (Figs. 1A, 9, 10, 16 and plate 1C& D). Moreover, the pointed cusps observed in both fox and dog became less prominent in herbivorous animals and the hypsodont molars with blunt cresentic to rounded cusps prevailed (Figs 6& 7).

1- In the buffalo:

Examination of the occlusal surface of the molar teeth in the buffalo showed a commonly relative decrease in the height of the cusps of such teeth. In addition, the enamel invagination together with the surrounding dentin had sickle- like form (Fig. 2).

The upper molars of the buffalo present four cusps; two mesial and two distal. The mesial cusps were arranged lingual and buccal and might be designated as protocone and paracone (Fig. 11/ 1,2) while the distal cusps might be termed hypocone and metacone (Fig.11/3, 4).

The four cusps of both first and second lower molars in buffalo (Fig. 8) were oriented in the following order; a mesiobuccal protoconid, a mesiolingual metaconid, a distobuccal hypoconid and a distolingual entoconid. It was also noticed that the lingual cusps were more prominent than the buccal ones, resulting in a more prominent lingual edge. It must be pointed out that, the last lower molar (M_3) had an additional cusp, named hypoconulid (Fig. 8/5).

2- In the Camel:

A study of the cusps occlusal surface of the molars of the camel giving a proof of deep invagination of the enamel that was also divided each tooth unit into two cusps (Fig. 1A). Thus, each unit had a central semilunar cup and two cresentic cusps oriented buccal and lingual. The usual term and relative position of the four cusps in the upper and lower molars described previously in the buffalo could be applied favourably in case of camel. Moreover, the cusps of the camel were steepy inclined; the upper molar cusps were inclined upward from the buccal towards the lingual side and the lower molar from the lingual downward toward the buccal side.

3- In the donkey:

It was evident that the occlusal surface of the molar teeth in the donkey was rendered complex by the appearance of new cusps at the corners of the teeth. The additional cusp of the upper molar was situated lingually and named protoconule and it was considered as a secondary diverticulum from the pulp cavity (Fig. 12/5).

Gross examination of the lower molars of the donkey revealed that the cusps were greatly elongated and the area between them were filled by a modified form of cement giving some irregularity to the cusps. Moreover, the general design of the cusps showed the same arrangement like that of the previously mentioned herbivorous, with an additional major cuspid, metastyle (Fig 9/6) and two minor subsidiary ones. The later two cuspides might be considered, in fact, as a medial extension from the protoconid and hypoconid and therefore could be designated as protoconulid (Fig 9/7) and hypoconulid respectively (Fig 9/5).

In comparing the different ridges connecting the various cusps of the teeth of the herbivorous species under investigation, it was evident that they might be either angulated like letter "W" (Fig 13/A) as in the case of the buffalo and camel or as an irregular complex form in donkey. It was also noticed that the distance between the mesiobuccal and distobuccal cusps tip was definitely greater than the distance between the mesiolingual and the distolingual, consequently the outline of the crown converged lingually. Also, it was observed that, the distance between the mesiobuccal and the mesiolingual cusps end was greater than that found at the distal ends and thus the line of crown converges distally (Fig. 12).

As the surface of the fully erupted tooth began to wear the tips of the cusps and then the crests of the ridges were the first to suffer. The enamel in these area worn away and the underlying dentin was exposed as a dark spot on the occlusal surface termed dental star (Fig. 7) which was situated in a cusp.

DISCUSSION

In a trial to explain the mode of ontogeny of the cusps in buffalo-calves, the present study achieved that; when the molar cheek tooth first erupt; they have a crown made up of two columns. Each column carried two cusps separated by a deep groove. Moreover an interesting series of unions between the different cusps in the examined species ascertained that the interunit connection proceeded the intraunit union between the two cusp units. These findings agreed with Bodurov and Binev (1968) in the lower molars of ox.

According to the current study the cusps of both the upper and lower molar teeth acquire a different morphological patterns in relation to the eating habits of animal concerned. However, in the wild state the existence of the animals depend upon their teeth almost to the same extent as upon sight, hearing and swiftness of movement (Mohr, 1961). In these animals the enlarged cutting blade-like cusps of symmetrical opposed triangles interdigitate with each other during the occlusion of both jaws. Accordingly, this pattern has apparently a functional superiority in the shearing mechanism of both dog and fox that do not chew their food to any great extent related to technical of flesh-eating beasts (Davis, 1961 and Hopson, 1971). It is to add that, the sharp pointed cusps in the fox permit the overlapping of the lower teeth by the upper ones to be converted into side- to – side type of occlusion which makes a more harmonious series in fox rather that in case of dogs. This is supported by the statement

made by Matthew (1926) and Romer (1966) that extreme specialization of the carnassial dentition has occurred in canines more than one in herbivorous animals.

Regarding the pattern of distribution of the cusps in both the upper and lower molars in canines, the observations made during this work confirmed the findings of Widdowson (1952), St. Clair and Johen (1957) and St. Clair (1975) in dog. It is to add that, the rostrolateral cusp of the upper molar and the caudal one in the lower molar is larger than that of the other two cusps of the triangle.

Contrary to the elongated sharp trigonid major cusps observed in canines, herbivorous animals acquired multituberculate teeth having flatter cusps of approximately equal height. These findings coincided with that given by Hiiemae (1967) who stated that herbivorous animals have too low blunt cusps adopted to grinding function. However, St. Clair (1967), in bovine, did not evidently define its shape.

The present investigation in both buffalo and camel ascertained that the morphological configuration of the cusps described sickle to round shape. On the other hand, the current study revealed that the cusps attained a relatively irregular to elongated form in donkey. Furthermore, it was established that the last lower molar has either only one additional cusp as in buffalo and camel or two minor cuspsids in donkey. These findings support that given by Ellenberger and Baum (1943) in both horse and ox. The present findings gave more evidence supporting the process of apperance of the dental star in a cusp of all examined herbivorous animals mentioned by St. Clair (1975) only in the molars of the horse.

Concerning the dietary function, it is relevant to point out that the occlusal surfaces of the upper molar with its cusp units in both buffalo and camel slope toward the hard palate, in contrast to that of the lower molars. This may be related to the habit of chewing in both species during this process, the molars with its cusps are in full contact, as they pass transversly, only on one side and lost the contact on the other side (Schummer et al., 1979). The later design is more pronounced in the camel. Therefore, it may be suggested that, these criteria enable the camel to extract all of the few nutrients from a diet not as readily utilized by other forms of live stock.

Eventually, it may be concluded that modification of the cusps reflects the functional adaptation and the essential demands to the environment in which the animal lives. Consequently, herbivorous animals have so the broad molars which are devoid of high cusps while canines have sharp pointed cusps.

Likewise, cusps pattern of Dimer theory held by Bolk (1922) can be applied almost without doubt for the hoofed investigated animals in the present study. According to Bolk (1922), each mammalian tooth was made up of an outer element (Protomere) and an inner one (deuteromere). In addition, each element carried 2-3 cusps, so that each tooth had 4-6 cusps.

Furthermore, it may be suggested that the complicated pattern of cusps, observed, in herbivorous may be due to the appearance of new cusps on the tooth

margins and to the prominent ridges connecting the cusps to each other, as well as to the transformation of the pointed cusps to cresentic ones.

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Legends of figures

Plate-1 Radiographs of different skulls showing the occlusal surface, of the teeth at various view
I- Fox (Lateral view): B- Dog (Lateral view)
(* & 1) sharp pointed cusp, (2) side- to- side occlusion
C- Donkey (Dorsoventral view) Note, the tips of the cusp (1) directed buccal
D- Buffalo (Lateral view). Note, the quadrate form of occlusal surface due to addition of new cusps

Fig 1: Photograph showing the profile of the cusps elevation (*) on the crown portion of a molar tooth in:
a- camel b- buffalo c- fox

Fig 2:
A) Drawing of the pattern of developing molar in buffalo-calves, showing the sequence of unions between the growth centers at birth.
1) Four growth centers
a- Mesiobuccal cusp, b- Mesionlingual cusp,
c- Distolingual, d- Distobuccal cusp, e- Mesial side,
f- distal side
2) Union between mesiobuccal cusp (a) and distolingual cusp (c). Interunit connection "arrow"
3) Union of distobuccal cusp (d) to interunite connection.
4) Union of mesiobuccal (a) to mesiolingual cusp (b) at mesial side (e).
5) Union of distobuccal to distolingual cusp and mesiolingual cusp to interunit connection at the center as well.

B,C&D) Photographes showing the previous sequence of unions in the molar of bulffalo- calf.

Fig. 3 Photograph showing the pattern of the cups in fox.
I- Upper molar and upper carnassial teeth
1- Protocone, 2- Paracone, 3- Metacone,4- Hypocone, 5- Metaconule
II- Lower molar tooth:
1- Protoconid, 2- Paraconid, 3- Metaconid,4- Entoconid 5- Hypoconid, 6-Hypoconulid, 7- mesial roat, 8- distal root

N.B L: Lingual, B: Buccal, M: Mesial & D: Distal

Fig 4: The skull of dog showing the mode of occlusion

Fig 5: The skull of Fox. Note the (side-to-side occlusion of premolar and molar teeth.

Fig 6: Occlusal view of maxillary teeth with a portion of caudal part of hard palate at 9 month. Note, the horn of cresentic cusps in buffalo calf.

Fig 7: The profile of rounded cusps in bunodont molar in herbevora (dotted line), star (arrowhead).

Fig 8: Pattern of cusps in the lower molar in buffalo:
1- protoconid, 2- metaconid , 3- hypoconid, 4-entoconid,
5- hypoconulid

Fig 9: Patten of cusps in the lower molar in the donkey
1- protoconid, 2- metaconid, 3- hypoconid, 4- entaconid
5- hypoconulid, 6-metastyle, 7- protoconulid

Fig 10: A: Photograph of nature maxilla of the camel showing the cusps embrasure.
B: Enlarged models of the maxillary cusps in the camel.

Fig 11: Pattern of cusps in the maxillary molars in buffalo:
1- protocone ,2- paracone, 3- hypocone, 4- metacone

Fig 12: Pattern of cusps in the maxillary molars in donkey:
1- protocone,2 – paracone, 3- hypocone, 4- metacane,
5- protoconule

Fig 13: Photograph illustrating the ridges connecting the different cusps:
i- Buffalo
ii- Camel 1- Mesiobuccal groove, 2- Distolingual groove

Fig 14: The skull of the camel. Note: the tables of the upper set slope towards the buccal surface and overhangs the lower set.(Isognathic type of occlusion).

Fig 15: Photograph of the longitudinal section of the upper molar of the buffalo 1- Dental cavity, 2- Dentin, 3- Enamel, 4- Cement- 5- Enamel septum

Fig 16: Generalized diagram showing the principle features of the:
(A) Triangular three-cuspsid teeth of canidae
(B) Quadrate teeth in herbivorous animals.

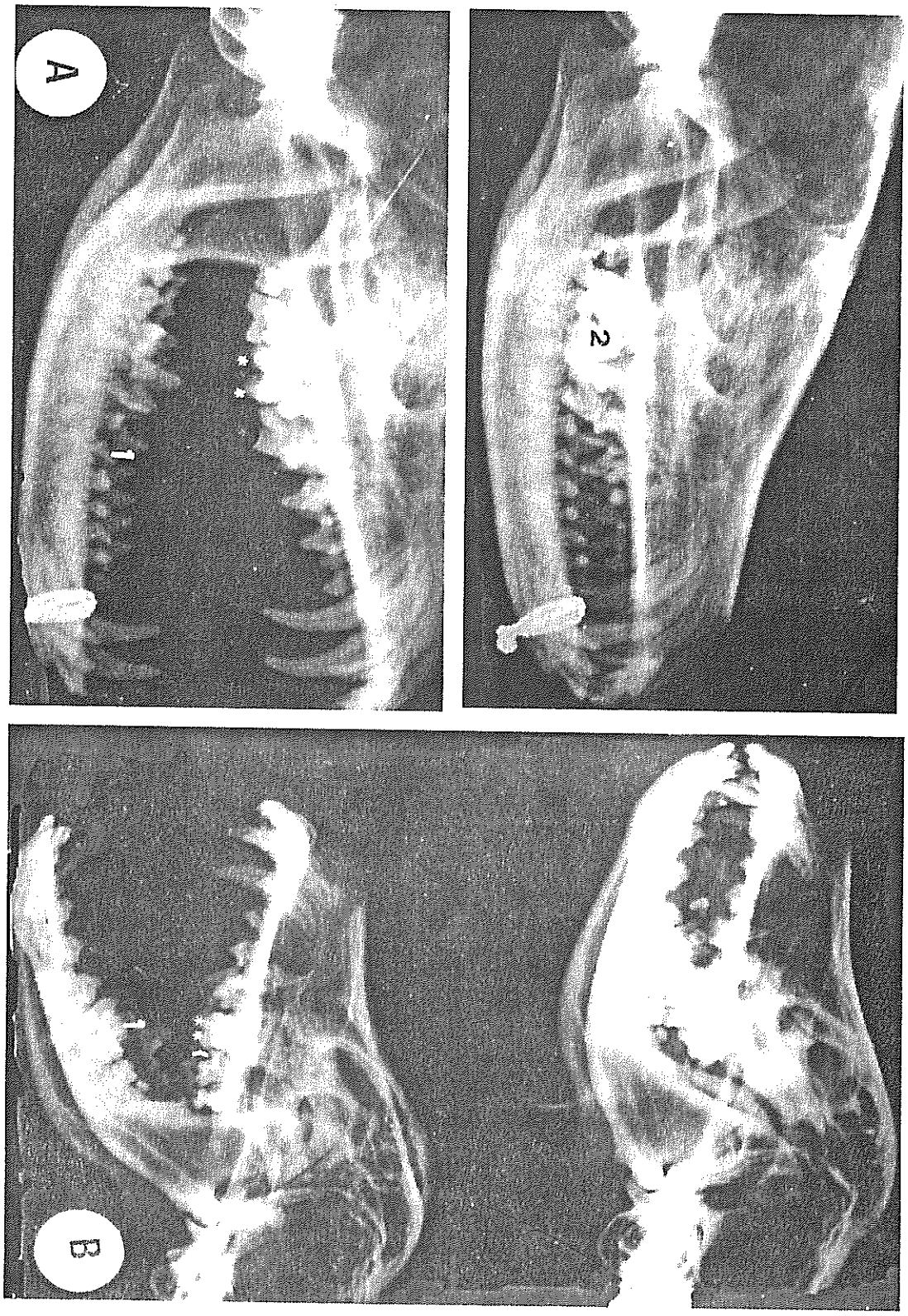

PLATE 1

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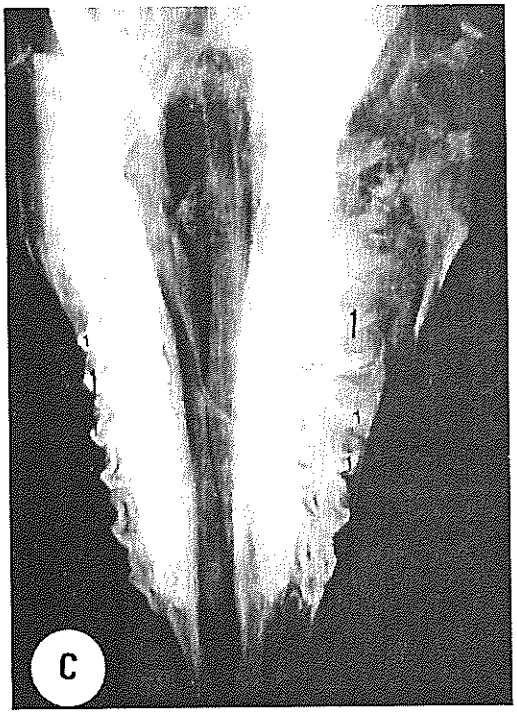

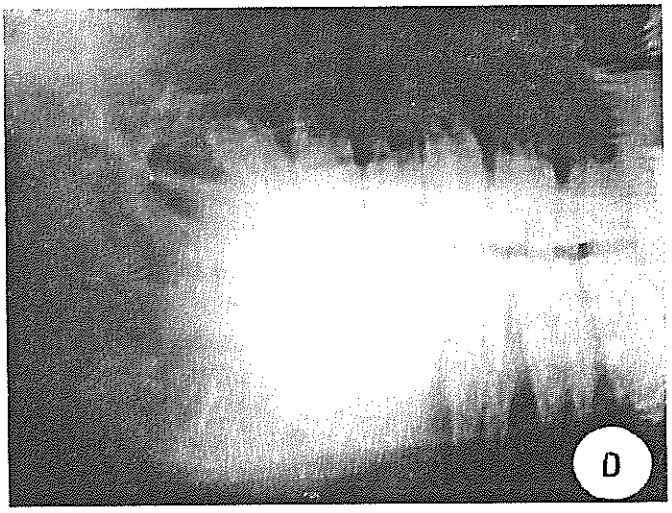

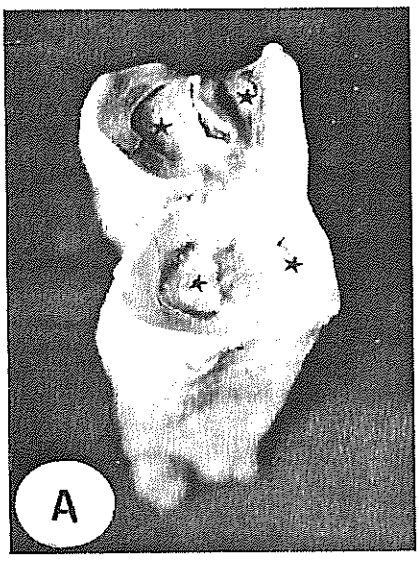

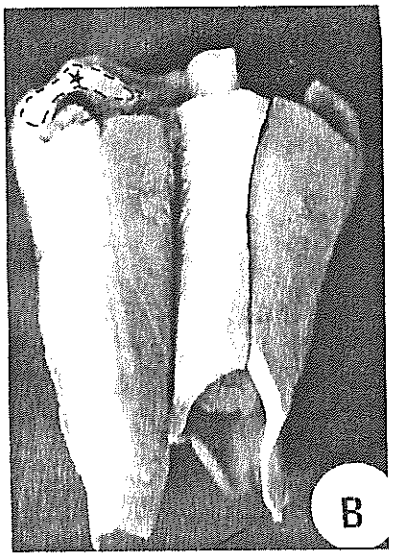

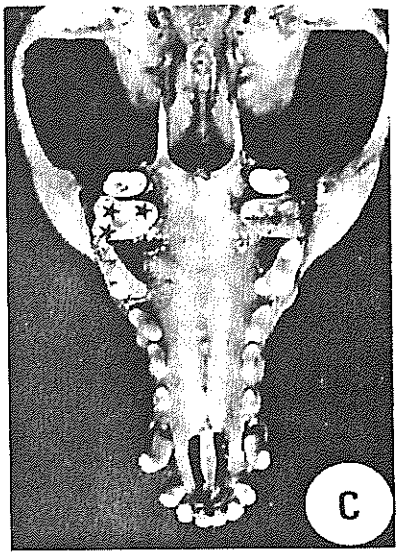

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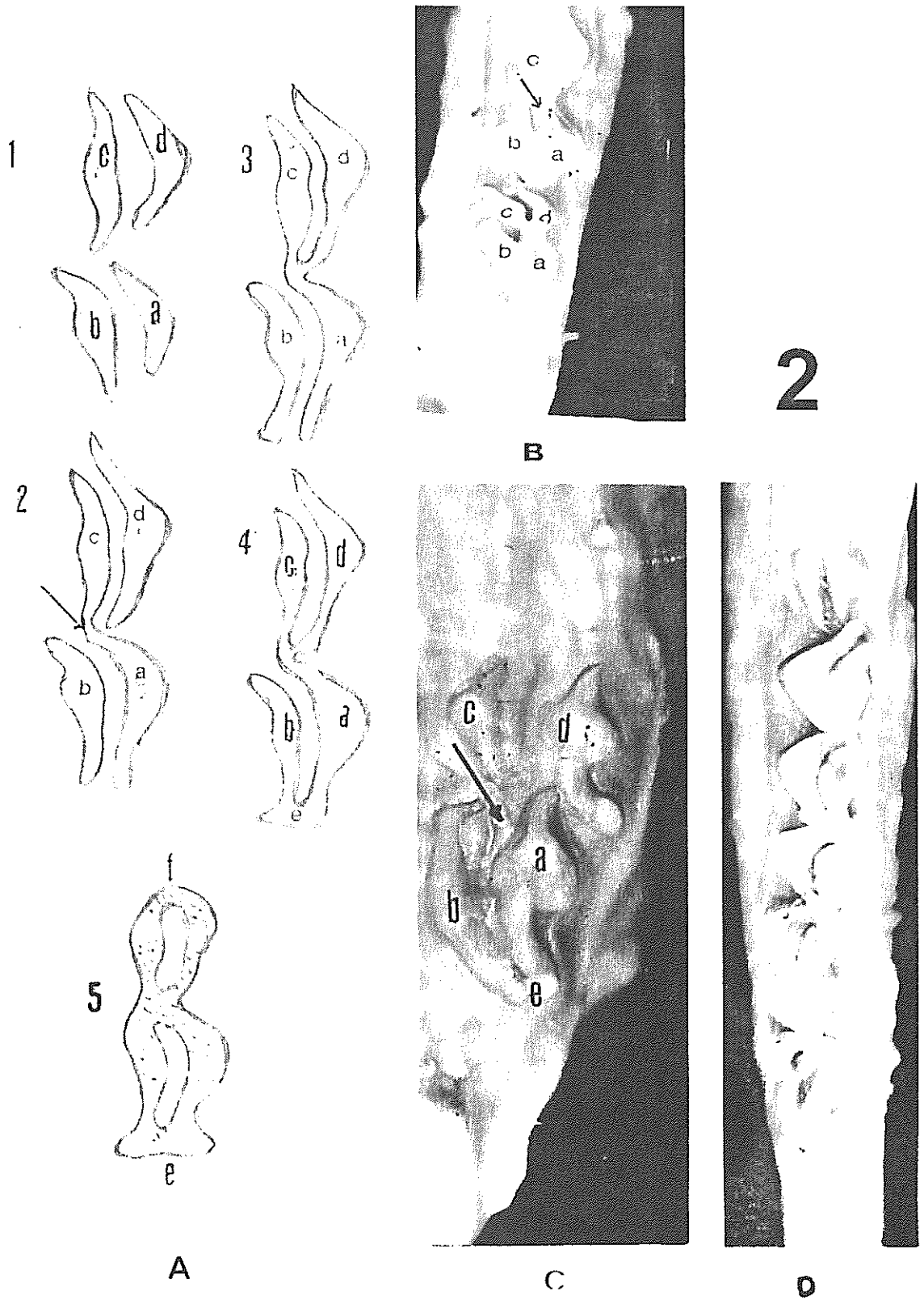
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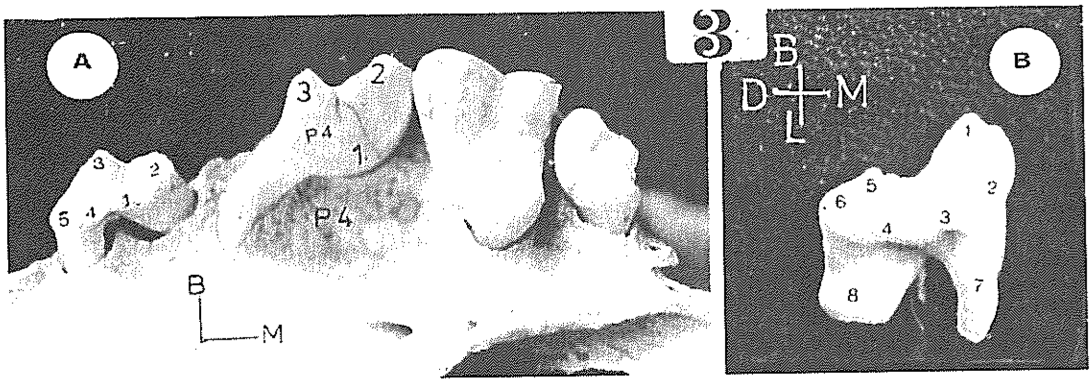
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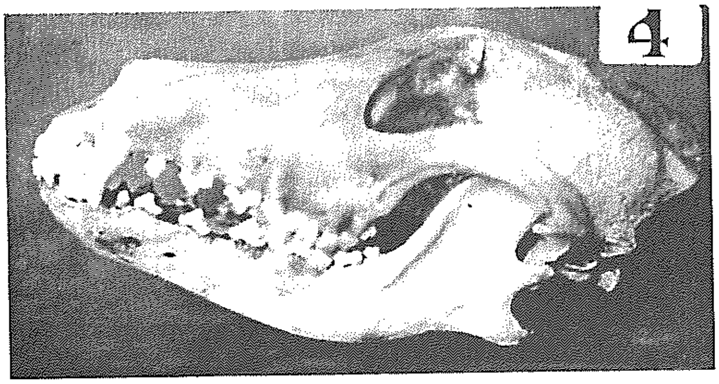
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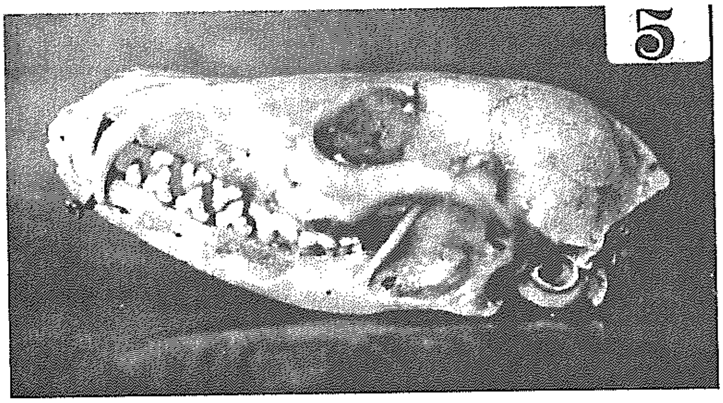
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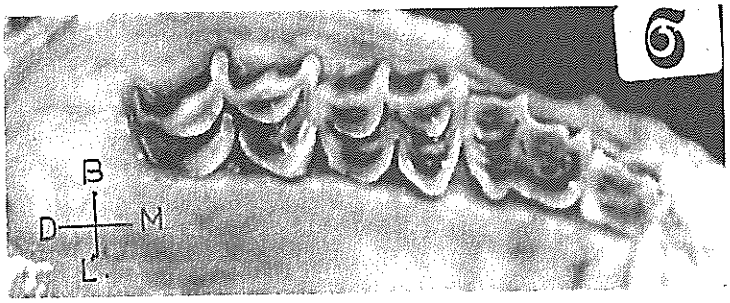
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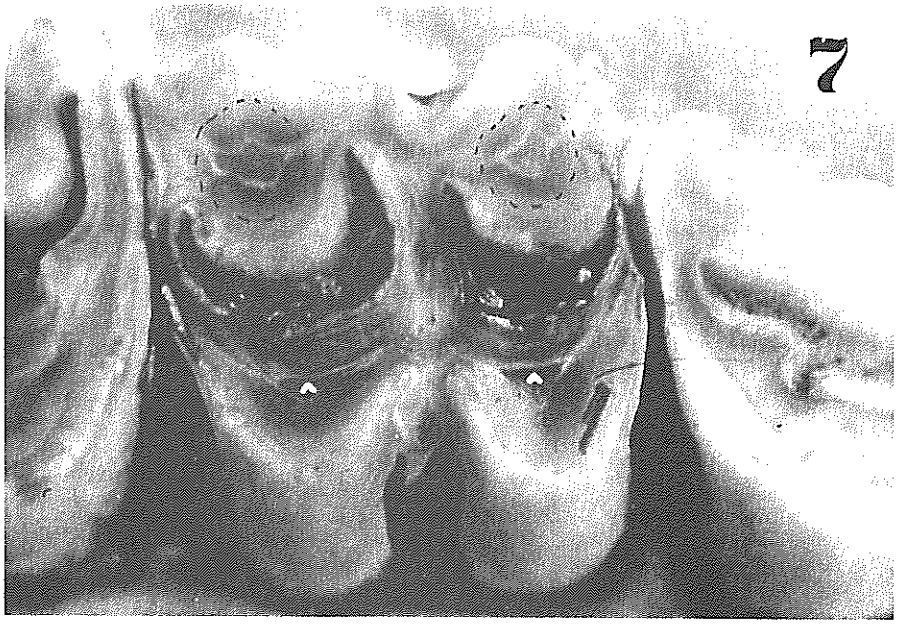
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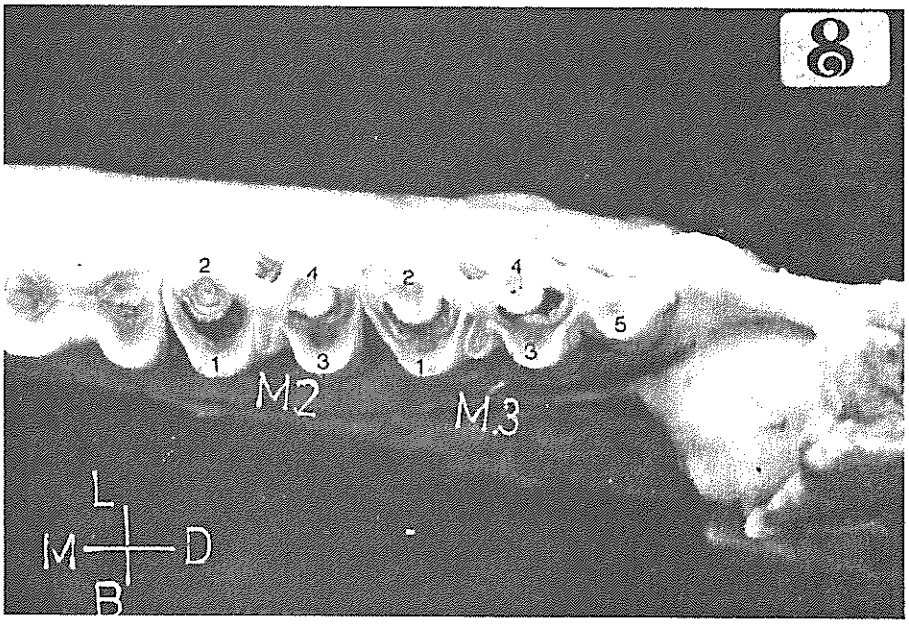
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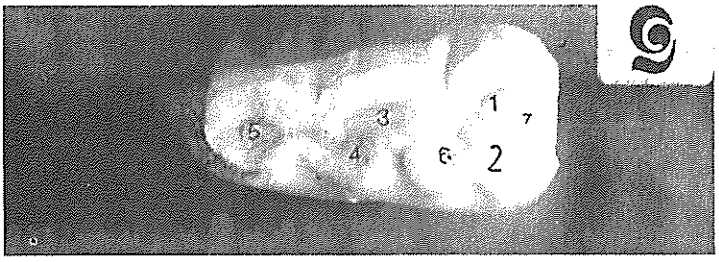
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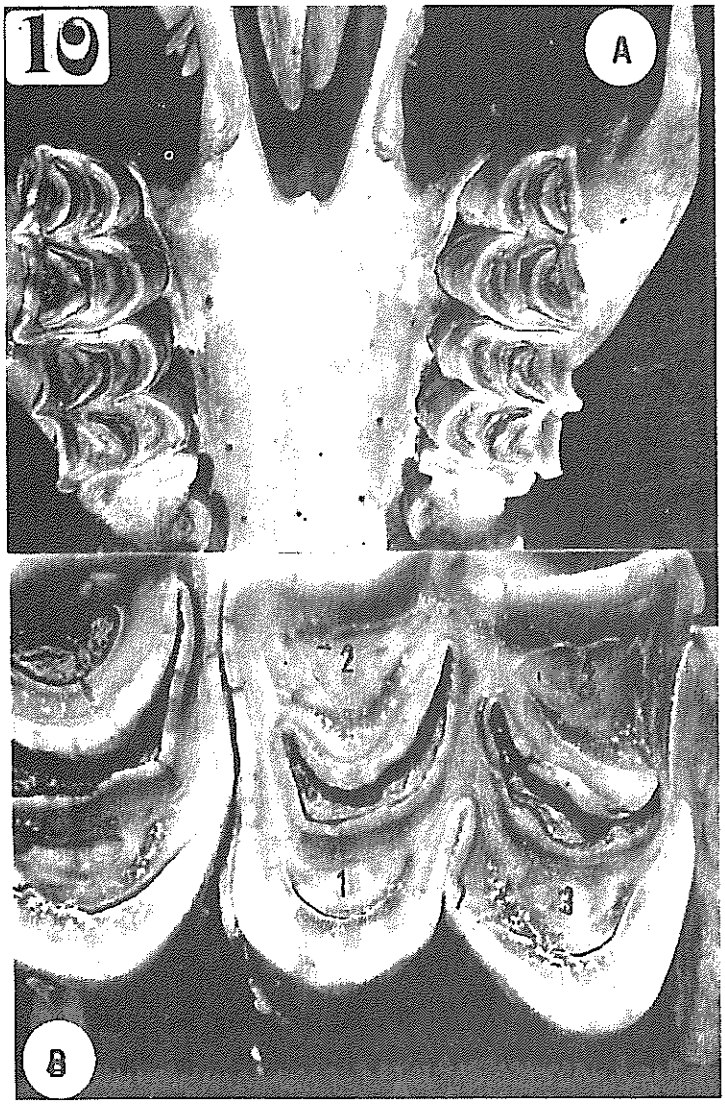
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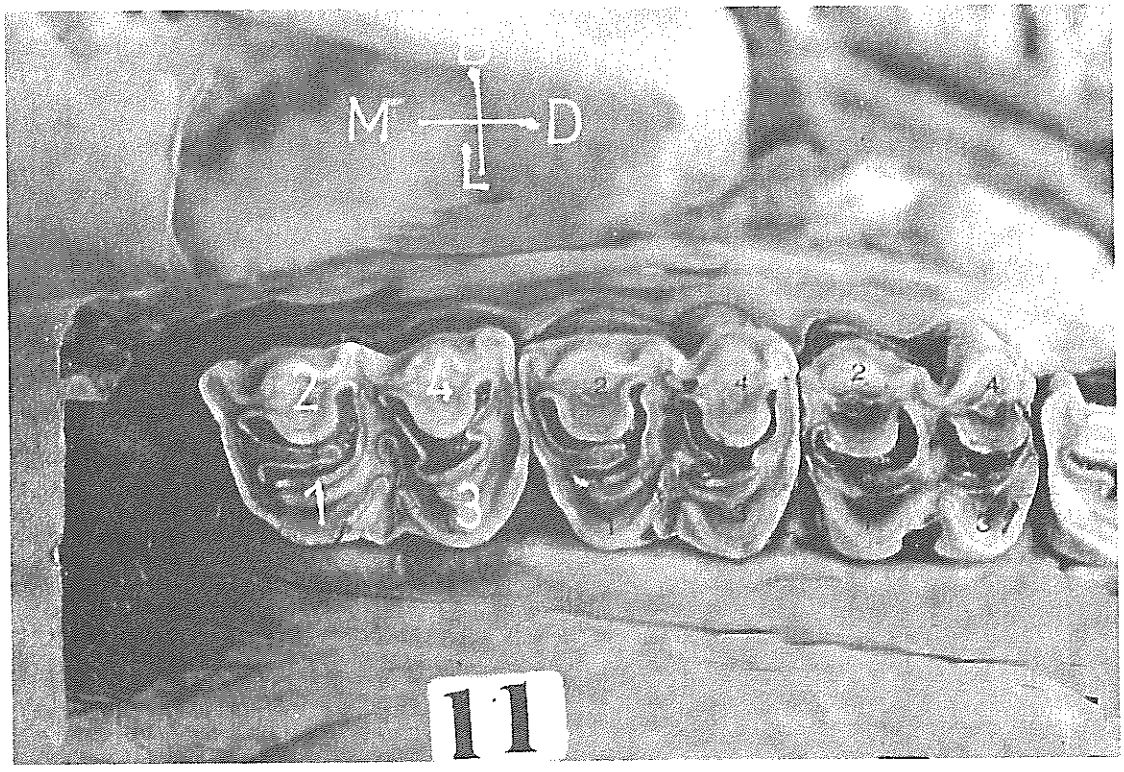
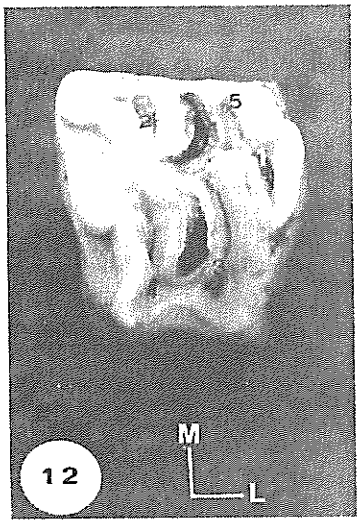
3


M
D
L
11


M
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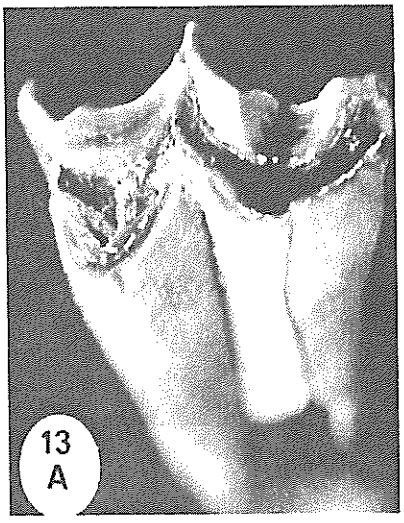
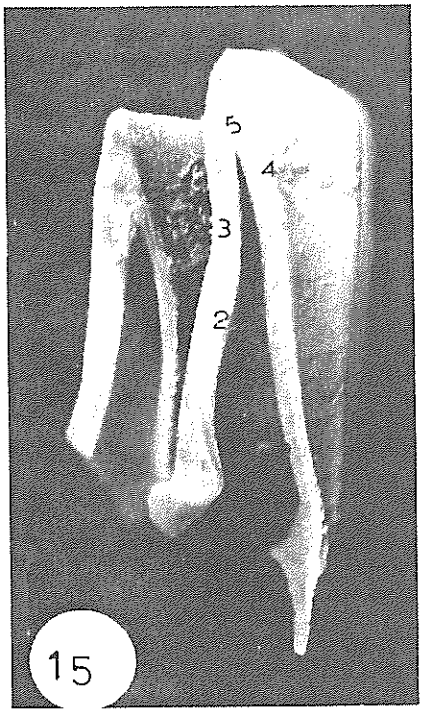
12

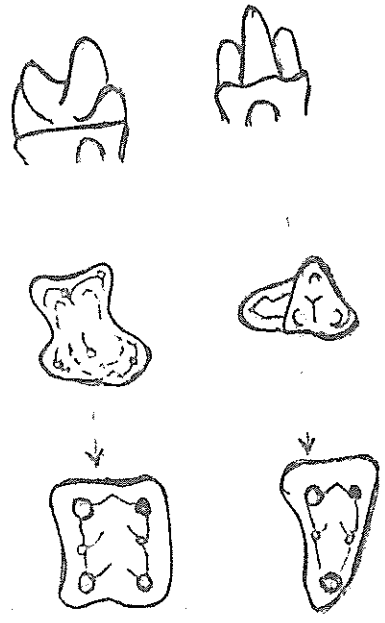

13
A


13
B

14



15



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الملخص العربى

نمط التوزيع لنتوءات الطواحن وملاءمتها الوظيفية فى بعض الحيوانات

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تفيد المعلومات المتوفرة على وجود ترابط وثيق بين كل من نوع الغذاء والشكل المورفولوجى للنتوءات الموجودة على الضروس .

قدمت الدراسة الحالية خلفية تشريحية من الناحية الوصفية وأسلوب توزيع النتوءات واوجه الاختلاف والتشابه فى طواحن الفك العلوى والسفلى وذلك فى خمس أنواع من الحيوانات (الثعلب ــ الكلب ــ الجاموس ــ الجمل ــ الحمار) ممثلة لفصائل اللواحم وآكلات الأعشاب .

كما تم دراسة مراحل نمو هذه النتوءات فى عجول الجاموس كنموذج لآكلات العشب إضافة إلى كونها تحتوى على النمط الأمثل لمثل هذه النتوءات وأوضحت الدراسة وجود أربع مراكز لنمو هذه النتوءات اثنان قاصيان والآخران دانيان يفصل بينهما منطقة غائرة ــ ثم تمر بعدة مراحل من الالتحام حتى يتم تكوين وحدتان لكل طاحنة ، وقد تبين أن الاتحاد البينى بين الوحدتين يسبق الاتحاد الداخلى فى كل وحدة وينشأ المظهر الأخير للسطح المضغى للضرس باتحاد الوحدتين معاً " .

وقد أثبتت الدراسة ان التيجان الخاصة بضروس الفك العلوى فى كل من الثعلب و الكلب تتميز بوجود ثلاث نتوءات حادة الشكل (أثنان خارجيان يعرفان باراكون وميتاكون ، والثالث داخلى مختزل يعرف برتوكون) وعلى ذلك ينتج سطح مضغى مثلث يطوق بواسطة برثن صغير يحمل نتوءين ثانوين (هيبوكون وميتاكونيول) بينما فى ضروس الفك السفلى يتحرك الباراكون والميتاكون إلى الداخل إضافة إلى ذلك يتضخم الضرس الطاحن الأول فى الفك السفلى بدرجة ملحوظة نتيجة لإقتران برثن خلفى تالونيد ، بالمثلث السابق يخرج من هذا البرثن نتوء خارجى يسمى هيبوكونيد وآخر داخلى يسمى أنتوكونيد وينمو بينهما هيبوكونييد .

فى ضوء نتائج هذا البحث ظهر بوضوح أن عملية تحول الغذاء من اللواحم إلى آكلات العشب ينعكس على شكل وترتيب النتوءات المصاحبة للضروس وعلى ذلك تتحول الأسنان ذات النتوءات الثلاث فى اللواحم إلى أسنان متعددة النتوءات وفى نفس الوقت تكون النتوءات فى نفس المستوى .

يتبين أيضاً أن تاج الضروس فى الجاموس يحتوى على أربع نتوءات هلالية الشكل تترتب على هيئة مربع ، إثنان قاصيان والآخران دانيان ، وتتماثل نتوءات الطواحن فى الجمل مع نظيراتها فى الجاموس من حيث الترتيب والوصف غير أن ميل النتوءات تجاه الحنك فى الفك العلوى ــ والعكس فى الفك السفلى ــ يكون اكثر وضوحاً " فى الجمل وفى كلا النوعين يكون الإتحاد بين النتوءات على شكل حرف (w) وفى حالة الفصيلة الخيلية يظهر تعقيد لسطح المضغ فى الطواحن نتيجة إضافة نتوءات أخرى مما يعكس طبيعة المضغ فى هذه الفصيلة .