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MANDIBLE MORPHOLOGY IN MAMMALS (MAMMALIA: INSECTIVORA, CHIROPTERA, RODENTIA, CARNIVORA) OF ROMANIA

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Abstract. In this paper the mandible morphology is presented for 19 mammal species (Insectivora, Chiroptera, Rodentia, Carnivora) of Romania.

Résumé. On présente la morphologie de la mandibule de 19 espèces de mammifères (Insectivora, Chiroptera, Rodentia, Carnivora) de Roumanie.

Key words: mandible, morphology, mammals, Romania.

INTRODUCTION

When describing or identifying the species/genera, most of the scientists presented the skull and inclusively the mandible, but without making a description of their morphology.

Others, in their studies of comparative anatomy, pointed out especially the main parts on the outer side of the mandible.

In their comparative study of osteology and myology, George & Gaughran (1954) described and figured the skull and cervical side of *Blarina brevicauda* (Say, 1823) and *Scalopus aquaticus* (Linnaeus, 1758), inclusively the outer and inner side of the mandible.

Răduleț (2005; 2006 a, b; 2007 a, b) presented the mandible morphology of several micromammal species figuring and describing its structure remarked both on the outer side and the inner one.

Our study refer to the description of the outer and inner side of the mandible in different mammal species (Ord. Insectivora, Chiroptera, Rodentia, Carnivora) of Romania. Thus, the number of the main characters on which a species can be identified increases, especially making easier the systematists' identification of the mammals basing on mandible.

MATERIAL AND METHOD

For this study I used the material present in the collections of „Grigore Antipa” National Museum of Natural History (Bucharest). Around 1,100 mandibles of 19 mammal species of Romania were studied. But, I had at my disposal only 1 – 2 pieces from the species: *Myotis mystacinus* (Kuhl, 1817), *Spalax microphthalmus* Gldenstaedt, 1770, *Vormela peregusna* Gldenstaedt, 1770.

Mandibles were studied with the stereomicroscope and drawn using *camera lucida*.

English translation by Mihaela Barcan Achim.

Abbreviations: *condyloid apophysis* – APC; *caput mandibulae* – CAPM; *corpus mandibulae* – CORM; *crista ramus mandibulae* – CRM; *foramen mandibulae* – FM; *fossa ramus mandibulae* – FRM; *fossa (fovea) submandibularis* – FSM; *incisura mandibulae inferior* – IMI; *incisura mandibulae superior* – IMS; *linea mylohyoidea* – LM; *processus angulus mandibulae* – PAM; *processus corpus mandibulae* – PCM; *processus condylaris (condyloideus)* – PCON; *processus coronoideus* – PCOR; *ramus mandibulae* – RM; *sulcus mylohyoideus* – SM; *tuberositas pterygoidea* – TP.

RESULTS AND DISCUSSIONS

Order Insectivora

Family Soricidae Fischer von Waldheim, 1817

Subfamily Crocidurinae Milne-Edwards, 1872

Crocidura russula (Hermann, 1780) (Fig. 1), on the outer side, RM has a slight central depression; PCOR is a trapezoidal thick blade with a rounded tip, and subterminally a semicircular crest towards PCON which borders a depression to the posterior margin of PCOR and IMS; CAPM is L-shaped, with the upper arm thicker, the inner one oblique downwards; IMS and IMI semicircular; PAM like an elongated thin spine, dorso-ventrally flattened with the tip bevelled upwards; FRM is like a truncated cone and continues with a semicircular wide ditch; FM oval, with the opening to PCON; SM is superficially concave; LM oblique; FSM superficial depression.

Order Chiroptera

Family Vespertilionidae Gray, 1821

Subfamily Vespertilioninae Gray, 1821

Myotis mystacinus (Kuhl, 1817) (Fig. 2): RM can be observed on the outer side of the mandible which has a concavity from CORM to PCON, centrally deeper; PCOR is a triangular blade, with thickened margins, oblique outwards; PCON triangular in lateral view; IMS straight; IMI in a right angle; CAPM like a transversal stick on PCON where the outer tip is pointed shorter, and the inner one, rounded; PAM arm with the inferior margin and the tip thickened, and the upper margin, narrow; FM semicircular, with the opening to IMI; SM oval, concav; LM parallel with the tooth row; FSM superficial ditch.

Order Rodentia

Family Sciuridae Hemprich, 1820

Subfamily Sciurinae Hemprich, 1820

In *Spermophilus citellus* (Linnaeus, 1766) (Fig. 3), from an outside view, the mandible can be observed as it follows: RM is a little behind the tooth row; CORM has a large depression, like a truncated cone longitudinally; PCOR a lamellar spine-like with an elongated pointed tip, directed hindwards; CAPM, in lateral view, is ram-headed, and like a comma in dorsal view; PCON trapezoidal which has a conic concavity on the outer side, with the base in RM and centrally with a small prominence. Conic concavity from PCON is less deep centrally, and its tip is in

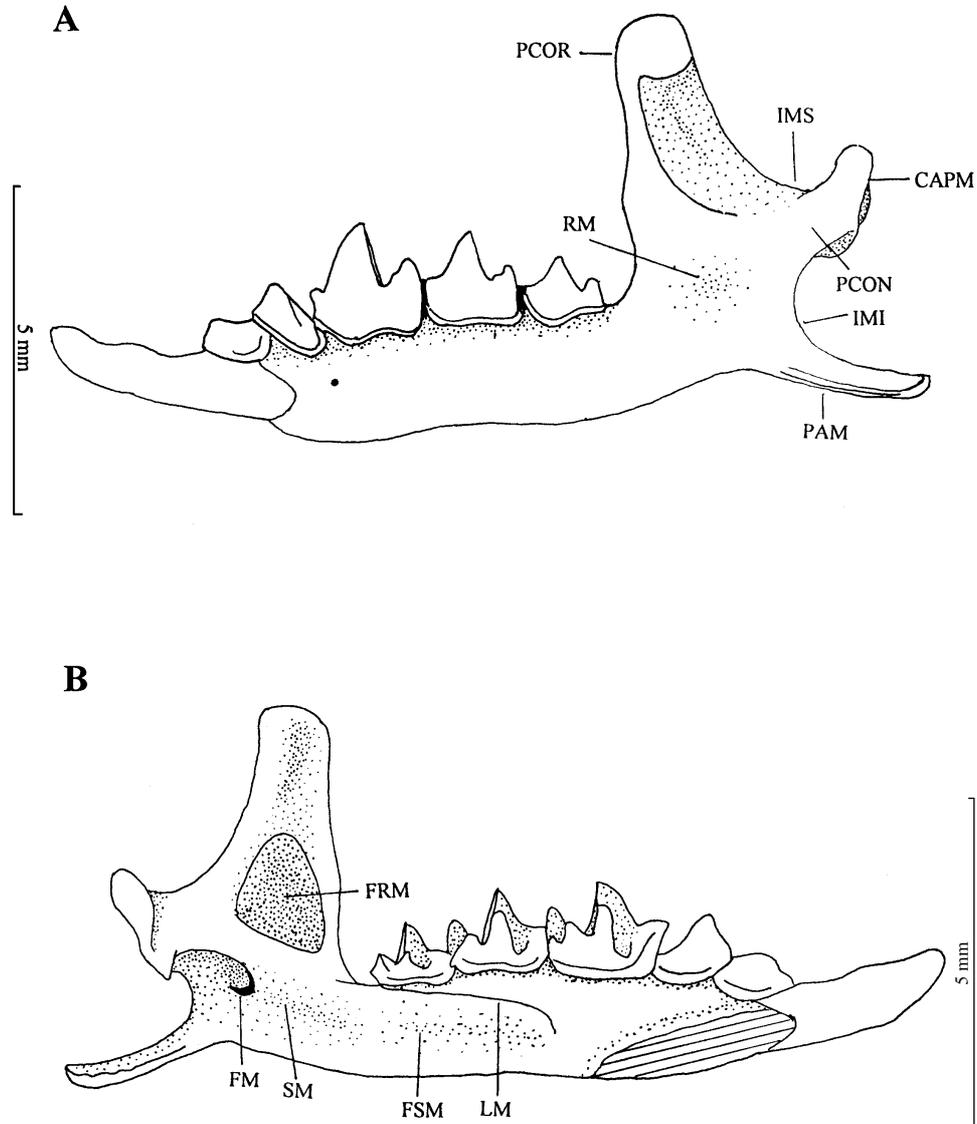


Fig. 1 – Mandible in *Crocidura russula* (Hermann, 1780): A, outside view; B, inside view.

PCON subterminally; IMS ellipsoidal; IMI semicircular; PAM almost square with the lower margin thickened, obliquely bounded interiorly. Posterior side and the tip thickened, like a right-angled triangle, where the right angle is outwards directed and a cathetus laterally upwards. Anterior side thickened, more prominent interiorly; TP has an incomplete costal prominence, oblique, on the lower margin. CRM is like a mane from CORM to the PCON; FM almost lenticular, on the upper side of CRM, at the base of PCOR, with the opening to PAM; LM oblique against the dentition; FSM large, oval, slightly concave.

The mandible of *Spermophilus suslicus* (Guldenstaedt, 1770) (Fig. 4), mostly resembles that of *Spermophilus citellus* (Linnaeus, 1766), but is different by: PCOR has on the outer side a conic depression, deeper to the upper margin, and the tip extended up to CAPM. In RM, under PCOR, there is a prominence downwards limited by a superficial concavity which extend with a truncated cone-like one in CORM; PAM has a thickened lower margin bent inwards in a right angle. Its posterior side is upwards thickened as a right-angled triangle, with the right angle towards outside and inwards elongates with a lobe. Anterior margin thickened, less prominent innerwards than in *Spermophilus citellus*. FM lenticular is under and at the base of PCOR asymmetrically to IMS.

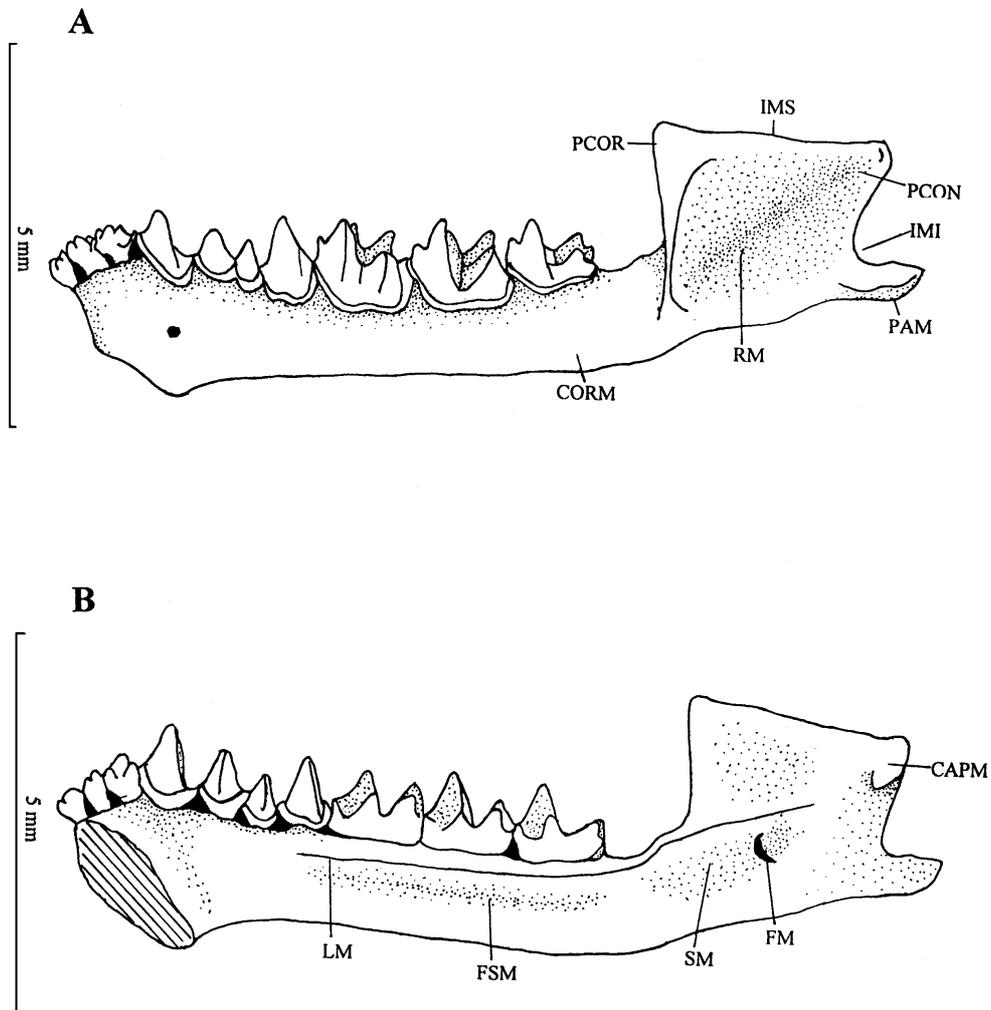


Fig. 2 – Mandible in *Myotis mystacinus* (Kuhl, 1817): A, outside view; B, inside view.

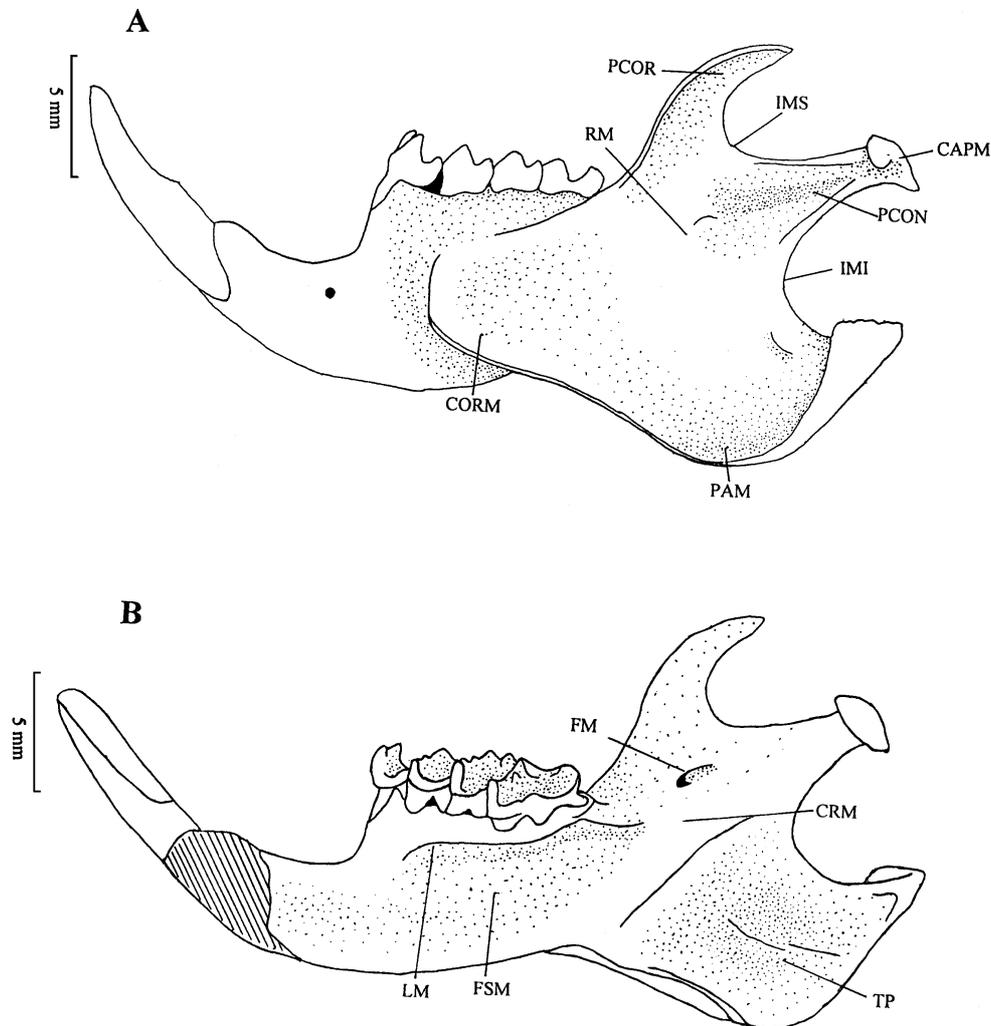


Fig. 3 – Mandible in *Spermophilus citellus* (Linnaeus, 1766): A, outside view; B, inside view.

Family Myoxidae Gray, 1821
Subfamily Myoxinae Gray, 1821

Muscardinus avellanarius (Linnaeus, 1758) (Fig. 5) has: RM behind the tooth row, and the outer side even; CORM with a wide truncated-cone-like depression; PCOR as a triangular blade with the tip hindwards bent; PCON is a rectangular blade, longitudinally centrally slightly concave; CAPM oblique elliptical cap forwards-hindwards; PAM blade almost squared whose thickened lower margin is inwards bent, centrally with a depression almost circular with a very thin wall. Posterior side thickened, hindwards curved, with the upper side elongated in a lobe

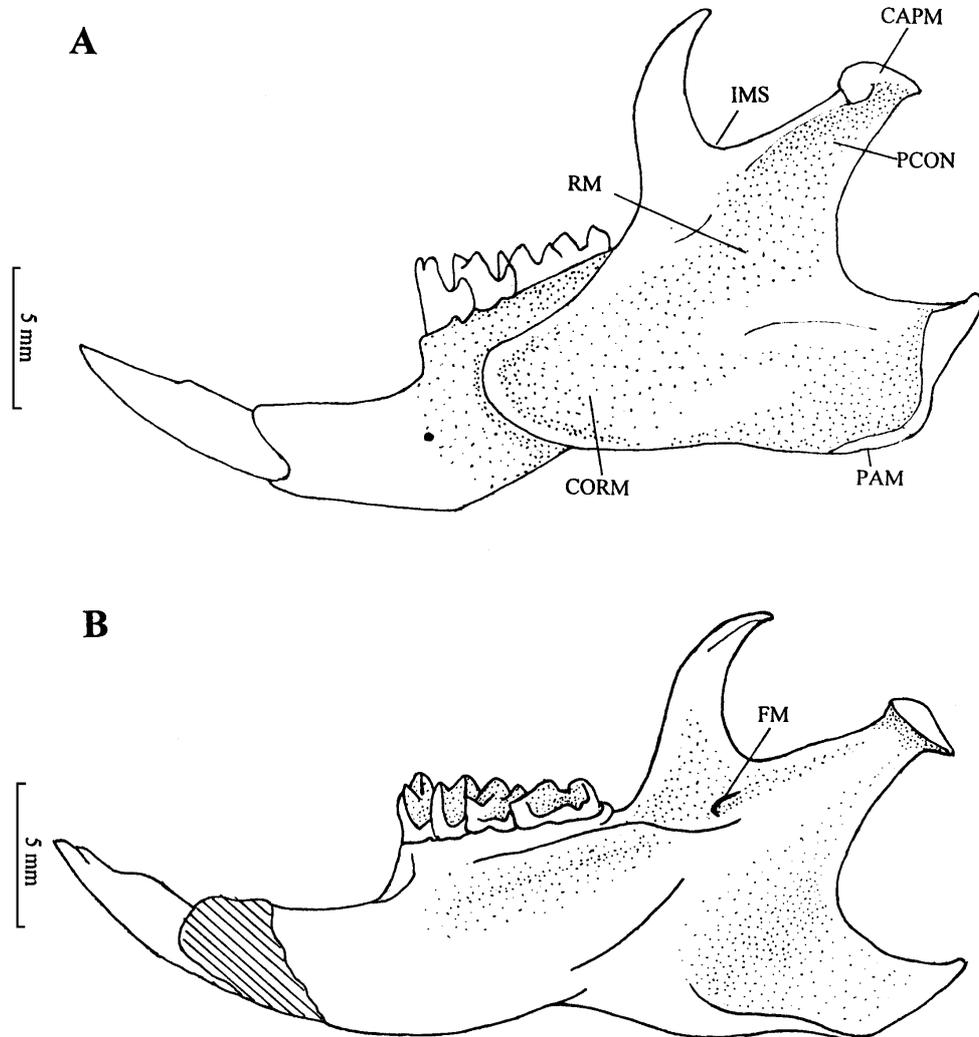


Fig. 4 – Mandible in *Spermophilus suslicus* (Guldenstaedt, 1770): A, outside view; B, inside view.

hindwards directed. Anterior side is much thickened; IMS oval; IMI semicircular; CRM like a flattened mane between M_3 and the base of PCON; FM is a U-shaped longitudinal orifice at the limit between CRM-PCON; TP concave surface on PAM; LM oblique to the diastema; FSM ovally elongated.

Family Muridae Gray, 1821
Subfamily Arvicolinae Gray, 1821

Microtus agrestis Linnaeus, 1761 (Fig. 6) has: RM behind the tooth row, with the outer side even; CORM has a longitudinal semicircular crest; PCOR is a triangular blade with a hindwards bent pointed tip; PCON an almost rectangular blade with a ventrally bent crest placed centrally longitudinally which limits a

depression upwards; CAPM sole-like cap with the wider side directed forwards; IMS oval; IMI in right angle; PAM triangular blade with the lower margin curved inwards and a rounded tip, widened hindwards; PCM rectangular, oblique with a longitudinally notched surface, and the anterior corner rounded exceeding the lower margin of CORM; CRM is a mane from CORM to the lower margin of PCON, with a flattened surface; FM lenticular, at the limit between CRM-PCON, under IMS; TP concave surface on PAM; LM parallel with the tooth row, then oblique; FSM oval, centrally deeper.

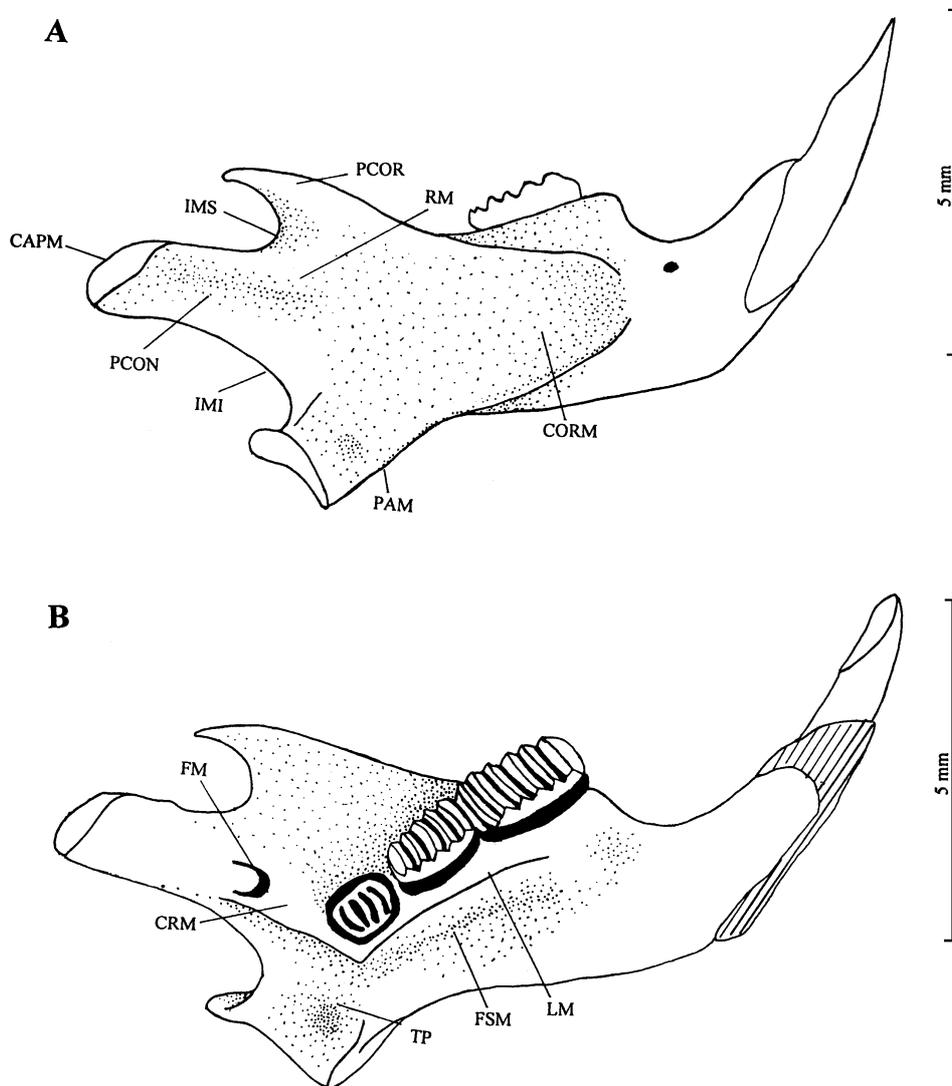


Fig. 5 – Mandible in *Muscardinus avellanarius* (Linnaeus 1758): A, outside view; B, inside view.

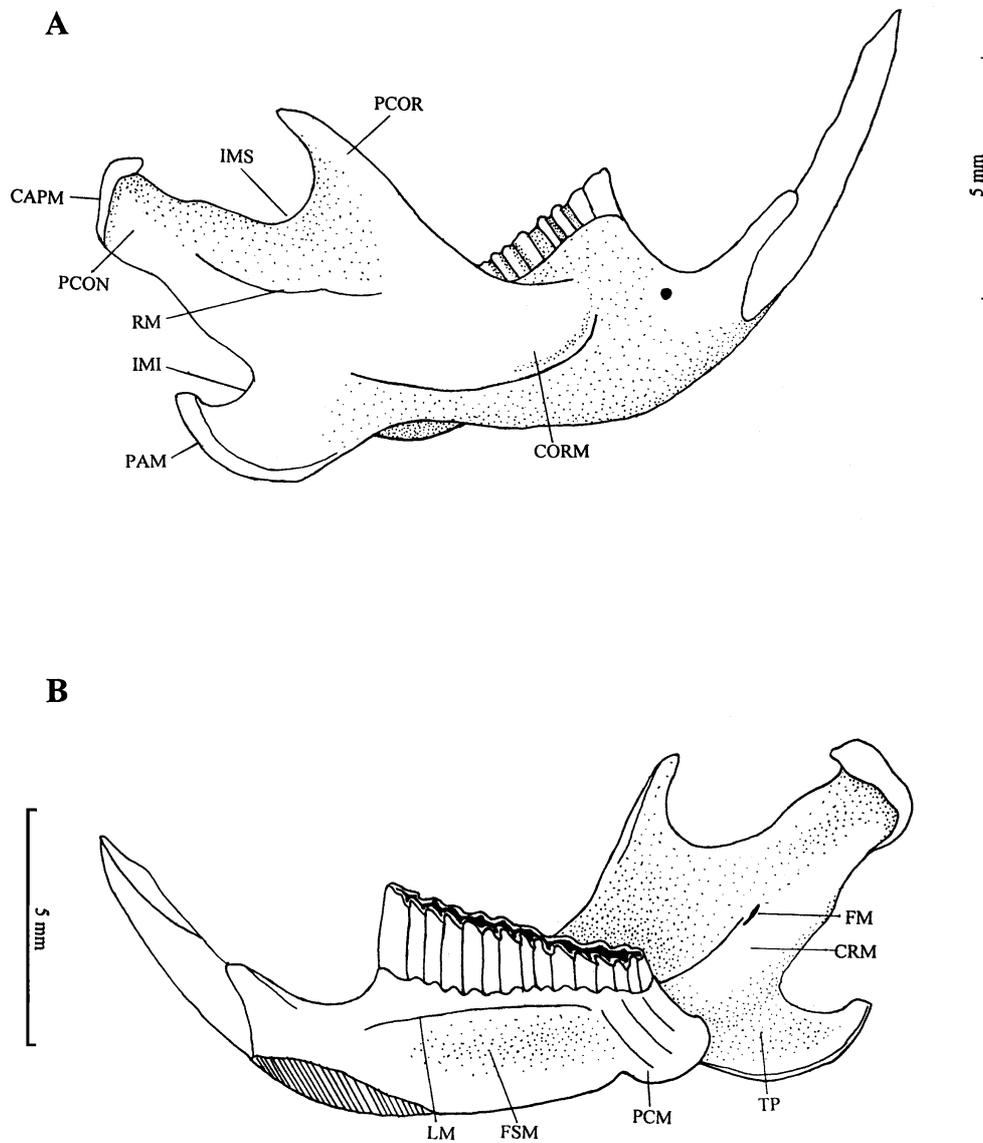


Fig. 6 – Mandible in *Microtus agrestis* Linnaeus, 1761: A, outside view; B, inside view.

Microtus rossiaemeridionalis Ognev, 1924 (Fig. 7) has: in CORM a rugged longitudinal crest which limits upwards a slight depression and downwards a rugged surface; RM behind the tooth row; PCOR is a lamellar spine with the tip hindwards directed; PCON a trapezoidal blade with a bent central longitudinal crest which upwards limits a depression; PAM almost a “L”-shaped blade where the lower margin is bent inwards, the tip rounded and rugged; PCM rectangular, oblique, lower margin rounded, does not exceed the lower margin of CORM; CRM mane from PCM to the lower margin of PCON; FM ellipsoidal hole at the limit of CRM-

base of PCON; IMS semicircular; IMI almost in a right angle; FSM elongated depression; TP almost triangular, slightly concave.

Subfamily Murinae Illiger, 1815

Mandible morphology for the 4 species of the genus *Apodemus* of Romania is very similar. They have RM behind the tooth row and, on the outer side, they have a

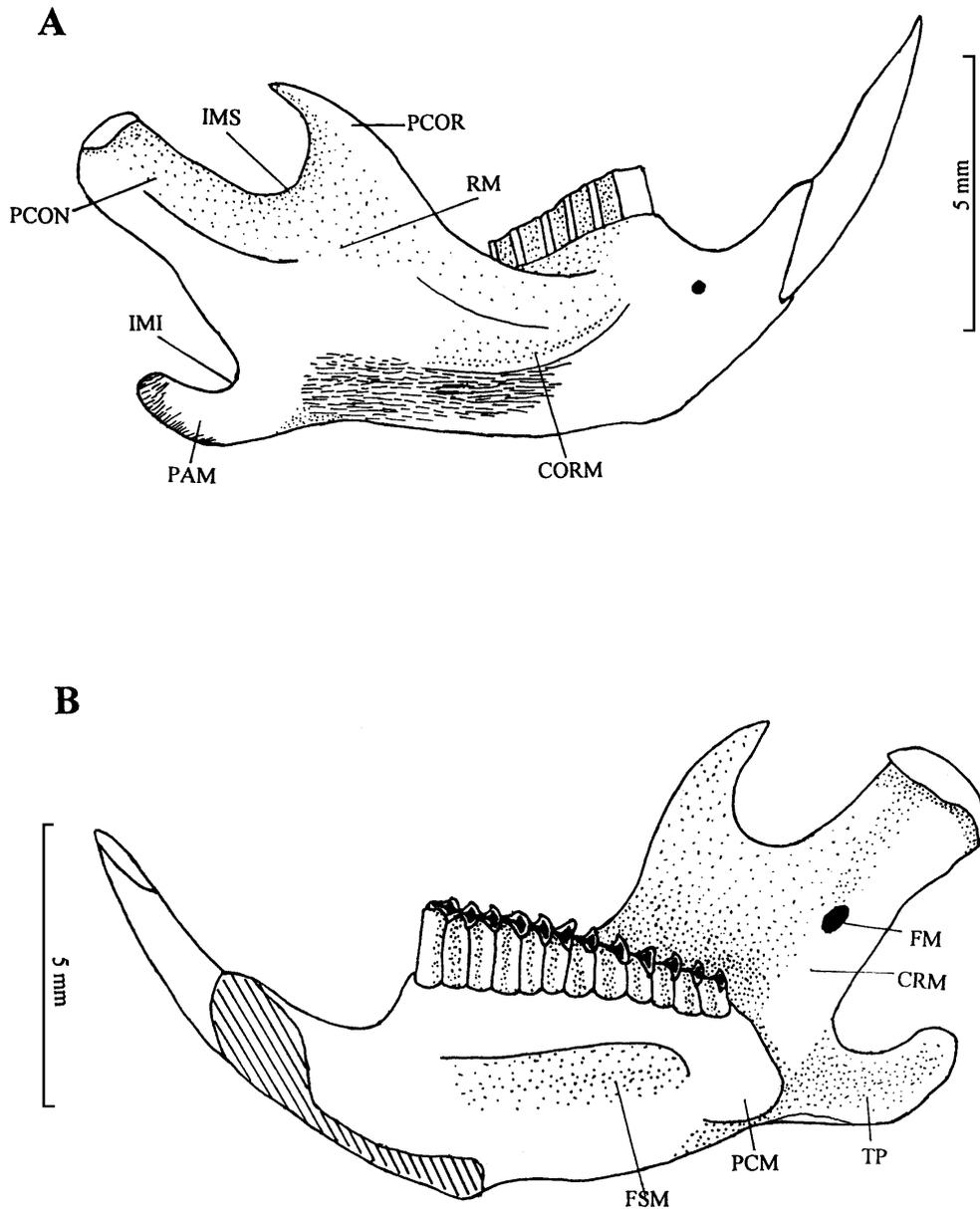


Fig. 7 – Mandible in *Microtus rossiaemeridionalis* Ognev, 1924 : A, outside view; B, inside view.

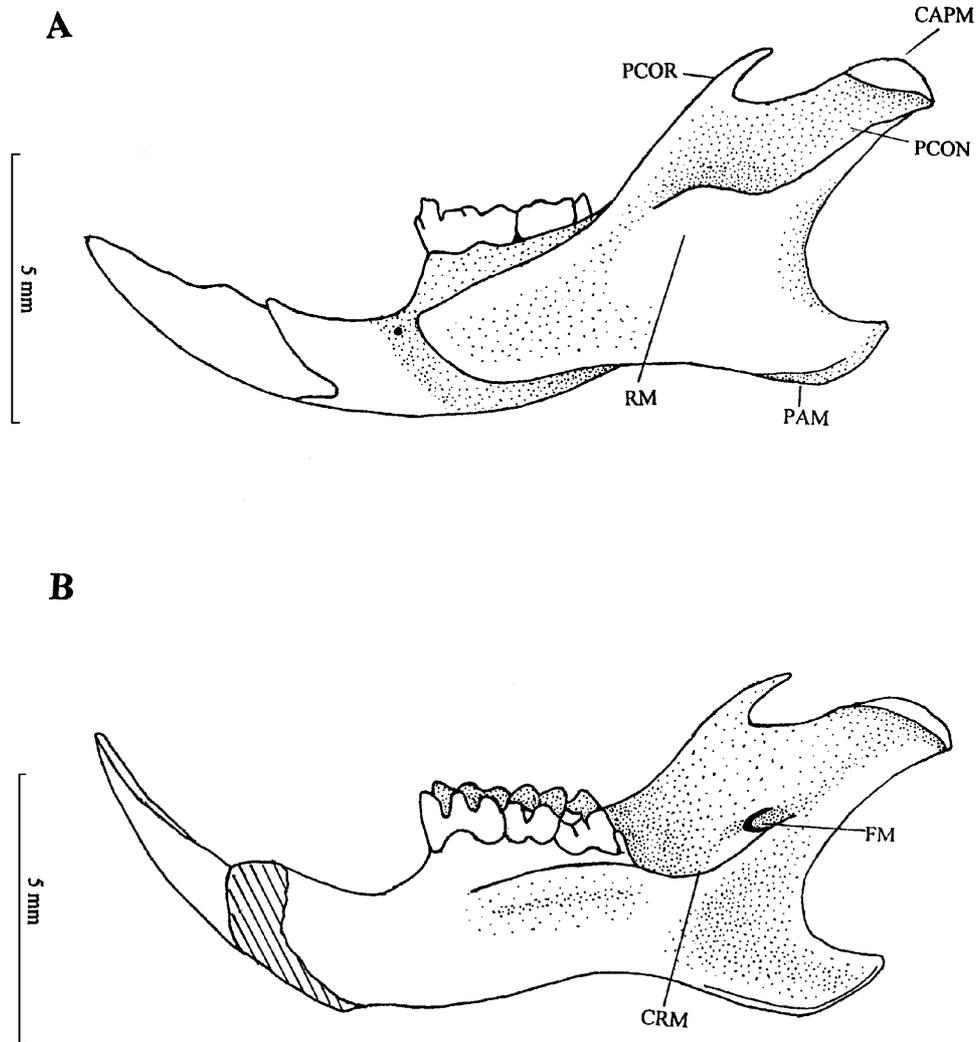


Fig. 8 – Mandible in *Apodemus sylvaticus* (Linnaeus, 1758): A, outside view; B, inside view.

“S”-shaped “crest” with an obvious prominence; PCOR is a short thin lamellar spine, pointed and hindwards directed; PCON trapezoidal; CAPM oval cap, obliquely displayed on the ending side of PCON; IMS elliptical; IMI semicircular; LM oblique to the diastema; SM oval; FSM oval elongated, centrally deeper.

Yet, their mandible has also features which differentiate them.

Apodemus sylvaticus (Linnaeus, 1758) (Fig. 8), on the external side has a prominence from RM under and in the anterior part of PCOR; PAM is a triangular blade to which the lower margin is bent inwards, in a right angle, and the tip bent upwards; CAPM, in lateral view, is like a cap on the upper side of PCON; CRM like a crest from M₃ to the lower side of PCON, terminally like a mane; FM ellipse, under PCOR, superior CRM, in a deeper depression with the opening towards PCON.

Apodemus flavicollis (Melchior, 1834) (Fig. 9) prominence from the outer side of the RM is the biggest and present under and in the anterior part of PCOR; PCOR spin curved obliquely outwards; PAM is a trapezoidal blade with the lower margin bent inwards, in a right angle, and the terminal one is oblique; CAPM in lateral view; big cap on the upper terminal side of PCON; CRM a crest from M_3 to the lower margin of PCON, terminally like a mane; FM ellipse-shaped, superior CRM, in a more superficial concavity than in *Ap. sylvaticus*, but under PCOR with the opening towards PCON.

Apodemus agrarius (Pallas, 1771) (Fig. 10) prominence from the external side of RM is central, under PCOR; PAM like a triangular blade where the basal side of the lower margin is in a right angle, and the terminal one oblique; rounded tip bent upwards; CAPM like a cap on the upper terminal side of PCOR; CRM very obvious, from M_3 to the lower margin of PCON; FM lenticular in the upper

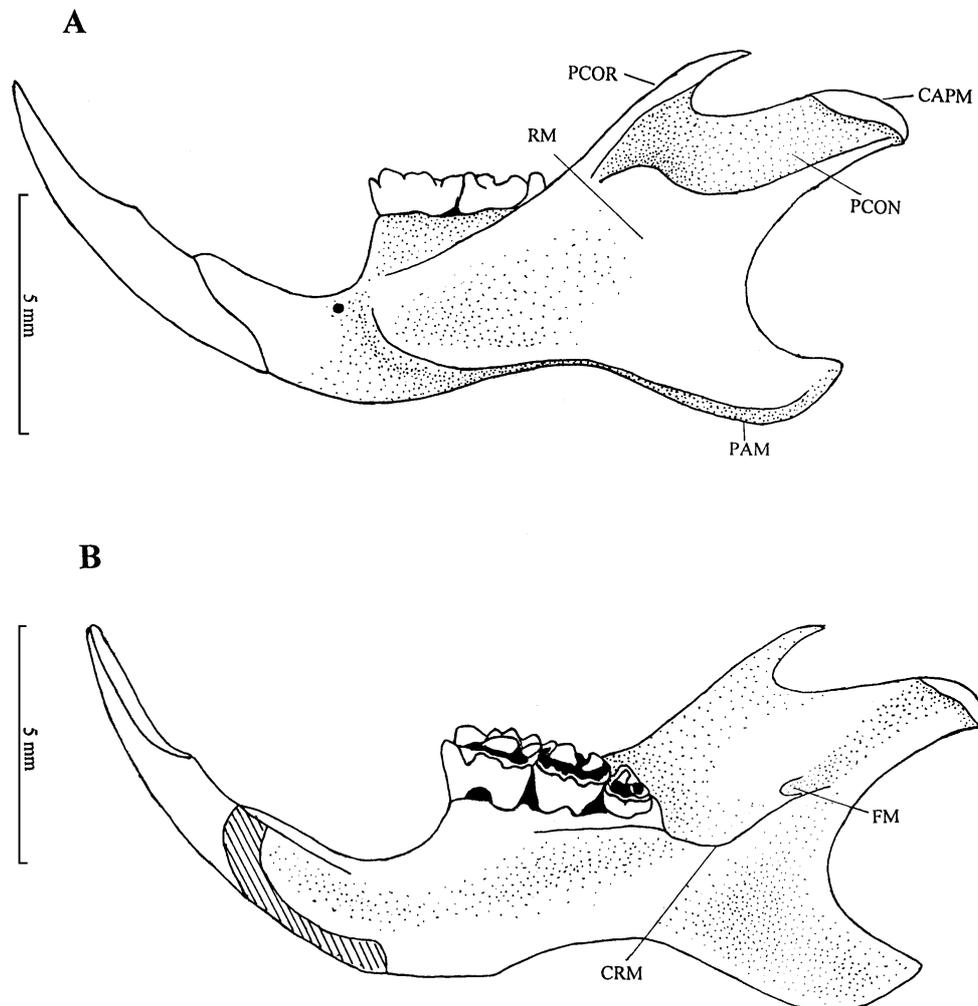


Fig. 9 – Mandible in *Apodemus flavicollis* (Melchior, 1834): A, outside view; B, inside view.

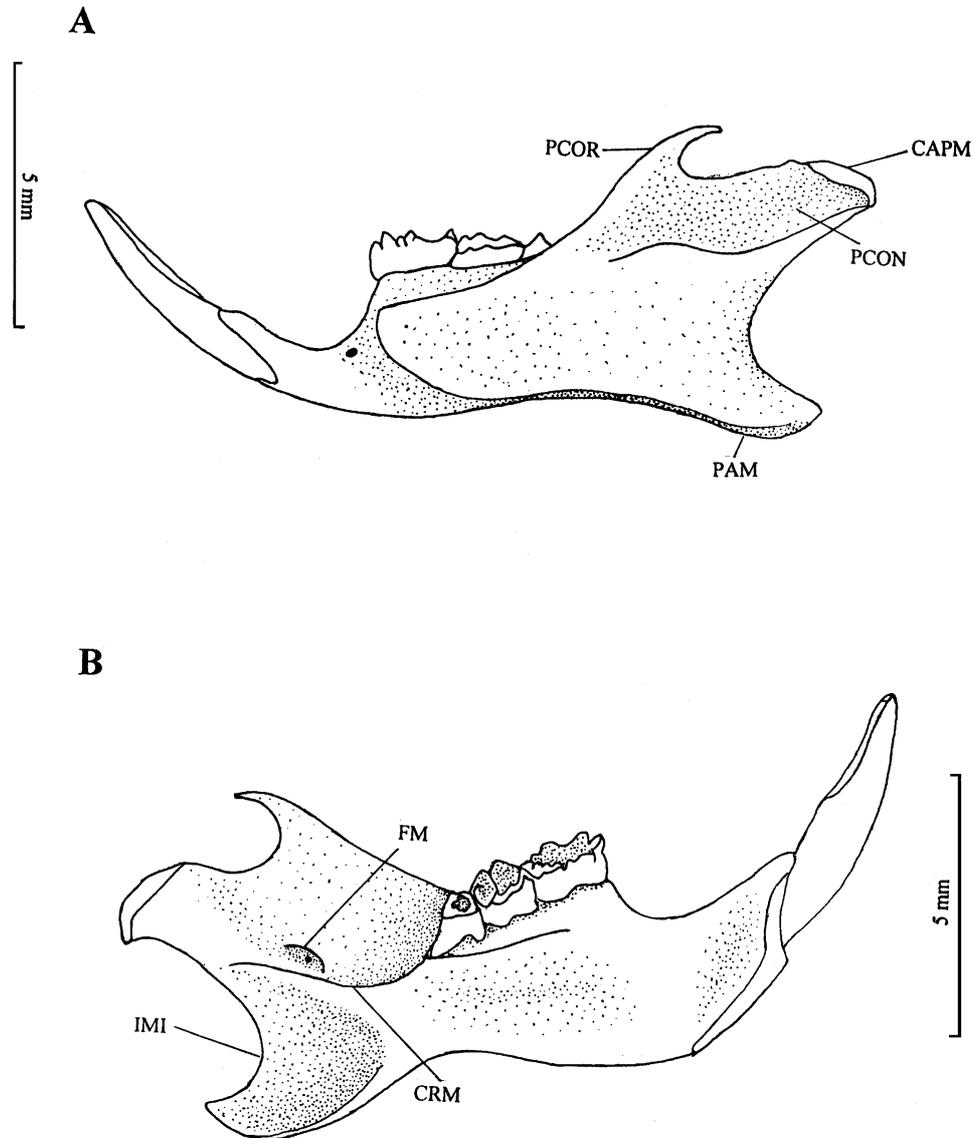


Fig. 10 – Mandible in *Apodemus agrarius* (Pallas, 1771): A, outside view; B, inside view.

posterior 1/3 of CRM, in a deep depression, with the opening to IMI, almost centrally with a small hole.

Apodemus uralensis (Pallas, 1811) (Fig. 11), on the external side, RM has a less obvious prominence, under IMS; PAM trapezoidal blade with the lower margin bent inwards, in a 90° angle, but the terminal part oblique; CAPM narrow cap on the terminal upper margin of PCON; CRM visible from M_3 to the lower margin of PCON and superior in comparison with the end of CRM; FM lenticular, at the base of PCON, asymmetrical and with the opening towards IMI.

Subfamily Spalacinae Gray, 1821

In *Spalax microphthalmus* Gldenstaedt, 1770 (Fig. 12) the mandible is thick and strong. On the outer side RM has a wide depression, deeper under PCOR; PCOR is an elongated lamellar spine with a rounded tip; CAPM is like an oval cap narrower towards outside; PCON is perpendicular on APC, and this is ca. 10 mm high, strong, terminally rounded and oval (in cross section); PAM is like a narrow blade fused mostly to RM, terminally rounded, like an apophysis at the base of APC; IMS semicircular. From the inner side view the mandible points out PCON; PCOR and

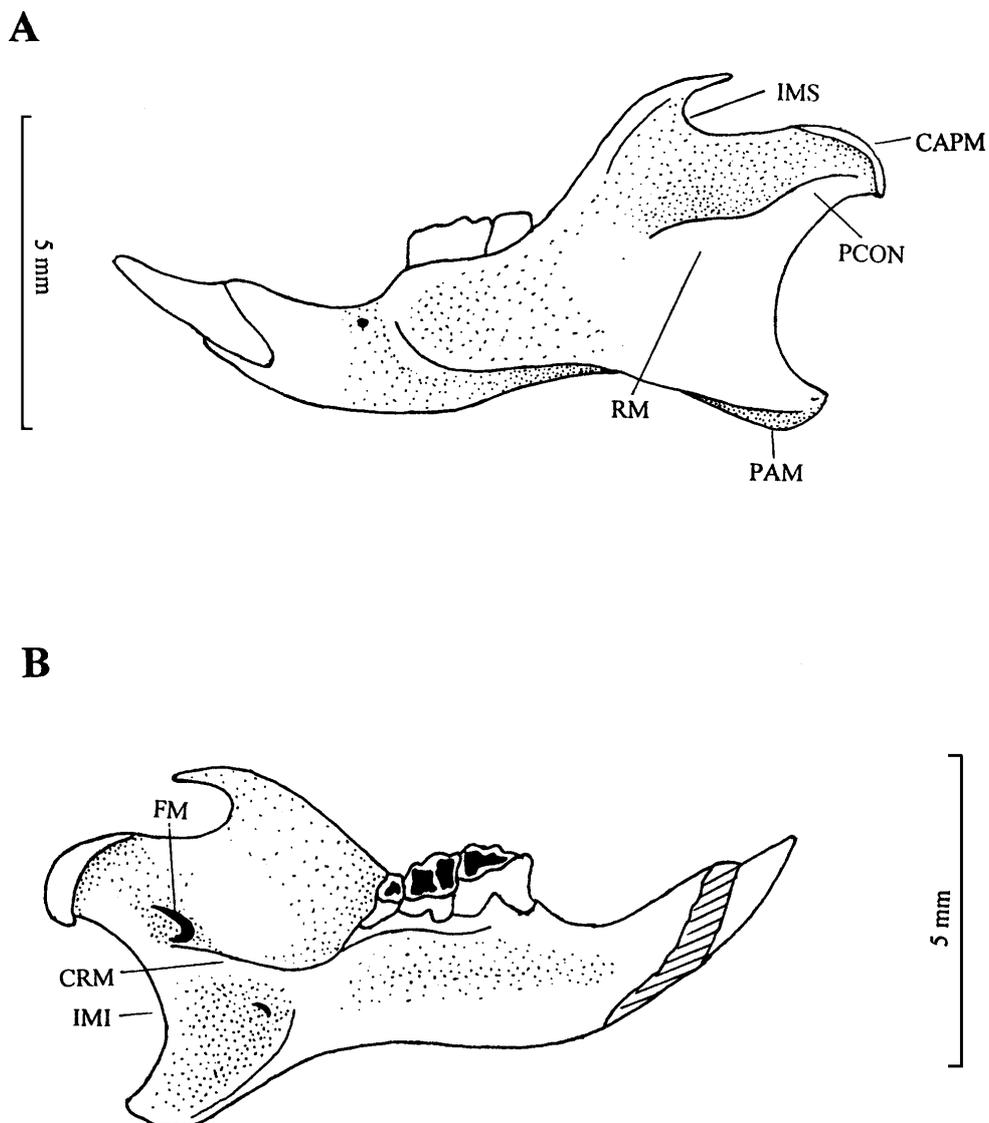


Fig. 11 – Mandible in *Apodemus uralensis* (Pallas, 1811): A, outside view; B, inside view.

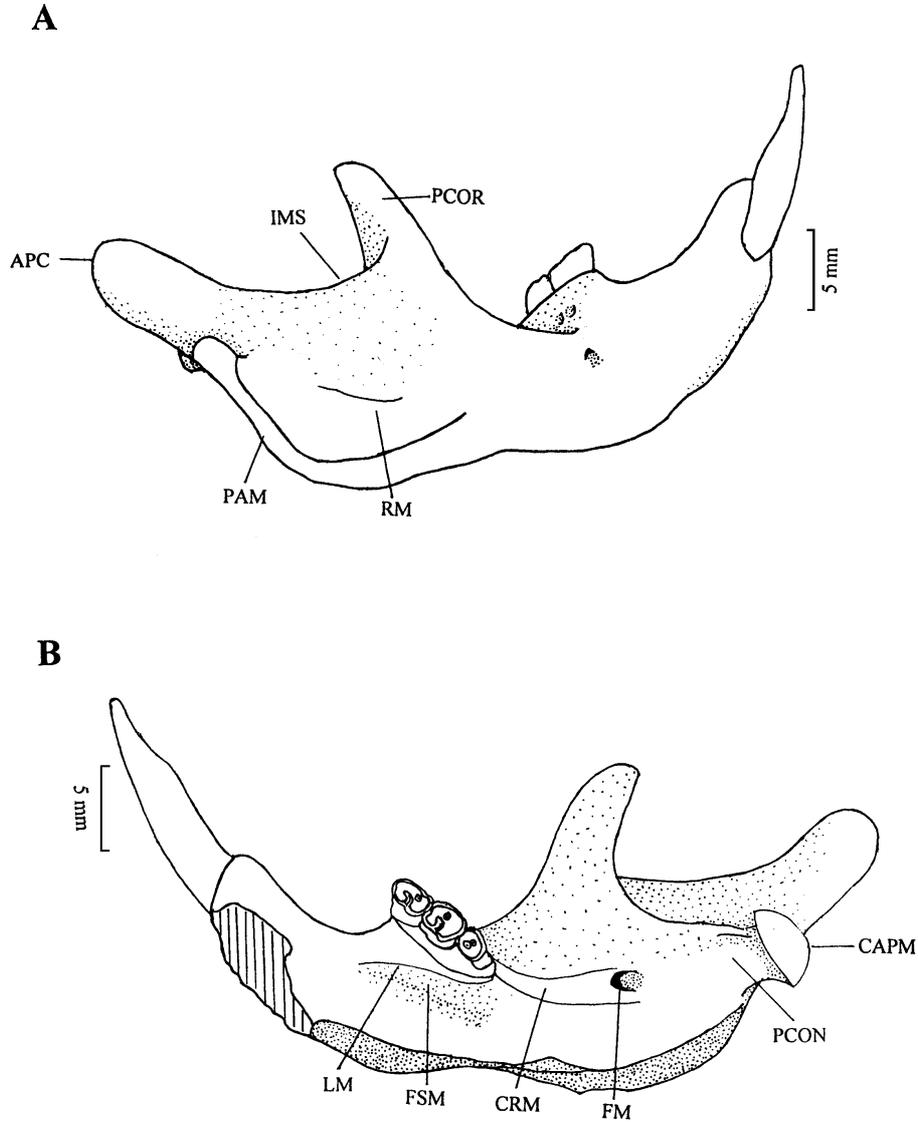


Fig. 12 – Mandible in *Spalax microphthalmus* Gldenstaedt, 1770: A, outside view; B, inside view.

APC behind the tooth row; CRM is like a mane between the lower margin of PCON and CORM; FM oval under IMS; FSM oval elongated, centrally deeper; LM oblique.

Family Dipodidae Fischer, 1817
Subfamily Sicistinae Allen, 1901

Sicista subtilis (Pallas, 1773) (Fig. 13) has: RM behind the tooth row, with the outer surface even and under PCOR an elongated prominence with a semicircular crest to the lower margin of PCON. The prominence is upwards limited by a

depression at the base of PCOR and extended in PCON; PCOR is like a short lamellar spine with a pointed tip, backwards directed; CAPM an oval-elongated oblique cap on the terminal side of PCON; PAM trapezoidal blade with the margins bent inwards, with a rounded tip obliquely-hindwards directed; IMS oval; IMI semicircular; CRM crest from M_3 till under FM; FM lenticular with the opening towards IMI; TP concave surface on PAM; LM oblique towards diastema; FSM oval.

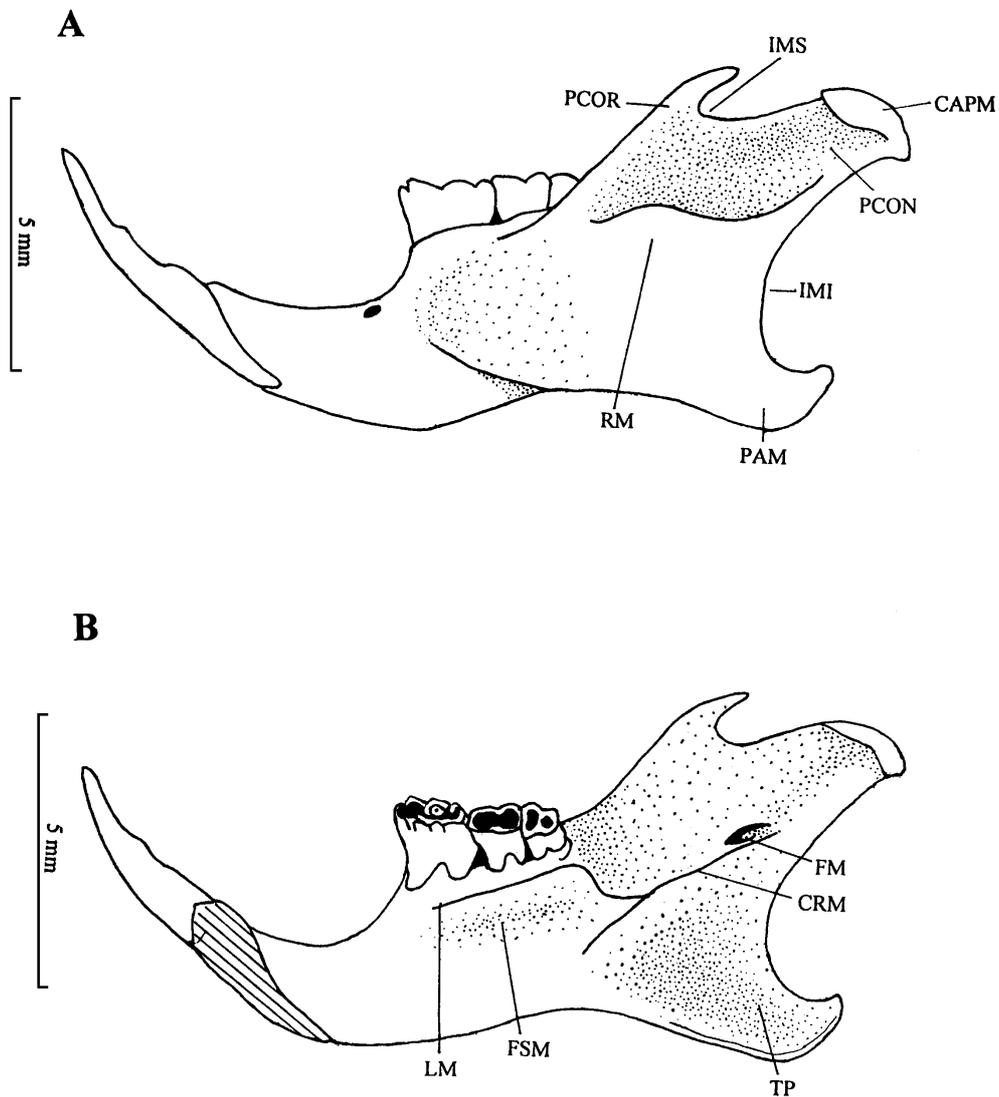


Fig. 13 – Mandible in *Sicista subtilis* (Pallas, 1773): A, outside view; B, inside view.

Order Carnivora

Family Mustelidae Fischer, 1817
Subfamily Mustelinae Fischer, 1817

In *Lutra lutra* (Linnaeus, 1758) (Fig. 14) the mandible has: RM with a deeper concavity, fan-like from CORM towards PCOR, IMS, PCON, PAM; PCOR is like a triangular thick blade, outside with a concavity which continues from RM, but less deep; PAM is like a short thick spine, with the lower margin widened and a thick tip bent inwards and upwards; CAPM is cone-shaped rod crossing PCON and the tip outwards directed; IMS, IMI are in a right angle; FM semicircular continues with a ditch till under PCON; SM a less deep ditch; LM oblique begins from the prominence, which is under M_2 ; FSM elongated superficial concavity.

Mustela putorius (Linnaeus, 1758) (Fig. 15) outwards, RM has a fan-like depression from CORM to IMS, PCON, PCOR. The concavity is deeper in RM and superficial in PCOR; PCOR is like a trapezoidal blade, with the anterior margin and the tip thicker; CAPM cone-like rod slightly bent and with the tip outside directed; PAM triangular blade where the tip is rounded, curved inner- and upwards; IMS in a right angle; IMI semicircular; FM "U"-shaped, with the opening to IMI; LM parallel with the tooth row; FSM elongated, superficial; SM superficial.

In *Mustela nivalis* Linnaeus, 1766 (Fig. 16), on the external side of the mandible, it can be observed: RM with a triangular concavity from CORM to the base of PCOR, PCON, IMS; PCOR a triangular blade with a rounded tip; CAPM is a rod with a rounded surface and the outer tip sharper, oblique upwards; PAM is small, as a right-angled triangle with a rounded tip; IMS in a right angle; IMI semicircular. Inner side has: FM semicircular directed towards IMI; LM oblique; FSM elongated, superficial.

In *Mustela erminea* Linnaeus, 1758 (Fig. 17) on the outer side it can be observed that RM has an oval depression on the direction CORM – IMS; PCOR is like a triangular blade with a central superficial depression, and the tip is rounded and bent backwards; PAM is like a small isosceles triangle whose tip is rounded; CAPM is like a comma where the outer side, sharper, is oblique upwards; IMI is widely semicircular; IMS is almost in a right angle. On the inner side it can be seen: FM semicircular, with the opening towards PCON; LM oblique; FSM elongated, superficial.

Vormela peregusna Gldenstaedt, 1770 (Fig. 18). On the outer side there is a fan-like depression from CORM towards and in RM (deeper), and in PCOR more superficial; PCOR is a trapezoidal blade with thickened margins and a rounded tip; CAPM like a crossed rod on PCON, slightly bent outside and the tip inside; IMS in a right angle; IMI semicircular; PAM is like a short thick trapezoidal prominence with the tip rounded, FM is "U"-shaped with the opening to PCON; TP is a rugged surface on PAM; LM oblique; FSM elongated, almost even.

Martes martes (Linnaeus, 1758) (Fig. 19) has on the outer side a fan-like depression from CORM to PCON, IMS, deeper in RM and superficial in PCOR; PCOR almost a trapezoidal blade with the anterior margin thickened; CAPM a conical rod, oblique descending to inside and the tip outside; IMS in a right angle; IMI semicircular; PAM thick lamellar short spine with a rounded tip, flattened backwards; FM oval with the opening to PCON; TP a ditch on the inner margin of PAM; LM almost parallel with the dentition; FSM elongated superficial depression.

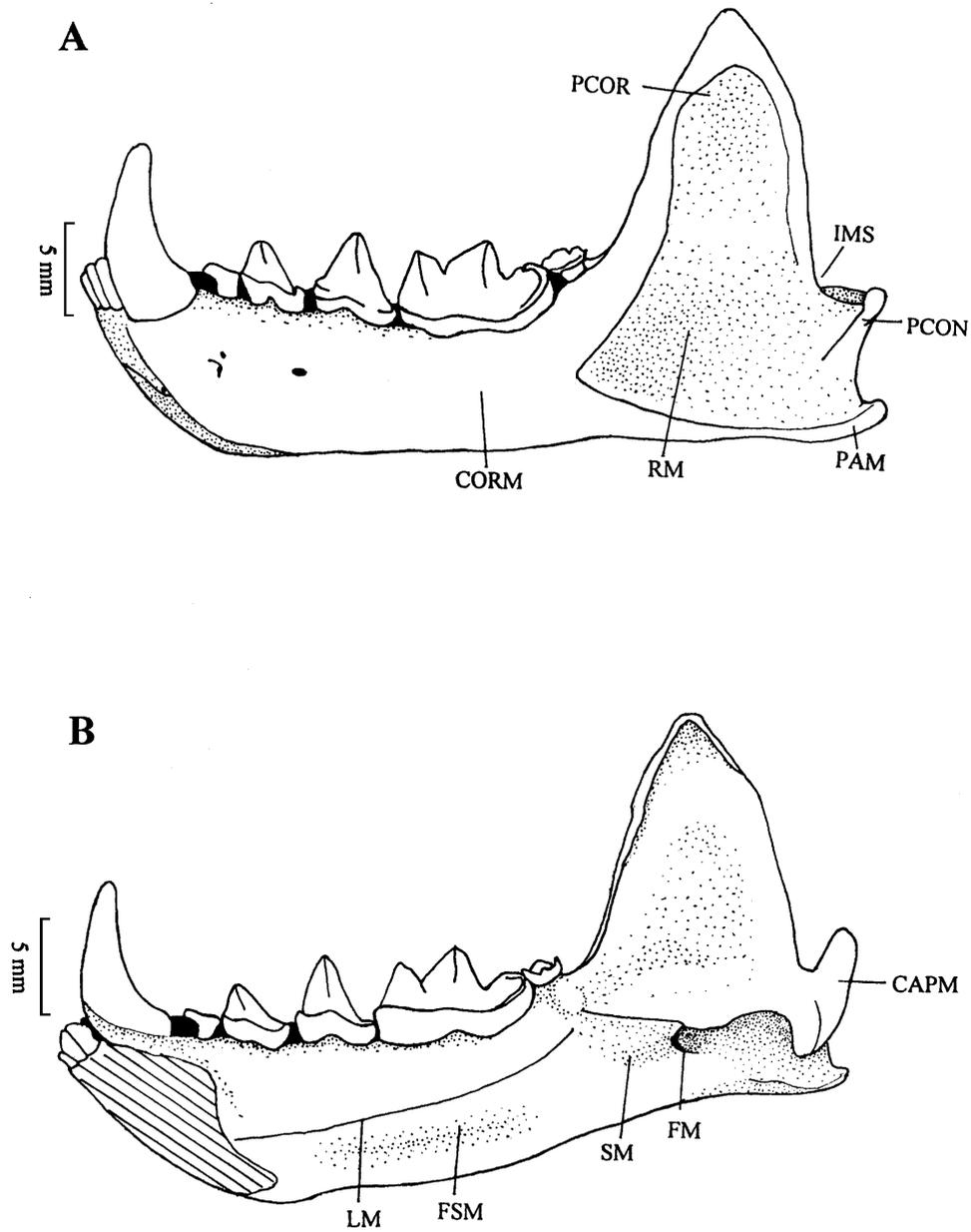


Fig. 14 – Mandible in *Lutra lutra* (Linnaeus, 1758): A, outside view; B, inside view.

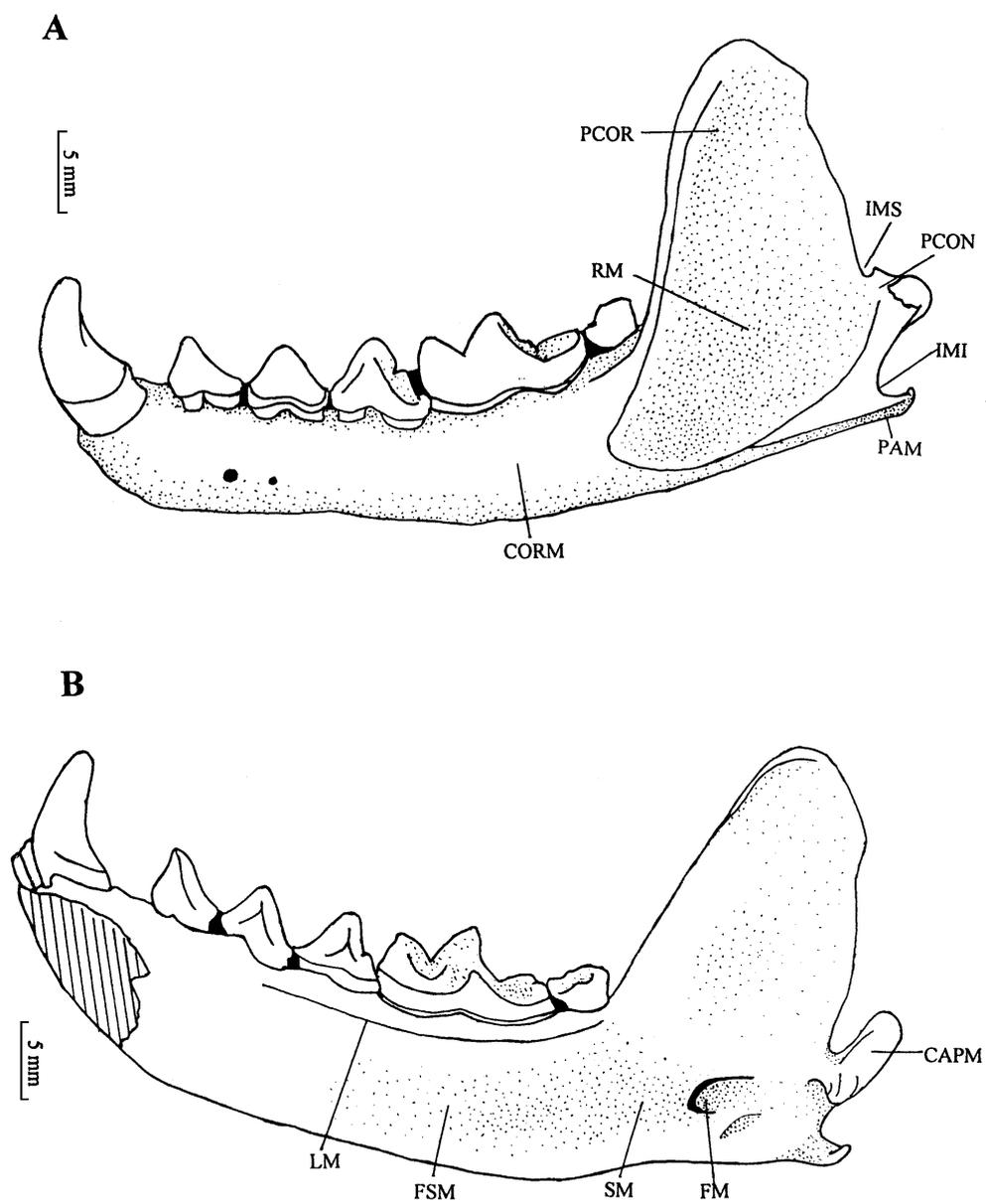


Fig. 15 – Mandible in *Mustela putorius* (Linnaeus, 1758): A, outside view; B, inside view.

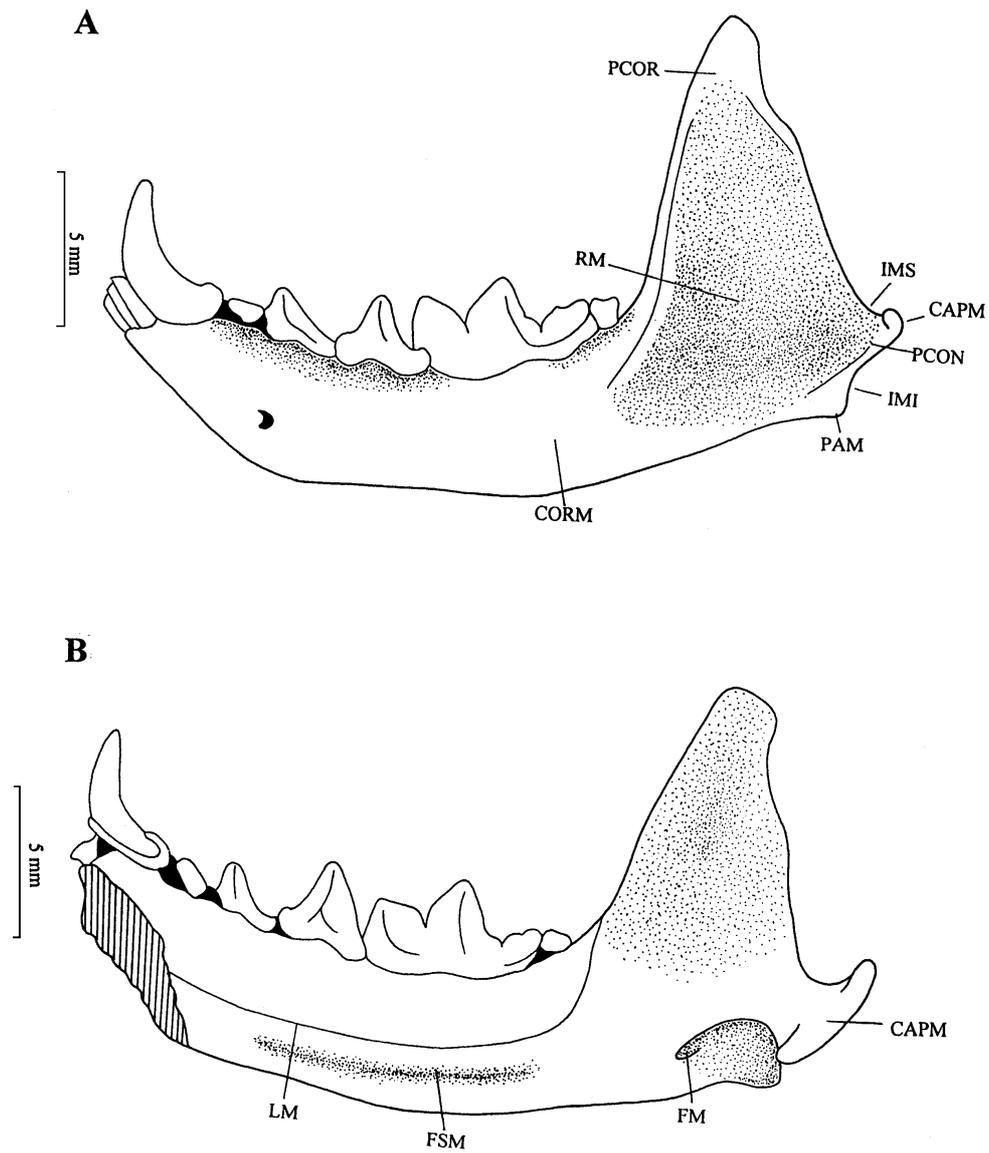


Fig. 16 – Mandible in *Mustela nivalis* Linnaeus, 1766: A, outside view; B, inside view.

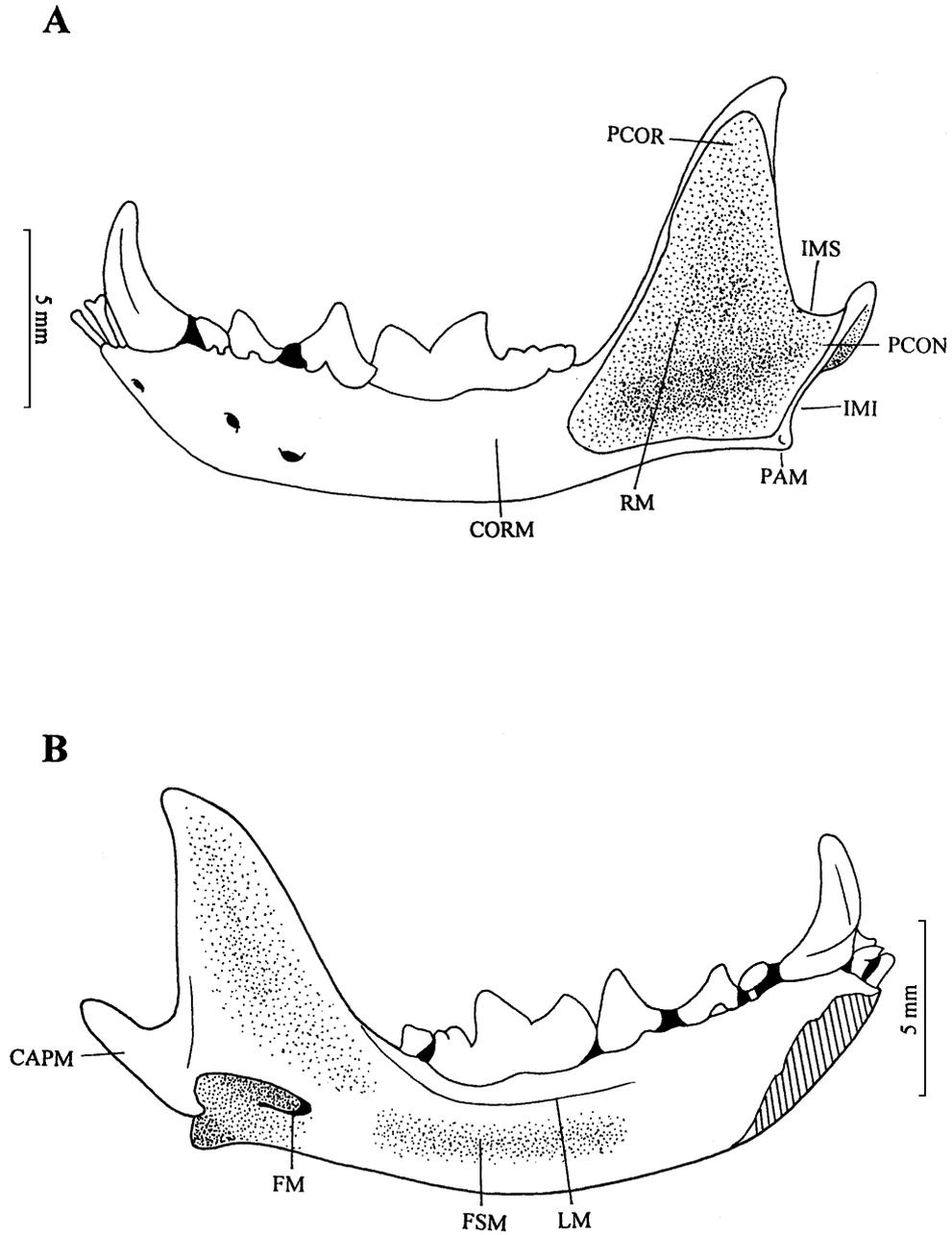


Fig. 17 – Mandible in *Mustela erminea* Linnaeus, 1758: A, outside view; B, inside view.

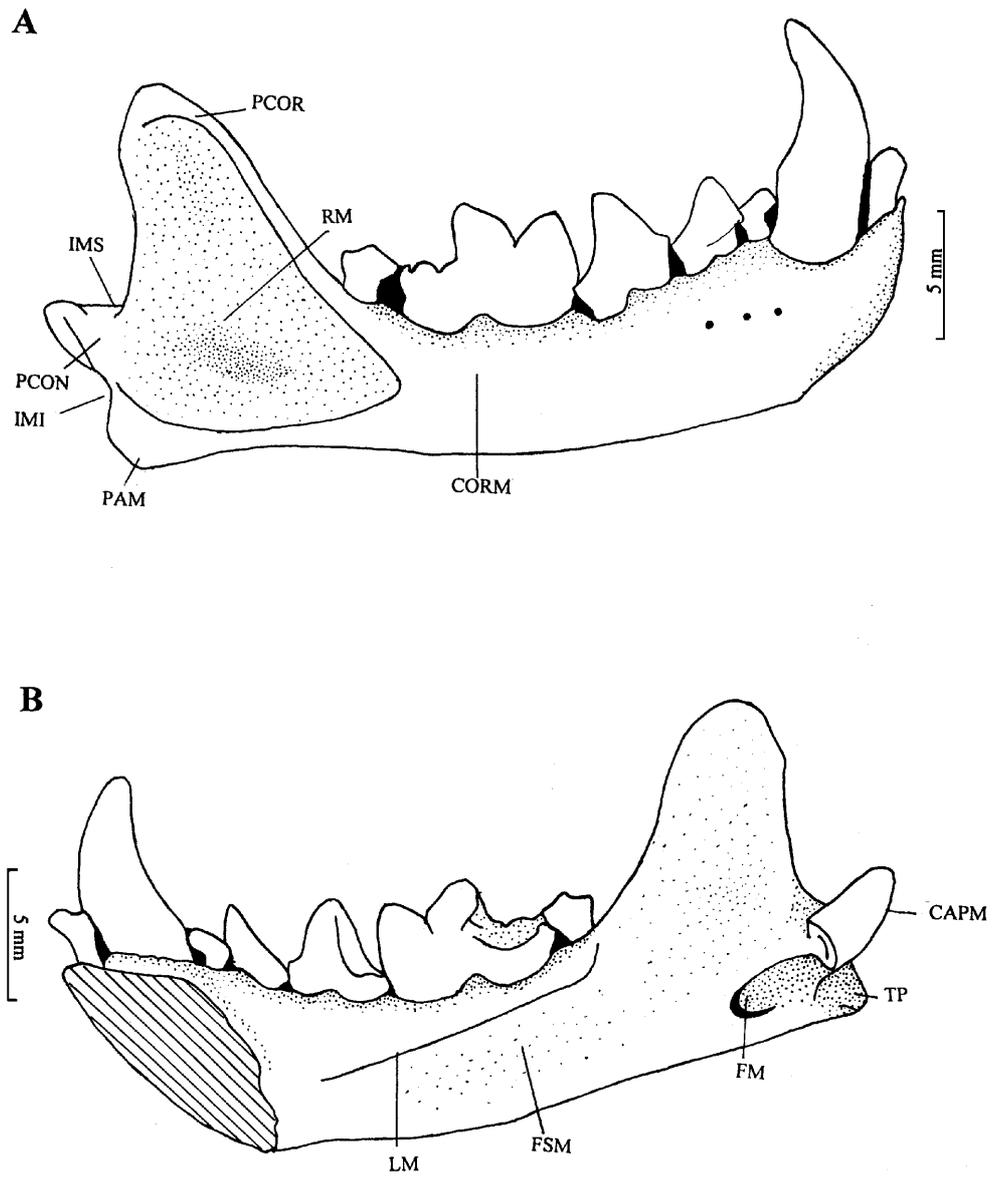


Fig. 18 – Mandible in *Vormela peregusna* Gldenstaedt, 1770: A, outside view; B, inside view.

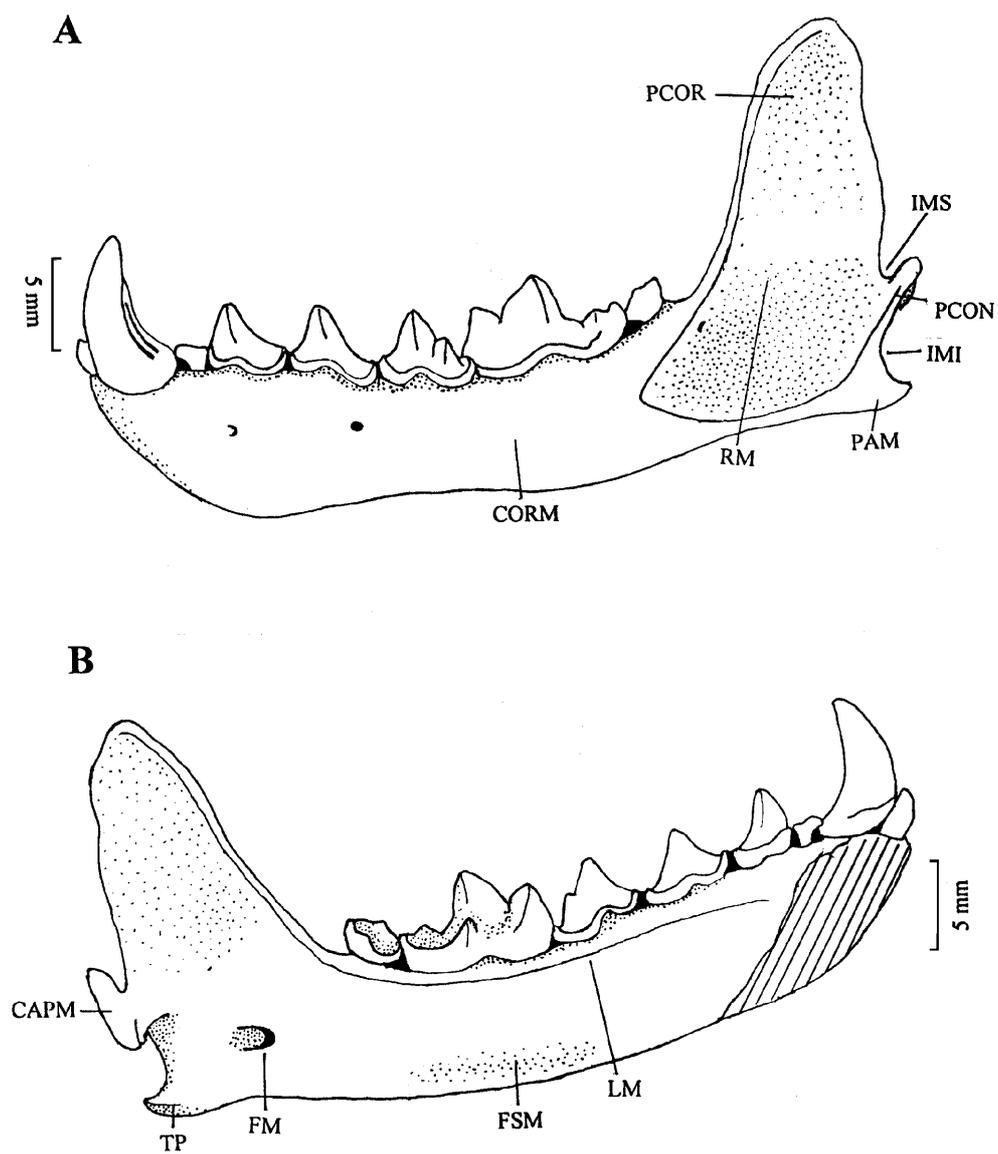


Fig. 19 – Mandible in *Martes martes* (Linnaeus, 1758): A, outside view; B, inside view.

Conclusions

The description of the components of the outer and inner side of the mandible in different mammal species increases the number of the features after which they can be identified. So, the systematic biologists', ornithologists' who study the food of the birds of prey, and even the palaeontologists' activity improves and become easier.

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MORFOLOGIA MANDIBULEI LA MAMIFERE (MAMMALIA: INSECTIVORA, CHIROPTERA, RODENTIA, CARNIVORA) DIN ROMÂNIA

REZUMAT

Autorul prezintă morfologia mandibulei de la 19 specii de mamifere (Mammalia: Insectivora, Chiroptera, Rodentia, Carnivora), din fauna României. Craniile studiate provin din colecțiile științifice ale Muzeului Național de Istorie Naturală "Grigore Antipa" (București). Prin noile structuri ale mandibulei descrise se mărește numărul caracterelor pe baza cărora se poate determina o specie îmbunătățind activitatea, mai ales, a biologilor sistematicieni.

LITERATURE CITED

- GEORGE, R., L. GAUGHRAN, 1954 – A comparative study of the osteology and myology of the cranial and cervical regions of the shrew, *Blarina brevicauda*, and the mole, *Scalopus aquaticus*. Miscellaneous, Michigan, 80: 1-82.
- RĂDULEȚ, N., 2005 - Comparative anatomy of the mandible in the mammal systematic (Mammalia: Insectivora, Chiroptera, Rodentia) from Romania (I). Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa", 48: 447-463.
- RĂDULEȚ, N., 2006 a - Comparative anatomy of the mandible in the mammal systematic (Mammalia: Insectivora, Chiroptera, Rodentia) from Romania (II). Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa", 49: 363-372.
- RĂDULEȚ, N., 2006 b - Comparative anatomy of the mandible in the nine bat species (Mammalia: Chiroptera) from Brazil. Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa", 49: 373-380.
- RĂDULEȚ, N., 2007 a – Morphology of the inner side of the mandible in micromammals (Mammalia: Insectivora, Chiroptera, Rodentia) of Romania. Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa", 50: 371-393.
- RĂDULEȚ, N., 2007 b – Description of the inner side of the mandible in ten bat species (Mammalia: Chiroptera) from Brazil (South America). Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa", 50: 363-370.

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