

An interesting case of polyodontia in *Epomophorus wahlbergi*, with a review of this dental anomaly in bats (Chiroptera)

Zajímavý případ polyodontie u kaloně Wahlbergova (*Epomophorus wahlbergi*) s přehledem této zubní anomálie u netopýřů (Chiroptera)

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Abstract. Extra teeth in Chiroptera and description of the first case of dental anomaly in the pteropodid *Epomophorus wahlbergi*: bilateral occurrence of a supernumerary upper molar.

Key words. Polyodontia in Chiroptera, Megachiroptera, Microchiroptera., *Epomophorus wahlbergi*, Somalia.

INTRODUCTION

We found a specimen of the Pteropodid bat *Epomophorus wahlbergi* (Sundewall, 1846) with one bilateral supernumerary tooth during a reassessment of the Somali bat collection of the Museo di Storia Naturale (Sezione Zoologica «La Specola»), University of Florence (Italy). The find deserves a particular consideration as, although *E. wahlbergi* is a rather common bat species, well represented in many collections, no dental abnormality was known up to now in this species.

At least in Chiroptera, and especially in Microchiroptera, polyodontia (= hyperodontia, hyperdodontia), i.e. the presence of more than the normal number of teeth, is an anomaly much more rare than oligodontia; the absence of teeth is often determined, in addition to genetic or embryological factors, by injury, abnormal attrition, erosion, malnutrition or disease, e.g. by caries or periodontal affections of different nature, as those caused by bacteria or (PHILLIPS 1971, MILES & GRIGSON 1990) protonymphs of mites of the genus *Radfordiella*.

The most extraordinary case of oligodontia, impossible to leave aside, occurs in the pteropodid *Myonycteris brachycephala* (Bocage, 1889), endemic of São Thomé Island: «... this species exhibits an asymmetric dental formula unique among heterodont mammals. Described as an individual anomaly (Andersen, 1912) [In a footnote of p. 577 this Author remarks that in the type of *M. brachycephala* the entire space between i_2-i_2 was filled by one broad incisor], the holotype (now lost) showed a totality of three lower incisors instead of the normal four (i.e., i_1 and i_2 bilaterally present). Based on as many as 19 new specimens of this rare bat, Juste &

Ibáñez (1993) demonstrated that the asymmetry in the incisor count is fixed in the species, so that one I_1 is always missing and with similar frequency in the left and right mandible» (GIANINI & SIMMONS 2007).

Chiropteran taxonomy and systematics are largely based on teeth formula and morphology, whence the fundamental importance of the research on dental anomalies, whether for palaeo- or neontology; the underestimate of these anomalies has already caused misidentifications and even descriptions of invalid taxa, e.g. of the three Pteropodidae *Myonycteris leptodon* Andersen, 1908 and *Myonycteris wroughtoni* Andersen, 1908, both synonyms of *Myonycteris torquata* (Dobson, 1878), as well as *Odontonycteris meyeri* Jentink, 1902, a synonym of *Macroglossus minimus lagochilus* Matschie, 1899.

MATERIALS AND METHODS

Our study has been preceded by a thorough bibliographical research on the extra teeth occurrence in Chiroptera, as well as by some inquiries about the possible presence of dental anomalies in specimens of *Epomophorus wahlbergi* occurring in other museums.

All the 48 specimens of *Epomophorus wahlbergi* examined by us are housed in the Zoological Section «La Specola» of the Museum of Natural History, University of Florence (MZUF). The anomalous subject of the present paper, MZUF 2971, is a young adult ♂ (cranial sutures incompletely obliterated!) from the fluvial Alessandra Island (= Labaddei Id., Touata Id.; 00° 34' N – 42° 46' E), Jubba River, near Jilib (= Gelib; southern Somalia), collected by Benedetto LANZA on 13 August 1962, during the «1962 Mission in Somalia of the Florence University».

The measurements were obtained with a vernier caliper at 0.01 mm precision. The following body and cranial dimensions were measured as follows (in mm): FL = the forearm length *in situ*, including the joint with the upper arm and carpals; SLg = the greatest skull length from the gnathion (premaxilla tip) to the opisthocranium; CbL = condylobasal length, between the posteriormost point of occipital condyles and gnathion; ZW = zygomatic width, the greatest distance across the zygoma; MW = mastoid width, the greatest distance across the mastoid region; CM¹L = upper toothrow length, the crown length from the forwardmost point of the upper canine to the posteriormost projection of m^1 ; CM²L = upper toothrow length, the crown length from the forwardmost point of the upper canine to the posteriormost projection of m^2 ; CM³L = lower toothrow length, the crown length from the forwardmost point of the lower canine to the posteriormost point of the last molar; ML = mandible length, the distance from the most posterior portion of the articular process to the anteriormost edge of the alveolus of the first lower incisor.

In the text, the upper and lower teeth are always indicated respectively as follows: i^n , c^1 , p^n , m^n and i_n , c_1 , p_n , m_n . Radiographs were carried out using a dental X-ray machine. Transliteration of Cyrillic is in accordance to PACTL (1955).

MUSEUM ACRONYMS. BMNH = The Natural History Museum, London, U.K.; CM = Carnegie Museum of Natural History, Pittsburg, USA; DZMAM = Laboratório de Mamíferos, Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil; IB (or UNAM) = Instituto de Biología de la Universidad Nacional Autónoma de México; FMNH = Field Museum of Natural History, Chicago, USA; KMMA (now MRAC); KU = University of Kansas Museum of Natural History, Lawrence, USA; LADA = Laboratorium voor Algemene Dierkunde, Antwerp, Belgium; MCZ = Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U. S. A.; MNHN = Muséum National d'Histoire Naturel, Paris, France; MRAC = Musée Royal de l'Afrique Centrale, Tervuren, Belgium; MZUF = Museo di Storia Naturale, Zoological Section «La Specola», University of Firenze, Italy; NHRM = Naturhistoriska Riksmuseet, Stockholm, Sweden; ORSTOM = Laboratoire d'Écologie des Mammifères et des Oiseaux, Centre O.R.S.T.O.M., Adiopodoumé, Ivory Coast; RMNH = Rijksmuseum van Natuurlijke Historie, Leiden, Holland; SMNS = Staatliches Museum für Naturkunde in Stuttgart, Germany; UAMI = Universidad Autónoma Metropolitana Unidad Iztapalapa, Mexico; UNAM (or IB) = Universidad Nacional

Autónoma de México, Instituto de Biología; USNM = United States National Museum, Washington, USA; ZIDTU = Dresden Technical University Zoologisches Institut, Dresden, Germany; ZMA = Universiteit van Amsterdam Zoologisch Museum, Holland; ZMB = Museum für Naturkunde, Humboldt Universität, Berlin, Germany.

POLYODONTIA IN BATS

We know the cases of polyodontia listed and described hereunder (taxonomical nomenclature according to SIMMONS 2005).

P t e r o p o d i d a e

Cynopterus brachyotis javanicus Andersen, 1910

ANDERSEN (1912: xxxii): « m_3 . – present on one side, in one *C. b. j.* ([BMNH] 9.1.5.73). The tooth is normally lost in *Cynopterus*, but present in all Fruit-bats with unmodified dental formula». ANDERSEN (1912: 588): «A small m_3 , quite hidden in the bone, is present on the left side in one skull» (*C. b. javanicus*, imm., 9.1.5.73; Buitenzorg = Bogor, W Java, Indonesia). In this subspecies ANDERSEN (1912) found in total 2 dental anomalies (polyodontia + oligodontia) out of 21 skulls examined. In the genus *Cynopterus* he found in total 7 dental anomalies (polyodontia + oligodontia) out of about 200 skulls examined.

Cynopterus sphinx angulatus Miller, 1898

ANDERSEN (1912: xxxiii; quoted as *C. brachyotis angulatus*): « i^2 reduplicated on one side. – In one *C. b. a.*» ([BMNH] 6.11.6.42). ANDERSEN (1912: 588): «One skull shows a reduplication of i^2 on the left side» (*C. b. angulatus*, imm. 6.11.6.42; Nha-Trang, Annam, Vietnam). In this subspecies ANDERSEN (1912) found in total 2 dental anomalies (polyodontia + oligodontia) out of 35 skulls examined.

Eidolon helvum (Kerr, 1792)

ANDERSEN (1912: xxxii): « m^3 . – Present on one side» (BMNH, unregistered, specimen ♂, p. 15). ANDERSEN (1912: 2): «One skull of *E. h.* in the collection (ad., teeth slightly worn; no history; specimen c^3 in the list – *infra* p. 15) has a minute m^3 on one side». GIANNINI & SIMMONS (2007): «A single-rooted m^3 is present on one side» (BMNH, unregistered specimen, identified with the code c^3) [the same specimen quoted by ANDERSEN]. A specimen with a right m^3 , shaped as a small protuberance is quoted by EISENTRAUT (1956: 538–539) (SMNS 18 ♂, 1938; Nicolls Id., Cameroun). ANDERSEN (1912) found in total 3 dental anomalies (polyodontia + oligodontia) out of 43 skulls examined.

Eonycteris spelaea (Dobson, 1871)

ANDERSEN (1912: xxxiii): «“ p_2 ”, *i. e.* a tooth occupying the position of a p_2 present on one side in [...] one *E. s.*» ([BMNH] 1.3.9.1) (this tooth has been interpreted as p_1 by MILLER 1907: cf. dental formula, p. 69) and GIANNINI & SIMMONS (2007: 3559). ANDERSEN (1912) found in total 3 dental anomalies (polyodontia + oligodontia) out of 12 skulls examined.

Epomophorus gambianus (Ogilby, 1835)

ANDERSEN (1912: xxxiii): «“ p_2 ”, *i. e.* a tooth occupying the position of a p_2 , present on one side in [...] *E. g.*» ([ZMB] 10171). ANDERSEN (1912: 516): «A “ p_2 ” present on the left side, situated about midway between p_1 and p_3 , in bulk subequal to $\frac{1}{3}$ of p_1 » (*E. gambianus* ad., [ZMB] 10171, type of *E. zechi*; Kunjuruma, Togo). ANDERSEN (1912: xxxiii): «“ p_2 ” in one, *i. e.* a tooth occupying the position of a p_2 , present on both sides in one *E. g.*» ([BMNH] 99.6.15.3). ANDERSEN (1912: 516): «A “ p_2 ” present on both sides, closely wedged in between p_1 and p_3 , small, about equal in cross-section and height to a lower incisor, and similar in general shape and structure to p_1 of a *Rousettus* and *Pteropus*» (*E. g.* juv., 99.6.15.3; Gambaga, Republic of Ghana). GIANNINI & SIMMONS (2007): «[...] BMNH 99.6.15.3, an extra tooth occupies the position of a p_2 on both sides. The tooth is small and conical, and emerges from its own alveolus that completely fills the space between the anterior and posterior teeth (identified as P_1 and P_3 by Andersen)». ANDERSEN (1912:

xxxiii): «Supernumerary tooth between p^3 and p^4 . – On one side (tooth small) in one *E. g.*» ([BMNH] 99.6.15.2). ANDERSEN (1912: 516): «[...] a small supplementary premolar between p^3 and p^4 , equal in size to a lower incisor» (*E. gambianus* yg. ad., 99.6.15.2; Gambaga, Ghana). ANDERSEN (1912) found only the above-mentioned 3 dental anomalies out of 35 skulls examined.

***Lissonycteris angolensis* (Bocage, 1898)**

ANDERSEN (1912: xxxiii; quoted as *Rousettus angolensis*): «Supernumerary tooth between m^1 and m^2 . – On one side [...] (tooth extremely narrow, abnormal in shape) in one *R. a.*» ([BMNH] 6.12.4.5; “Ruwendzori East”). ANDERSEN (1912: 18; also 52, fig. 4): «In one skull [...] (*Rousettus angolensis*, ♂ ad.; 6.12.4.5) a small supernumerary molar (very broad, but excessively compressed antero-posteriorly) is present on the right side, closely wedged in between m^1 and m^2 ». ANDERSEN (1912) found in total 2 dental anomaly (polyodontia + oligodontia) out of 8 skulls examined. ALLEN & LAWRENCE (1936) quote a ♀ from Sipi (Uganda; MCZ 31149) with a «supernumerary lower molar lying to the inner side of the alveolar line, between the usual two molars». A specimen with a right m^3 and a right m_4 , both shaped as a small protuberance (SMNS 293 ♂, 1954; Cave Mombe, near Buea, Cameroun) is quoted, as *Rousettus angolensis*, by EISENTRAUT (1956: 539).

***Macroglossus* sp.**

ANDERSEN (1912: 754): «An additional molar (“ m_4 ”) in both halves of the mandible (it looks as if m_3 had been divided into two separate teeth) [...] *M. sp.* Temminck, Mon. Mamm, i p. 192, pl. xv, fig. 26». ANDERSEN (1912: 754–755) quotes in total 10 dental anomalies (polyodontia + oligodontia) for the genus, out of about 70 skulls examined.

***Macroglossus minimus* (Geoffroy, 1810)**

GIANNINI & SIMMONS (2007): «An additional specimen (BMNH 69.230, not reported by Andersen) shows a small (ca. 0.6 mm) single-rooted m_4 with an oval crown on the left side» (origin not indicated).

***Macroglossus minimus minimus* (Geoffroy, 1810)**

ANDERSEN (1912: xxxii): « m^3 . – Present on both sides, in [...] *M. m. m.*» ([BMNH] 10.4.7.2; Marengan, near Sumenep, E Madura Id, Java, Indonesia). GIANNINI & SIMMONS (2007): «[...] a double-rooted m^3 is present on both sides in BMNH 10.4.7.2». ANDERSEN (1912: xxxiii): « m_4 . – On both sides, in [...] *M. m. m.*» ([BMNH] 10.4.7.4; Marengan, near Sumenep, E Madura Id, Java, Indonesia). In this subspecies ANDERSEN (1912) found in total 3 dental anomalies (polyodontia + oligodontia) out of 24 skulls examined.

***Macroglossus minimus lagochilus* Matschie, 1899**

JENTINK (1902: 140; quoted as *Odontonycteris Meyeri* from Tabukan, Great Sangi [= Great Sangir Id., Great Sanghir or Great Sangihe Id., about 300 km NNE of Sulawesi Id, Indonesia; ♂ ZIDTU]): «This specimen, although externally – as far as can be judged after a dried skin – so alike to a *Macroglossus*, belongs indeed to a quite different genus, as it has 2 molars (*on each side an upper molar*) [i.e. a supernumerary m^3 on both sides] more than any hitherto described members of the *Macroglossine* group!». MILLER (1907: 71–72): «Genus *Odontonycteris* Jentink. [...] *Type species*. – *Odontonycteris meyeri* Jentink. [...] *Characters*. – Like *Kiodotus* [a synonym of *Macroglossus*], but upper molars 3–3 [...]. *Species examined*. – *Odontonycteris meyeri* Jentink or a closely related species from Cagayan Sulu (north of Sandakan, Borneo) [read: Cagayan Id., 09° 37' N – 121° 12' E, Sea of Sulu, between Palawan and Negros Ids., Philippines]. *Remarks*. – While the characters of the single specimen of *Odontonycteris* that I have examined (male ad. Cat. No. 125316, U.S.N.M. [...] might suggest an abnormal *Kiodotus*, they are too important to permit the name to be placed in synonymy. This individual has in the left mandible a small supplemental tooth behind the third molar [i.e. a supernumerary m_4 on the left side]». ANDERSEN (1912: 755): «*M. l. lagochilus*, ♂ ad., Buru [Kayeli, Buru Id, Amboina, Indonesia]» ([BMNH] 10.3.3.23); an “ m^3 ” on left side (with what appears to be a newly closed corresponding alveolus on right side) and an “ m_4 ” on right. GIANNINI & SIMMONS (2007; quoted as *Macroglossus minimus*): «[...] a double-rooted m^3 is present on [...] the left side [...] in BMNH 10.3.3.23». ANDERSEN (1912: 755): «*M. l. lagochilus*, ♀ ad.,

Buru, [BMNH] 10.3.3.24; an additional upper molar (“m³”) on right side (accidentally lost during cleaning of skull)». ANDERSEN (1912: xxxii; quoted as *M. l. lagochilus*): «m³. – Present on both sides [...] in *M. l. l.*» ([USNM] 125316; Cagayan, Sulu Ids, S Philippines). ANDERSEN (1912: 755): «*M. l. lagochilus*, ♂ ad., Cagayan Sulu, U.S. nat. Mus. 125316; an “m²” [misprint; read “m³”] on both sides». ANDERSEN (1912: 755): «[USNM 125316] [...] “m₄” on left (the skull, not the mandible, has been examined by writer; the presence of a left “m₄” is mentioned by Miller 1907, *Fam. & Gen. Bats*, p. 72). This specimen was by Miller referred to *Odontonycteris*». In this subspecies ANDERSEN (1912) found in total only the 4 above-mentioned dental anomalies out of 16 skulls examined.

***Macroglossus minimus nanus* Matschie, 1899**

ANDERSEN (1912: xxxiii; quoted as *M. lagochilus nanus*): «“m₄”. – On one side, [...] in one *M. l. n.*» ([BMNH] 10.3.3.3 [misprint; read 10.3.2.3]; Dobo, Aru Ids, Indonesia). ANDERSEN (1912: xxxiii; quoted as *M. lagochilus nanus*): «“m₄” – On both sides, [...] in one *M. l. n.*» ([BMNH] 10.3.2.2; Dobo, Aru Ids, Indonesia). In this subspecies ANDERSEN (1912) found in total only the 2 above-mentioned dental anomalies out of 19 skulls examined.

***Macroglossus sobrinus* Andersen, 1911**

ANDERSEN (1912: xxxiii; quoted as *M. minimus sobrinus*): «i¹ reduplicated on both sides. – In one *M. m. s.*» ([BMNH] 3.2.6.17; Patany, Malay Peninsula). ANDERSEN (1912) found in total only the 1 above-mentioned dental anomalies out of about 20 skulls examined.

***Megaloglossus woermanni* Pagenstecher, 1885**

A specimen with a right m³ (SMNS young ♀ 408, 1954; Nyasoso, NW slope of Mount Kupe, Cameroun) is quoted by EISENTRAUT (1956: 539). BERGMANS & VAN BREE (1972): «[...] a specimen from Luluabourg MRZC 33371 [Democratic Republic of Congo] with a minute m³ on each side and a small m₄ on the right side». BERGMANS & VAN BREE (1972): «[...] a specimen from Kitongo (MRAC 32580) [Democratic Republic of Congo] with a small left m₄». BERGMANS & VAN BREE (1972): «[...] a specimen from Odjolo (LADA V 25.35) [Togo] with two small m₄». BERGMANS & VAN BREE (1972): «[...] a specimen from Adzope (ORSTOM A9183) [Ivory Coast] with two small m₄». BERGMANS & VAN BREE (1972): «[...] and one from Adzope (ORSTOM A9184) with two small m₄».

***Myonycteris torquata* (Dobson, 1878)**

HAYMAN & HILL (1971) summarize data on the presence of supernumerary m³ among specimens of *M. torquata*: «Additional material obtained recently shows that the characters used by Andersen for his “species” *leptodon* and *wroughtoni* are not constant. Eisentraut (1963), describing the molar pattern as variable in *torquata*, considers *wroughtoni* no more than an eastern race, and Kuhn (1965) suggests that *leptodon* is only a western race. Kuhn pointed out that his two specimens from Liberia lacked the supernumerary m³ possessed by Andersen’s type, and an excellent series of 22 specimens collected [...] at Khumasi, Ghana is of importance as supporting Kuhn’s view. Not one of these skulls possesses an m³ [...]». DE VREE (1971; quoted as *M. torquata leptodon*): «Non seulement la taille de m² est variable, mais aussi le nombre de molaires. Le type de *M. leptodon* présente une molaire supplémentaire m³ [on both sides [...]]. L’exemplaire [MRAC, from Adiopodoumé, Ivory Coast] 34999 ♀ ad. présente, à la mâchoire supérieure droite, une molaire supplémentaire (m³), subégale à p¹ (voir fig. 3, 5); la mâchoire inférieure présente une molaire supplémentaire (m₄) minuscule, développée également des deux côtés». BERGMANS (1976): «An adult male from Adiopodoumé [Ivory Coast] MRAC 34999, had one m³ and two m₄ (De Vree, 1971). A male from Sierra Leone (BMNH 91.2.13.1; type of *M. leptodon* Andersen) had two m³. A male from Ivory Coast (ORSTOM AX0745) and one from Ikunde [Rio Muni] (Jones, 1971) had both one m³. One male from Lamto [Ivory Coast] (ORSTOM 21.623) had two M₄. A female from 6 miles north of Kade [Ghana] (USNM 414789) and another from 32 miles west of Prestea [Ghana] (USNM 413803) had one m₄. Apart from these seemingly atavistic cases there were three specimens with aberrant supernumerary teeth. A subadult specimen from Ivory Coast (OERSTOM AX0733) had a very small extra tooth between the right m₂ and m₃. An adult female from Biteye [Cameroon] (BMNH 11.5.5.3) had two small upper incisors

instead of the right i^2 , and in front of these and also in front of the left i^2 , an additional small tooth. A row of four additional small teeth in front of the four upper incisors was found in an adult male from Sibiti [People's Republic of Congo] (MNHN; field number 556). The chance that, in the two last mentioned cases, the extra teeth were milk teeth is small. The specimens were clearly adult, and neither the position of the extra teeth in front of the mature teeth, nor their obtuse form reminded me of milk teeth». According to GIANNINI & SIMMONS (2007), BERGMANS (1976) found supernumerary incisors in several individuals; the most remarkable case was the presence of a full second row of 4 incisors in front of the one typically present in an adult specimen; the author discarded that the extra incisor row represented the retention of deciduous teeth on the basis of morphology of the elements; furthermore, he reported cases of unilateral and bilateral presence of small m_4 , and a case of a single-rooted m^3 on one side. GIANNINI & SIMMONS (2007): «[...] we found a specimen of *Myonycteris torquata* (KMA/MRAC80.020-M-0001) that possesses four upper premolars [on both sides] (Fig. 17A, B). This is a seemingly unique case in Megachiroptera. The first premolar ... closely resembles in size and crown morphology the anterior premolar (putative p^1) in *Myonycteris* specimens with typical premolar count (i.e., three elements as in *M. torquata* AMNH 236246 in fig. 17C,D). By contrast, the second premolar is smaller and appears simpler. In our interpretation, the atavism seen in the KMMA/MRAC specimen (retention of an ancestrally lost tooth with signs of reduction) provides anomaly-based evidence that p^1 , p^3 , and p^4 are the premolars present in bats and that p^2 is the missing chiropteran upper premolar».

***Nyctimene albiventer* (Gray, 1863)**

GIANNINI & SIMMONS (2007): «We also found an m_3 [on the right side: cf fig. 18] in *Nyctimene albiventer* (AMNH 198617; fig. 18), a species normally characterized by only two lower molars».

***Pteropus giganteus giganteus* (Brünnich, 1782)**

ANDERSEN (1912: xxxiii; quoted as *P. giganteus*): «“ m_4 ”. – On one side, in [...] one *P. g.*» ([BMNH] 106.d; Bengal, India). ANDERSEN (1912: 66): «an “ m_4 ”, similar in bulk to i_1 of the same skull, present on one side: one *Pt. giganteus* (ad., teeth somewhat worn, Bengal no.106.d); m_3 in this skull slightly larger than usual». GIANNINI & SIMMONS (2007): «Andersen (1912) reported a presumed m_4 in ... *Pteropus giganteus* (not seen by us)». In this subspecies ANDERSEN (1912: 65–66) found in total 3 dental anomalies (polyodontia + oligodontia) out of 29 skulls examined. In the genus *Pteropus* he found in total 10 dental anomalies out of about 600 skulls examined.

***Pteropus giganteus leucocephalus* Hodgson, 1834**

ANDERSEN (1912: xxxii; quoted as *P. giganteus*): « m^3 . – Present on both sides [...] in one *P. g.*» ([BMNH] 45.5.15.4; Nepal). ANDERSEN (1912: 66): «“ m^3 ” present on both sides: one *Pt. giganteus* (ad., teeth somewhat worn, Nepal, 45.5.15.4; mentioned by Dobson, Cat. Chir. B. M. p. 16, footnote); these two “ m^3 ” are very similar in size to “ m^2 ” of a normal skull, whereas “ m^2 ” is noticeable larger than usual, about half the bulk of m^1 (the possibility therefore being that “ m^2 ” is supernumerary, and “ m^3 ” homologous with the normal “ m^2 ”). In this subspecies ANDERSEN (1912) found in total only 2 dental anomalies (polyodontia + oligodontia) out 12 skulls examined. GIANNINI & SIMMONS (2007): «A single-rooted m^3 is present on one side in [...] *Pteropus giganteus* (BMNH 13.4.11.4)».

***Pteropus scapulatus* Peters, 1862**

ANDERSEN (1912: xxxiii): «“ p_2 ”, i. e. a tooth occupying the position of a p_2 . – Present on one side, in [...] one *P. s.*» ([BMNH] 86.11.1.1; Mackay, E Queensland, Australia). ANDERSEN (1912: 405): «In one specimen a supernumerary premolar is present on the left side situated in the broad diastema between p_1 and p_3 , in shape and size a copy of p_1 , in position corresponding to the premolar (p_2) which is permanently missing in Chiroptera; no trace of a corresponding tooth on right side (6.11.1.1, ad.)». GIANNINI & SIMMONS (2007): «In this specimen an extra premolar appears in the position of p_2 on the right [read “left”; cf. fig. 16] side only. The p_1 is normal except in that it appears displaced rostrally, closer to the canine on both sides, even when the extra tooth is present only on the right [read “left”; cf. fig. 16] side (fig. 16). In normal individuals, p_1 is closer to the center of the c – p_3)» (BMNH 86.11.1.1). ANDERSEN (1912: xxxiii): «Supernumerary tooth

between p^3 and p^4 . – On both sides (tooth well developed) ([BMNH] 8.8.8.3), in one *P. s.*» (Burdekin River, E Queensland, Australia). ANDERSEN (1912: 405): «In one specimen [the above-mentioned one] a supernumerary premolar is present on *both* sides between p^3 and p^4 , which, to give room for the additional tooth, in this specimen are more broadly separated than usual: structure of supernumerary premolar typical Pteropine, size nearly half that of p^4 (8.8.8.3, ♂ ad.)». ANDERSEN (1912: 405) found in total no less than 5 dental anomalies (polyodontia + oligodontia) out of 21 skulls examined.

Pteropus vampyrus vampyrus (Linnaeus, 1758)

ANDERSEN (1912: xxxiii; quoted as *Pteropus vampyrus*): « i_3 . – In one *P. v.* skull ([BMNH] 55.12.26.90 [provenience unknown, but Java, Indonesia]) a tooth present, on both sides, behind i_2 and leaning against the inner side of the canine. The possibility of this tooth being really an i_3 (lost in all Megachiroptera, but preserved in some Microchiroptera) cannot of course be denied, but from the position and general shape of the tooth it appears more likely that it is an accidental outgrowth». ANDERSEN (1912: 66): «[...] a well developed “ i_3 ” is present on both sides in one skull of *Pt. vampyrus* (B.M. 55.12.26.90, locality unknown); the left and right i_3 are perfectly alike in size, larger than but essentially similar in form to i_2 , and situated on inner side of tooth-row, at base of canine». In this subspecies ANDERSEN (1912: 66) found in total (polyodontia + oligodontia) only 2 dental anomalies, both in the nominal ssp., out of 75 skulls examined.

Rousettus aegyptiacus aegyptiacus (Geoffroy, 1810)

ANDERSEN (1912: XXXII; quoted as *R. aegyptiacus*): « m^3 . – Present on both sides [...] in one *R. a.*» ([BMNH] 4.4.9.2; Pungo Andongo, Loanda, Gaboon). ANDERSEN (1912: 18): « m^3 present on both sides: *R. aegyptiacus*, one adult, teeth practically unworn (4.4.9.2)». GIANNINI & SIMMONS (2007): « m^3 [...] *Rousettus aegyptiacus* BMNH 4.4.9.2 has single-rooted alveoli on both sides, the teeth having apparently been shed». In this subspecies ANDERSEN (1912) found only the above-mentioned dental anomaly out of 21 skulls examined. In the genus *Rousettus* he found in total 3 dental anomalies out of about 88 skulls examined. GIANNINI & SIMMONS (2007): «A single-rooted m^3 is present on one side in [...] *Rousettus aegyptiacus* (BMNH 37.4.28.67)» (specimen not seen by ANDERSEN).

Rousettus aegyptiacus leachii (Smith, 1829)

ANDERSEN (1912: xxxii; quoted as *Rousettus leachi*): « m^3 . – Present on one side in [...] one *R. l.*» ([BMNH] 37.4.28.67; near Cape Town, Republic of South Africa). In this subspecies ANDERSEN (1912) found only the above-mentioned dental anomaly out of 18 skulls examined.

Rousettus leschenaultii (Desmarest, 1820)

GIANNINI & SIMMONS (2007): «*Rousettus leschenaultii* BMNH 95.7.27.1 exhibits a double-rooted m^3 on the left side and a single-rooted m^3 on the right side. A single-rooted m^3 is present on both sides in another specimen of the same taxon (BMNH 4.4.9.2)» (specimens not seen by ANDERSEN). GIANNINI & SIMMONS (2007): «Therefore, several degrees of development of extra upper molars occur in isolated megachiropterans. Whereas most m^3 s are minute oval pegs, in *R. leschenaultii* BMNH 66.5490 the tooth is crescent-shaped and more robust» (specimen not seen by ANDERSEN).

Rousettus leschenaultii seminudus (Kelaart, 1850)

ANDERSEN (1912: xxxii; quoted as *R. seminudus*): « m^3 . – Present on one side in [...] one *R. s.* ([BMNH], unregistered, specimen α , p. 39) (Sri Lanka).

Emballonuridae

Balantiopterix plicata Peters, 1867

PHILLIPS & JONES (1969), out of 170 specimens studied, found in total 6 dental anomalies, 2 of which referable to polyodontia; they write: «In one, an adult female (87265 KU) from Jalisco [Mexico], there is an extra first lower premolar [...] on the right. The supernumerary tooth resembles the normal first lower premolar and has about the same amount of wear. The two teeth completely fill the gap between the canine

and second premolar, whereas normally there is an evident space between the canine and second premolar. An adult female from Nayarit [Mexico] (34070 KU) has a supernumerary left lower premolar [...] that is about half the size of the normal first premolar but generally is of the same morphological configuration. The extra tooth is located lingual to the toothrow at the junction of the first and second premolars».

Balantiopteryx plicata plicata Peters, 1867

RAMÍREZ-PULIDO & MÜDESPACHER (1987), out of 436 specimens studied, found in total 18 dental anomalies, 17 of which referable to polyodontia: one extra upper hypoplastic incisor on the left or right side or on both sides (material from several Mexican states, IB and UAMI collections; see original paper for further data, collection numbers and places of origin).

Balantiopteryx io Thomas, 1904

PHILLIPS & JONES (1969) found 2 cases of polyodontia out of 116 specimens studied; they write: «Two males had supernumerary premolars. One, an adult from Guatemala (64634 KU, has an extra upper first premolar on each side [...] resulting in a pair of small, peglike teeth between the canine and last premolar. [...] Another adult male from Guatemala (64636 KU) also has an extra first premolar on each side. As in the first specimen, all four teeth are wear».

Rhynchonycteris naso (Wied-Neuwied, 1820)

PHILLIPS & JONES (1969) found 2 cases of polyodontia out of 72 specimens studied; they write: «An adult male from Veracruz [Mexico] (19122 KU) has a supernumerary tooth in that two small premolar are between the canine and the normal second upper premolar on the left side. The small premolars, possibly resulting from a split germ bud, are somewhat smaller than the normal first premolar and resemble each other in general outline and in having less well-developed accessory cusps than the normal premolar on the other side (Fig. 1, A). In another male from Veracruz (19101 KU), an extra tooth is present between the left lower first and second premolars. This supernumerary tooth, which is displaced slightly lingually from the toothrow, resembles the first premolar to a greater degree than the second, but is smaller and noticeably narrower than either of the other teeth and effectively fills the gap between them (Fig. 1, B)».

Saccolpteryx bilineata (Temminck, 1838)

PHILLIPS & JONES (1969) found one case of polyodontia out of 97 specimens studied. Adult ♀ (91467 KU) from Campeche (Mexico) with two supernumerary upper incisors, too large to be unshed deciduous teeth, one on each side and sharing alveoli with the normal upper incisors; therefore, they possibly resulted from split germ buds.

M o r m o o p i d a e

Pteronotus parnellii (Gray, 1843)

PHILLIPS & JONES (1969) found one case of polyodontia out of 292 specimens studied; they write: «An adult male (36405 KU) from Nayarit [Mexico] has supernumerary right and left upper premolars (Fig. 2). What may well have been the normal premolars are crowded posteriorly and slightly lingually relative to their normal position, but have the same axial position, relative to the toothrow, as in normal specimens. Anterior to the “normal” premolars and abutting on the canines, are somewhat smaller teeth [Authors refer to the above-mentioned left and right extra teeth] having approximately the same configuration as the normal premolars but lacking the same orientation relative to the toothrow [...]».

P h y l l o s t o m a t i d a e

Artibeus Leach, 1821

See RUI & DREHMER (2004) regarding the presence or absence of molars in the whole genus.

Artibeus fimbriatus Gray, 1838

RUI & DREHMER (2004: 641, figs 7–8), who examined 44 skulls, found only 1 dental anomaly: a small extra upper premolar between the right canine and the first premolar in the ♂ DZMAM 0037 from the municipality of Maquiné, Planície Costeira do Rio Grande do Sul, Brazil; crown of the supernumerary tooth high, compressed antero-posteriorly, and with only one cusp.

Artibeus lituratus (Olfers, 1818)

RUI & DREHMER (2004: 641), who examined 104 skulls from the municipality of Maquiné (Planície Costeira do Rio Grande do Sul, Brazil), found one case of oligodontia and the following 2 cases of polyodontia. Extremely small and simple right m^3 , its crown low and without obvious cusps (♀ DZMAM 0062; figs 1–2). A medial, morphologically normal upper incisor, wedged between left and right i^1 , hardly larger than the latter ones (♀ DZMAM 0100; figs 3–4).

Artibeus lituratus palmarum Allen et Chapman, 1897

RAMÍREZ-PULIDO & MÜDESPACHER (1987), out of 409 Mexican specimens studied, found 20 dental anomalies, 3 of which referable to polyodontia. Female IB 11434 from Oaxaca (quoted as *A. intermedius* Allen, 1891): a supernumerary lower incisive, hypoplastic and external to tooth-row, occurs on both sides behind i_2 ; a rudimental upper molar is present behind m^3 . Male 21120 IB from San Luis Potosí (quoted as *A. intermedius*): a supernumerary right upper incisor between i^2 and canine. Male 20357 IB from Chiapas: a supernumerary upper incisive on both sides, in front of and in contact with i^1 .

Choeronycteris mexicana Tschudi, 1844

RAMÍREZ-PULIDO & MÜDESPACHER (1987), out of 113 specimens studied, found in total 32 dental anomalies, 30 of which referable to polyodontia: one extra lower incisor on the left or right side or on both sides (material from several Mexican states, IB and UAMI collections; see original paper for further data, collection numbers and places of origin).

Choeroniscus godmani (Thomas, 1903)

PHILLIPS (1971) found in total only a case of polyodontia out of 12 specimens examined: «In an adult male (AMNH 131765) from Costa Rica there is an extra molariform tooth on the right side, anterior to the normal first lower molar. Because the supernumerary tooth is set directly behind the last premolar (p_4), all of the molars, which appear to be normal, are moved farther posteriorly than are those on the left side of the jaw. The extra tooth has the same size as a normal first molar and has many of the same features, except that a “paraconid” is lacking and the cusps are less distinct than on a normal first molar. The most likely explanation for the presence of the supernumerary tooth is that it resulted from a double initiation of the first molar but for one reason or another did not develop fully (perhaps because of the crowding from the last premolar [...])».

Choeroniscus minor (Peters, 1868)

HUSSON (1962): «[...] between the left canine and the left upper premolar of the holotype, a very minute tooth is present; as this supernumerary tooth is widely separated from the following premolar, it is improbable that this tooth is a persistent milk-tooth of that premolar». PHILLIPS (1971): «[...] Husson (1962: 134) reported that in the holotype of *C. minor*, a specimen from Trinidad, there is a small, extra tooth located on the left side, between the upper canine and first premolar. Because the extra tooth was widely separated from the canine and p^3 , Husson thought that it may be a persistent deciduous premolar. Although I have not examined this specimen, it seems likely that the extra tooth either is an atavistic permanent p^2 or the deciduous p^2 , which probably is found in *Choeroniscus* just as it is in the other glossophagines thus far studied». PHILLIPS (1971) found in total only 1 case of true polyodontia out of 19 specimens examined: «In [...] an adult male of *Choeroniscus inca* [synonym of *C. minor*] (ANMH 67626) from Ecuador, there are extra upper premolars on the left and right sides directly behind the canines and anterior to the premolars (p^3). The extra teeth are smaller than a normal p^3 , being only about 40 per cent its size, and probably are atavistic teeth representing permanent p^2 . The supernumerary tooth on the right is slightly larger than the

one on the left and appears to have an anterior and posterior root, whereas the one on the left has but one root. Morphologically, however, both of the extra teeth are otherwise much the same».

Glossophaga soricina (Pallas, 1766)

PHILLIPS (1971), out of 818 specimens examined, found in total 27 dental anomalies, 16 of which of polyodontia in 14 specimens: extra upper incisors (in one ♀; KU, from Chiapas, Mexico), extra lower incisors [in 7 ♂♂; KU, from Chiapas, Sinaloa, Nayarit, Jalisco (Mexico), and Guatemala], and extra upper premolars (in 1 ♂ and 5 ♀♀; KU, from Chiapas and Sinaloa, Mexico); see original paper for further data, collection numbers and places of origin.

Glossophaga soricina handleyi Webster et Jones, 1980

RAMÍREZ-PULIDO & MÜDESPACHER (1987), out of 640 Mexican specimens studied, found in total 47 dental anomalies, 13 of which referable to polyodontia. Female 7016 IB (from Chiapas), ♀ 17155 IB (from Michoacán), and ♂ 17179 IB (from Michoacán): one extra left lower incisor; ♀ 15455 IB (from Guerrero, Mexico): one extra right lower incisor. Male 6539 IB and ♀ 6541 IB (both from Veracruz, Mexico): one lower incisor on both side. Male 9927 IB (from Sonora): one upper incisor on both side; i^1 of normal size, i^2 and the extra tooth smaller. Female 5447 IB (from Jalisco [Mexico]): one supernumerary left upper incisor, probably the central one, i.e. placed between i^1 and i^2 . Male 15738 IB (from Jalisco [Mexico]) and ♀ 9934 IB (from Sonora): one upper premolar on both sides, to be considered atavistic ones due to their size and shape. Female 16130 IB (from Puebla [Mexico]) one extra right upper premolar. Male 5712 UAMI (from Puebla [Mexico]): an atavistic upper premolar on both sides (seemingly lost ahead of time on the left side), between c^1 and the anterior premolar; the right extra tooth, in side view, like the right p^3 but its size only a third that of the latter. Female 11054 IB (from Veracruz, Mexico): «en la rama derecha de la mandíbula presenta un pequeño premolar [*lapsus calami*: read molar] supernumerario implantado entre el tercer molar y la base del proceso coronoide». Further details in the original paper.

Leptonycteris yerbabuenae Martínez et Villa-R, 1940

PHILLIPS (1971: 76–77; quoted as *L. sanborni*) found in total 6 dental anomalies, 2 referable to true polyodontia; number of specimens examined not stated; the number 157 quoted by MILES & GRIGSON (2003: 137) is wrong, as it, according to PHILLIPS (1971: 69), refers only to a series of 157 specimens from Jalisco [Mexico] «used for a study of morphological and dimensional variation in the dentition». RAMÍREZ-PULIDO & MÜDESPACHER (1987) found no instances of polyodontia in the 301 skulls examined. PHILLIPS (1971): «In an adult male from Guerrero (UNAM 8835 [Mexico]), there are extra first upper premolars on each side. The extra teeth are located between the canines and first premolars. The extra teeth are duplicates of the “normal” first premolars but are only about half their size. The supernumerary teeth are located between the canines and first premolars; the latter are normal in position and in morphology [...].» PHILLIPS (1971): «In an adult male from Veracruz (KU 23693 [Mexico]) the lower right second premolar (p^3) is divided into two parts, neither of which appears to be a “normal” tooth. The anterior part, which is about 50 per cent larger than the posterior part, consists of a main cone and an anterior cingular heel; the posterior surface of the main cone is slightly flared. The posterior part consists of a main cone and the fairly well developed posterior heel. Both the anterior and posterior “teeth” have two roots and apparently are not connected. This abnormal condition probably did not result from a double initiation because neither part forms a complete tooth. It is more likely tet some disturbance during morpho-differentiation caused a split in the developping tooth [...].» RAMÍREZ-PULIDO & MÜDESPACHER (1987; quoted as *L. sanborni*), out of 301 Mexican specimens studied, found in total 75 dental anomalies, none of them referable to polyodontia.

Lichonycteris obscura Thomas, 1895

PHILLIPS (1971) found in total only the following 2 cases of dental anomalies out of 15 skulls examined. PHILLIPS (1971): «An adult male (USNM 331258) of *obscura* from Panamá was found to have an extra tooth directly anterior to the upper first premolar on the right side. The small supernumerary tooth is about 20 per cent the size of the first premolar, which appears to be normal. The extra tooth differs from the p^3 , in addition to side, in having but a single root that is set in its own alveolus, but it resembles the p^3 in

overall coronal configuration. It is likely that the extra tooth is an atavistic p^2 [...]. PHILLIPS (1971; quoted as *L. degener*): «In an adult female (AMNH 95485) of *degener* from Brazil there is an extra tooth located directly posterior to the upper canine on the right side. The abnormal tooth is separated from the p^3 by a small gap, and is about 25 per cent its size. The p^3 appears normal in all ways. As in the above specimen, the extra tooth in this individual probably is an atavistic p^2 because it has a single root and resembles the p^3 in coronal morphology, although it is relatively lower-crowned [...].»

***Lionycteris spurrelli* Thomas, 1913**

PHILLIPS (1971; 25 specimens examined) writes: «An adult male (AMNH 97267) from Brazil has an extra tooth anterior to the normal first upper premolar (p^3) on the right side [...] only about 30 per cent the size of p^3 and, unlike the p^3 , has but one root. The crown [...] is high and pointed and has a small notch on the posterior end that fits under and against the anterior cingular style of the p^3 . The extra tooth differs



Fig. 1. *Epomophorus wahlbergi* (photos by B. LANZA). Left – Upper teeth of a normal specimen; young (cranial sutures incompletely obliterated!) adult ♀ MZUF 3013, Alessandra Island (= Touata Id.), 00° 34' N, 42° 46' E, Jubba River, near Jilib (= Gelib), S Somalia, 13 August 1962, «1962 Mission in Somalia of the Florence University». Right – Upper teeth of the abnormal specimen; young (cranial sutures incompletely obliterated!) adult ♂ MZUF 2971, same locality and collecting date.

Obr. 1. Kaloň Wahlbergův (*Epomophorus wahlbergi*) (foto B. LANZA). Vlevo – horní chrup normálního jedince; raná (lebeční švy dosud nesplynuly) dospělá ♀ MZUF 3013, ostrov Alessandra (= Touata), 00° 34' N, 42° 46' E, řeka Jubba u Dželibu, jižní Somálsko, 13. 8. 1962, «Expedice Florentinské university do Somálska 1962». Napravo – horní chrup abnormálního jedince; raný mladý ♂ MZUF 2971; stejné okolnosti sběru jako u předešlého obrázku.

from the normal first premolar in size and number of roots and resembles it only slightly in coronal morphology. It seems likely that the extra premolar is an atavistic p²».

Lonchophylla mordax Thomas, 1903

Adult female (USNM 309389; Panamá) with a bilateral extra upper premolar, consisting in a tiny peg-like single-rooted spicule mesial to p³, probably an atavistic p² (PHILLIPS 1971; 13 specimens examined).

Lonchophylla robusta Miller, 1912

Adult ♀ (FMNH 51732; Colombia) with an extra upper right very miniature premolar, probably an atavistic p² (PHILLIPS 1971; 31 specimens examined).

Macrophyllum macrophyllum (Schinz, 1821)

MCCARTHY et al. (1989) found a specimen (CM 91679 from Toledo District, Belize) with extra teeth out of 340 animals studied; they write: «The skull possesses a complete dental complement of 34 teeth plus two additional first upper incisors. These redundant teeth are exposed directly above and partially overlap the permanent incisors. Although the former are about one half the size of the normal incisors, their appearance is similar. Each secondary incisor covers half the length of their respective counterpart along the right side of each normal tooth. Both ectopic incisors appear to be rooted within alveoli, independent of their respective normal incisors».

Pygoderma bilabiatum (Wagner, 1843)

According to DICK (2002), «Intraspecific variation (presence or absence) of third molars has been reported for various stenodermatine species, including [...] *Pygoderma bilabiatum* (Owen & Webster, 1983; Webster & Owen, 1984; Bárquez et al., 1999; Wetterer et al., 2000). The dental formula of *P. bilabiatum* has been reported to be I 2/2, C 1/1, PM 2/2, M 2/2 [...] with third molars occurring infrequently in females only (Owen & Webster, 1983). Slightly more than 25% of the 52 female specimens they studied were found to have third molars in 1 or both mandibles, 1 specimen with third molars additionally in each maxillary tooth row. Not 1 of 26 males they examined possessed third molars. Restriction of dental formula variability to 1 or the other sex is otherwise unreported among mammalian species». Actually, research on a more rich material, demonstrated that a third molar occurs, though rather rarely, in males too (DICK 2002): «Out of 251 skulls examined, 36 (14.3%) were found to contain third molars. Female specimens (152 individuals; 60.6% of total) accounted for 33 of the 36 individuals found with third molar. Of the 152 female specimens examined, 33 (21.7%) had third molars and 119 (78.3%) did not, whereas 3 (3.0%) of the 99 males examined possessed third molars, but 96 (97.0%) did not. [...] When present, third molars are much more likely to occur within the mandibles than the maxillae. Of a total of 64 third molars recorded from 36 individuals, 60 (93.6%) were present in mandibles and 4 (6.3%) in maxillae. Of 502 mandibles and maxillae examined, 35 mandibles and 3 maxillae were found to contain third molars. [...]».

Rhinolophidae and Vespertilionidae

WOŁOSZYN (1992; see also «Discussion»), in a paper unfortunately represented only by an «abstract», writes: «Twenty three species of the European bats from families Rhinolophidae and Vespertilionidae were examined as to the occurrence of abnormalities. Forty cases (2.29%) of dental abnormalities have been found among 1749 specimens (skulls mainly) investigated. Specimens of the following species are recognized as having abnormalities: *Rhinolophus hipposideros*, *R. ferrumequinum*, *Myotis myotis*, *M. bechsteini*, *M. dasycneme*, *M. nattereri*, *M. mystacinus/brandti* and *Myotis sp.*».

Vespertilionidae

Barbastella barbastellus (Schreber, 1774)

LICHOTOP & PAUŽA (1998; Lithuania, 54° 54' N, 23° 50' E): «[...] additional lower premolar on the left side of the mandible [...] A conic unicuspid and single-rooted tooth with a distinct cingulum. It is crowded between P₂ and P₄, intruded from toothrow and markedly reduced in size (about one half length of P₂)».

Corynorhinus mexicanus Allen, 1916

HANDLEY (1959: 102; quoted as *Plecotus mexicanus*) writes: «An example of a clearly abnormal extra incisor may be seen in a specimen of *P. mexicanus* (KU 29858; unspecified origin). In place of the right outer upper incisor there are two closely approximated twin teeth, neither of which resembles the normal outer incisors in the left premaxilla».

Corynorhinus towsendi (Cooper, 1837)

ALLEN (1916, p. 335, pl. 1, fig. 1) writes: «In the *Corynorhinus* mentioned (*C. m[egalotis] towsendii*, Biol. Surv. Coll. 150273, from Happy Camp, [Siskiyou Co.] California) it is evident from the agreement in form, that the two inner incisors correspond with the two normally present in the genus, and that the supernumerary one has been added at the *outer* side, – is in fact the i^3 usually missing in all living bats. In outline (Plate 1, fig. 1) this tooth is roughly a right-angled triangle with its height a little less than its base. It is a very little shorter than i^2 but much stouter, and with a long base, rather than with the terete form characteristic of the second incisor. In crown view it has a broad cutting edge, as broad as the crowns of the other incisors. The skull of the specimen is unfortunately in fragments, and the corresponding teeth of

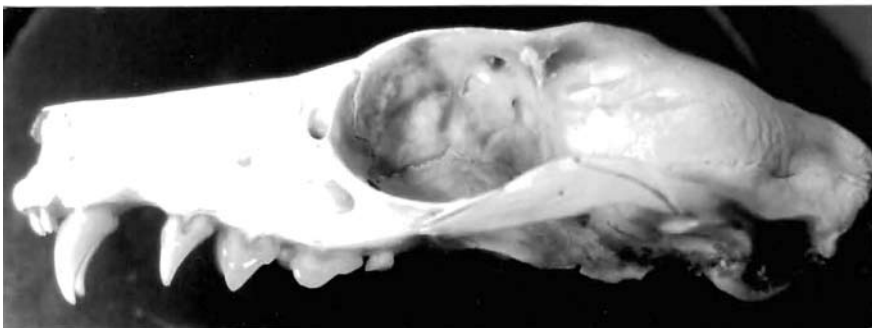
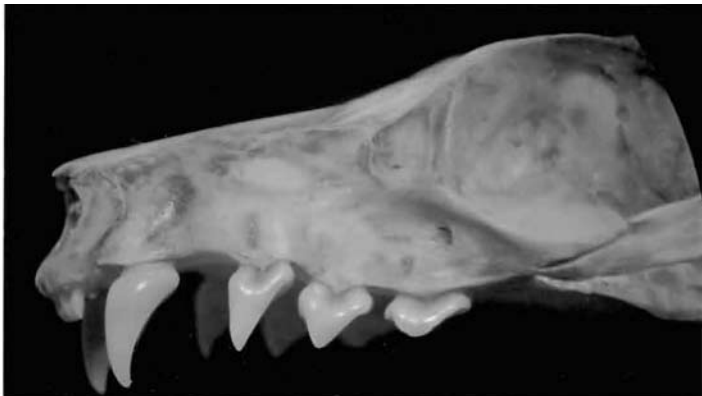


Fig. 2. *Epomophorus wahlbergi* (photos by B. LANZA). Above – Left toothrow of the normal specimen of Fig. 1; side view. Below – Left toothrow of the abnormal specimen of Fig. 1; side view.

Obr. 2. Kaloň Wahlbergův (*Epomophorus wahlbergi*) (foto B. LANZA). Nahoře – levá zubní řada normálního jedince z obr. 1, boční pohled. Dole – levá zubní řada abnormálního jedince z obr. 1, boční pohled.

the left side are lost, but the remaining teeth are normal. The case is instructive as indicating not only that it is i^3 that has been lost in the Chiroptera, but that in this case, it was probably a larger tooth than i^2 which is retained». HANDLEY quotes that «G. Allen (1916, p. 335 [pl. 1, fig. 1]) described a specimen (USNM [read USNM] 150273) with three upper permanent incisors. The “extra” incisor was the outermost of the three and differed in form from the other two. Allen speculated that this might represent a long lost i^3 ». HANDLEY (1959; quoted as *Plecotus towsendi*): «A specimen of *P. t.* (USNM 81647 [unspecified origin]) has four premolars in one mandible; the other ramus is normal. The extra tooth is on the lingual side of the tooth row, adjacent to the normal anterior premolar and forcing that to the labial side of the row. Both teeth touch the canine. The extra tooth is smaller than the normal anterior premolar and rather like p_3 in size and shape. If it were to be assumed that this extra tooth reflects a primitive condition in which the normal mandible bore four premolars, then it would be necessary, because of its position, to assume that the extra tooth is p_4 ».

Eptesicus serotinus (Schreber, 1774)

RUPRECHT (1978; Poland): a supernumerary upper incisor bilaterally present behind i^1 (skull found without mandible in a *Tyto alba* pellet).

Myotis velifer (Allen, 1890)

RAMÍREZ-PULIDO & MÜDESPACHER (1987; quoted as *M. velifer velifer*), out of 311 specimens studied, found in total 6 dental anomalies, one of which referable to polyodontia: ♂ 18522 IB (from Morelos, Mexico) with a supernumerary right upper inciseive, between i^1 and i^2 ; its size half that of the normal teeth, but longer and with trilobate distal margin.

Pipistrellus abramus (Temminck, 1838)

MUYAO (1973; Japan): «One has an extra incisor tooth in 14 specimens examined».

For general information on dental anomalies in mammals see WOLSAN (1984), HOFF & HOFF (1996), MILES & GRIGSON (2003), PETERKOVA et al. (2006), and GIANNINI & SIMMONS (2007).

RESULTS

The normal dental formula of *Epomophorus* is

$$\frac{\begin{array}{cccccccc} i & - & 2 & 3 & c & 1 & pm & - - & 3 & 4 & m & 1 & - - \end{array}}{\begin{array}{cccccccc} i & 1 & 2 & - & c & 1 & pm & - & 2 & 3 & 4 & m & 1 & 2 & - \end{array}} \times 2 = 28$$

It is shared only with other seven pteropodid genera: *Casinycteris*, *Dyacopterus*, *Epomops*, *Hypsignathus*, *Micropteropus*, *Nanonycteris*, and *Scotonycteris*. The only upper molar of the above-mentioned megabats has been always regarded as an m^1 (e.g. cf. MILLER 1907, ANDERSEN 1912, GIANNINI & SIMMONS 2007). The dental formula of the anomalous *Epomophorus wahlbergi* MZUF 2971 is

$$\frac{\begin{array}{cccccccc} i & - & 2 & 3 & c & 1 & pm & - - & 3 & 4 & m & 1 & 2 & - \end{array}}{\begin{array}{cccccccc} i & 1 & 2 & - & c & 1 & pm & - & 2 & 3 & 4 & m & 1 & 2 & - \end{array}} \times 2 = 30$$

The body and skull measures of the anomalous specimen are (see «Material and methods»; in mm): FL 73; SLg 44.8; CbL 44.8; ZW 23.8; MW 18.3; CM¹L 14.8 (left side) and 15.05 (rightside); CM²L 16.3 (left side) and 16.4 (right side); CM₂L 17; ML 34.75. In the anomalous individual the left m^2 , a little larger than the right m^2 , measures 1.83×1.20 mm, the right m^2 1.67×1.50 mm; the occlusal surface of both the extra teeth is a little less than 1/3 that of m^1 , has

a pyriform outline and is longitudinally concave; the main, longitudinal axes of m^3 , m^4 and m^1 coincide with the axis of the toothrow, while the axis of each extra tooth is oblique, with its anteriormost and wider extremity on the lingual side; the approximate maximum crown height of left and right extra teeth 1.0 and 0.9 mm, respectively. As far as can be judged by radiographs, the extra teeth seem to be single-rooted. The normal upper left and right molars (m^1) measure 3.66×2.01 mm and 3.50×2.50 mm, respectively; their approximate maximum crown height measures 2 mm.

DISCUSSION

According to our research and bibliographical inquiry, polyodontia has been surely found at least in the cases indicated hereunder; the number of the latter ones, in fact, is to be considered approximate, because either the possible incompleteness of data at our disposal or the unusability of some bibliographical records, e.g. those of a WOŁOSZYN's preliminary contribution (1992; see p. 120), never published *in extenso*, on dental anomalies in 2 species of Rhinolophidae and 6–7 species of *Myotis*. Pteropodidae (about 42 genera and 186 species): in 11 genera and 17



Fig. 3. *Epomophorus wahlbergi* (photos by B. LANZA). Left – Left m^1 and extra m^2 of the abnormal specimen of Fig. 1. Right – Right m^1 and extra m^2 of the abnormal specimen of Fig. 1.

Obr. 3. Kaloň Wahlbergův (*Epomophorus wahlbergi*) (foto B. LANZA). Vlevo – levá horní stolička a nadpočetná třetí stolička jedince z obr. 1. Napravo – pravá horní stolička a nadpočetná třetí stolička jedince z obr. 1.

Table 1. Cases of polyodontia in bats (cf. Discussion; Is = incisivés; Ps = premolars; Ms = molars)

Tab. 1. Případy polyodontie u netopýřů (Is = řezáky; Ps = třenové zuby; Ms = stoličky; unilateral = jednostranně; bilateral = oboustranně; family & genus = čeleď a rod)

family & genus	unilateral extra Is	bilateral extra Is	unilateral extra Ps	bilateral extra Ps	unilateral extra Ms	bilateral extra Ms
Pteropodidae						
<i>Cynopterus</i>	1				1	
<i>Eidolon</i>					2	
<i>Eonycteris</i>			1			
<i>Epomophorus</i>			2	1		1
<i>Lissonycteris</i>					2	1
<i>Macroglossus</i>		1			7	5
<i>Megaloglossus</i>					3	4
<i>Myonycteris</i>		2	1		6	3
<i>Nyctimene</i>					1	
<i>Pteropus</i>		1	1	1	2	1
<i>Rousettus</i>					4	3
Emballonuridae						
<i>Balantiopteryx</i>	12	9	2	2		
<i>Rhynchonycteris</i>			2			
<i>Saccopteryx</i>		1				
Mormoopidae						
<i>Pteronotus</i>				1		
Phyllostomatidae						
<i>Artibeus</i>	2	2	1		1	
<i>Choeronycteris</i>	10	20				
<i>Choeroniscus</i>			1	1	1	
<i>Glossophaga</i>	12	3	4	9	1	
<i>Leptonycteris</i>			1	1		
<i>Lichonycteris</i>			2			
<i>Lionycteris</i>			1			
<i>Lonchophylla</i>				1		
<i>Macrophyllum</i>		1				
<i>Pygoderma</i>	(extra molars sometimes present uni- or bilaterally, usually in females)					
Vespertilionidae						
<i>Barbastella</i>			1			
<i>Corynorhinus*</i>	1	1	1			
<i>Eptesicus</i>		1				
<i>Myotis</i>	1					
<i>Pipistrellus</i>	1					

*possibly present bilaterally: left side of the skull lacking (see under *C. townsendii*).

(or possibly 18) species. Emballonuridae (about 13 genera and 51 species): in 3 genera and 4 species. Mormoopidae (about 2 genera and 10 species): in 1 genus and 1 species. Phyllostomatidae (about 55 genera and 160 species): in 10 genera and 13 species. Vespertilionidae

(about 48 genera and 407 species): 5 genera and 6 species. These data, as well as Table 1, clearly show the relative rare occurrence of polyodonty in Chiroptera, up to now found only in a few families and genera despite the tremendous number of specimens studied, surely amounting to several dozen thousands.

With regard to extra molars, they were known to occur uni- or bilaterally, before our research, only in 9 genera and 10–11 species of Pteropodidae (*Cynopterus brachyotis*, *Eidolon helvum*, *Lyssonycteris angolensis*, *Macroglossus* sp., *Macroglossus minimus*, *Megaloglossus woermani*, *Myonycteris torquata*, *Nyctimene albiventer*, *Pteropus giganteus*, *Rousettus aegyptiacus*, *Rousettus leschenaultii*), and in 3 genera and 3 species of Phyllostomatidae (*Artibeus lituratus*, *Choeroniscus godmani*, *Pygoderma bilabiatum*). The presence of supernumerary molars appears therefore to be a rare phenomenon in bats, and even more when it occurs bilaterally, as in our *Epomophorus wahlbergi*; in Pteropodidae, in fact, supernumerary molars are known to occur bilaterally only in 19 cases out of a total of 46 cases of supernumerary molars. ANDERSEN (1912) found no dental anomalies in 106 specimens of *E. wahlbergi* belonging to the collections of BMNH, NHRM, RMNH, and ZMB. Dr S. G. SOWLER (pers. comm., 17 September 2007) studied the deciduous dentition in *E. wahlbergi* (SOWLER 1980) and did not recall any similar anomalies in 200 skulls of the ZMA. Also Dr Norberto P. GIANNINI, who examined a large number of flying foxes skulls for his analysis of the dentition in megabats (GIANNINI & SIMMONS 2007), didn't find any dental anomalies in *Epomophorus* (pers. comm., 17 September 2007).

Many hypotheses have so far been presented to explain the origin of polyodontia in mammals. In WOLSAN'S (1984) opinion «[...] however, most of the extra teeth hitherto described in mammalian dentitions may be interpreted either (1) as the effect of additional creation and development of a tooth germ, caused by the influence of genes which are rare but still present in the gene pool of a given species and which occurred much more frequently in those of its ancestral species [...], or (2) as the effect of development of a supernumerary tooth germ originated as a result of complete splitting of a tooth germ; the ability for such a splitting may be inherited or due to a mutation or a disturbance or change in the genetic control of tooth development [...].»

Without the slightest doubt, the origin of the extra m^2 found in *E. wahlbergi* MZUF 2971 is to be interpreted as a case of atavism, meant as the occasional and usually more or less rare occurrence in an extant species of a character normally present in its extinct ancestors.

SOUHRN

V příspěvku jsou shrnuty údaje o nadpočetných zubech u netopýřů (Chiroptera) a popis prvního nálezu této anomalie u kaloně Wahlbergova (*Epomophorus wahlbergi*): oboustranné přítomnosti nadpočetné horní stoličky.

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