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TAXONOMICAL VALUE OF THE MORPHOLOGICAL DIFFERENCES OF THE COXAL BONE IN SIX SOUTH-AMERICAN BAT SPECIES (CHIROPTERA: EMBALLONURIDAE, MORMOOPIDAE AND PHYLLOSTOMIDAE)*

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Abstract. We describe the coxal bone in six South-American bat species: *Saccopteryx bilineata* (Temminck, 1838), fam. Emballonuridae; *Pteronotus parnellii* (Gray, 1843), fam. Mormoopidae; *Phyllostomus hastatus* (Pallas, 1767), *Glossophaga soricina* (Pallas, 1766), *Carollia perspicillata* (Linnaeus, 1758), *Desmodus rotundus* (E. Geoffroy, 1810), fam. Phyllotomidae. Coxal bones, having specific structures, are useful in the identification of the species. The paper is important for systematists in mammalogy and for ornithologists to study some birds of prey as well as for the paleontologists interested in the knowledge of the faunal structure of some fossil deposits.

Résumé. On décrit l'os coxal des six espèces sud-américaines de chauves-souris: *Saccopteryx bilineata* (Temminck, 1838), fam. Emballonuridae; *Pteronotus parnellii* (Gray, 1843), fam. Mormoopidae; *Phyllostomus hastatus* (Pallas, 1767), *Glossophaga soricina* (Pallas, 1766), *Carollia perspicillata* (Linnaeus, 1758), *Desmodus rotundus* (E. Geoffroy, 1810), fam. Phyllotomidae. Les os coxaux, ayant des structures specifiques, sont necesaires pour l'identification des espèces. Le travaux est important pour les études sur des certaines oiseaux de proie et pour les paléontologistes qui sont intéresés de la structure faunistique des certaines dépôts fossilifères.

Keywords: os coxae, identification keys, Chiroptera, Emballonuridae, Mormoopidae, and Phyllostomidae

It is known that the value of the characteristic divergences is important in establishing the statute of different taxa. In order Chiroptera there are keys for the species identification but they refer to entire specimens and, especially, to comparative series.

But in some cases only remains of the skeleton have been preserved and for them comparative reseaches were not made.

However, till the present paper, studies of comparative anatomy in mammals have been made for: the spine (Dornescu and Nițescu, 1965; Nițescu, 1966), measurements of the coxal bones (Heráň, 1967), pelvic girdle (Heráň, 1968), nasal ducts (Andreescu, 1970), coxal bone (Andreescu, 1971), omoplate (Žalman, 1971), postcranial skeleton (Červený and Žalman, 1974; Červený, 1978).

The aim of this paper is to add new anatomical data on the structure of the coxal bone of six species of south-American bat species.

We have chosen the coxal bone because both in the skeleton fragments, preserved in shelters (caves, attics, cellars, hollows, etc.) and in the prelets of the birds of prey, the pelvic girdle is very well preserved, besides the teeth.

The paper is necessary both the mammalogists who study the present bat species, ornithologists interested in knowing the food of some birds of prey, and the palaeontologists who study the faunal structure of some fossiliferous deposits.

* English translation by Mihaela Barcan Achim.

MATERIAL AND METHOD

The bat species are collected by the authors on the occassion of the expedition organized by "Grigore Antipa" National Museum of Natural History in Brazil, in 1994. The material was obtained by maceration, mechanical cleaning and treatment with hydrogen peroxide. The study was made using a stereomicroscope, and the drawings, using a camera lucida. For this parper we examined some specimens belonging to six species of six genera which are included in the following three families: Emballonuridae, Mormoopidae and Phyllostomidae. Nomenclature is according to Nomina Anatomica Veterinaria (NAV), used by Červený (1978).

RESULTS AND DISCUSSIONS

Family EMBALLONURIDAE Dobson, 1875

From the 13 present genera and 47 species, we present the description of the coxal bone in a single species of genus *Saccopteryx.*

Genul *Saccopteryx* Illiger, 1811

Saccopteryx bilineata (Temminck, 1838)
(Fig. 1)

It was cited by K. F. Koopman (1993), Nowak (1994) with a distribution from southern Mexico to Bolivia and in south-eastern Brazil, as well as in the Trinidad and Tobago Islands. The specimens collected by us are from Vila Nova – Amapa State from northern Brazil. The colony was formed of about 7 individuals, sheltered in a hollow of a venerable tree. The two white zigzag lines from their back make this species undoubted.

Coxal bone in the species *S. bilineata* has the *crista iliaca* (CI) rounded, *eminentia iliopubica* (EIP) is short with a cut tip, almost choped off (Fig. 1). *Fossa acetabuli* (FA) is like a horseshoe, bordered by *facies lunata* (FL). *Foramen obturatum* (FO) is large and caudiform with an asymetrical tip on the ventral side. *Ramus caudalis ossis pubis* (RCOP) and *ramus ossis ischii* (ROI) are thin and slightly convex. *Spina iliaca dorsalis cranialis* (SIDCR) and *spina iliaca ventralis* (SIV) without specific structures. *Symphysis pubica* (SP) is long in comparison with the ilium and pubis. *Tabula ossis ischii* (TAI) and *tuber ischiadicum* (TI) are strongly developed and have rugged surfaces. *Tuberculum pubicum* (TP) has a pointed tip, curved innerly, which cannot be seen from an outer lateral view (Fig. 1 and Tab. 1).

Family MORMOOPIDAE Koch, 1862-63

From the two present genera and eight species, we present the description of the coxal bone for a single species of genus *Pteronotus.*

Genus *Pteronotus* (Gray, 1843)

Pteronotus parnelii (Gray, 1843)
(Fig. 2)

The geographical distribution cover the regions from USA (Sonora), Tamaulipas (Mexico) to Peru, Brazil, Guiana and Venezuela; Cuba, Jamaica, Puerto

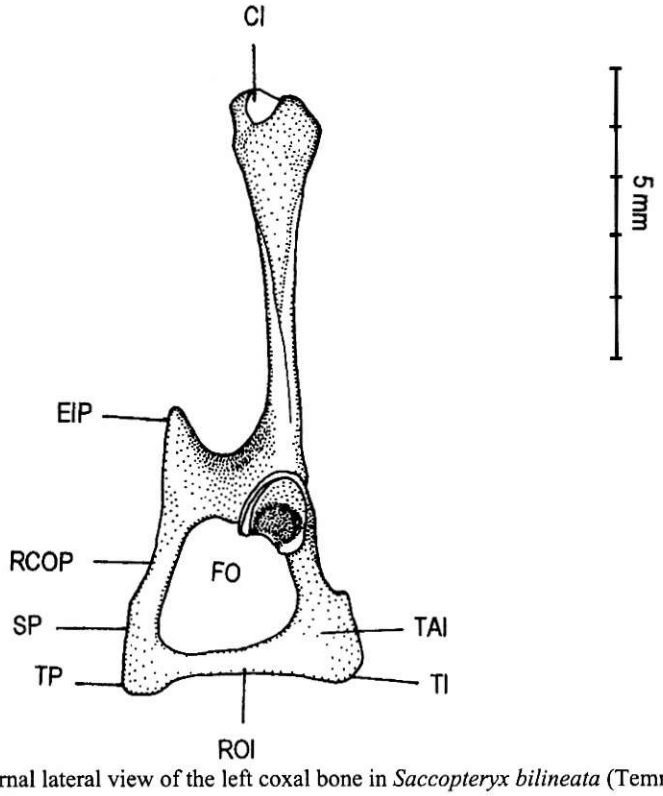

Fig. 1 – External lateral view of the left coxal bone in *Saccopteryx bilineata* (Temmink, 1838)

Rico, Hispaniola, Trinidad, Tobago; Margarita Islands (Venezuela), Gonave Islands (Haiti) – Koopman (1993), Nowak (1994). We collected individuals of this species from a cave placed in a forest near locality Serra do Navio, Amapa State (northern Brazil).

Coxal bone of *P. parnelii* has *crista iliaca* (CI) asymmetrical, widened. *Eminentia iliopubica* (EIP) is of about 4 mm long, with a pointed tip (in a lateral view) (Fig. 2. a, c) and rounded, widened (in an antero-posterior view) (Fig. 2 b). Also in an antero-posterior view the oblique position of EIP towards the inner side of the body is is more obvious. *Fossa acetabuli* (FA) deep, and *facies lunata* (FL) is well marked. *Foramen obturatum* (FO) cordiform, in which the anterior cornua of the coccy is slightly prominent. *Ramus caudalis ossis pubis* (RCOP) thicker and wider than *ramus ossis ischii* (ROI). *Spina iliaca dorsalis cranialis* (SIDCR) well individualized, with a clearer outline, in an antero-posterioar view (Fig. 2, b).*Tabula ossis ischii* (TAI) prominent, thick, and *tuber ischiadicum* (TI) big. *Tuberculum pubicum* (TP) is rounded, with the tip caudally directed.

Family PHYLLOSTOMIDAE Gray, 1825

From the 49 present genera and 141 species we present the description of the coxal bone of four different genera.

Table 1

Comparison between the structures of ossis coxae in six bat species of South America

Structure \ Species	*Saccopetryx bilineata*	*Pteronotus parnellii*	*Phyllostomus Hastatus*	*Glossophaga soricina*	*Carollia perspicillata*	*Desmodus rotundus*
CI	rounded	big, wide asymetrical	oblique dorso-ventraly	strongly concave	slightly concave	developed, slightly convex
EIP	short, with the tip straightly cut off	cca. 4 mm, rounded tip, widened (in a antero-posterioar view), bent innerly	long around 4 mm pyramidal, straight tip slightly bent innerly	conic, bent antero-posteriorly, outerly	of about 2 mm with the tip slightly bent innerly	of about 5 mm straight, with the tip oblique antero-posteriorly
FA	horseshoe-shaped	deep			deep	relatively deep
FG			slightly convex	convex	slightly convex	convex
FL		well marked		narrow, semicircular	reniform	reniform
FO	widely cordiform	cordiform	cordiform in which the cornua anterior is prominent	ovally elongated	ovally elongated	ovally elongated
RCOP	thin, convex	convex, wider, thicker than ROI	wider, thicker than ROI	narrow, thin	long, convex	narrow, thin
ROI	thin, convex	convex	narrow, thin, slightly convex	slightly convex	convex	
SIDCR		visible	slightly marked	big, rugged		big, rugged
SIV						visible
SP	long					
TAI	strong, rugged	thick	big, rugged		robust, rugged	fussed with the coccyx, rugged
TI	strong, rugged	big	well developed	slightly developed, rounded, thick, rugged	well developed	fussed with the coccyx, rugged
TP	pointed, curved innerly	rounded, caudally directed	visible			

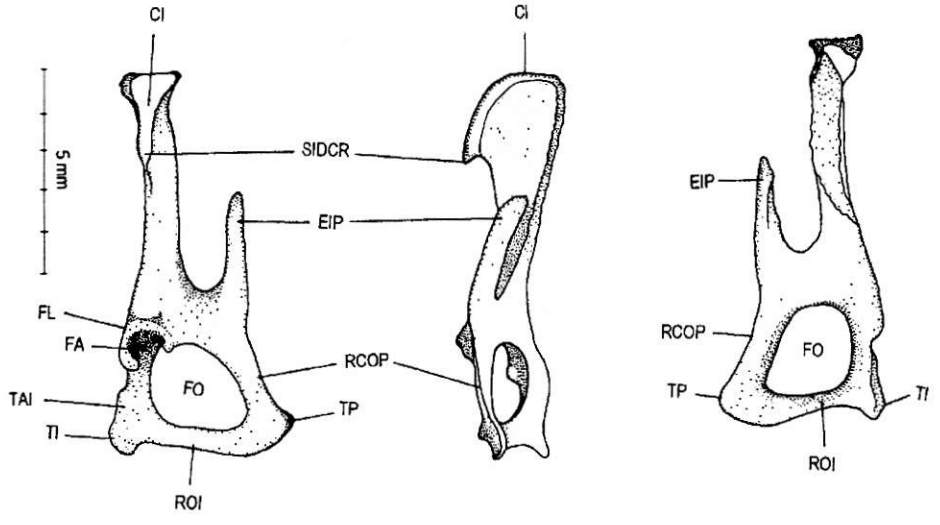

Fig. 2 – Right coxal bone in *Pteronotus parnelii* (Gray, 1843): a – external lateral view; b – antero-posterior view (profile); c – inner lateral view

Genus *Phyllostomus* Lacépède, 1799

Phyllostomus hastatus (Pallas, 1767)
(Fig. 3)

It is distributed in Honduras, Guiana, Bolivia, eastern Brazil, Paraguay, northern Argentina, Peru, Trinidad, Tobago, Margarita Islands (Venezuela) – Koopman (1993), Nowak (1994).

Coxal bone has an oblique *crista iliaca* (CI) dorso-ventrally. *Eminentia iliopubica* (EIP) is of about 4 mm long, pyramidal, with three mucles and the tip slightly curved innerly. *Facies glutea* (FG) has a slight convexity. *Foramen obturatum* (FO) cordiform, with the border interrupted by the anterior cornua of the coccy. *Ramus caudalis ossis pubis* (RCOP) is slightly shorter but more robust, the thickness and width larger than in *ramus ossis ischii* (ROI). The last one has a slight outer convexity. *Spina iliaca dorsalis cranialis* (SIDCR) slightly marked. *Tabula ossis ischii* (TAI) with the dorsal margin strongly prominent and with the lateral outer surface rugged. *Tuber ischiadicum* (TI) and *tuberculum pubicum* (TP) well individualized (Fig. 3).

Genus *Glossophaga* E. Geoffroy, 1818

Glossophaga soricina (Pallas, 1766)
(Fig. 4)

It is distributed from USA (Sonora), Mexico (Tamaulipas) to Peru, northern Argentina, south-eastern Brazil; in Tres Marias and Margarita Islands (Venezuela), Grenada (Lesser Antilles), Jamaica and Bahamas – Koopman (1993), Nowak (1994). We collected individuals of *G. soricina* from Serra do Veado, Serra do Navio.

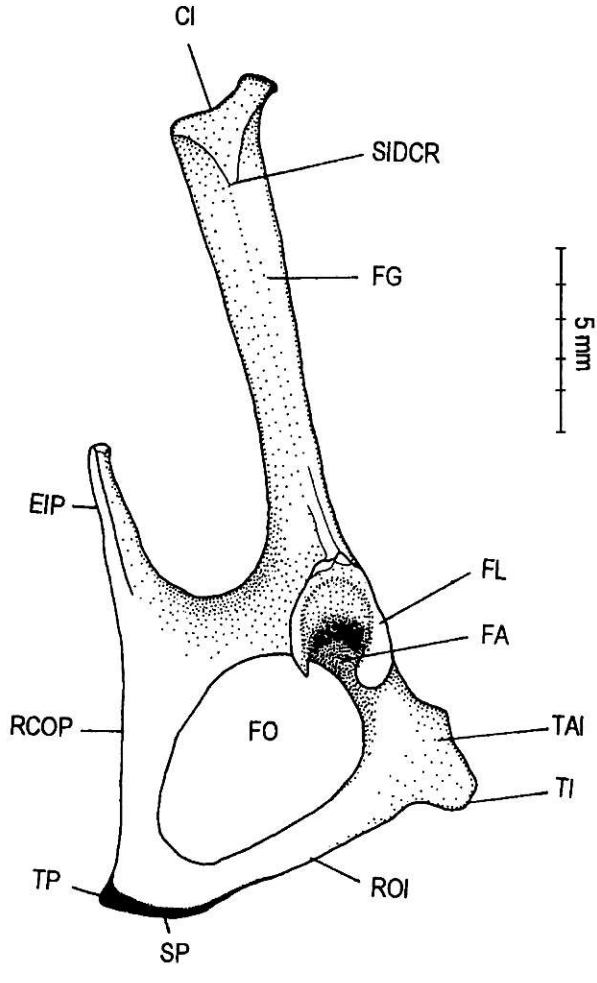

Fig. 3 – External lateral view of the left coxal bone in *Phyllostomus hastatus* (Pallas, 1767)

Coxal bone of *G. soricina* has a *crista iliaca* (CI) strongly concave. *Eminentia iliopubica* (EIP) cone-shaped, curved antero-posteriorly and outwards, but with a straight tip (Fig. 4). *Facies glutea* (FG) has a stronger convexity than in the previous species. *Facies lunata* (FL) narrow, semicircular, with the anterior cornua of the coccy slightly individualized. *Foramen obturatum* (FO) oval-shaped, elongated towards the cranio-caudal part. *Ramus caudalis ossis pubis* (RCOP) narrow and thin, longer than *ramus ossis ischii* (ROI), the last one having a slight convexity outerly. *Spina iliaca dorsalis cranialis* (SIDCR) is strongly developed and with an outer surface rugged. *Tuber ischiadicum* (TI) slightly developed, rounded, thick and rugged.

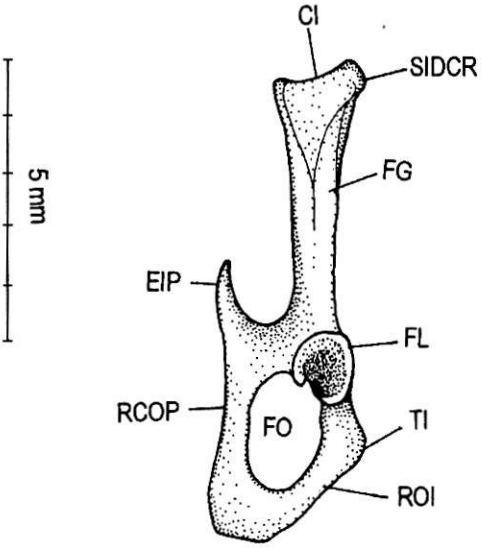

Fig. 4 – External lateral view of the left coxal bone in *Glossophaga soricina* (Pallas, 1766)

Genus *Carollia* Gray, 1838

Carollia perspicillata (Linnaeus, 1758)
(Fig. 5)

It is distributed from southern Mexico (Oaxaca, Veracruz, Yucatan Peninsula) to Peru, Bolivia, Paraguay, southern Brazil, as well as in the Islands Trinidad, Tobago, Grenada and Lesser Antilles - Koopman (1993), Nowak (1994). We collected individuals of *C. perspicillata* from Olivença.

Coxal bone of *C. perspicillata* has *crista iliaca* (CI) slightly concave. *Eminentia iliopubica* (EIP) is thin and short, up to 2 mm, with a pointed tip, slightly curved innerly. *Fossa acetabuli* (FA) well marked, deep, bordered by a reniform *facies lunata* (FL). *Facies glutea* (FG) convex. *Foramen obturatum* (FO) oval elongated to the cranio-ventral-caudal direction. *Ramus caudalis ossis pubis* (RCOP) long, convex, thicker in its cranial half. *Ramus ossis ischii* (ROI) in the middle, with an obvious outer convexity. *Tabula ossis ischii* (TAI) robust, with a rugged outer surface. *Tuber ischiadicum* (TI) well developed and with a rounded tip. *Tuberculum pubicum* (TP) unindividualized (Fig. 5).

Genus *Desmodus* Wied – Neuwied, 1826

Desmodus rotundus (E. Geoffroy, 1810)
(Fig. 6)

It is distributed from USA (Sonora), Mexico (Nuevo Leon, Tamaulipas) to Uruguay, northern Argenitna, northern Chile and in the islands Trinidad, Margarita (Venezuela) – Koopman (1993), Nowak (1994). We collected individuals of *D. rotundus* from Olivença (mixed colony), two tunnels from the farm Ponte Alta (Barrá do Piraí).

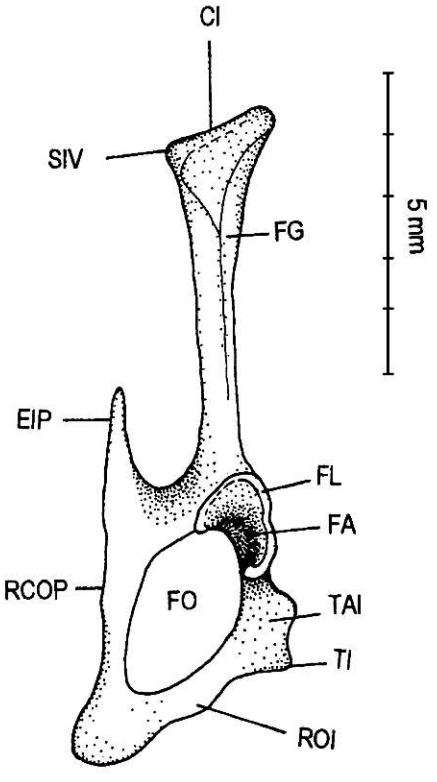

Fig. 5 – External lateral view of the coxal bone in *Carollia perspicillata* (Linnaeus, 1758)

Coxal bone of *D. rotundus* has *crista iliaca* (CI) well developed and slightly convex between SIDCR and SIV. *Spina iliaca doraslis cranialis* (SIDCR) prominent and with a rugged surface. *Spina iliaca ventralis* (SIV) smaller than SIDCR. *Eminentia iliopubica* (EIP) is of about 5 mm, with a thin and oblique tip towards antero-posterioar side. *Fossa acetabuli* (FA) relatively deep. *Facies glutea* (FG) is convex. *Facies lunata* (FL) reniform. *Foramen obturatum* (FO) oval, elongated to the cranio-ventral-caudal direction, bag-like. *Ramus caudalis ossis pubis* (RCOP) relatively short and almost uniformly thick, with *symphysis pubica* (SP) without specific structures. *Tabula ossis ischii* (TAI) and *tuber ischiadicum* (TI) are fussed with the coccyx and have a rugged surface (Fig. 6).

Coxal bones of the six bat species from South America have specific structures, useful in identifications when we have at our disposal only remains of the pelvic girdle. CI, EIP, FA, FG, FL, FO, RCOP, ROI, SIDCR, SIV, SP, TAI, TI, TP present important differences in each species, in shape, size, position and relations with the other structures.

We consider these differences extremely useful for completing the identification keys of the present bat species, only for the above-mentioned species, for the time being.

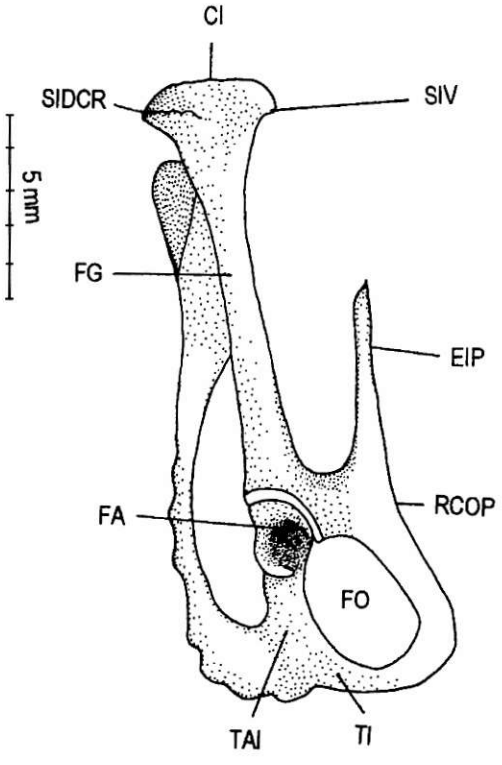

Fig. 6 – External lateral view of the right coxal bone in *Desmodus rotundus* (E. Geoffroy, 1810)

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VALOAREA TAXONOMICĂ A DIFERENŢELOR MORFOLOGICE ALE OSULUI COXAL LA ŞASE SPECII DE LILIECI SUD-AMERICANI (CHIROPTERA: EMBALLONURIDAE, MORMOOPIDAE ŞI PHYLLOSTOMIDAE)

REZUMAT

Materialul cercetat de noi provine din colectările efectuate în teren cu ocazia expediţiei Muzeului Naţional de Istorie Naturală "Grigore Antipa" în Brazilia, din 1994. În lucrare sunt

prezentate structurile caracteristice ale osului coxal la şase specii de lilieci sud-americani din trei familii: Emballonuridae, Mormoopidae şi Phyllostomidae.

Componente ca CI, EIP, FA, FG, FL, FO, RCOP, ROI, SIDCR, SIV, SP, TAI, TI şi TP diferă de la o specie la alta în ceea ce priveşte forma, dimensiunea, poziţia şi relaţia cu celelalte structuri.

Pe baza studiului osului coxal se pot completa cheile de determinare ale speciilor de mamifere, în general, şi ale celor de lilieci actuali, în special. Deci lucrarea este necesară mamalogilor, ornitologilor care cercetează hrana unor păsări răpitoare dar şi paleontologilor care vor să stabilească structura faunistică a unor depozite fosilifere.

REFERENCES

ANDREESCU, N. I., 1970 - Étude comparative des cornetes nasaux chez: *Talpa europaea* L., *Crocidura leucodon* Herm., *C. suaveolens* Pall., *Sorex araneus* L., et *Neomys fodiens* Schreb.(Ord. Insectivora) de Roumanie.Trav. Mus. Hist. nat "Grigore Antipa", 10: 359 – 363.

ANDREESCU, N. I., 1971 – Contributions a l'étude de la morphologie du squelet des Mammifères de petite taille. Trav. Mus. Hist. nat. "Grigore Antipa", 11: 417 – 427.

ČERVENÝ, J., 1978 – Comparative anatomy of large bones in three models of european bats (Rhinolophus, Myotis, Tadarida) Vestník čs. společ. Zool., 42 (3): 161 – 171.

ČERVENÝ, J., ŽALMAN, J., 1974 – Diagnostiké znaky na kostech předni končetiny vrápenců. Lynx. Mus. Nat. Praha, 16: 86 – 100.

DORNESCU, TH., NIŢESCU, I., 1965 – Anatomie comparée de la colonne vertébrale chez plusieurs espèces de rongeurs de Roumanie. Trav. Mus. Hist. nat "Grigore Antipa", 5: 423 – 441.

HERÁŇ, I., 1967 – K rozdílům v morfologii pánve sviště horského (*Marmota marmota* L.) veverky obecné (*Sciurus vulgaris* L.) a sysla obecného (*Citellus citellus* L.). Lynx Mus. Nat. Praha, 8: 7 –14.

HERÁŇ, I., 1968 - Diagnostiké znaky na pánvích šelem. Lynx Mus. Nat. Praha, 9: 25 – 33.

KOOPMAN, K. F., 1993 – Order Chiroptera. *In*: WILSON D. E, REEDER DEE ANN M., Mammal species of the World. A taxonomic and geographic reference. Second edition. Smithson Inst. Press. Washington, London: 137 – 241.

NIŢESCU, I., 1966 – Anatomie comparée de la colonne vertébrale chez *Ondatra zibethica* L., *Apodemus agrarius* Pall. et *Spalax leucodon* Nordmann. Trav. Mus. Hist. nat "Grigore Antipa", 6: 345 – 356.

NOWAK, R. M., 1994 – Walker's Bats of the World. The John Hopkins University Press. Baltimore, London: 1-287.

ŽALMAN, J., 1971 – Diagnostiche merkmale an den schulterblättern einiger fledermäuse der familie Rhinolophidae Bell, 1836 und Vespertilionidae Gray, 1821. Věstnik čs. společ. Zool., 35 (4): 311 – 319.

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