

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/259516386>

Late Miocene lagomorphs from the Republic of Moldova

Article in *Annales de Paléontologie* · January 2013

DOI: 10.1016/j.annpal.2013.10.004

CITATIONS

11

READS

367

1 author:



Andrian Delinschi

Moldova State University

12 PUBLICATIONS 69 CITATIONS

SEE PROFILE

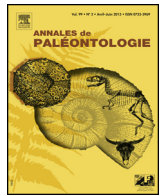


Disponible en ligne sur

ScienceDirect
www.sciencedirect.com

Elsevier Masson France

EM|consulte
www.em-consulte.com



Original article

Late Miocene lagomorphs from the Republic of Moldova

Lagomorphes du Miocène Supérieur de la République de Moldavie

Andrian Delinschi

National Museum of Ethnography and Natural History of Moldova, 82, Kogalniceanu str., 2009 Chisinau, Republic of Moldova



ARTICLE INFO

Article history:

Received 30 August 2013

Accepted 4 October 2013

Available online 22 December 2013

Keywords:

Mammalia
Lagomorpha
Systematic
Late Miocene
Republic of Moldova

Mots clés :

Mammalia
Lagomorpha
Systématique
Miocène supérieur
République de Moldova

ABSTRACT

The aim of this paper is to enlarge knowledge about still poorly documented and understood record of Lagomorpha (Mammalia) from the Late Miocene of Moldova. The lagomorph material from two new Late Miocene localities, Razeni (MN11/12), Gradishte (MN12), and re-sampling locality Chimishliya (MN12), of Southern Moldova, is described in detail here. The localities yielded small vertebrate fauna including five lagomorph taxa: *Prolagus* cf. *oeningensis*, "*Proochotona*" cf. *eximia*, *Alilepus laskarewi*, "*Proochotona*" sp., and *Alilepus* sp. *P. cf. oeningensis* is described for the first time in the studied area. A short review of the lagomorph record from the Republic of Moldova is provided. This contribution outlines the importance of the lagomorphs for biostratigraphic purposes, and highlights the gaps in our knowledge related to the faunal succession in this area.

© 2013 Elsevier Masson SAS. All rights reserved.

RÉSUMÉ

Le but de ce travail est d'élargir les connaissances, encore limitées, sur les Lagomorpha (Mammalia) du Miocène supérieur de la Moldavie. Le matériel provenant de trois nouvelles localités du Miocène, Razeni (MN11/12), Gradishte (MN12) et Chimishliya (MN12), dans le sud de la Moldavie, est ici décrit en détail. Les localités ont livré de petits vertébrés comprenant cinq taxons de lagomorphes : *Prolagus* cf. *oeningensis*, « *Proochotona* » cf. *eximia*, *Alilepus laskarewi*, « *Proochotona* » sp., et *Alilepus* sp. *P. cf. oeningensis* est décrit pour la première fois dans la zone étudiée. Un bref examen du registre fossile des lagomorphes de la République de Moldavie est fourni. Cette contribution souligne l'importance des lagomorphes à des fins biostratigraphiques, mais aussi le manque de données relatives à la succession faunique de cette région.

© 2013 Elsevier Masson SAS. Tous droits réservés.

1. Introduction

The Late Miocene continental deposits from the Republic of Moldova (former Moldova) are rich in fossil terrestrial vertebrates (e.g. Lungu, 1981; Rzebik-Kowalska and Lungu, 2009; Lungu and Rzebik-Kowalska, 2011). The new localities of Turolian age, namely, Gradishte, Razeni, and re-sampling locality Chimishliya (MN12) (see Appendix for translations) are of a special interest, because they are placed at the interference of three paleobiogeographical regions: Eastern European, Central European and Mediterranean. As a result of intensive fieldwork undertaken on these sites during the last years fossil small vertebrates of an exceptional scientific value have been collected. The assemblages contain fishes, amphibians, reptiles and mammal remains, and they are at the

moment under study. A significant part of the mammalian assemblages is represented by lagomorphs. This mammal group was widespread during the Late Miocene in Eurasia, and it seems to be a good tool for the understanding of the paleogeography of the Late Miocene of Moldova (Lungu, 1990; Lungu and Delinschi, 2008).

The first report on this group in the Republic of Moldova was provided by Khomenko (1914). A new step in the research on lagomorphs began in 1980s, when new Vallesian-Turolian localities with vertebrate fauna from Moldovan Plate were discovered (Lungu, 1981; Lungu and Cemyrtan, 1989; Lungu, 1990). More recently, new data on Ochotonidae and Leporidae have been presented by Delinschi (2009, 2012) (Table 1). Although the lagomorphs represent most often an important part of the fossil communities and are commonly present in the fossil material from the Moldovan Plate, they are rarely studied. The present paper is an attempt to fill in this knowledge gap (Table 1).

E-mail address: andriandelinschi@yahoo.com

Table 1

Fossil Lagomorpha record from the Republic of Moldova: state of the art.

Enregistrement des lagomorphes fossiles de la République de Moldavie: état des lieux.

Taxon	Synonym	Localities	References
" <i>Proochotona</i> " <i>kalfense</i> , Lungu, 1981		Otovasca I Buzhor I Kalfa	Lungu, 1981, Lungu and Rzebik-Kowalska, 2011
" <i>Proochotona</i> " <i>eximia</i> , Khomenko, 1914		Chiobruchiu, Tarakliya, Leordoaya	Khomenko, 1914, Lungu and Delinschi, 2008, Lungu and Rzebik-Kowalska, 2011
" <i>Proochotona</i> " cf. <i>eximia</i> Khomenko, 1914		Gradishte	This paper
" <i>Proochotona</i> " sp.		Lepushna, Varnitsa, Otovaska II, Veveritsa I, Keinar, Pitushka, Pokshesht, Respopen, Razeni, Kalfa, Buzhor I	Lungu, 1990, Lungu and Rzebik-Kowalska, 2011, this paper
<i>Eurolagus fontannesi</i> (Deperet, 1887)	<i>Amhilagus fontannesi</i> (Lungu, 1981), <i>Eurolagus bujorensis</i> (Lungu et al., 2007)		Lungu, 1981, Lungu et al., 2007, Lungu and Rzebik-Kowalska, 2011
<i>Alilepus laskarewi</i> (Khomenko, 1914)	<i>Lepus laskarewi</i> (Khomenko, 1914)	Tarakliya, Chimishliya	Khomenko, 1914, Delinschi, 2009, this paper
<i>Alilepus</i> sp.		Keinar, Pitushka, Gura-Galbene, Gradishte, Leordoaya	Sukhov, 1945, Lungu and Rzebik-Kowalska, 2011, this paper
<i>Prolagus</i> cf. <i>oengensis</i> (König, 1825)		Razeni	This paper
<i>Prolagus</i> cf. <i>sorbinii</i> Masini, 1989	<i>Prolagus</i> cf. <i>michauxi</i> López-Martínez, 1976 (Nicoara and Lungu, 2008), <i>Prolagus crusafonti</i> (López-Martínez) (Lungu et al., 2007)	Leordoaya	Lungu and Rzebik-Kowalska, 2011
<i>Prolagus</i> sp.		Pitushka	Lungu and Rzebik-Kowalska, 2011

2. Geological settings

A Turolian continental deposit, if to consider facies and structural composition, practically does not differ from the similar deposits of Late Vallesian age, which are included in the Balta Formation (Khubka, 1968, 1969). This demonstrates that the same conditions for sedimentation existed in Turolian. Balta Formation is represented by terrigenous formations consisting of sand-clay sediments and it represents a considerable layer of alluvial deposits, which probably was formed as result of migration of river arms and tributaries of rivers at the end of Miocene. Under the conditions of low plains, they covered the central area of the territory between the Prut and Dniester (Khubka, 1968). All localities considered here are located on sand-clay sediments without any "Carpathian jasper" which is typical for Late Turolian deposits (Lungu and Rzebik-Kowalska, 2011). This fact indicates to the Middle Turolian age of the investigated localities.

3. Material and methods

The lagomorphs were collected during fieldwork campaigns undertaken between 2000 and 2012. Beside the re-sampling of the Turolian locality Chimishliya lagomorphs material from two new localities are presented: the Turolian locality Razeni (the precise age correlation is still unclear), but preliminary we assign to Early/Middle Turolian) and the Turolian locality Gradishte (faunal assemblage from this locality has much in common with locality Chimishliya, through the presence of common rodents like: *Spermophilinus* sp., *Myomimus dehmi/maritsensis* group, *Vasseuromys* cf. *panonicus* (Kretzoi, 1978), *Lophocricetus* sp., *Kowalskia progressa* (Topachevski and Scorik, 1992) (Fig. 1).

The Turolian locality Razeni (46.788763 N, 28.911261 E) is located near the highway M3, in the district Ialoveni, the bone material is collected from gravels of clay/sand quarry.

The Turolian localities Chimishliya (46.546347 N, 28.75682 E) and Gradishte (46.617492 N, 28.764298 E) are situated in the district Cimishliya. In both localities (sand quarries), the fossil material is found in the gravels (Fig. 1).

The fossils were extracted from the sediments by dry screen washing. They are stored in the palaeontological collections of the

National Museum of Ethnography and Natural History of Moldova (NMENHM). The drawings were done directly from the teeth using Camera lucida mounted on a microscope Leica M50. The measurements were done using digital microscope LEICA DVM 5000 in Eberhard Karls University Tübingen Institute for Geoscience, University of Tübingen, Germany. The dental nomenclature and measurement follow Angelone and Sesé (2009) for ochotonids and López-Martínez et al. (2007) for leporids. Some of the dental elements can be very similar in shape and size, and the distinction between them, based on isolated teeth, is not always possible. Herein these dental elements are considered together as, e.g., P4/M1.

The biostratigraphic terminology used in this paper follows Lungu and Rzebik-Kowalska (2011).

For comparative purposes the following material: López-Martínez (1976, 1977), Lungu (1981, 1990), Brijn (1995), Şen (2003), Hordijk (2010), Angelone and Sesé (2009), Angelone and Rook (2011), Čermák and Wagner (2013); and the Late Miocene vertebrate collection of Tiraspol State University, was taken into account.

4. Systematic paleontology

Order LAGOMORPHA Brandt, 1855.
Family OCHOTONIDAE Thomas, 1897.
Genus *Prolagus* Pomel, 1853.

Prolagus cf. *oeningensis* (König, 1825) (Fig. 2A–2F).

Locality: Razeni, Republic of Moldova.

Age: Early/Middle Turolian (MN 11/12).

Material: 2 P3 sin: MNEIN 1–2 Lag/Raz.; 2 P4 dx: MNEIN 3–4 Lag/Raz.; p3 dx: MNEIN 5 Lag/Raz.; p3 sin: MNEIN 6 Lag/Raz.

Measurements (see Table 2).

Description:

P3: the two teeth are of triangular shape and belonged to adult specimens. The mesoflexus is quite deep and well curved. The long lagiloph reaches the labial border of the tooth. The lagicone is well pronounced. A notch between lagiloph and lagicone cannot be seen.

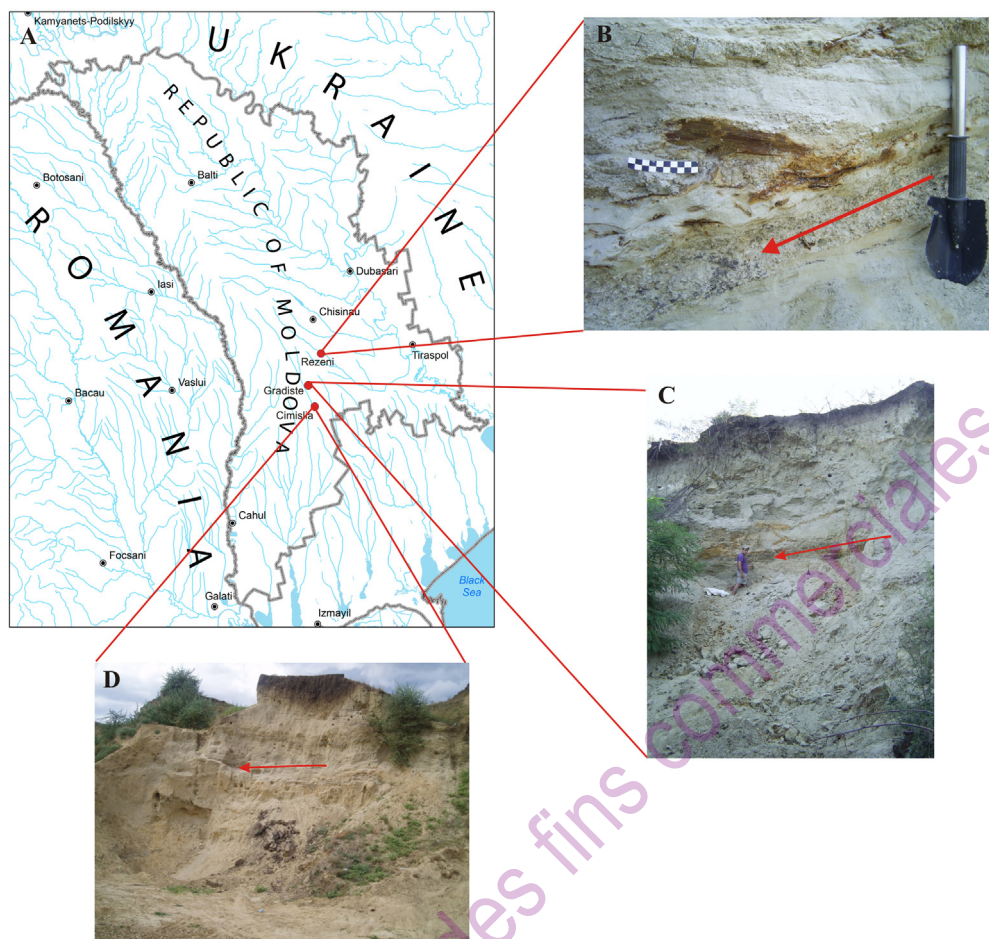


Fig. 1. The map of the Republic of Moldova, showing the location of the studied fossil localities (A), photos of localities Razeni (B), Gradishte (C), and Chimishliya (D). The red line indicates fossiliferous horizons.

Carte de la République de Moldavie, montrant l'emplacement des localités de fossiles étudiés (A), photos de localités Razeni (B), Gradishte (C), Chimishliya (D). La ligne rouge indique horizons fossilifères.

Table 2

Teeth measurements in mm.

Mesures des dents en mm.

Element	Length	Width
<i>Prolagus</i> cf. <i>oeningensis</i>		
P3	1.50–1.70	2.15–2.50
P4	1.30–1.44	2.27–2.58
p3	1.65–1.70	1.63–1.73
<i>"Proochotona"</i> cf. <i>eximia</i>		
P3	1.38	2.90
P4-M1	1.40–1.94	2.60–3.25
M2	1.67	2.53
p3	1.61–1.72	1.61–1.85
p4	1.88	2.05
m1	2.02–2.00	2.09–2.05
m2	1.95	1.95
m3	0.81	1.37
p4-m3 row	6.92	2.32
<i>"Proochotona"</i> sp.		
P3	1.31	2.72
p3	1.90	1.84
<i>Alilepus</i> <i>laskarewi</i>		
P4-M2	1.70–2.41	3.44–4.71
p3	2.60–3.06	2.20–2.93
p4	3.08	3.39
m1	3.14	3.10
m2	3.28	3.29
<i>Alilepus</i> sp.		
p3	3.13	3.45

The curved paraflexus are deeper than the mesoflexus. The mesial hyperloph exceeds in width the two thirds of tooth in one specimen and is shorter in another one. The hypoflexus is present in both teeth, but more developed in a larger specimen (Fig. 2B). Mesial and distal hypercones have the same size in the smaller P3 (Fig. 2A), and distal hypercone is more pronounced in the larger one. Both teeth on the mesial hyperloph, have devoid of enamel area – *hiatus*.

P4: the mesofossette is small and rounded; the parafossette has an elongated J-shape. It merges almost with the disto-labial border of the tooth. Distal hypercone is little wider than mesial on one tooth (Fig. 2C) and have basically the same morphology on another one (Fig. 2D). The hypoflexus is wide in the first part, relatively narrow in second and occupies up to the half of the width of the tooth. p3. The anteroconid is rounded (Fig. 2E) or quadrangular (Fig. 2F), but it is smaller than the metaconid. The anteroconid is located more in the lingual portion of teeth. Protoconulid is well developed and connected to a small protoconid. The metaconid is well developed, connected to the entoconid, and is almost quadratic. The antero-labially-oriented hypoconid is rounded in outline. The protoflexid is well developed, and almost reaches the posterior border of the tooth. The small mesoflexid is not too deep and has a light posterolabial inclination. The centroflexid is thin in the smaller tooth and slightly larger in the larger one. The thick entoconid has enamel hiatus in its postero-lingual part (Fig. 2E) or does not have hiatus (Fig. 2F). The crochet is present and is straight.

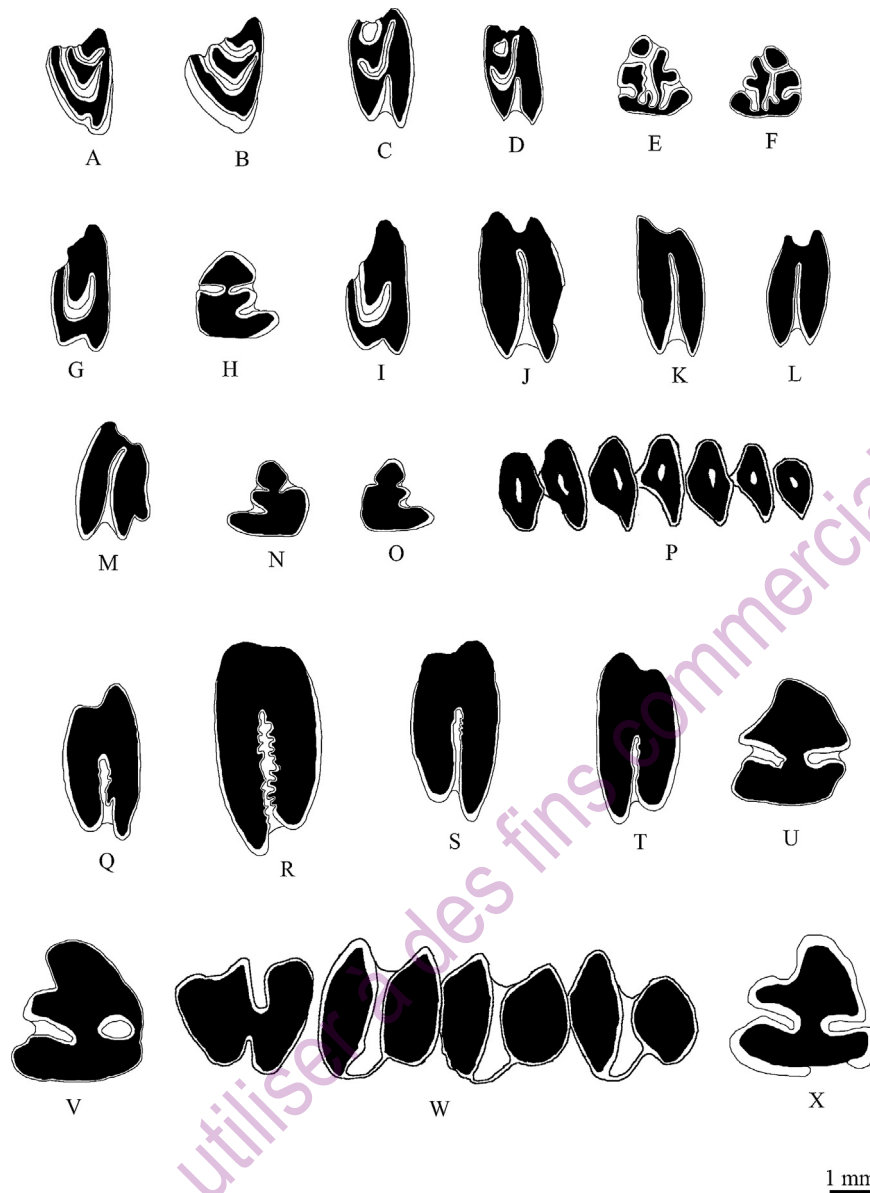


Fig. 2. Late Miocene lagomorphs from Republic of Moldova.

Miocène supérieur lagomorphes de la République de Moldavie. *Prolagus* cf. *oeningensis*: **A, B** - P3 sin: MNEIN 1-2 Lag/Raz.; **C, D** - P4 dx: MNEIN 3-4 Lag/Raz.; **E** - p3 dx: MNEIN 5 Lag/Raz.; **F** - p3 sin: MNEIN 6 Lag/Raz. and "Proochotona" sp.: **G** - P3 sin: MNEIN 7 Lag/Raz.; **H** - p3 dx: MNEIN 8 Lag/Raz from Razeni; *Proochotona* cf. *eximia*: **I** - P3 sin: MNEIN 1 Lag/Grad; **J, K** - P4/M1 dx: MNEIN 2-3 Lag/Grad; **L** - P4/M1 sin: MNEIN 4 Lag/Grad; **M** - M2 sin: MNEIN 6 Lag/Grad; **N** - p3 sin: MNEIN 7 Lag/Grad; **O** - p3 dx: MNEIN 8 Lag/Grad; **P** - mandible fragment with p4-m3: MNEIN 9 Lag/Grad from Gradishte. *Alilepus laskarewi*: **Q** - P3 sin: MNEIN 1 Lag/Cim; **R** - P4-M1 dx: MNEIN 2 Lag/Cim; **S** - M2 dx: MNEIN 4 Lag/Cim; **T** - M2 sin: MNEIN 5 Lag/Cim; **U, V** - p3 sin: MNEIN 6-7 Lag/Cim; **W** - mandible fragment with p3-m2 dx: MNEIN 8 Lag/Cim. from Chimishliya and *Alilepus* sp.: **X** - p3 dx: MNEIN 9 Lag/Grad ("radical" surface) from Gradishte.

Taxonomical position:

Prolagus from Razeni is similar to *Prolagus oeningensis* from Las Umbrias 12, Manchones, Spain (Hordijk, 2010) and *P. oeningensis* from Paşalar (Şen, 1990) in having same sizes, configuration and position of anteroconid, and metaconid. Other tooth elements correspond to the species as well, like position and configuration of crochet, protoconid, hypoconid (Angelone and Sesé, 2009). Unfortunately, the lack of sufficient material does not allow confident determination, and it is assigned to *Prolagus* cf. *oeningensis*.

Remarks:

The genus *Prolagus* was reported from several Late Miocene localities of the Republic of Moldova but detailed descriptions of the teeth material are rare. The first record of the described genus (*Prolagus* sp.) was from Buzhor (MN9) (Lungu, 1981) showing

similarities to *P. crusafonti* (unfortunately the material from Buzhor was not found to confirm or refute the determinations of Lungu). The taxonomic position of *Prolagus* from the Late Turolian locality Leordoaya (MN13) is also unclear. First it was mentioned as *Prolagus crusafonti* (Lungu et al., 2007), later as *Prolagus* cf. *michauxi* by Nicoara and Lungu (2008). The last studies present it as *Prolagus* cf. *sorbini* (Lungu and Rzebik-Kowalska, 2011). The *Prolagus* record is then in urgent need of revision.

Prolagus oeningensis is reported from more than 150 localities from the Iberian Peninsula, western to Central Europe and Anatolia (e.g., Şen, 1990; Angelone, 2009; Angelone and Sesé, 2009; Prieto et al., 2012). It ranges from MN 4 to earliest MN 9, last occurrences of this species being found in the Iberian Peninsula (Álvarez-Sierra et al., 1990), France (Aguilar et al., 2004) and Switzerland (Kálin and Engesser, 2001). If the relationship of the remains from Razeni to

P. oeningensis is confirmed, it would be one of the youngest records of the species.

Genus “*Proochotona*” Khomenko, 1914.

“*Proochotona*” cf. *eximia* Khomenko, 1914 (Fig. 2I–2P).

Locality: Gradishte, Republic of Moldova.

Age: Middle Turolian (MN11/12).

Material: P3 sin: MNEIN 1 Lag/Grad; 2 P4/M1 dx: MNEIN 2–3 Lag/Grad; 2 P4/M1 sin: MNEIN 4–5 Lag/Grad; M2 sin: MNEIN 6 Lag/Grad; p3 sin: MNEIN 7 Lag/Grad; p3 dx: MNEIN 8 Lag/Grad; mandible fragment with p4–m3: MNEIN 9 Lag/Grad; mandible fragment with m1: MNEIN 10 Lag/Grad.

Measurements: (see Table 2).

Description:

P3: is elongated oval. The paraflexus has an average length and a distinct J-shape. The lagicone is sharp. The better-preserved tooth shows deeper hypoflexus (Fig. 2I). Proto-loph is narrow and in the labial end shows a small interruption of the enamel–hiatus.

Upper molariforms: The hypoflexus is deep and close to the labial border of the tooth. p3: is triangular with rounded lingual part. The anteroconid is small, elongated and rounded. The protoflexid and paraflexid are poorly developed in one tooth (Fig. 2O) and deeper in another one (Fig. 2N). The relatively stronger hypoflexid has a light posterolingual inclination in one tooth (Fig. 2N). The protoflexid, paraflexid and hypoflexid are filled with cement. The hypoconid is relatively well developed, the entoconid is missing.

Lower molariforms: Two separated rhomboid lobes are connected by a thin layer of cement. The labial parts of trigonid and talonid are sharper than the lingual ones. m3: the tooth consists of a single conid, pointed in labial outline.

Taxonomical position:

“*Proochotona*” from Gradishte differs from “*P.*” *kalfense* from Buzhor and Kalfa (MN9) by its larger size, higher degree of hypsodonty, different configuration of the anteroconid on the p3 and it is morphologically similar to “*P.*” *eximia* from Tarakliya (MN11–12), but differs in being smaller. “*Proochotona*” from Gradishte has an intermediate position between “*P.*” *kalfense* and “*P.*” *eximia*, but the lack of adequate material does not allow to provide a clear taxonomic assignment at the specific level.

Remarks:

Originally genus *Proochotona* was described by Khomenko (1914) from Tarakliya, (Republic of Moldova), but until now the validity of the genus is subject of discussion. Argyropulo and Pidoplochko (1939) proposed the inclusion the genus *Proochotona* into *Ochotona*, and *P. eximia* was attributed to genus *Ochotona*. Gureev (1964) revised the group and reassigned the validity of the genus, including here also other three species: *Proochotona gigas* Argyropulo and Pidoplochko, 1939, *Proochotona kurdjukovi* Gureev, 1964, and *Proochotona kirgizica* Gureev, 1964. The species *P. gigas* was later assigned to the genus *Pliolagomys* (Erbajeva, 1988). *Proochotona kalfense* was described from Kalfa (MN9, Lungu, 1981). The revision of Eurasian ochotonids provided by Erbaeva (1988) included only two species in the genus *Proochotona* – *P. kalfense* and *P. eximia*. Later, Şen (2003) considers *P. kalfense* as a species of genus *Bellatonoïdes*, and *P. eximia* as belonging to *Ochotona*. Čermák (2010) supports the invalidity of *Proochotona*, but transfers *P. kalfense* to *Ochotona* (cf. Čermák and Rekovets, 2010). Erbajeva et al. (2011) in the general overview of the Late Cenozoic ochotonids of Asia and North America mentioned the presence of genus *Proochotona* in the Late Miocene of Europe and Asia. So, the validity of the genus is still under discussion and for solving this taxonomic problem further study on the additional material including holotypes of *Proochotona eximia* and *Proochotona kalfense* is necessary.

“*Proochotona*” sp. (Fig. 2G–2H).

Locality: Razeni, Republic of Moldova.

Age: Early Turolian (MN11/12).

Material: P3 sin: MNEIN 7 Lag/Raz.; p3 dx: MNEIN 8 Lag/Raz. Measurements: (see Table 2).

Description:

P3: trapezoidal in occlusal outline. U-shaped paraflexus is well developed and strongly curved. The less deep hypoflexus separates the distal and mesial hypercones.

p3: heavily eroded and damaged and has the shape of an equilateral triangle. The anteroconid is well developed and triangular. The connection between anteroconid and trigonid is very thin. The paraflexid is deep as the protoflexid. The posterolingual part of p3 is missing.

Taxonomical position:

These teeth show similarities with “*P.*” *eximia* from Tarakliya, Moldova and “*P.*” *kalfense* from Buzhor and Kalfa, Moldova, but due to insufficient amount of material, I prefer to describe the teeth as “*Proochotona*” sp (Table 2).

Family LEPORIDAE Gray, 1821.

Genus *Alilepus* Dice, 1931.

Alilepus laskarewi (Khomenko, 1914) (Fig. 2Q–2W).

Locality: Chimishliya, Republic of Moldova.

Age: Middle Turolian (MN12).

Material: P3 sin: MNEIN 1 Lag/Cim; 2 P4–M1 dx: MNEIN 2–3 Lag/Cim; M2 dx: MNEIN 4 Lag/Cim; M2 sin: MNEIN 5 Lag/Cim; 2 p3 sin: MNEIN 6–7 Lag/Cim; mandible fragment with p3–m2 dx: MNEIN 8 Lag/Cim.

Measurements: (see Table 2). Mandibular height at the level of p3: 13 mm; length of dental series p3–m2: 11.5 mm.

Description:

Upper molariforms: the width of P4/M2 is approximately twice as large as the tooth crown length. The lingual part of the tooth is characterized by a presence of a well-pronounced hypoflexus, which composes the 2/3rd of tooth width. The distal hypercone is more elongated than the mesial hypercone. p3: the posterior part shows deep mesoflexid and hypoflexid. They are directed to the center of the tooth and hypoflexid is slightly posteriorly tilted. The protoisthmus is very thick. The anterolabial border of the tooth is characterized by the presence of the protoflexid which is less expressed than the hypoflexid and mesoflexid. The anteroconid is rounded. On a strongly eroded tooth the mesoflexid is lingually closed (Fig. 2V).

Lower molariforms: p4–m2 are composed of 2 lobes, which are united by a thin layer of cement.

Taxonomical position:

Alilepus from Chimishliya is similar to *Alilepus laskarewi* described from Tarakliya (Khomenko, 1914). From other European species like *Alilepus ucrainicus* Gureev, 1964 (Odessa, Ukraine, Pliocene) (Gureev, 1964), *A. laskarewi* differs by the presence of the strongly developed hypoflexus in M1, and deeper mesoflexid and hypoflexid in p3; from *Alilepus hungaricus* Kormos, 1934 (Polgárdi, Hungary, Late Miocene) (Kormos, 1934) by larger size, smaller hypoflexid and larger mesoflexid on p3; species *Alilepus meini* Angelone and Rook, 2011 (Baccinello–Cinigliano basin, Italy, Late

Miocene) (Angelone and Rook, 2011) is smaller in size and has less simplified flexids on p3. López-Martínez (1977) described a new species *Alilepus turoloensis* from El Arquillo (Spain, Upper Miocene, MN 13), which has some similarities to *A. laskarewi* from the Turolian deposits of the Moldovan Plate, but also has some differences: the deeper hypoflexid and mesoflexid of p3. Lungu et al. (2007) assigned *A. turoloensis* from Maramena (Bruijn, 1995; Greece, MN13) to *A. laskarewi*, based on the few differences (only narrower protoisthmus). For clarification of this assignation, study of the additional material, including material from Maramena and holotype of *A. laskarewi* is necessary. López-Martínez (1976) described *Alilepus* sp. from Pikermi based of d3 and a fragmentary p3. Unfortunately scanty material on *Alilepus* from Pikermi does not allow us to make some conclusions, we can only mention that p3 from Pikermi is different from *Alilepus laskarewi* from Moldova by different shape of mesoflexid and hypoflexid and very narrow protoisthmus.

Remarks:

A. laskarewi is a typical representative of the continental Turolian deposits of Dniester-Prut interfluves, and it is known from two localities: Chimishliya (MN12) and Taracliya (MN12) (see Table 1). Probably after enriching the collection with new remains of small mammalian fauna from Turolian deposits of the Republic of Moldova, it will be possible to assign some lagomorphs described as *Alilepus* sp. (see Table 1), to *A. laskarewi*, thus enlarging the area of former habitat of this species. During the Pliocene (Early Ruscinian) the genus *Alilepus* as replaced by *Trischizolagus* in that area (Averianov and Tesakov, 1997; Čermák and Wagner, 2013).

Alilepus sp.

(Fig. 2X).

Locality: Gradishte, Republic of Moldova.

Age: Turolian (MN11/12).

Material: p3 dx: MNEIN 9 Lag/Grad.

Measurements: (see Table 2).

Description:

p3: the occlusal surface is strongly eroded and damaged, and it is impossible to make any descriptions. The “radical” surface is better represented. The anteroconid is triangular, mesoflexid and hypoflexid are less deep and protoisthmus is wide. The protoflexid is well pronounced. The hypoconid is massive. The flexids are not filled with cement.

Taxonomic position:

Regarding the size and overall morphology, the p3 is similar to *Alilepus laskarewi* from Chimishliya and Taracliya. Taking into account lack of sufficient material, I refrain from the specific assignment of this remain to a certain genus (?).

5. Discussion and conclusions

The analysis of lagomorph material from the Late Miocene three localities of the Republic of Moldova has resulted in the recognition of three genera: *Prolagus*, “*Proochotona*” and *Alilepus*. Two localities, Razeni and Gradishte contain two genera, while Chimishliya just one.

The oldest finding of the genus *Prolagus* in the Republic of Moldova is *Prolagus* sp. from Pitushka. (MN 10, Lungu and RzebiK-Kowalska, 2011). The youngest *Prolagus* was clearly known from Leordoaya (MN 13, Lungu and RzebiK-Kowalska, 2011). *Prolagus* cf. *oeningensis* from Razeni might represent a link between Late Vallesian and Late Turolian records of the genus. The genus has a relatively long evolutionary history on a small territory of the Republic

of Moldova, but it is in sharp contrast with the few localities in which it occurs.

“*Proochotona*” cf. *eximia* from Gradishte is considered here as intermediate between “*P.*” *kalfense* and “*P.*” *eximia*. The oldest locality from the Republic of Moldova containing “*Proochotona*” is Kalfa (MN 9, Lungu and RzebiK-Kowalska, 2011), and the youngest is Leordoaya (MN13, Lungu and RzebiK-Kowalska, 2011). “*P.*” *kalfense* – “*P.*” cf. *eximia* – “*P.*” *eximia*, might represent a single phylogenetic line, but to be sure some taxonomic details of specimens from several Vallesian and Turolian localities should be made (see Table 1).

A. laskarewi is at present restricted within MN 12 in the Republic of Moldova and previously it was reported from Chimishliya and Taracliya (e.g. Delinschi, 2008; Lungu and RzebiK-Kowalska, 2011). *Alilepus* sp. from Gradishte belongs most probably to the same species and it points out more a correlation with MN 12 for the locality.

In the present paper, only new material of the Moldavian Late Miocene lagomorphs is presented. For better understanding of the evolution of this group, additional researches, including fieldwork and collection studies (collections of Tiraspol State University) are needed. In addition, due to the large discontinuity of the fossil lagomorph record of the neighbouring areas, any detailed comparative study is difficult.

Disclosure of interest

The author declares that he has no conflicts of interest concerning this article.

Acknowledgements

I am grateful to Theodor Obada and Tudor Calestru (Kishinev) for assistance during fieldworks. Many thanks to colleagues from the Paleontological collection and Museum, University of Tübingen, Germany Madelaine Böhme, Jérôme Prieto and Davit Vasilyan for their help in providing references, as well as valuable comments and critical remarks. Also I am grateful to Stanislav Čermák (Institute of Geology AS CR, v. v. i., Prague) for his advices, help and suggestions to the manuscript and Aurelia Ciornei (Kishinev) for the improvement of the English (Fig. 2).

Appendix A. Romanian, Russian and English names of localities mentioned in the text.

Noms roumain, russe et anglais des localités mentionnées dans le texte.

English	Romanian	Russian
Buzhor 1	Bujor	Бужор
Chimishliya	Cimişlia	Чимишлия
Chiobruciu	Ciobruciu	Чиобручиу
Gura Galbene	Gura Galbenei	Гура Галбенеи
Gradishte	Gradişte	Градиште
Kalfa	Calfa	Калфа
Keinar	Căinari	Кэинарь
Kishinev	Chişinău	Кишинев
Leordoaya	Leordoaia	Леордоая
Lepushna	Lăpuşna	Лэпушна
Otovaska 1	Otovasca I	Отоваска
Pitushka	Pituşca	Питушка
Pokshesh	Pocşesti	Покшешт
Razeni	Răzeni	Рэзень
Respopen	Răspopeni	Рэспопены
Tarakliya	Taraclia	Тараклия
Varnitsa	Varniţa	Ворница
Veveritsa 1	Veveriţa I	Веверица

References

- Aguilar, J.-P., Bergren, W.A., Aubry, M.-P., Kent, D.V., Clauzon, G., Benammi, M., Michaux, J., 2004. Mid-Neogene Mediterranean marine-continental correlations: an alternative interpretation. *Palaeogeography, Palaeoclimatology, Palaeoecology* 204, 165–186.
- Álvarez-Sierra, M.A., Civis, J., Corrochano, A., Daams, R., Dabrio, C.J., García, E., González, A., López Martínez, N., Mediavilla, R., Rivas Carballo, R., Valle, M.F., 1990. Un estratotipo del límite Aragoniense-Vallesiense (Mioceno Medio–Mioceno Superior) en la sección de Torremormojón (Cuenca Duero, Provincia de Palencia). *Actas de Paleontología* 68, 57–64.
- Angelone, C., 2009. Lagomorphs from the Miocene of Sandelzhausen (southern Germany). *Paläontologische Zeitschrift* 83 (1), 67–75.
- Angelone, C., Rook, L., 2011. *Alilepus meini* nov. sp. (Leporidae, Lagomorpha) from the Early Messinian of Tuscany (central-western Italy). *Geobios* 44 (2-3), 151–156.
- Angelone, C., Sesé, C., 2009. New characters for species discrimination within the genus *Prolagus* (Ochotonidae, Lagomorpha, Mammalia). *Journal of paleontology* 83 (1), 80–88.
- Argyropulo, A., Pidoplocho, I.G., 1939. Representatives of ochotonids (Duplicidentata, Mammalia) in the Pliocene of the USSR. Reports of Academy of Sciences of USSR 24 (7), 723–728. [In Russian].
- Averianov, A., Tesakov, A.S., 1997. Evolutionary trends in Mio-Pliocene Leporinae, based on *Trischizolagus* (Mammalia, Lagomorpha). *Paläontologische Zeitschrift* 71, 145–153.
- de Bruijn, H., 1995. The vertebrate locality Maramena (Macedonia, Greece) at the Turolian-Ruscian boundary (Neogene). 11. Lagomorpha. *Münchner Geowissenschaftliche Abhandlungen (A)* 28, 133–136.
- Čermák, S., 2010. The Late Miocene and Pliocene Ochotoninae (Lagomorpha, Mammalia) of Europe – the present state of knowledge. Morphology and systematics of fossil vertebrates. DN Publisher, Wrocław, pp. 9–28.
- Čermák, S., Rekovets, L.I., 2010. Early Pliocene ochotonids (Mammalia, Lagomorpha) from Southern Ukraine. *Geodiversitas* 32 (1), 107–120.
- Čermák, S., Wagner, J., 2013. The Pliocene record of *Trischizolagus* and *Pliopentalagus* (Leporidae, Lagomorpha, Mammalia) in Central Europe, with comments on taxonomy and evolutionary history of Leporinae. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 268, 97–111.
- Delinschi, A., [PhD thesis] 2008. Study of the Meotian micro-vertebrate fauna from the Southern part of Republic of Moldova. Iasi, pp. 1–222 [In Romanian].
- Delinschi, A., 2009. Contribution to the study of Maeotian hipparion faunas from the Republic of Moldova. Muzeul Olteniei Craiova. Oltenia. Studii și comunicări. Științele Naturii 25, 391–395.
- Delinschi, A., 2012. Some dates about paleontological sites in the vicinity of village Gura Galbenei. *Scientific Bulletin of National Museum of Ethnography and Natural History of Moldova. Ethnography, Natural Sciences and Museology* 16 (29), 88–92. [In Romanian].
- Erbajeva, M.A., 1988. Pikas of Cenozoic. *Nauka, Moscow*, pp. 1–224 [In Russian].
- Erbajeva, M.A., Alexeeva, N.V., Mead, J.L., Angelone, C., Swift, S.L., 2011. Asian and North American ochotonids (an overview). *Paleontologia Electronica* 14 (3), 9 [42A].
- Gureev, A., 1964. Lagomorpha. In: Pavlovskiy, E.N. (Ed.), *Fauna of USSR. Mammals. Nauka, Moscow, Leningrad*, pp. 1–276 [In Russian].
- Hordijk, K., 2010. Perseverance of Pikas in the Miocene: interplay of climate and competition in the evolution of Spanish Ochotonidae (Lagomorpha, Mammalia). *Geologica ultraiectina* 333, 1–232.
- Kälin, D., Engesser, B., 2001. Die jungmiozäne Säugertierfauna vom Nebelbergweg bei Nunningen (Kanton Solothurn, Schweiz). *Schweizerische Paläontologische Abhandlungen* 121, 1–61.
- Khomenko, J., 1914. La faune méotique du village Taraklia du district de Bendery. *Travaux de la Société des Naturalistes et des Amateurs des Sciences Naturelles de Bessarabie* 5, 1–55 [In Russian].
- Khubka, A., 1968. On the conditions of formation of Balta deposits on territory of Moldova. Reports of the Academy of Sciences of the USSR 180 (3), 25–36 [In Russian].
- Khubka, A., 1969. Litho-facies characteristic and stratigraphy of continental sediments of Upper Miocene of Moldavian SSR and adjacent areas of Ukrainian SSR. *Stratigraphy of Moldavia and Southern of Ukraine. AN MSSR, Kishinev*, pp. 56–72 [In Russian].
- Kormos, T., 1934. Felső pliocénkori új rovarevők, denevérek és rágcsálók. *Földt. Közl.* 64 (1), 296–321.
- López-Martínez, N., 1976. *Lagomorpha* from the Turolian of Pikerimi (Greece). *Proceedings Koninklijke Nederlandse Akademie van Wetenschappen B* 79, 235–243.
- López-Martínez, N., 1977. Nuevos Lagomorfos (Mammalia) del Neógeno y Cuaternario Español. *Trabajos sobre Neogeno-Cuaternario* 8, 7–15.
- López-Martínez, N., Likius, A., Mackaye, H.T., Vignaud, P., Brunet, M., 2007. A new Lagomorph from the Late Miocene of Chad (Central Africa). *Revista Española de Paleontología* 22, 1–20.
- Lungu, A., 1981. *Hipparion* fauna of Middle Sarmatian of Moldova: Insectivores, Lagomorphs and Rodents. *Știința, Kishinev*, pp. 1–135 [In Russian].
- Lungu, A., 1990. Early evolution stages of the Hipparion fauna in the continental frame of the Paratethys. *Academy of Sciences of Georgian SSR, Tbilisi*, pp. 1–36 [In Russian].
- Lungu, A., Cemyrtan, G., 1989. Evolutionary history of the Late Sarmatian Hipparion fauna in the north part of the continental frame of the Eastern Paratethys. *Transaction of the State Local History Museum of Moldavian SSR* 3, 48–66 [In Russian].
- Lungu, A., Delinschi, A., Nicoara, I., 2007. Some dates about studies representative order *Lagomorpha* from hipparion fauna, of superior Miocen from Republic of Moldova. *Scientific Bulletin of National Museum of Ethnography and Natural History of Moldova. Ethnography, Natural Sciences and Museology* 6 (19), 141–143.
- Lungu, A., Delinschi, A., 2008. Les particularités des orictocénoses de la faune de *Hipparion* du site Cimișlia. *Acta Palaeontologica Romaniae* V, 187–193 [Iasi, Romania].
- Lungu, A., Rzebik-Kowalska, B., 2011. Faunal assemblages, stratigraphy and taphonomy of the Late Miocene localities in the Republic of Moldova. *Polish Academy of Sciences, Kraków*, pp. 62.
- Nicoara, I., Lungu, A., 2008. Main geological features and fossil vertebrate fauna of Stolniceni Formation in the central area of Codru Rand. *Muzeul Olteniei Craiova. Oltenia. Studii și comunicări. Științele Naturii* 24, 251–254.
- Prieto, J., Angelone, C., Gross, M., Böhme, M., 2012. The pika *Prolagus* (Lagomorpha, Mammalia) in the Late Middle Miocene fauna from Gratkorn (Styrian Basin, Austria). *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 263 (2), 111–118.
- Rzebik-Kowalska, B., Lungu, A., 2009. Insectivore mammals from the Late Miocene of the Republic of Moldova. *Acta zoologica cracoviensis* 52A (1-2), 11–60.
- Sen, S., 1990. Middle Miocene lagomorphs from Paşalar, Turkey. *Journal of Human Evolution* 19, 455–461.
- Sen, S., 2003. Lagomorpha. In: Fortelius, M., Kappelman, J., Şen, S., Bernor, R.L. (Eds.), *Geology and Paleontology of the Miocene Sinap Formation, Turkey. Columbia University Press, New York*, pp. 163–178.