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Variations in Coat Colouration of the Romanian Hamster (*Mesocricetus newtoni* Nehring, 1898) with the First Description of a Black (Atypical Melanistic) Form

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Abstract: The Romanian hamster (*Mesocricetus newtoni* Nehring, 1898) is an extremely rare rodent, endemic to Bulgaria and Romania and listed as Vulnerable by the International Union for Conservation of Nature (IUCN). The article reviews variations in fur colouration in individuals caught by the authors, as well as in museum collections, scientific publications and photographs on websites and social media. We observed variations in the size and shape of the black chest patch, variations in the length of the black stripe on the cheeks and others. A black (atypical melanistic) form was described for the first time in *M. newtoni*. That variant was rare, occurring in only 0.6% of the total 167 individuals examined or described. We believe that the reduction in population abundance, which, according to literature data, has decreased by about three times, leads to a reduction in genetic diversity, a high level of inbreeding and the appearance of similar melanistic specimens.

Key words: Dobrudzha hamster, collections, melanism, population decrease, Bulgaria

Introduction

The genus *Mesocricetus* comprises medium-sized hamsters, intermediate between the large *Cricetus* and the small hamsters *Cricetulus* (Nehring, 1898). The genus *Mesocricetus* contains four species: Syrian hamster (*Mesocricetus auratus* Waterhouse, 1839), Ciscaucasian hamster (*Mesocricetus raddei* Nehring, 1894), Brandt's Hamster (*Mesocricetus brandti* Nehring, 1898) and the Romanian hamster (*Mesocricetus newtoni* Nehring, 1898). *M. brandti* has the widest distribution, whereas the other three species are endemic to restricted areas (Wilson et al. 2017). *Mesocricetus newtoni* is restricted to Bulgaria and Romania, where it occurs in Dobrudzha and the Danube Plain (situated between the Stara Planina Mountains and the Danube River). The Ogosta River represents the westernmost limit of its distribution. Four records exist south of the Stara Planina Mountains. Reports from Sofia and Kazanlak are considered introductions (Popov 1955, Markov 1960). Two additional records from Peshtersko (Aytoska Mountain) and the vicinity of Sredets are based only on pellets of birds of prey (Georgiev 2003, Milchev 2006). Given the species` widespread presence during the Pleistocene and Holocene, these records may represent relict, declining populations (Peshev et al. 2004).

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The colouration of *M. newtoni* is not uniform. The dorsal surface is ochre-brown, the ventral surface is lighter greyish-brown and the lateral sides of the body are paler. Its most distinctive feature is a black patch located on the chest between the forelimbs, which gives one of its Bulgarian common names, "black-breasted homiak". A black stripe of hair extends along the sides of the cheeks, bordered by golden-yellow bands. The individual hairs in the lower part of the body are lead grey (Markov 1960).

In the recent past, the species was more widespread, however, it is currently restricted mainly to Dobrudzha (predominantly in the Romanian part and, to a lesser extent, in the Bulgarian part) and central northern Bulgaria (Nedyalkov et al. 2015). The species is classified as Vulnerable (VU) in the IUCN Red List and the Red Book of the Republic of Bulgaria (Popov 2015, Nedyalkov & Rusin 2024).

The present study aims to review available materials including skins, museum specimens and descriptions in scientific publications, photographs and records of captures by the authors, relating to Romanian hamsters, with a focus on cases that deviate from the typical colouration pattern of *M. newtoni*.

Materials and Methods

In this study, we examined the following sources for reviewing the colouration of Romanian hamsters in Bulgaria:

Field observations (2022–2025): We captured and documented 15 (Suppl. 1, Table 1) adult Romanian hamsters (14 females, one male) using Sherman live traps baited with fresh vegetables and raw seeds;

Museum specimens: The collection at the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS) contains 28 skins (Suppl. 1, Table 2) from individuals caught between 1911 and 1959 in Dobrudzha, Pleven and Svishtov. The oldest specimen is from Constanța, Romania and dates to 1911;

Catalogue review: Examination of museum and university records revealed one skin of *M. newtoni* in the National Museum of Natural History (Bulgarian Academy of Sciences) (Suppl. 1, Table 2). In the exhibition of the Natural History Museum in the village of Kotel (Sliven Province), there is a hamster with an incorrect label, including both its Latin and Bulgarian names. Due to the poor condition of the specimen, this individual was not included in the analysis. No specimens were found at the Faculty of Biology at Sofia University, the Natural History Museum in Varna or the Pleven Regional Historical Museum;

A critical review of the scientific literature on hamster colouration has been conducted (Nehring 1901, Hristovich 1901, Kozarov 1909, Markov 1960, Hamar & Schutowa 1966, Niethammer & Krapp 1982, Simeonovska-Nikolova & Dekov 2013, Gavril et al. 2023a, b, Kryštufek & Shenbrot 2025). The analysis of figures and descriptions is provided in Suppl. 1, Table 3;

Photographs of *M. newtoni* available on websites and social networks in Bulgaria and Romania were reviewed. A total of 21 images were identified; duplicates and photographs of the same specimens were excluded from the analysis (Suppl. 1, Table 4).

In total, sources containing descriptions or photographs of 167 individuals were examined: 15 animals were caught in the wild between 2022 and 2025; 28 skins were found in the collection of IBER-BAS; one specimen in the NMNH-BAS; 102 individuals - described, illustrated or photographed in scientific publications and 21 photographs were obtained from social media.

Live hamsters captured in the field were examined and described. Photographs of prepared skins and live animals were taken with a Sony DSC-H400 digital camera against a black background, with a dimension line, colour checker card and grey card for white balance.

Results

The reviewed materials indicated that individuals in Bulgaria generally matched the fur colouration described in the literature (Markov 1960, Peshev et al. 2004). The following deviations from the standard colouration were observed:

Variations in the Size of the Black Patch on the Chest

Two specimens from the IBER-BAS collection had variations in the chest patch: adult individual No 160/59 (6 August 1959) and juvenile individual No 132/59 (3 August 1959). In individual No 160/59 (Fig. 1A), the patch was larger than in other specimens and extended to the interior third of the abdominal region. In individual No 132/59 (Fig. 1B) the black patch was shorter and smaller in area, barely reaching the forelimbs.

In some cases, the black patch was elongated towards the mouth, as in adult male specimen No 36/58 (Fig. 1C) and adult female specimen No

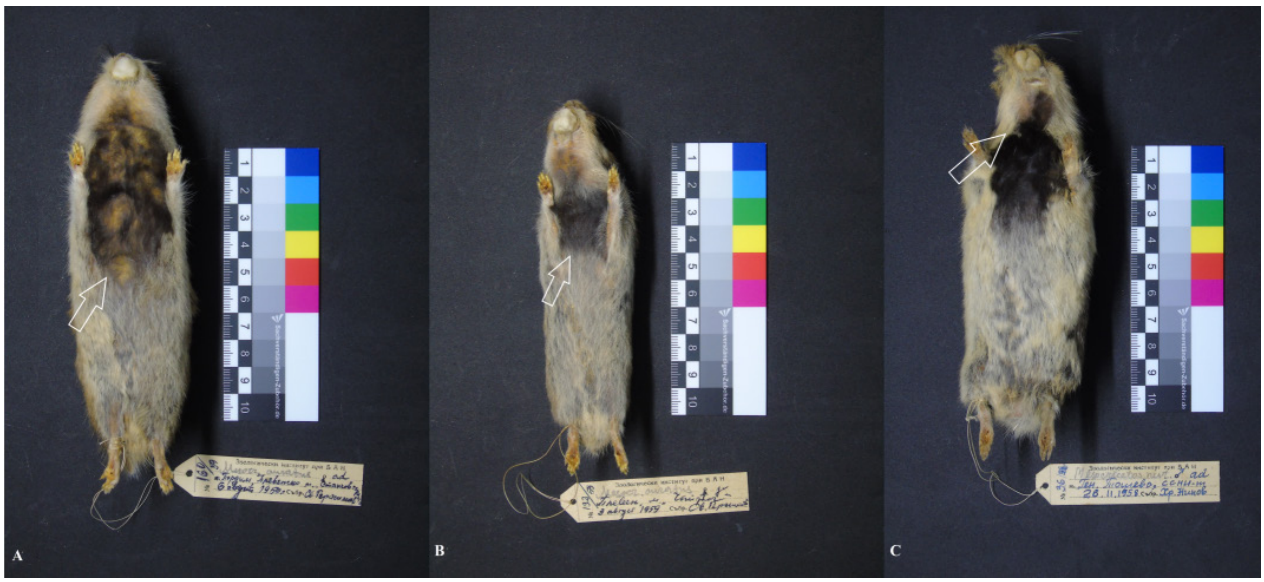

Fig. 1. Ventral view of variations in the size of the black patch on the chest in an adult (A), juvenile (B) and male adult (C) individual from the IBER-BAS collection.

160/59 (Fig. 1A). The same variation was found in specimens captured by us: No 8543/30.05.2024, No 8545/30.05.2024, No 8546/30.05.2024.

In one female adult individual (No 117/59) caught on 23 June 1959 near the town of Dobrich, a darker colouration was observed in the inguinal zone.

Variations in the Structure of the Black Patch on the Chest

In a young female specimen (No 108/57) captured on 29 October 1957, a white stripe separating the black chest patch into two distinct parts was observed (Fig. 2).

Variations in the Lateral Stripes

Occasionally, variations occurred in the size of the lateral stripes on the cheeks. Individual No 112/59 (Fig. 3A) had longer stripes, whereas individual No 36/58 (Fig. 3B), caught on 26 February 1958, exhibited shorter stripes. Both animals were documented as adult males.

Variations in the Black Patch on the Crown

In some individuals, a dark stripe between the ears, known as the „crown", was present. It was well developed in individuals No 95/57 and No 117/59 as compared with individual No 90/59 (Fig. 4).

Black (Atypical Melanistic) Form

Only one of the 15 individuals captured between 2022 and 2025 exhibited dark fur colouration: No 8542/21.07.2024, a female hamster weighing 80 g, caught in the Pleven Region (Fig. 5).

The dorsal colouration partially corresponded to the standard pattern for the species but was significantly darker, with a more intense black colour and black hair tips as compared to the specimens from the IBER-BAS collection. The crown between the two ears was less pronounced (Fig. 6).

The chest and abdomen were darker than in individuals with typical colouration (Fig. 7).

The lateral black stripe on the cheeks was wider, more intensely black and covered a larger part of the cheek (Fig. 8) compared to the stripes in normal individuals, where the colouration was golden yellow under the significantly thinner black stripe (Fig. 3). Black pigmentation was observed on the forelimbs and hindquarters. Additionally, the pigmentation along the entire lateral region was considerably darker in the individual with atypical coat colouration.

Apart from the variations described above, the individuals analysed from our captures and collections exhibited standard colouration.

Discussion

The colouration of *M. newtoni* is uniform as compared with other species in the family Cricetidae, such as *Cricetus cricetus*, which exhibits greater diversity in colouration and more frequent melanistic forms (Chișamera et al. 2023). Hamar & Schutowa (1966) provided a detailed analysis of the colouration of three species of genus *Mesocricetus*: they noted several individuals of *M. newtoni* from

Fig. 2. Ventral view of a chest patch divided by a white stripe.

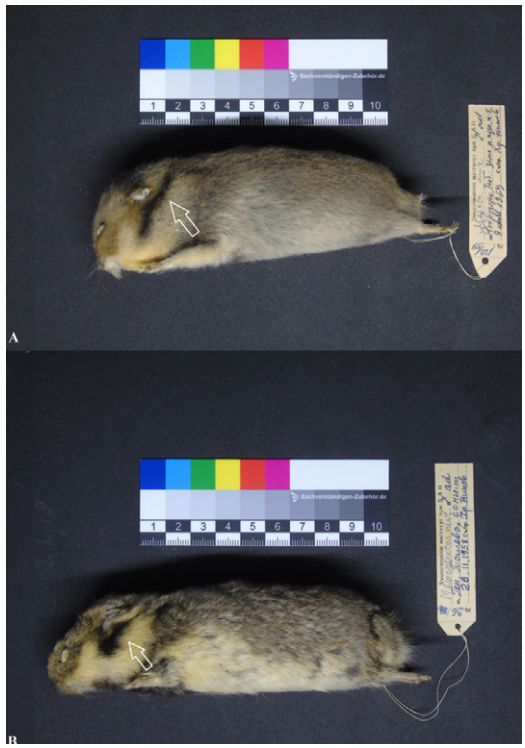

Fig. 3. Lateral view of variations in the length of the black stripe on the cheeks in adult males.

Fig. 4. Comparison of individuals with variation in the "crown": black colouration between the ears and down the neck.

Fig. 5. Photos taken during the capture of female specimen No 8542 on 21 July 2024, in Pleven Region.

Fig. 6. Comparison of colouration: dorsal view showing normal colouration from the IBER-BAS collection, individual No 115/59 (A) and individual No 8542/21.07.2024 (B) with atypical colouration.

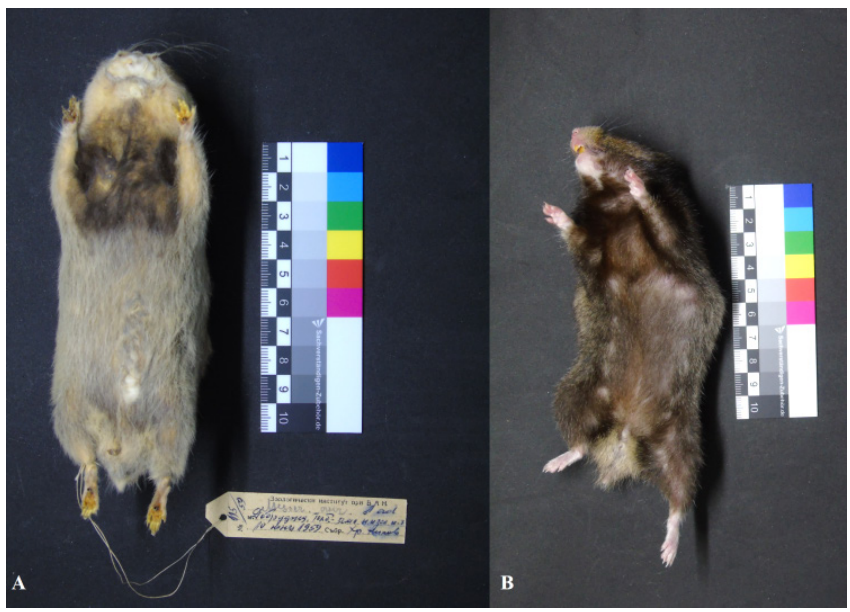

Fig. 7. Ventral view of an individual No 115/59 with standard colouration (A) and individual No 8542/21.07.2024 (B) with atypical colouration.

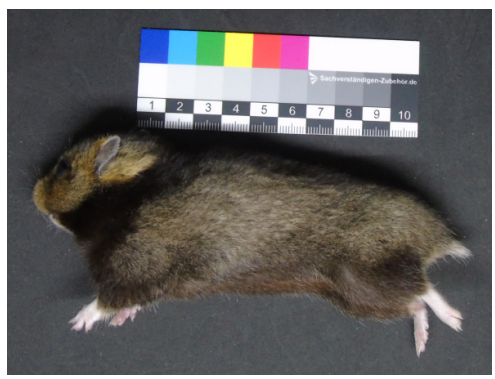

Fig. 8. Lateral view of individual No 8542/21.07.2024 with atypical colouration.

Kolarovgrad (now Shumen) with darker dorsal colouration but did not describe the atypical melanistic colouration reported in the present study (n=41); *M. raddei* from Dobrudzha had darker colouration compared with *M. newtoni* and *M. brandti* but as there are no records of *M. raddei* from Dobrudzha, this is likely an error.

Kryštufek & Shenbrot (2025) studied the variability in the sternal zone of *M. newtoni*: approximately half of the skins they examined had a black patch in the inguinal zone and in extreme cases the underside could be dark, similarly to *M. raddei*. Such substantial variability of the dark chest patch, white patches in the inguinal zone or black discolouration, including the abdomen, was not observed in our analyses nor was reported in the scientific literature or photographs on social media (Suppl. Tables 3 and 4). Among the individuals we examined, only one had darker colouration in the inguinal zone. It should be noted that Kryštufek & Shenbrot (2025) did not provide information on the number of individuals studied, age, sex, origin, year and location of capture and storage details, photographs or other supporting material, which makes it difficult to discuss the results presented in the monograph and the associated tables on colouration variability.

Upon detailed examination of the fur colouration of individual No 8542/21.07.2024, the fur was found to be lighter on the paws, chin and around the nose. We consider this specimen to present a black (atypical melanistic) form. Similar forms have been described in *Cricetus cricetus* (Kryštufek et al. 2016, Chișamera et al. 2023). Based on the evidence reviewed, we conclude that such individuals are extremely rare in *M. newtoni*: less than one percent (0.6%) of the individuals studied (n= 167; Suppl. 1).

Furthermore, both literature data and our own observations indicate a severe decline in the population. In the 1950s, *M. newtoni* accounted for 2.5-3.6% of field rodents, with a population density of 0.4-0.7 individuals per 100 traps-nights. During the period 1982-1990, the population density was estimated at 0.12/100 trap-nights, representing at least a threefold decrease (Markov et al. 2008). Simeonovska-Nikolova et al. (2020) failed to record a single individual in 2019-2020, despite conducting intensive studies that included transects of about 200 km and the setting of Sherman-type live traps. We also recorded very low densities of *M. newtoni*: within three years (2022-2024), after surveying approximately 4,000 km by car and on foot to search for burrows, only 15 hamsters were caught (Koshev, Gensuzov & Kachamakova, unpublished data).

We suggest that the atypical colouration observed in this individual is most likely linked to reduced population size, which can cause a loss of genetic diversity and increase the likelihood of inbreeding (Charlesworth 2003). In rodents, coat colour is strongly influenced by the melanocortin 1 receptor (MC1R) gene and variations in this gene can produce different pigmentation patterns (Gonçalves et al. 2012, Singaravelan et al. 2013). We further assume that the reduced population size in our study area is a consequence of anthropogenic pressures, such as habitat loss, intensive agriculture and the excessive use of herbicides, rodenticides and other chemical agents for pest control. Similar processes have been reported to affect *C. cricetus* populations (Chișamera et al. 2023).

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Welfare considerations: In the scientific research, we have adhered to the highest standards of ethical treatment of animals (NENT 2018). No animals were harmed during capture and handling. We have adhered to best-practice guidelines for field-based surgery and anaesthesia of free-ranging wildlife (Chinnadurai et al. 2016). Individual No 8542/21.07.2024 was sedated via intramuscular injection with a mixture of Xylazine (0.04mg) and Ketamine (0.04mg) under veterinary supervision. After the 30-minute session, the hamster received Atipazole® (0.04mg) as a reversal agent, with no negative effects on the animal. The activities were carried out with permits NSZP-50/17.02.2021 and NSZP-440/01.08.2024 issued by the Ministry of Environment and Water of the Republic of Bulgaria.

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Supplement 1. Methodological approach to evaluating colour variation in *Mesocricetus newtoni*

Table 1. Complete list of specimens captured during fieldwork by the authors.

	ID number from our database	Place, Country	Date	Sex	Age
1.	4103	Pleven Province, Bulgaria	27.07.2022	F	Ad.
2.	8545	Pleven Province, Bulgaria	26.03.2023	F	Ad.
3.	8546	Pleven Province, Bulgaria	28.09.2023	F	Ad.
4.	1594	Pleven Province, Bulgaria	27.09.2023	F	Ad.
5.	1899	Pleven Province, Bulgaria	20.04.2024	F	Ad.
6.	4449	Pleven Province, Bulgaria	22.04.2024	F	Ad.
7.	1899	Pleven Province, Bulgaria	22.04.2024	M	Ad.
8.	1992	Pleven Province, Bulgaria	22.04.2024	F	Ad.
9.	1991	Pleven Province, Bulgaria	23.04.2024	F	Ad.
10.	3088	Pleven Province, Bulgaria	20.07.2024	F	Ad.
11.	3094	Pleven Province, Bulgaria	20.07.2024	F	Ad.
12.	014	Pleven Province, Bulgaria	26.05.2023	F	Ad.
13.	030	Pleven Province, Bulgaria	26.05.2023	F	Ad.
14.	8543	Pleven Province, Bulgaria	30.05.2024	F	Ad.
15.	8542	Pleven Province, Bulgaria	21.07.2024	F	Ad.

Table 2. Complete list of specimens in IBER-BAS skin collection.

	ID number from IBER-BAS collection	Place, Country	Date	Sex	Age
1.	113/59	Dobrudzha, Bulgaria	9.06.1959	F	Ad.
2.	132/59	Pleven, Bulgaria	3.08.1959	F	Juv.
3.	114/59	Dobrudzha, Bulgaria	09.06.1959	M	Ad.
4.	117/59	Dobrudzha, Bulgaria	23.07.1959	F	Ad.
5.	95/57	Dobrudzha, Bulgaria	18.10.1957	M	Ad.
6.	112/59	Dobrudzha, Bulgaria	09.06.1959	M	Ad.
7.	223	Bulgaria	1924	N/A	N/A
8.	161/59	Pleven, Bulgaria	08.08.1959	F	Ad.
9.	160/59	Pleven, Bulgaria	06.08.1959	F	Ad.
10.	115/59	Dobrudzha, Bulgaria	10.06.1959	M	Ad.
11.	136/59	Pleven	03.08.1959	F	Ad.
12.	108/57	Gen. Toshevo, Bulgaria	29.10.1957	F	Juv.
13.	105/57	Gen. Toshevo, Bulgaria	06.11.1957	F	Ad.
14.	111/59	Dobrudzha, Bulgaria	09.06.1959	M	Ad.
15.	32	N/A	N/A	N/A	N/A
16.	1276/67 (101)	Constanta, Romania	18.03.1911	N/A	N/A
17.	72/Д/10	Rosica, Bulgari	29.06.1952	F	Ad.
18.	102/941	Svishtov, Bulgaria	02.05.1941	N/A	N/A
19.	123/940	Chernograd (Shumen), Bulgaria	02.07.1940	N/A	N/A
20.	N/A	Pordim, Bulgaria	05.06.1954	N/A	N/A

21.	94/57	Gen. Toshevo, Bulgaria	18.10.1957	M	Ad.
22.	36/58	Gen. Toshevo, Bulgaria	26.02.1958	M	Ad.
23.	131/59	Pleven, Bulgaria	09.08.1959	F	Juv.
24.	106/57	Gen. Toshevo, Bulgaria	20.10.1957	F	Ad.
25.	90/59	Dobrudzha, Bulgaria	02.06.1959	F	Ad.
26.	103/59	Dobrudzha, Bulgaria	01.06.1959	M	Juv.
27.	233/58	Dobrudzha, Bulgaria	19.10.1958	M	Ad.
28.	218/58	Dobrudzha, Bulgaria	19.06.1958	F	Ad.
29.	One specimen in exhibition hall in NMNHS Sofia	N/A			

Table 3. Scientific articles with figure or description of the colour pelage of *Mesocricetus newtoni.*

Referee (for most information see the article)	**Place, Country**	**Year**	**Number of pictures, videos and individuals**	**Melanistic**
Nehring (1901)	Bulgaria, Romania	1901	4 individuals described, 1 figure	no
Hristovich (1901)	Bulgaria	1900-1901	2 individuals, described	no
Kozarev (1909)	Bulgaria	1909	5 individuals, described	Reported one female exhibits a gray-black dorsum, whereas another displays a gray-brown ventral coloration. A melanistic phenotype has not been observed.
Markov (1960)	Bulgaria	1940-1959	24 specimens, described	no
Hamar § Schutowa (1966)	Romania (36), Bulgaria (5)	before 1966	41 specimens, described, some figures	Two individuals exhibit darker dorsal sides. Misidentification with *Mesocricetus raddei*. No melanistic form has been reported.
Peshev et al. (2004)	Bulgaria	-	14 individuals have measured skulls	no
Chişamera et al. (2012)	Romania, Bulgaria	-	1 photos/1 individual	no
Simeonovska-Nikolova & Dekov (2013)	Bulgaria	2012	1 photo, 5 individuals (4 females and 1 male)	no
Gavril et al. (2023a, b)	Romania	2023	5 individuals (1 female and 4 juveniles)	no
Kryštufek & Shenbrot (2025)	Bulgaria	2023	1 individual - picture	Figure and caption provided without explanatory details. no
TOTAL			**102 individuals**	**no**

The full reference of the literature sources is in the main text

Table 4. Public photos of *Mesocricetus newtoni* in internet sites, data-base, social networks and etc.

Name of the site	Place, Country	Date	Number of pictures, videos and individuals	Melanisitic or other colour variation if it is visible	Internet Website and link to web archive, where is possible. The sites accessed on 26 June 2025
https://www.inaturalist.org/	Constanta, Romania	08.2021 - 25.08.2024	19 pictures 7 individuals	no	https://www.inaturalist.org/taxa/44918-Mesocricetus-newtoni/browse_photos?layout=grid https://web.archive.org/web/20250715152911/https%3A%2F%2Fwww.inaturalist.org%2Ftaxa%2F44918-Mesocricetus-newtoni%2Fbrowse_photos%3Flayout%3Dgrid
https://www.gbif.org/	Romania		2 pictures 2 individuals	no	https://www.gbif.org/es/species/2438483 https://web.archive.org/web/20250715151121/https%3A%2F%2Fwww.gbif.org%2Fes%2Fspecies%2F2438483
https://vildaphoto.net/	Romania, Dobrogea	07-10.08.2018	10 pictures 1 individual	no	https://vildaphoto.net/en/combosearch?q=romanian+hamster#p162156-r1 https://web.archive.org/web/20250715153444/https%3A%2F%2Fvildaphoto.net%2Fen%2Fcombosearch%3Fq%3Dromanian%2Bhamster
https://www.earthsendangered.com/	-	-	1 picture 1 individual	no	https://www.earthsendangered.com/profile.asp?gr=&view=c&ID=6&sp=11240 https://web.archive.org/web/20250715155337/https%3A%2F%2Fwww.earthsendangered.com%2Fprofile.asp%3Fgr%3D%26view%3Dc%26ID%3D6%26sp%3D11240
https://www.mammalwatching.com	Pleven region, Bulgaria	09.2022	1 picture 1 individual	no	https://www.mammalwatching.com/2022/10/13/romanian-hamsters-revisited-bulgaria-2022/ https://web.archive.org/web/20250715153937/https%3A%2F%2Fwww.mammalwatching.com%2F2022%2F10%2F13%2Fromanian-hamsters-revisited-bulgaria-2022%2F

https://www.flickr.com/	Ceamurlia de Jos, Tulcea, România	15.09.2013	1 picture 1 individual	no	https://www.flickr.com/photos/cserkesz/12034594965/in/photostream/ https://web.archive.org/web/20250715154132/https%3A%2F%2Fwww.flickr.com%2Fphotos%2Fcserkesz%2F12034594965%2Fin%2Fphotostream%2F
https://www.flickr.com/	Besteppe, Romania	6.08.2018	1 picture 1 individual	no	https://www.flickr.com/photos/markhows/42706181660/ https://web.archive.org/web/20250715154227/https%3A%2F%2Fwww.flickr.com%2Fphotos%2Fmarkhows%2F42706181660%2F
https://observation.org/	Constanta, Romania	13.05.2023	1 picture 1 individual	no	https://observation.org/photos/66168553/ https://web.archive.org/web/20250715154309/https%3A%2F%2Fobservation.org%2Fphotos%2F66168553%2F
https://www.zoochat.com/	Romania	26.08.2021	1 picture 1 individual	no	https://www.zoochat.com/community/media/romanian-hamster-mesocricetus-newtoni.543323/ https://web.archive.org/web/20250715154344/https%3A%2F%2Fwww.zoochat.com%2Fcommunity%2Fmedia%2Fromanian-hamster-mesocricetus-newtoni.543323%2F
https://wildlifeconservation.bg	North eastern Bulgaria	-	1 picture 1 individual	no	https://wildlifeconservation.bg/english/opening-of-the-exhibition-the-wildlife-of-northeastern-bulgaria/ https://web.archive.org/web/20250715154508/https%3A%2F%2Fwildlifeconservation.bg%2Fenglish%2Fopening-of-the-exhibition-the-wildlife-of-northeastern-bulgaria%2F
Facebook group - Mammals in Bulgaria	Bulgaria		3 pictures 1 individual	no	https://www.facebook.com/photo?fbid=1022363034887595&set=pcb.4263993310370759&locale=bg_BG
Facebook group - Mammals in Bulgaria	Bulgaria	07.2017	3 pictures 1 individual	no	https://www.facebook.com/photo/?fbid=1555890987775204&set=pcb.1066373593466096&locale=bg_BG
Facebook group - Mammals in Bulgaria	Bulgaria	07.2017	4 pictures 1 individual	no	https://www.facebook.com/photo/?fbid=1578947338802902&set=pcb.1086300058140116&locale=bg_BG
Facebook group - Mammals in Bulgaria	Bulgaria	25.05.2018	5pictures/ videos 1 individual	no	https://www.facebook.com/100000629544114/videos/oa.1358442504259202/1883305031700463?locale=bg_BG
TOTAL			**21 individuals**	**no**	