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A history of Common hamster (*Cricetus cricetus*) settling in Moscow (Russia) and Simferopol (Ukraine)

Key words: *Cricetus cricetus*, Common hamster, urban territories, semicommensal

Urbanization is a unique and evolutionary new phenomenon and it has no natural analogues. Urban territories are characterized by specific environmental conditions: microclimate, soil structure, vegetation, wildlife, etc. Some species, in particular rodents, have adapted to live in cities. The most well known are rats – *Rattus norvegicus*, *R. rattus* and house mouse (*Mus musculus*).

These rodents are successfully taking advantages of existence near humans, which allowed them to expand their natural habitats and disperse all over the world (Kucheruk 1988). In addition to these commensals, there is another group of animals – semicommensal partly associated with human settlements. Common hamster (*Cricetus cricetus*) is one of the typical representatives of this group. Apart from to natural habitats (steppe, forest-steppe) common hamster settles in gardens, parks and even penetrates buildings.

The Common hamster is widely spread across Europe, W. Siberia, and N. Kazakhstan to the upper Yenesei, Altai region and NW China (NW Xinjang) (Mammal species of the world 2005; A Guide to the Mammals of China 2008). Until recently this animal was abundant in Europe and in Russia, Ukraine, Moldova, Kazakhstan. However, negative trend in Common hamster are obsereved over the last 45 years (Neumann et al. 2005). In the Netherlands (Backbier and Gubbels 1998), Belgium (Mercelis 2002), Austria, France and Poland were occurred dramatic declines of hamster population (tabl. 1), the extinction of northern population in Germany (Krüger and Krüger 1998).

Common hamster is strictly protected by the Bern Convention and EC Habitats Directive as well as in Belgium, the Netherlands, Austria, France some provinces of Germany (Nechay 2000). It is also protected in countries where it is rare, being at the edge of the species range, even when there are occasional recent sightings in new areas e.g. Bulgaria, Croatia, Slovenia, Slovakia. It is a common but protected species in Czech, Hungary, Romania and Ukraine. Its status is uncertain but not protected in Kazakhstan, Moldova and Russia.

However, with the overall decline in the number, in some cities, particularly in Vienna (Austria) (Schmelzer, Millesi 2003), Brno (Czech) (Pelikan et al. 1983), Nalchik, Omsk (Rusin 2013), Moscow (Telitzina et al. 1994), Simferopol (Ukraine) (Tovpinetz et al. 2006) and some others, the Common hamster actively colonizes urban environment and its abundance

Table 1 State of Common hamster according to countries (from Nechay, 2000 with our comments and additions)

Country	Population Trend	Red Data Book Category	Protection	
Austria	D	EN	++	Feldhamster (*Cricetus cricetus*) in Österreich unter besonderer Berücksichtigung Niederösterreichs. 2010. http://noe-naturschutzbund.at/PDF/Aktionsplan%20Feldhamster18122010.pdf
Belarus	D	VU	+	Red Book of the Republic of Belarus. Digital edition. http://redbook.minpriroda.by/animalsinfo.html?id=12
Belgium	D	EN	++	G. Fauville, F. Count and J.-P. Jacob, 2003. The Hamster (*Cricetus cricetus*) in Wallonia (Belgium): census campaign and protection // The Common hamster in Europe: ecology, management, genetics, conservation, reintroduction : proceedings of the 11th, 14th, and 15th meeting of the International Hamster Workgroup: Budapest, Hungary (2003), Munster- schwarzach, Germany (2006) and Kerkrade, the Netherlands (2007). P. 44
Bulgaria	D	VU	++	Red Data Book of the Republic of Bulgaria. Digital edition. Joint edition of the Bulgarian Academy of Sciences &Ministry of Environment and Water. Sofia, 2011. http://e-ecodb.bas.bg/rdb/bg/vol2/Crcricet.html
Croatia	D	NT	+	Implementation of Recommendation No. 136 (2008) on improving the conservation of the Common hamster (*Cricetus cricetus*) in Europe. REPORT BY THE GOVERNMENTS. 2011.
Czech Republic	I	VU	++	
Republic of Serbia	D	NT	++	
Poland	D	DD → EN	++	J. Ziomek and A. Banaszek. The Common hamster, *Cricetus cricetus* in Poland: status and current Range // Folia Zool. – 56 (3): 235–242 (2007). http://www.ivb.cz/folia/56/3/235–242_MS1248.pdf
France	D → E	EN	++	I. Losinger and M.C.Wencel, 2006. The Common hamster (*Cricetus cricetus*) in France // The Common hamster in Europe: ecology, management, genetics, conservation, reintroduction: proceedings of the 11th, 14th, and 15th meeting of the International Hamster Workgroup: Budapest, Hungary (2003), Munster-schwarzach, Germany (2006) and Kerkrade, the Netherlands (2007) / org. G. Nechay, R. Schreiber, M. La Haye. P. 11–13
Germany	D	EN	++	Mammen, K., 2001. Status and endangering of the Common hamster in Europe and Russia with special consideration of NON-EU-countries in central and Eastern Europe. – Report assigned by the German Federal Agency for Nature Conservation (BfN), Bonn/Germany

Country	Population Trend	Red Data Book Category	Protection	
Hungary	D	n		Bihari Zoltán, 2003. Regression in distribution of hamster (*Cricetus cricetus*) in Hungary during the past fifty years // The common hamster in Europe: ecology, management, genetics, conservation, reintroduction: proceedings of the 11th, 14th, and 15th meeting of the International Hamster Workgroup: Budapest, Hungary (2003), Munsterschwarzach, Germany (2006) and Kerkrade, the Netherlands (2007) / org. G. Nechay, R. Schreiber, M. La Haye. P. 27–30
Kazakhstan	?	n		Red Book of the Republic of Kazahstan. Digital edition. http://www.redbookkz.info/ru/
Moldova	?	n		
the Netherlands	D	EN	++	http://content.alterra.wur.nl/Webdocs/PDFFiles/Alterrarapporten/AlterraRapport2022.pdf
Romania	D	SV (nearly meets the criteria for VU)	++	http://www.pnportiledefier.ro/A5%20Vertebrate%202011.pdf
Russia	D	n		
Slovakia	D	in	++	http://www.sopsr.sk/natura/dokumenty/legislativa/eu/priloha6.pdf
Slovenia	D	E (nearly meets the criteria for EN)	++	Rules on the classification of endangered plant and animal species on the Red List ANNEX 3: RED LIST mammals (Mammalia) https://sirena.arso.gov.si/REZA/Vrsta.aspx?id=11619&act=1&ucrszact=1&prev=VrstaIskalnik.aspx http://www.arhiv.mop.gov.si/fileadmin/mop.gov.si/pageuploads/zakonodaja/okolje/ohranjanje_narave/rds_zivali_rastline_priloga.pdf
Switzerland	ext.	EX		
Ukraine	D	NE		Red Book of Ukraine. Digital edition. http://redbook-ua.org/
China		Rl-Nt (nearly meets the criteria for VU)		

I-increasing, D – decreasing, E-endangered; ? – questionable; n – not incuded; in – incuded; ++ = strict protection; + = protection; prop. – proposed to be protected; ext. – extinct

IUCN Red List classification:
- Extinct (EX) – No known individuals remaining.
- Extinct in the Wild (EW) – Known only to survive in captivity, or as a naturalized population outside its historic range.
- Critically Endangered (CR) – Extremely high risk of extinction in the wild.
  Endangered (EN) – High risk of extinction in the wild.
- Vulnerable (VU) – High risk of endangerment in the wild.
- Near Threatened (NT) – Likely to become endangered in the near future.
- Least Concern (LC) – Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
- Data Deficient (DD) – Not enough data to make an assessment of its risk of extinction.
- Not Evaluated (NE) – Has not yet been evaluated against the criteria.

is high and stable in settlements during last decades. So, there is a number of questions that have to be answered concerning potential causes (ecological, behavioral, phylogeographic) of this phenomenon .

In this paper we are going to consider the history of Common hamster settlings in Moscow and in Simferopol that may be useful for planning future studies. Also, we try to describe the distribution of mtDNA haplotypes in Moscow and Simferopol.

Materials and methods

To study mtDNA haplotypes diversity in the Common hamster we analyzed partial sequences of mtDNA control region (ctr, 878 bp) of 32 hamsters captured in 13 points of Russia, Ukraine and Kazakhstan (table 2). Three hamsters were captured in Moscow and seven ones – in two differents points of the Simferopol: – 1) Gagarin Park and Kievskaya street and, 2) Sevastopolskaya street (see below).

Also, we analyzed cytochrome *b* gene (cyt b, 925 bp) and short fragment of the control region (337 bp) for a total of 23 Common hamsters from 12 localities of Russia, Ukraine and Kazakhstan (table 3).

DNA was extracted from muscle tissue (or ear tissues in the case of live-captured animals) fixed in 96 % ethanol. The methods of DNA exctraction, amplification, sequencing, and the sequences alignment were the same as used in the analysis of the phylogeographical structure of two species of the genus *Phodopus* (Meschersky, Feoktistova 2009). The unique nucleotide sequences (haplotypes) were deposited in the Genbank (table 2, 3). Median-joining network (Bandelt et al. 1999) was constructed using NETWORK 4.6.1.1 (Bandelt et al. 1999).

Common hamster in Moscow

First records of Common hamster within the city boundary date back to the end of the 19th century (Telitzina et al. 1994). It referred mainly to river banks, ravine slopes with bushy vegetation etc. But the largest colonies in Moscow and outskirts were found in the south-east of the city in the Liublin and Lyubertsy fields of filtration. Wastewater was accumulated accumulated in the ponds, separated by earthen ramparts 10–12 m wide and 2 m high. Due to high humidity this banks were covered with bushes and grass and, hence, presented a favorable habitat for many rodents, and for Common hamster in particular. Moscow Rodent control service surveyed the local rodent population from 1963 to 1993 trapping animals twice a year (in autumn and spring). In 1985 the treatment plant was closed and since then the area was intensively built up with city blocks. In 1990s this area and Liublin fields of filtration was completely build up (Telitsina et al. 1994). So, we may say that the largest colony of hamster in Moscow does not exist in present.

Now Common hamster survived only in the southern part of Moscow, where it is confined to the Moscow River flood plains. The real number of animals in the city is unknown for present time.

Up to 2013 Common hamster was included in the Red book of Moscow city (Red book of Moscow city 2001). But now it is excluded from the new edition of this Book. It is interesting that no natural populations of the species were found around Moscow and in the center of the city. So the question is how Common hamster appeared in Moscow. There could be two versions: it is a relict population or an invasive one. We compared mtDNA haplotypes known for Moscow and other geographical regions.

In Moscow two closely related haplotypes were found (fig. 1). It suggests that the Moscow population originated from a few female-founders and this event happened only once. But because of the small number of samples analyzed, the problem requires further study. It is also noteworthy that of two Moscow haplotypes was also found in Ryazan Oblast (fig. 2).

Common hamster in Simferopol

By 2000, the Common hamster has become rare in natural habitats in the Crimea, but in 2000–2004 it was recorded in 8 cities and 6 towns (Tovpinetz et al., 2006). Over the next 8 years it became even more widespread in the human settlements and was registered in 18 cities and 42 towns of the Crimean peninsula.

Table 2 Sampling location of European common hamsters, number of individuals (haplotypes) included in mitochondrial (ctr) analyses and № in Genbank.

Sampling region (country)	Location (city or village, country)	Haplotype	№ in Genbank
Russia	Voroneg (Russia)	3VORON	KF271769
	Mozdok\Caucasus (Russia)	43MOZD	KF271770
	Moscow (Russia)	48MOS	KF271766
	Moscow (Russia)	32MOS	KF271767
	Saratov\Slavianka (Russia)	013SAR	KF271764
	Saratov\Dyuakovka(Russia)	165SAR	KF271772
	N. Novgorod (Russia)	38NOVG	KF271765
	Bryansk (Russia)	10BRNK	KF271768
	Stavropolie\ Caucasus (Russia)	8STAV	KF271771
Ukraine	Crimea (Ukraine), village Razdolnoe	401RZK	KF271777
	Crimea (Ukraine), village Razdolnoe	402RZK	KF271778
	Crimea (Ukraine), village Razdolnoe	050 RZK	KF271776
	Crimea (Ukraine), Simferopol city, village Zuyu, village Perovo	40SEMS	KF271779
	Crimea (Ukraine), Simferopol city	02SEMP	KF271780
Kazakhstan	Kazakhstan	16TURG	KF271773
	Kazakhstan	12TURG	KF271775
	Kazakhstan	57TURG	KF271774

Since the late 1970s hamster started to colonize Simferopol (Tovpinetz, Alexeev 1992). A remarkable peculiarity is that constant colonies of hamsters occur not only in the periphery of Simferopol but in the central part as well. During the survey of 2000 year animals were found in 13 localities within the city. Although Common hamster is typically nocturnal (Niethammer 1982), in urban environment it sometimes demonstrates diurnal activity. The same pattern was noticed in Vienna (Schmelzer, Millesi 2003). We have seen hamsters renovating their burrows, climbing a bush up to 1 m for leaf cutting. Young hamsters would never move away from the burrow were entrance for more than 1–2 m. Animals paid no attention to the traffic noise although their burrows were located close to the road. In case of unusual sound hamsters would stand up acquiring the typical upright posture. If frightened they would run to the nearest entrance (not necessary their own) and hide inside.

Accurate information confirming the reduction of aggression of the Common hamster in urban areas compared with the natural ones is limited. In the Altay foothills during May–June fierce fights among males were recorded. Each male visited individual territories of several females mating with those which were in estrous. In Vienna's population the maximum number of aggressive interactions between males is registered in March–June (the peak of the breeding). In July–August (the end of the breeding season) no intra-sexual interactions could be observed (Pfaum, Millesi 2003). In the Crimea (Simferopol) where we worked in August we found the same phenomenon. During the encounters males would sniff each other and retreated peacefully. Often several males would enter the same entrance one by one. In August

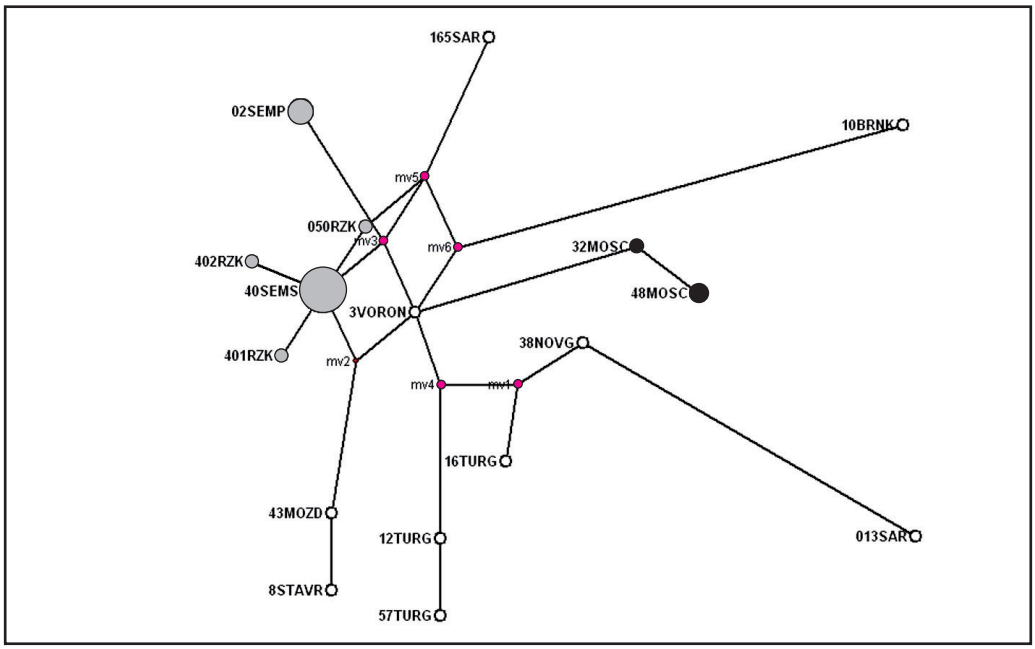

Fig. 1 Median-joining network based on combined ctr (878 bp) haplotypes (n=17) obtained from Common hamsters (n = 32). Geographic locations are shown in table 2. Gray circles – Crimea haplotypes (two of this – 40SEMS and 02SEMP – are described from Simferopol); black circles – Moscow haplotypes.

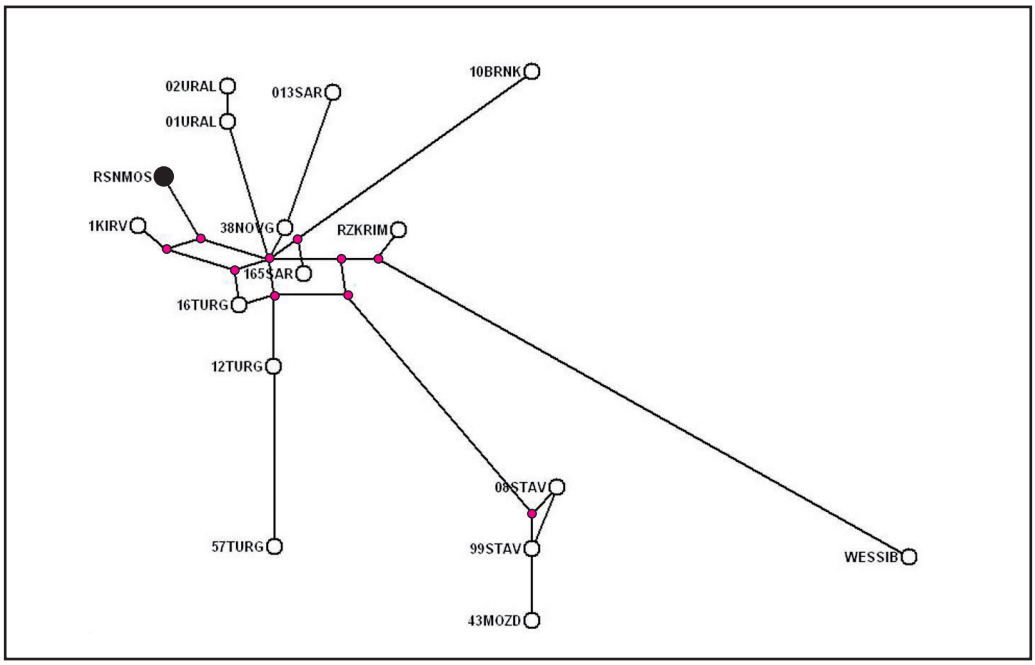

Fig. 2 Median-joining network based on combined ctr and cyt b (1262 bp) haplotypes (n = 16) obtained from Common hamsters (n = 23). Geographic locations are shown in table 3. Black circle – the same haplotype for Ryazan and Moscow.

females were not aggressive as well but they are more active than males what is due to the fact that, by that time, they did not accumulate sufficient amount of fat. Females had less fat than males, some of them had little pups what stimulated their foraging behavior. Their average run per day was 7 times larger than in males. At the same time, males spent more time in the burrows demonstrating minimal surface activity.

In Vienna dogs cause no harm to hamsters as they are never released from leashes. But in Simferopol home and stray dogs and cats hunted on hamsters successfully. We have observed a dog having killed a hamster. Cats probably could hunt on young ones.

One of the central streets of Simferopol (for example, Sevastopolskaya str.) proved to be a suitable place for hamsters. Here, their density was very high (on average 36 burrows per hectare what amounts to approx. 12 animals per hectare (in 2000) and 26 burrows per hectare in 2012). High density might be accounted for by a number of reasons. The substrate was firm and hence the burrow walls were less subjected to crumbling. Bushes planted along the street provided protection. In dry seasons trees and bushes were watered what played an important role for hamster during the drought season. Seeds and fruits of these trees constituted a significant part of their diet.

In the city hamster are faster to escape in burrows, being in general more fussy and cautious. At the same time, they are accustomed to traffic noise, pedestrians, illumination etc. Thus, city populations in the Crimea are featured by resistance to stress on the one hand and by increased vigilance on the other. At the same time population number in natural habitat is very low. So, population dynamics in urban hamsters of the Crimea is not coherent with that in natural populations.

Analysis of haplotype diversity of Common hamster in Simferopol showed that different parts of the city are inhabited by hamsters belonging to two different maternal lines (fig. 1).

For 13 investigated locations in Russia, Ukraine and Kazakhstan we found 17 haplotypes, and, additionally, 5 haplotypes were found in the Crimea (Ukraine).

Two of the five Crimean haplotypes were found in Simferopol. One occured in the Gagarin Park and in the Kievskaya street and another one (differing by 3 substitutions) was found in the Sevastopolskaya street, located at 6–8 km from the previous area (fig. 1). The latter haplotype was also found in the vicinity of the Simferopol, in Perovo and Zuya towns. However, until now the former haplotype was not found outside Simferopol.

It is hard to explain why some species find more favorable conditions in urban environment than in natural habitats. For certain, it is largely brought about by higher stress resistance, ecological opportunism, polyphagy and higher fertility. These features may be associated with genetics. This problem is becoming more and more important due to progressive urbanisation during the last decades. Additional studies of ecological and behavioral adaptation strategies in semisynantropic species are highly war-ranted.

For conclusion we would like to remark that, contrary to the opinion of V. Vorontzov who regarded hamsters as an ancient group on the way to extinction, we can see that hamsters` potential for adaptation to novel evolutionary factors such as human impact is very high; and, hence, this unpredictable species will continue to puzzle us as well as our descendants. This research was supported by the grant “Wild world: Current State and Development” and the Contract № 5180 (Russian Ministry of Education).

Abstract

The Common hamster is widely spread across Europe, W. Siberia, and N. Kazakhstan to the upper Yenesei river, Altai region and NW Xinjang (China). In the last 45 years there was a sharp decline in the number of Common hamster throughout its range. However, with the overall decline in the number, in some cities, particularly in Vienna (Austria), Brno (Czech), Moscow (Russia), Simferopol (Ukraine) and some others, this species is expanding in urban environment with its abundance remaining high and stable in settlements during last decades. In this paper we analyze the history of the Common hamster settlings in Moscow and in Simferopol and the occurrence of different haplotypes in those cities.

Table 3 Sampling location of Common hamsters, number of individuals (haplotypes) included in mitochondrial (ctr, cyt b) analyses and № in Genbank.

Sampling region (country)	**Location (city or village, country,)**	**Haplotypes**	**№ in Genbank**
Russia	Mozdok \ Caucasus (Russia)	43MOZD	KF271755+ KF271770
	WSib (Russia)	WESSIB	NU AJ633734
	Ural \ Ekaterinburg (Russia)	02URAL	AJ633779+ AJ633735
	Ural \ Ekaterinburg (Russia)	01URAL	AJ633779+ AJ633732
	Kirov (Russia)	1KIRV	AJ633780+ AJ633736
	Ryazan, Moscow (Russia)	RSMOS	KF271752+ KF271766, KF271752+ KF271767
	Saratov \ Slavianka (Russia)	013SAR	KF271757+ KF271764
	Saratov \ Dyuakovka (Russia)	165SAR	KF271758+ KF271772
	N. Novgorod (Russia)	38NOVG	KF271763+ KF271765
	Bryansk (Russia)	10BRNK	KF271759+ KF271768
	Stavropolie \ Caucasus (Russia)	08STAV	KF271753+ KF271771
	Stavropolie \ Caucasus (Russia)	99STAV	KF271754+ KF271771
Ukraine	Crimea (Ukraine)	RZKRIM	KF271756+ KF271777 KF271756+ KF271778
Kazakhstan	Kazakhstan	16TURG	KF271761+ KF271773
	Kazakhstan	12TURG	KF271762+ KF271775
	Kazakhstan	57TURG	KF271760+ KF271774

NU – by K. Neumann, unpublished data

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