PECKIANA • Volume 8 (2012) • pp. 117–128

ISSN 1618-1735

Dryomys nitedula (Pallas, 1778) in Mongolia[1]

MICHAEL STUBBE, ANNEGRET STUBBE, RAVČIGIJN SAMJAA & HERMANN ANSORGE

Abstract

The forest dormouse was first discovered by the Mongolian-German Biological Expedition in May 1973 to SW-Mongolia. It occurs in the Dzungarian Gobi in the Salix-woodlands near the river Bulgan-gol, close to the border China/Mongolia. Hibernation finished in the first days of May. Offsprings were born in the second half of June in tree nests. Mongolian forest dormice show a very high reproduction rate and produce perhaps two litters per year. The age structure is well balanced, one third of the population overwintered twice or more. It seems that the population belongs to the subspecies *Dryomys nitedula angelus* (Thomas, 1906).

Keywords: Forest dormouse, Central Asia, distribution, reproduction, tree nests

1. Introduction

In the year 1973 the forest dormouse was found for the first time in Mongolia by the senior author and the Mongolian colleague Prof. Dr N. Davaa. It was also the first evidence of dormice in general for Mongolia. Furthermore this is the most eastern point of the species´ range. Since then we tried to collect data on the biology and ecology of the forest dormouse under the special conditions of the Mongolian desert. Because information from literature is very scarce the preliminary results are presented here in a shortened form.

2. Material and methods

The forest dormouse is now only known in Mongolian territory from the lower course of the Bulgan-gol. This river runs from the Mongolian Altai through the Dzungarian desert up to Lake Uljungur in NW-China, bordered by *Salix* and *Populus* woodland. The area along the river was declared as a nature reserve to benefit the Central-Asiatic beaver population (*Castor fiber birulai*) and is described by Stubbe & Dawaa (1983). There we found the most eastern point in the whole distribution area of the forest dormouse (Figs 1, 2).

The first finding was on 30th of May 1973 at the Bulgan river, about 5 km east of the state border Mongolia/China. A *Salix*-tree was climbed to reach a nest of the black kite *Milvus migrans* and below it escaped two forest dormice. One animal was collected. In 1974, 1975 and 1978 we have worked during our beaver expeditions to the Bulgan-gol and collected more material of this dormouse with metric and ecological data. Further information was recorded by the Mongolian student S. Dorž 1979 and 1980 for his diploma-work (Dorž 1980). All these materials were the basis for a first publication (Stubbe et al. 1986). In 1985, 1988 and 2002 the Mongolian-German Biological Expedition was working again on *Castor fiber birulai* in that river valley and new data on *Dryomys nitedula* were registered (Figs 3, 4).

[1] Results of the Mongolian-German Biological Expeditions since 1962, No. 309

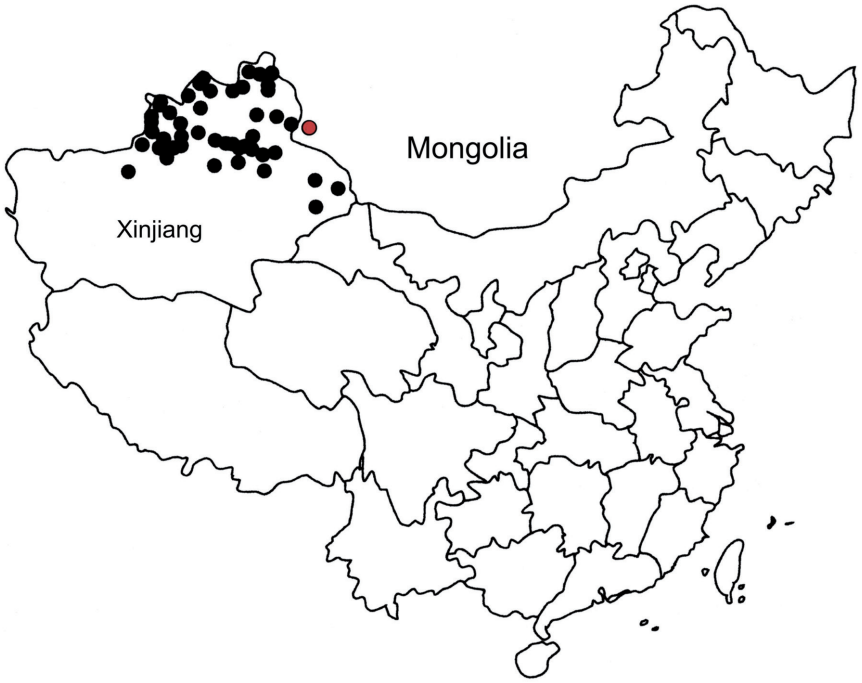

Fig. 1 Distribution of *Dryomys nitedula* in China (Smith & Xie 2008).

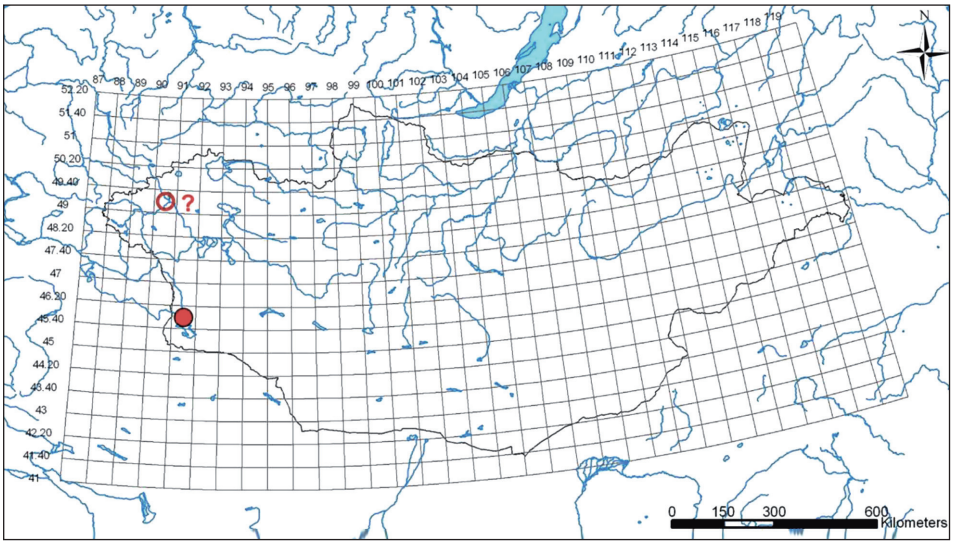

Fig. 2 Distribution of *Dryomys nitedula* in Mongolia.

Fig. 3 Nature Reserve Bulgan-gol in the Dzungarian Gobi.

Fig. 4 Bulgan-gol area 5 km above the Somon Bulgan.

3. Results and discussion

3.1. Distribution

The forest dormouse is widespread in Middle Asia. According to Ognev (1947) it ranges from Kopet-Dag up to the Kara-Tau, Talassk Alatau, Dzungarian Alatau, Tarbagataj and Kalbinsk Altai. The southern border includes the Pamir and runs through Iran. The most eastern points Ognev mentioned are near Šary Sjume (NE of lake Uljungur, Chinese Dsungaria, Mongolian Altai) and Bogdo-ola in SE Dsungaria (eastern Tjang-Šan). Summarized data for the distribution and biology of *Dryomys nitedula* in Europe are given by Storch (1978) and for the whole area by Rossolimo et al. (2001). In Daghestan the vertical distribution is going up to 2500 m above sea level (Gromov & Erbaeva 1995); in Mongolia we find the species in about 1200 m.

Bannikov (1954) following Ognev, stated that the dormouse is known from the Kran river near Šary Sjume on the southern slopes of the Mongolian Altai, about 80 km south of the border of Mongolia and he guessed that this species would also be found along the upper regions of the rivers Kran and Bulugun (Bulgan-gol) as well as on the wood islands between them. North of the Mongolian Altai the presence of forest dormouse is also possible up to the region of the lake Ačit-nuur, where Bannikov (1954) found one animal (on 31st of July 1945) near the Böchmörön river among poplars and buckthorn. He wrote that the species was very rare there, but we have no further evidence. Therefore it is possible that the species is also distributed in NW-Mongolia, north of lake Ačit-nuur.

3.2. Breeding and reproduction

When we arrived at the end of April 1974 at the Bulgan-gol, we soon discovered in the leafless trees of *Salix viminalis* (the dominant *Salix*-species) the nests of the dormice from the previous year or older (Fig. 5). The height of 100 nests in the trees (Fig. 6, Tab. 1) averaged 3.97 m ± 1.28 m (min. = 1.40 m, max. = 7.00 m). The willow trees had a height of maximal 10 m. The nests were big as a fist and made of wool from sheep and goats, as well as formerly green leaves, bark and some blades of grass. They were very well constructed in the tips of branches. The position of nests and their material are different to other populations (Angermann 1963).

The new nests were built in June and used until August for raising the young. In some nests were found a lot of excrements, also in a few nests of the penduline tit (*Remiz pendulinus)*. Banz (1953) also mentioned that *Dryomys nitedula* in the Ukraine had sometimes used nests of raptors (like our first finding in Mongolia). We have no information on the depth of the winter burrows between the roots of willows. In the middle of May the earth was frozen to a depth of 30 cm.

In 1974, 1975 and 1978 the expedition arrived in the Bulgan-gol not later than the 1st of May. The trap lines were established very quickly so the first activities of the dormice after hibernation could be registered. In these years the first animals were captured on 4th, 6th and 11th of May. Until mid-May mainly males were caught, all in good condition with a lot of fat and active testes (15–23 × 8–10 mm). In the second half of May copulations took place, even during the day. Angermann (1963) recorded testes with a length of 11 mm for the Voronesh-population and Kratochvil (1973) 15 mm for males in South Slovakia. Sludskij et al. (1977) have noticed testes length of 17–20 mm at the end of April/beginning of May. Mating behaviour was observed in the last ten days of May in the willows also in the bright daylight at Bulgan-gol.

Bite wounds were found in males already in the first ten days of May, evidently caused in the struggle for females. Eleven of 74 males lost the tip of their tail. In 30 females only one had lost it. At the end of May (27th) the first pregnant females were found. In 19 gravid females were noticed 3–9 embryos (average = 5.7, see Tab. 2). In comparison with the literature

Fig. 5 Nest of *Dryomys nitedula* in a *Salix*-tree.

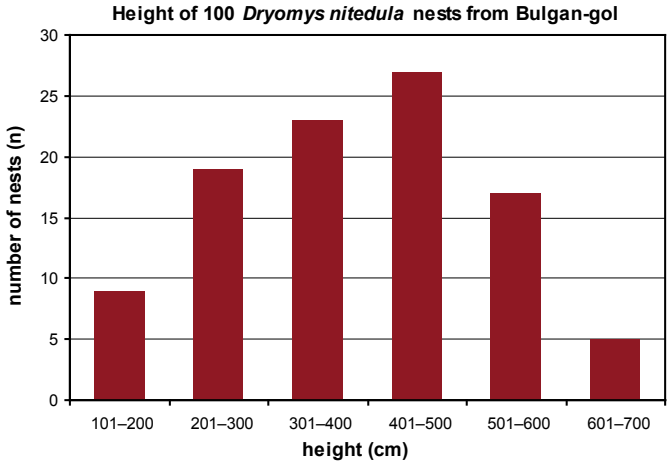

Fig. 6 Height of 100 *Dryomys*-nests in the Bulgan-gol area.

Tab. 1 Height of 100 nests of *Dryomys nitedula* at Bulgan-gol.

height of nests (cm)	number of nests (n)	height of nests (cm)	number of nests (n)
101–150	2	401–450	15
151–200	7	451–500	12
201–250	4	501–550	12
251–300	15	551–600	5
301–350	12	601–650	3
351–400	11	651–700	2

(Tab. 3) the reproduction rate was very high, perhaps in correlation with the hard climatic conditions and higher mortality. After a gestation period of 25 days (Gaffrey 1961) most of the first litters were born in the second half of June. It is not clear if they have one or two litters per year. In the middle of August 2002 we found in the area of Bulgan-gol lactating females and also young animals with a body mass of 28–35 g as well as 15–18 g. So it is assumed that in this region two litters per year are born. Gromov & Erbaeva (1995) mention only one litter per year generally.

Tab. 2 Reproduction data of *Dryomys nitedula* from Bulgan-gol area basing on number of embryos of gravid females.

number of embryos	**3**	**4**	**5**	**6**	**7**	**8**	**year**
number of females	-	-	-	-	-	2	**1978**
	2	2	3	4	-	2	**1979**
	-	-	1	2	1	-	**1980**
total	**2**	**2**	**4**	**6**	**1**	**4**	

Tab. 3 Reproduction data of *Dryomys nitedula* from different geographic regions.

author/year	**investigation area**	**litters/ year**	**offspring/ litter**	**average/litter**	**N (♀♀)**
Golodoško & Padutow (1961)	primeval forest of Bialowieža	1	?	?	?
Angermann (1963)	Nature Reserve	1	1–6	4.3 placentar scars	52
	Voronež		2–6	4.8 embryos	13
			3–6	4.0 juveniles	54
Nevo & Amir (1964)	Israel	2–3	1–4	3.0 juveniles	?
Alekperov (1966)	SW-Azerbaijan	2	3–8	5.1 embryos	190
Sludsky et al. (1977)	Kazakhstan	1	2–8	4.3 embryos	?
Gaisler et al. (1977)	North Moravia	1	2	2.0 placentar scars	2
			4	4.0 embryos	1
			1–5	2.9 juveniles	7
Averin & Lozan (1979)	Moldova	1	2–6	?	?
Stubbe et al. (1986)	SW-Mongolia	1 (?)	3–8	5.7 embryos	19

3.3. Population ecology

The evaluation of population density was difficult. In a line of 60 traps (distance between traps 2 m) were caught 4–7 animals on the first night, on the second only 1 or 2. The density after hibernation can be estimated at about 20 ± 5 animals per hectare. Dorž (1980) assumed up to 30 animals/ha. In some years the river is in flood and the valley is under water, especially after spring snow melt in the Mongolian Altai. Such situations were noticed in 1984 and 1985 and the population density of *Dryomys nitedula* was very low. Fluctuations of the population density are also mentioned by Angermann (1963), Ejgelis (1980) and Sludskij et al. (1977). In North Moravia Gaisler et al. (1977) reported a population density of 0.1 animals/ha. Averin & Lozan (1979) found in Moldavia 1–5, but also 20 or more animals/ha.

The sex ratio of captured animals was in favour of males in May, but more or less equal in June (Tab. 4). Sludskij et al. (1977) also found a changing sex ratio in Kazakhstan: in May 68.9 % males, in June 57.2 %, in July 54.1 %, in August 49.8 % and in September 50.3 %. For Azerbaijan further data are given by Ejgelis (1980). In contrast Angermann (1963) found more females (60.1 %) from May until September in the Voronesh region.

Tab. 4 Sex ratio of captured *Dryomys nitedula* in May/June and August at Bulgan-gol.

month/year	N	♂♂		♀♀		sex ratio
		n	%	n	%	
May 1974	34	23	67.6	11	32.4	1 : 0.48
May 1975	19	17	89.5	2	10.5	1 : 0.12
May1978	50	33	66.0	17	34.0	1 : 0.52
June 1979	44	21	47.7	23	52.3	1 : 1.10
June 1980	11	5	45.5	6	54.5	1 : 1.20
August 2002	21	9	42.9	12	57.1	1 : 1.33

We investigated the age structure (Tab. 5) and body measurements (Tabs 6, 7) of the forest dormouse population at Bulgan-gol after successful hibernation, using the tooth abrasion method (Angermann 1963, Lozan 1961). It was possible to distinguish the age classes because of the long hibernation period and the characteristic signs of tooth wear. We could differentiate between one-year-old and older individuals. The percentage of these two groups can vary considerably between years because of climatic conditions during hibernation and the breeding period, but detailed studies are lacking. In the population of the Bulgan-gol about one third of the animals hibernated for a second winter or more. Two thirds survived the first winter period successfully. At least 6 of 32 older dormice hibernated for a third winter, representing a relatively high life expectancy for micromammalia (Figs 7, 8).

Tab. 5 Age structure of captured *Dryomys nitedula* in May/June at Bulgan-gol.

month/year	N	♂♂		♀♀		total	
		1	2+	1	2+	1	2+
1974	30	9	10	8	3	17	13
1975	18	11	5	2	0	13	5
1978	50	25	8	11	6	36	14
total	**98**	**45**	**23**	**21**	**9**	**66**	**32**

3.4. Feeding and parasites

In the stomachs of animals investigated in May were found parts of green plants, willow blossoms, buds of leaves and leaves of willows and occasional remains of insects. Dorž (1980) remarked on regularly finding insects in June (Tipulidae and Formicidae), but in some cases also remains of young birds.

The Mongolian forest dormice were found to carry only the flea species *Monopsyllus sciurorum asiaticus* Ioff, 1936 (Smit 1980, Kiefer 1979). More information on parasites of the *Dryomys nitedula* population in Kazakhstan is given by Sludskij et al. (1977) and see also by Rossolimo et al. (2001).

Tab. 6 Body and skull measures (in g and mm) of male *Dryomys nitedula* from Bulgan-gol (all measures from animals captured in May after hibernation).

Measures of ♂♂	n	min.–max.	$\bar{x} \pm s_{\bar{x}}$	s	V
body mass	73	27–59	44.86 ± 0.86	7.23	16.1
body length	74	98–127	114.38 ± 0.73	6.26	5.5
tail length	63	70–110	91.73 ± 0.83	6.58	7.2
length of hind foot	74	20–24	21.86 ± 0.07	0.58	2.7
ear length	74	14–18	16.42 ± 0.10	0.83	5.1
condylobasal length	65	25.5–28.0	25.71 ± 0.12	0.97	3.8
zygomatic arch width	63	15.2–17.9	16.66 ± 0.08	0.60	3.6
interorbital width	66	4.1–4.8	4.46 ± 0.02	0.13	2.9
width of brain capsule	63	13.2–14.2	13.51 ± 0.03	0.24	1.8
height of brain capsule	61	10.5–12.0	11.09 ± 0.04	0.30	2.7
diastema	67	6.5–7.7	7.04 ± 0.03	0.25	3.6
length of upper row of teeth	67	3.4–3.9	3.64 ± 0.01	0.11	3.0

Tab. 7 Body and skull measures (in g and mm) of female *Dryomys nitedula* from Bulgan-gol (all measures from animals captured in May after hibernation).

Measures of ♂♂	n	min.–max.	$\bar{x} \pm s_{\bar{x}}$	s	V
body mass	30	23–48	38.33 ± 1.13	6.20	16.2
body length	30	95–117	108.87 ± 1.13	6.21	5.7
tail length	29	72–101	89.72 ± 1.36	7.34	8.2
length of hind foot	30	20–23	21.50 ± 0.16	0.86	4.0
ear length	30	15–18	16.03 ± 0.14	0.76	4.7
condylobasal length	27	23.1–26.6	25.13 ± 0.18	0.94	3.7
zygomatic arch width	30	15.0–17.5	16.32 ± 0.13	0.70	4.3
interorbital width	30	4.2–4.6	4.42 ± 0.02	0.09	2.0
width of brain capsule	26	13.0–14.0	13.47 ± 0.06	0.29	2.2
height of brain capsule	27	10.5–11.8	11.07 ± 0.06	0.30	2.7
diastema	30	6.4–7.2	6.83 ± 0.04	0.24	3.5
length of upper row of teeth	30	3.4–4.0	3.69 ± 0.03	0.15	4.1

3.5. Morphometry and taxonomy

Gromov et al. (1963) have shown 12 subspecies of *Dryomys nitedula* for the territory of the Soviet Union. But after the revision of Rossolimo (1971) only four of them are considered valid. Bannikov (1954) mentioned that *D. n. angelus* (Thomas, 1906) probably occurred in Mongolia. Synonyms are after Rossolimo the subspecies *bilkjewiczi*, *pallidus* and *saxatilis*. The taxonomic status of *D. n. milleri*, described by Thomas (1912) on the basis of one female from

Fig. 7 *Dryomys nitedula* from Bulgan-gol.

Fig. 8 Collection of micromammalia with *Dryomys nitedula* from Bulgan-gol area.

SE Dsungaria is unclear. Thomas worked on the material collected by D. Carruthers in 1910 and 1911 in Central Asia. Thomas described the route travelled by Carruthers as 'Commencing at Minnusinsks, on the Upper Yenisei, shortly after leaving the Siberian Railway, the party worked through the Sayansk Mountains into N. W. Mongolia, then through the Tannu-ola Mts., the Altai, the Barlik Mts., N. W. Dzungaria, along the Thian Shan chain eastwards to the interesting Hami Mts., then back to the Muzart Valley and Kuldja'. The animal mentioned was collected on 9th of May 1909 in the Bogdo-ola Mountains in SE-Dsungaria, in a valley with elm (*Ulmus)* trees. The subspecies *D. n. milleri* should have a shorter and wider skull and a more rounded brain capsule as well as shorter and higher bullae than *D. n. angelus*. Thomas recorded the following measurements: head-body: 94 mm, tail: 68 mm, hind foot: 20 mm, ear: 17 mm, condylobasal length: 25.2 mm, zygomatic arch width: 16.8 mm, Nasalia: 8.3 × 3 mm, interorbital width: 4.2 mm, length of upper row of teeth: 4.1 mm.

Zoogeographical the populations of the Black Irtysh and Bulgan-gol are similar. The craniometric data of the Irtysh animals are shown in Table 8 (Rossolimo 1971). There is a high degree of consent between the average and variation of measured skull values. Further measurements, divided in three age classes are given by Sludskij et al. (1977) for animals from the Sailijskij Alatau. Summarizing the knowledge of all these data it is our opinion that the Mongolian dormouse population belongs to the subspecies *D. n. angelus*. That is corresponding with Ognev (1947) and Bannikov (1954).

It would be important to collect new material in the basin of the Ačit-nuur – if the species is distributed there. In our expeditions to the west Mongolian river Chovd-gol we never saw any nests or living dormice. In the museums of Chovd-city, Ulgij and Ulaan-gom the species was not present and no information was found for the rivers Bodončijn-gol and Uenč-gol in the Dzungarian Gobi at the southern slopes of the Mongolian Altai.

Tab. 8 Skull measures (in mm) of *Dryomys nitedula angelus* (n = 18) from the area of Black Irtysh (Rossolimo 1971).

measures	min.–max.	$\bar{x} \pm s_{\bar{x}}$	V
condylobasal length	24.7–26.0	25.30 ± 0.18	1.98
diastema	6.4–7.0	6.69 ± 0.06	2.69
rostrum width	4.9–5.3	5.14 ± 0.04	2.33
interorbitale width	4.2–4.6	4.37 ± 0.04	2.74
zygomatic arch width	15.8–17.3	16,32 ± 0.16	2.88
width of brain capsule	13.0–13.6	13.24 ± 0.07	1.43
height of brain capsule	11.2–11.8	11.52 ± 0.06	1.47

6. References

Alekperov, Ch. M. (1966): Mlekopitajuščie jugo-zapadnogo Azerbajdžana. – Baku.

Angermann, R. (1963): Zur Ökologie und Biologie des Baumschläfers, *Dryomys nitedula* (Pallas,1779), in der Waldsteppenzone. – Acta Theriologica **7**: 333–367.

Averin, Ju. V. & Lozan, M. N. (1979): Mlekopitajuščie (Serja „Životnyj mir Moldavii"). – Kišinev.

Bannikov, A. G. (1954): Mlekopitajuščie Mongolskoj Narodnoj Respubliki. – Moskva.

Banz, K. (1953): Vom Baumschläfer (*Dryomys nitedula obolenskii* Ogn.) in Südrußland. – Zeitschrift für Säugetierkunde **17**: 153–155.

Dorž, S. (1980): To the biology of *Dryomys nitedula* and *Ellobius talpinus*. – Diploma thesis, National University of Mongolia, Ulaanbaatar, (in Mongolian).

Ejgelis, Ju. K. (1980): Gryzuny Vostočnogo Zakavkaz'ja i problema ozdorovlenija mestnych očagov čumy. – Saratov.

Gaffrey, G. (1961): Merkmale der wildlebenden Säugetiere Mitteleuropas. – Leipzig.

Gaisler, J., Holas, V. & Homolka, M. (1977): Ecology and reproduction of Gliridae (Mammalia) in Northern Moravia. – Folia Zoologica **26**: 213–228.

Goloduško, B. S. & Padutow, E. E. (1961): Materials to the ecology of the forest zone in the Byelovesk primeval forest. Fauna and ecology of the terrestrial vertebrates of Byelorussia. – Minsk. (in Russian)

Gromov, I. M., Gureev, A. A., Novikov, G. A., Sokolov, I. I., Strelkov, P. P. & Čanskij, K. K. (1963): Mlekopitajuščie Fauny SSSR. Čast 1. – Moskva, Leningrad.

Gromov, I. M. & Erbaeva, M. A. (1995): The mammals of Russia and adjacent territories. Lagomorphs and rodents. – St. Petersburg.

Kiefer, M. (1979): Bichy (Siphonaptera) Mongolskej Ludovej Republiky. – Dissertation University Bratislava.

Kratochvil, J. (1973): Männliche Sexualorgane und System der Gliridae (Rodentia). – Acta Scientiarum Naturalium Brno **7** (12): 1–52.

Lozan, M. N. (1961): Age determination of *Dryomys nitedula* Pall. and of *Muscardinus avellanarius* L. – Zoologičeskij Žurnal **40**: 1740–1743.

Nevo, E. & Amir, E. (1964): Geographic variation in reproduction and hibernation patterns of the forest dormouse. – Journal of Mammalogy. **45**: 69–87.

Ognev, S. I. (1947): The Mammals of Russia (USSR) and adjacent countries. – Vol. **5**, Moskau-Leningrad.

Rossolimo, O. L. (1971): Variability and taxonomy of *Dryomys nitedula* Pallas. – Zoologičeskij Žurnal **50**: 247–258.

Rossolimo, O. L., Potapova, E. G., Pavlinov, I. Ya., Kruskop, S. V. & Voltzit, O.V. (2001): Dormice (Myoxidae) of the world. – Archives of the Zoological Museum of the Moscow State University **42**: 1–232.

Sludskij, A. A., Bekenov, A. & Borisenko, V. A. (1977): Mammals of Kazakhstan. – Vol. **I**, part 2, Alma-Ata.

Smit, F. G. A. M. (1980): Some recent collections of Siphonaptera from Mongolia. – Mitteilungen aus dem Zoologischen Museum in Berlin **56**: 73–84.

Smith, A. T. & Xie, Y. (2008): A Guide to the Mammals of China. – Princeton and Oxford.

Storch, G. (1978): *Dryomys nitedula* (Pallas, 1779) – Baumschläfer. – In: Niethammer, J. & Krapp, F. (eds): Handbuch der Säugetiere Europas **1**: Wiesbaden, 226–237.

Stubbe, M. & Dawaa, N. (1983): Akklimatisation des Zentralasiatischen Bibers – *Castor fiber birulai* Serebrennikov, 1923 – in der Westmongolei. – Erforschung biologischer Ressourcen der Mongolischen Volksrepublik (Halle/Saale) **2**: 3–92.

Stubbe, M., Dawaa, N. & Dorž, S. (1986): Der Baumschläfer –*Dryomys nitedula* Pallas, 1778 – in der Mongolei. – Erforschung biologischer Ressourcen der Mongolischen Volksrepublik (Halle/Saale) **5**: 17–25.

Thomas, O. (1912): On Mammals from Central Asia, collected by Mr. Douglas Carruthers. – Annals and Magazine of Natural History **9** (8).

Accepted 1 August 2012

Authors' addresses:

Michael Stubbe*, Annegret Stubbe
Martin Luther University Halle-Wittenberg,
Institute of Biology, Department of Zoology
Domplatz 4
06099 Halle/Saale, Germany

Ravčigijn Samjaa
National University of Mongolia
School of Biology and Biotechnology, Department of Zoology
Ulaanbaatar, Korpus 2-483
Post Box 210646/348, Mongolia

Hermann Ansorge
Senckenberg Museum of Natural History Görlitz
Am Museum 1
02826 Görlitz, Germany

*Corresponding author: Michael Stubbe (e-mail: annegret.stubbe@zoologie.uni-halle.de)