One New Species of the Genus *Dryomys* (Rodentia, Glirgae) from Xinjiang China, *Dryomys Yarkandensis* sp. nov

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Abstract

During an expedition in June 2012 in Shache county of Tarim Basin in southern Xinjiang, China, a new species of the genus *Dryomys* (Gliridae) has been discovered and named *Dryomys yarkandensis* sp. nov. It has been found obviously different from *D. nitedulai* in northern Xinjiang, *D. laniger*, *D. niethammeri* and *D. nitedulai* in Europe, which are also belong to genus *Dryomys*. The new species *Dryomys yarkandensis* sp. nov is described below.

Holotype: No. N07, an adult female collected by Chen Zhenhai in June 2012, is deposited Center for disease prevention and control of Xinjiang (Xinjiang CDC). It was obtained from oasis orchard of desert in Tarim Basin (38°29'N, 77°32'E), 1211-1215 m.

Genus character: There is a dark chestnut round eye. The terminal of tail is club shape, covered with dense hairs, and cannot see the scale ring in external texture.

Description of the species: The eyes is large. The beard is long and the longest could reach 30 mm. The tail is thicker and slightly longer than body length about 10%. The terminal of the tail is fluffy. All the surface is covered with dense hairs.

External figure: The color of the new species on the back is lighter than that of *D. laniger*, *D. niethammeri* and *D. nitedulai* in *Dryomys*. The length of the tail is about 110% of the body length.

The length of the ears is 12.8 mm, which is 15% shorter than the other three species of *Dryomys*.

Skull and tooth: The ratio between the length of auditory bullae and the breadth of auditory bullae is 1.66 (8.35/5.02), which is larger than the other three species of *D. nitedula*.

The habitats of the new species is harsh, drought and hot in summer but dry and cold in winter. The habitats of *D. nitedula* in mountain valley in northern Xinjiang is temperate, humidity and low temperature, and there are berries or orchard.

Key Words: *Dryomys yarkandensis* sp. nov, New species, Tarim Basin, Gliridae

Introduction

Dryomys nitedula (Pallas, 1779) is the mode species established the genus *Dryomys* of family Gliridae (Thomas, 1906). It distributes extensively in central and southeastern Europe (Kryštufek and Vohralik, 1994), northern and eastern Russia, Turkey, the Middle East, Afghanistan, Pakistan, central Asia (Ognev, 1940; Allen, 1940; Sisson and Grossman, 1950; Bosessneck and Driesch, 1976; Sokolov, 1977; Sludskii, 1977; Kryštufek, 1999; Airapetyants and Fokin, 2005), as well as eastward to Dzungarian Alatau, Sawuer mountain, altai mountains in China and Khovd river upstream in western Mongolia (Shiirevdamba et al., 1997). *D. nitedula* lives in a wide range of habitats, including broad-leaved, mixed and coniferous woodlands, as well as rocky areas, dwarf mountain woodland, evergreen shrubland and wood-steppe (Kryštufek, 1999).

More than half a century, it has been considered as a monotype genera. According to previous work (Ellerman and Morrison-Scoot, 1951), 20 names species or subspecies of the genus had been published by 1946. But many taxonomists thought they are synonyms of *D. nitedula* (Огнев, 1947; Ellerman and Morrison-Scoot, 1951). In 1968, Felton and Storch considered that the specimen of forest dormice, which was collected from the Turkish Anatolia Rocky Mountains, is different from *D. nitedula* in terms of size and morphology characteristics, so they published a new species, *Dryomys laniger* (Felton and Storch, 1968). Later, *Dryomys niethammeri*, a new species of *Dryomys* collected from Pakistan's baluchistan province, was described and compared the morphology with *D. nitedula* and *D. laniger* (Holden, 1996). The research conclusions were recognized by another work (Rossolimo et al., 2001). At present, there are three species of the genus *Dryomys*, *D. nitedula*, *D. laniger* and *D. niethammeri*.

Up to now, there is only one species of the genus *Dryomys* in China, *D. nitedula*, which distributes in Tianshan mountain, Altai mountain, Dzungarian Alatau and Yili basin (Wang and Yang, 1983; Ma et al., 1987; Zhang, 1997). In 2012, we obtained some specimens of dormice from oasis orchard of desert in Tarim Basin of southern Xinjiang, China. The specimens are similar to *D. nitedula*, but has morphological differences from *D. nitedula*. In order to find out its classification status, we collected living specimens to breed in lab from Shache county in Tarim basin of southern Xinjiang and form Jinghe county of northern Xinjiang in 2013. We compared the specimens from the two areas from adult to larval according to morphological feature.

Part 1 Study of morphology on the dormice from Tarim basin in China

1. Materials

Specimens of the dormice from Tarim basin: n=15.

Specimens of *D. nitedulai* from northern Xinjiang in China: n=11, 6 specimens from mountains of northern Xinjiang deposited in Institute of Zoology, Chinese Academy of Sciences, including one from Altai, one from Fukang, one from Manas, one from Nuleke counties, two from Talbahatai mountain of Tacheng prefecture and five from Jinhe county deposited in Xinjiang CDC Herbarium.

Dryomys nitedulai: the data of 85 specimen are quoted from previous work (Holden, 1996).

Dryomys laniger: the data of 17 specimen are quoted from previous work (Felten and Storch, 1968).

Dryomys niethammeri: the data of 3 specimen are quoted from previous work (Holden, 1996).

2. Methods

Age criteria: Specimens were assigned to larvae, juveniles and adult age primarily according to the body length, degree of tooth wear and the time of actual breeding.

Sexual dimorphism: Krystufek (Krystufek, 1985) found no statistically significant differences of morphology between males and females.

Color comparison: We compared the color of specimens from Tarim basin and northern Xinjiang with different ages, areas and collecting seasons.

Morphologic Measurements: The measurement methods were described in previous work (Holden, 1996; Yang et al., 2005; Xia et al., 2006). Cranial and dental measurements were taken with dial calipers graduated to tenths of millimeters. Skin color and body weights were recorded by collectors on the original skin tags. Measurements are abbreviated in the text as follows:

LHB	length of head and body
LT	length of tail
LHF	length of hind foot
LE	length of ear
CIL	condylo-incisive length
ZB	zygomatic breadth
IB	interorbital breadth
BBC	breadth of braincase
BR	breadth of rostrum
LN	length of nasals
LD	length of diastema
LBP	length of bony palate
LIF	length of incisive foramina
BIF	breadth of incisive foramina

CLM1-3	crown length of M1-M3
PPL	post-palatal length
LB	length of auditory bullae (to the anterior margin of the paraoccipital process)
BB	breadth of auditory bullae
BBO	breadth of the basioccipital

Statistical analysis: The measure data were analyzed by Origin7.5 (Data Analysis & Scientific Graphing Origin). Differences between the two groups of the specimens were tested by t-tests. Significant differences were considered according to the average value and standard deviation, in which $\alpha \leq 0.05$.

Ratio diagram: We used exactly the same method as Holden to make ratio diagram (Holden, 1996).

Principal components analysis: A principal components analysis was performed by Origin7.5 on variance-covariance matrix computed from seven log-transformed dimensions: length of body, length of tail, length of ear, length of incisive foramina, breadth of incisive foramina, length of auditory bullae and basioccipital breadth. These particular dimensions are chosen because they are informative and obtainable from most specimens. Other measurements available from the same set of specimens have relatively low scores and do not aid in separation of the samples in multivariate space when included (Holden, 1996).

Etymology: The species is named according to place where specimens were collected, i.e. Tarim (the largest basin in China).

Part 2 *Dryomys yarkandensis* sp. nov from Tarim (a new species)

1. Information of the new species

Holotype: No. N07, an adult female collected by Zhenhai Chen in June 2012, is deposited Center for disease prevention and control of Xinjiang (Xinjiang CDC). It was obtained from oasis orchard of desert in Tarim Basin (38°29'N, 77°32'E), 1211-1215 m. The measurements are listed in table 1.

Allotype: No. N32, an adult male deposited in Xinjiang CDC, was obtained from Tarim Basin in June 2012. The rest information is the same as holotype.

Paratype: No. N9, an adult female, is deposited in Institute of Zoology, Chinese Academy of Sciences. No. N27, an adult female, is deposited in Xinjiang CDC. The rest information is the same holotype.

The other 11 adult female specimens deposited in Xinjiang CDC, were obtained from Tarim Basin at the same time. The rest information was as same as holotype. All the measurement data are listed in table 1.

Contrast samples: Specimens of *D. nitedula* from northern Xinjiang, n=11.

Pups picture: 16-day-old and 26-day-old pups of both *D. nitedula* collected in Jinghe county

and the new species collected in Shache county were all bred in laboratory (figure 1c,d,e,f). All the measurement data are listed in table 1,2.

Table 1. The measurements of *Dryomys yarkandensis* sp. nov.

No.	BW (g)	LHB	LT	LE	LHT	CIL	LBP	LN	IB	ZB	BBO	LB	BB	BBC	LD	LIF
Holotype N7	21.3	83	96	13	21	23.9	4.87	9.12	5.16	14.2	1.85	7.9	4.8	12.5	6.46	2.62
Allotype N32	18.6	85		12	23	25.2	5.25	9.78	4.31	15.3	2.01	8.87	5.17	13.1	6.56	3.32
Paratype N9	21.0	92	101	12	22	25.2	5.17	9.9	4.53	15.0	2.04	8.39	4.98	13.3	6.53	3.21
Paratype N27	21.7	84		13	21	25.8	4.93	9.08	4.6	15.8	2.01	9.35	5.31	13.3	6.86	2.96
Paratype N14	24.2	83	98	12	22	25.1	5.09	9.56	4.2	15.5	1.81	8.45	5.18	12.9	6.6	2.68
Paratype N23	23.7	84	85	12	22	26.2	5.61	9.35	4.43	15.5	1.89	8.69	4.97	13.2	6.72	2.76
Paratype N15	23.6	83	100	13	21	24.6	4.43	8.44	4.3	14.6	1.9	8.51	4.6	12.4	6.25	2.92
Paratype N35	22.7	86		14	22	24.4	4.98	9.34	4.33	14.4	1.77	7.52	4.73	12.5	6.08	2.41
Paratype N34	22.0	81	101	14	22	25.8	5.39	9.52	4.69	16.1	1.95	8.65	5.84	13.3	6.52	2.88
Paratype N44	21.5	82	95	15	22	24.2	4.8	9.51	4.58	15.0	1.91	8.69	5.11	13.6	6.42	2.67
Paratype N13	21.3	85	99	12	20	24.2	5.03	8.98	4.2	14.7	1.75	8.29	5.03	12.8	6.3	2.49
Paratype N40	21.1	96		14	21	24.8	4.75	9.6	4.55	14.6	1.81	8.14	4.8	12.7	6.6	2.76
Paratype N43	21.1	92		11	20	25.3	5.3	9.75	4.5	15.3	1.91	8.39	5.15	12.9	6.44	2.53
Paratype N20	21.1	83		13	22	25.1	4.44	9.3	4.17	14.4	1.81	8.17	4.71	12.7	6.39	2.51
Paratype N33	20.6	85		11	21	24.7	5.73	9.44	4.36	15.4	1.76	7.7	5.12	13.1	6.45	2.52
X	21.7	85.6	96.9	12.7	21.5	25.0	5.1	9.35	4.46	15.1	1.88	8.38	5.03	13.0	6.48	2.75
SD	1.41	4.29	5.28	1.16	0.83	0.66	0.38	0.36	0.25	0.56	0.10	0.46	0.30	0.35	0.19	0.27

2. Description of holotype of the new species

Appearance: Its appearance is squirrel-like. Coat on the body and tail is heavy and soft, on the caudal is longer. There is a light black stripe from ear root through the eye to nose on both sides of the head each (figure 1a,b). The range of its body mass is between 16 grams and 30 grams. The average length of body is 85.6 (81-96) mm and length of the tail is 96.88 (85-101) mm, which is 110% of the body length. Ears short and rounded, its average length is 12.8 (11-15) mm. The length of hind foot is 21.4 (20-22) mm. There are four toes on the fore foot and five toes on the hind foot, on which there are six pads. The bilateral symmetry whiskers form a bushy tuft about 25-30 mm long.

Physical description: The back color of adult is hazel in Summer, and turn light brown after Autumn gradually, which close to tail color. Hair tip of belly is cream yellow, and root hair of belly is white. There is the boundary line between side of the body and belly, and the color of tail is dark than the back, light brown, and abdominal hair of tail slightly shallow.

There is light chestnut from the head to back of pup between 16-day-old and 26-day-old after birth, and a white on belly. At autumn the color of back and tail are turn light brown, hair tip of

belly become cream yellow. Also the color of tail is dark than back and the boundary line between side of the body and belly become clear (figure 1a,c,e).

Table 2. Compare of measurements between *D. yarkandensis* sp and *D. nitedula* from northern Xinjiang.

Measurement	Average $\pm$ SD (n) mm			T-test	Difference [#]
	Holotype N7	<i>D. y</i> (14)	<i>D. n</i> (11)		
Body weight (g)	21.3	21.91 $\pm$ 1.166	26.4 $\pm$ 4.0	$P = 0.0014^*$	-13.92
Head & body length	83.6	85.64 $\pm$ 4.448	92.73 $\pm$ 6.51	$P = 0.0063^*$	-7.51
Tail length	96	96.88 $\pm$ 3.276	93.9 $\pm$ 8.61	$P = 0.2319$	4.54
Ear length	13	12.79 $\pm$ 1.188	16.45 $\pm$ 2.69	$P = 0.00014^{**}$	-19.2481
Hind foot length	21	21.36 $\pm$ 0.745	20.27 $\pm$ 2.28	$p = 0.2522$	2.68
CIL	23.9	24.94 $\pm$ 0.682	25.74 $\pm$ 1.14	$P = 0.1352$	-5.83
Condylobasal length	22.6	24.01 $\pm$ 0.775	24.67 $\pm$ 1.69	$P = 0.2356$	0.99
LBP	4.9	5.04 $\pm$ 0.385	4.79 $\pm$ 0.182	$P = 0.0839^{**}$	-5.83
LN	9.1	9.35 $\pm$ 0.364	8.26 $\pm$ 0.65	$P < 0.0002^{**}$	13.91
IB	5.2	4.47 $\pm$ 0.258	4.41 $\pm$ 0.157	$P = 0.5347$	1.32
ZB	14.2	15.03 $\pm$ 0.590	16.04 $\pm$ 0.573	$P = 0.0062^*$	-6.25
BBO	1.9	1.87 $\pm$ 0.091	2.28 $\pm$ 0.334	$P = 0.0006^{**}$	-16.46
LB	7.9	8.35 $\pm$ 0.460	7.39 $\pm$ 0.541	$P < 0.0001^{***}$	13.50
BB	4.8	5.02 $\pm$ 0.313	5.41 $\pm$ 0.295	$P = 0.0191^*$	-6.32
BBC	12.5	12.95 $\pm$ 0.378	13.34 $\pm$ 0.372	$P = 0.0290^*$	-2.76
LD	6.46	6.47 $\pm$ 0.195	6.41 $\pm$ 0.482	$P = 0.4591$	1.68
LIF	2.62	2.71 $\pm$ 0.223	2.94 $\pm$ 0.371	$P = 0.2024$	-4.71
BIF	2.21	2.51 $\pm$ 0.205	1.88 $\pm$ 0.169	$P < 0.0001^{***}$	34.99
Interparietal length	2.8	2.74 $\pm$ 0.37	3.37 $\pm$ 0.528	$P = 0.475$	-16.3
Interparietal width	8.55	8.58 $\pm$ 0.55	9.61 $\pm$ 0.717	$P = 0.0023^*$	-10.16
Anterior palatal breadth	3.6	3.9 $\pm$ 0.21	4.24 $\pm$ 0.402	$P = 0.0023^*$	-7.5
Posterior palatal breadth	3.6	3.81 $\pm$ 0.11	4.21 $\pm$ 0.35	$P = 0.0277^*$	-8.64

*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$, #: $(D. y - D. n) \times 100 / D. n$, SD: Standard deviation,

D. y: *D. yarkandensis* sp., *D. n*: *D. nitedula* in northern Xinjiang.

Skull characteristic: There are two pairs of incisors, smaller incisive foramina, developed heekbones, bulky zygomatic arch, bigger auditory bullae, which is separated into several small space by bone membrane on the kull. The dental formula: 1:0:1:3/1:0:1:3. The chewing surfaces of each molar has a few columns of transvrsal enamel teeth ridge. The length of incisive foramina is very close to length of interparietal bone (or incae), which is 11% of CIL. The ratio of LB to BB is 1.66 (8.35/5.02), and the length of audirory bullae is 2.28 (8.35/3.66) times of upper toothrow length. Junction between interparietal bone and two parietal bone is 130 degrees of a contact angle (figure 2b). The nasal bone embed into frontal bone with a convex shape (figure 2d).

Skull Measurements: The measurement data are shown in Table 1. Basicranial Length: 24.9 (23.9-25.4) mm. Interorbital Breadth: 15 (14.4 -16.1) mm. Length of diastema: 9.35 (8.4-9.9) mm. Breadth of the basioccipital: 1.87 (1.8-4.04) mm. Length of auditory bullae: 8.35 (4.6-5.2) mm. Upper Toothrow Length: 3.66 (3.53-3.79) mm. Diameter of M3: 1.05 (0.98-1.1) mm. Breadth of incisive foramina: 2.51 (2.2-2.86) mm. Length of bony palate: 5.04 (4.43-5.61) mm. Breadth of braincase: 12.94 (12.4-13.6) mm. Height of braincase: 11.13 (10.85-12.1) mm.

Figure 1. The coat color of larvae and adults of the new species and *D. nitedula* in northern Xinjiang.

- (a) The coat color of adults of the new species (the left one) and *D. nitedula* in northern Xinjiang (the right two).
- (b) The black stripe from ears across eyes in the new species (the left one) and *D. nitedula* in northern Xinjiang (the right one).
- (c) The 16-day larval of the new species.
- (d) The 16-day larval of *D. nitedula* in northern Xinjiang.
- (e) The 26-day larval of the new species.
- (f) The 26-day larval of *D. nitedula* in northern Xinjiang.

Figure 2. Comparison of the nasals and interpariet bone between the new species and *D. nitedula* in northern Xinjiang.

- (a) Interpariet bone of *D. nitedula* in northern Xinjiang. (b) Interpariet bone of the new species.
(c) The nasals of *D. nitedula* in northern Xinjiang. (d) The nasals of the new species.

3. Identification features of the new species

By comparing morphology (table 1 and figure 1,2) and statistical analysis (table 2,3), there are differences in geography distribution (figure 3,4) and habitat among the dormice from Tarim basin and the specimens from *D. nitedulai*, *D. laniger* and *D. niethammeri*. The dormouse from Tarim basin is considered as a new species of the genus *Dryomys* and named *Dryomys yarkandensis* sp..

Figure 3. Distribution of different species of the genus *Dryomys* in Eurasia. The yellow color and the symbol ●, ◆, ■ represent *D. nitedula*, *D. laniger*, *D. niethammeri* and the new species *D. yarkandensis* sp. respectively.

Figure 4. Distribution of the new species *D. yarkandensis* sp. (■) and *D. nitedula* (▲) of northern Xinjiang in China.

The skull shape of the specimens from Tarim Basin is similar to Muridae, but has a smaller incisive foramina and bigger auditory bullae, which is divided into several small space by bone membrane. There have well-developed cheekbones, thick zygomatic arch and two pairs of incisors on the skull. Dental formula: 1:0:1:3/1:0:1:3. The chewing surfaces of each molar have several columns of transverse enamel teeth ridge.

The color of pup is light chestnut from the head to the back (figure 1c,e), and a white on the belly. At autumn the color of back and tail are gradually turn light brown, hair tip of belly become cream yellow, also the color of tail is dark than back and the boundary line between side of the body and belly become clear. The length of incisive foramina is very close to length of Interparietal bone (or incae).

The ratio between length of auditory bullae and breadth of auditory bullae is 1.66 (8.35/5.02), and the length of auditory bullae is 2.28 (8.35/3.66) times of Upper Toothrow Length. Junction between Interparietal bone and two parietal bone is 130 degrees of a contact angle (figure 2b). The nasal bone embed into frontal bone with a convex shape (figure 2d).

Part 3 Comparison with other three species of the genus *Dryomys*

1. Comparison with *D. nitedula* in northern Xinjiang

1.1 Physical description

Specimens from Tarim basin: The color of adult on the back is lighter hazel. The color of pup or sub-adult is light chestnut hair from head to back, and a white on belly. There are a light black stripe from ear root through the eye to nose on both sides of the head each (figure 2). The length of the tail is significantly longer than body, more than 10% of the body length (table 1).

D. nitedula from northern Xinjiang: Coat on the body of the adult, pup and sub-adult are russet. The black stripe is darker from ear root through the eye to nose on both sides of the head. The length of tail is equal or less to the length of the body.

1.2 Comparison of skull measurements with *D. nitedula* from northern Xinjiang

There are ten indexes of skull measurements in the new species very close to *Dryomys* in northern Xinjiang, which was not statistically significant (table 2). There are very significant difference in 7 mean values of LN, BBO, LB, UTL, DM3, BIF, LBP and significant difference in the mean value of LN, ZB, BB, BBC, Interparietal width, Anterior palatal bread, and Posterior palatal bread, in which there are four index value (DM3, BBO, Interparietal width and UTL) of new species over 10% of *Dryomys* in northern Xinjiang, and three index value (LN, LB and BIF) less than 11% of *D. nitedula* in northern Xinjiang. The ratio of LB to BB in new species is 1.66 higher than the ratio (1.53) of *D. nitedula* in northern xinjiang. The ratio of LB to length of upper toothrow in the new species is 2.28, which is large than the ratio in *D. nitedula* of northern Xinjiang (1.83). The length of incisive foramina is close to the length of interparietal bone in the new species, but only 88% in *D. nitedula* of northern Xinjiang.

1.3 Skull and teeth

Junction between interparietal bone and two parietal bone is 130 degrees of a contact angle in the new species (figure 2b), but less than 70 degree contact angle for *D.nitedula* of northern Xinjiang (figure 2a). The nasal bone embed into frontal bone with a convex shape for the new species (figure 2d), but with a flat mouthconvex shape for *D. nitedulai* in northern Xinjiang (figure 2c). There are open angle of two odontoid processes in third molar of maxillary (upper jaw) and four slots of the premolar in the new species (figure 5a), while amall open angle of two odontoid processes in third molar of maxillary (upper jaw) and three slots of the premolar in *D. nitedula* of northern Xinjiang (figure 5c). The transverse diameter of the third molar on mandibular was significantly smaller than that of the second molar in the new species (figure 5b), while the transverse diameter of the third molar on mandibular was slightly smaller than that of the second molar in *D. nitedula* of northern Xinjiang (figure 5d). The differences of the maxillary of skulls between the two species are shown in table 1-3, and the differences in appearance are shown in figure 6.

Table 3. The measurement values on the new species and the other three species of the genus *Dryomys*.

Measurement items	Average±Standard deviation (n) mm				
	<i>D. niethammeri</i>	<i>D. nitedula</i>	<i>D. laniger</i>	<i>D. nitedula</i> in X.J	The new species
Body weight (g)	33 (1)	28.9 ± 7.1 (11)	22.2 ± 3.73(17)	26.4 ± 4.0 (8)	21.91 ± 1.17 (14)
Head & body length	101 ± 2.82 (3)	97.2 ± 9.7 (55)	89.9 ± 3.96(17)	92.73 ± 6.51(11)	85.64 ± 4.45 (14)
Tail length	93 ± 0 (1)	87.7 ± 11.88(44)	66.9 ± 6.15(15)	93.9 ± 8.61 (10)	96.88 ± 3.28 (8)
Ear length	19.9 ± 1.41 (2)	14.9 ± 2.38 (52)	14.4 ± 1.38(16)	16.45 ± 2.69(10)	12.79 ± 1.19 (14)
Hind foot length	21 ± 0 (2)	21 ± 1.51 (55)	16.8 ± 1.1 (17)	20.27 ± 2.28(11)	21.36 ± 0.75 (14)
CIL	25.2 ± 0.26 (3)	23.9 ± 1.15 (56)	23.1 ± 3.73(17)	25.74 ± 1.14 (11)	24.94 ± 0.68 (14)
LBP	5.2 ± 0.07 (2)	5.3 ± 0.31 (37)	5.2 ± 0.35 (15)	4.79 ± 0.182 (9)	5.04 ± 0.385 (14)
LN	9.3 ± 0.26 (3)	9.1 ± 0.44 (36)	8.4 ± 0.47 (13)	8.26 ± 0.65 (11)	9.35 ± 0.36 (14)

IB	3.9 ± 0.15 (3)	4.1 ± 0.19 (39)	4.2 ± 0.16 (18)	4.41 ± 0.16 (11)	4.47 ± 0.26 (14)
ZB	15.9 ± 0 (1)	15.7 ± 0.85 (30)	14.4 ± 0.47 (13)	16.04 ± 0.57 (5)	15.03 ± 0.59 (14)
BBO	1.4 ± 0.1 (3)	2 ± 0.26 (57)	1.4 ± 0.16 (16)	2.28 ± 0.33 (9)	1.87 ± 0.09 (14)
LB	9 ± 0.15 (3)	7.3 ± 0.45 (60)	8.1 ± 0.21 (18)	7.39 ± 0.54 (11)	8.35 ± 0.46 (14)
BB	5.9 ± 0.15 (3)	5 ± 0.29 (55)	5.3 ± 0.18 (17)	5.41 ± 0.30 (9)	5.02 ± 0.31 (14)
LB/BB	1.53	1.46	1.53	1.37	1.66
BBC	12.9 ± 0.75 (3)	12.8 ± 0.39 (37)	12.6 ± 0.26 (12)	13.34 ± 0.37 (11)	12.95 ± 0.38 (14)
LD	6.3 ± 0.2 (3)	6.3 ± 0.34 (39)	5.8 ± 0.25 (18)	6.41 ± 0.48 (11)	6.47 ± 0.20 (14)
LIF	3.9 ± 0.06 (3)	3.6 ± 0.29 (39)	3.4 ± 0.2 (17)	2.94 ± 0.37 (9)	2.71 ± 0.22 (14)
BIF	2.2 ± 0.06 (3)	2 ± 0.19 (39)	1.9 ± 0.11 (18)	1.88 ± 0.17 (7)	2.51 ± 0.21 (14)

Figure 5. Comparisons of the crowns between the new species and *D. nitedula* in northern Xinjiang.

- (a) The dentition on left side of maxillary in the new species.
- (b) The dentition on left side of mandible in the new species.
- (c) The dentition on left side of maxillary in *D. nitedula* in northern Xinjiang.
- (d) The dentition on left side of mandible in *D. nitedula* in northern Xinjiang.

1.4 Habitat comparison

The new species is distributed in the desert oasis orchard, 1200 m above sea level in Tarim

Basin. The climate there is harsh, drought and hot in summer but dry and cold in winter (figure 7a). *D. nitedula* in northern Xinjiang is mainly distributed in mountain valley between 700 m to 1200 m above the sea level. The climate there is temperate, humidity and low temperature, and there are berries or orchard (figure 8b). It is obvious difference for the climates and habitats between the two distributions.

The color over the back of a new species is similar to yellow sand of the habitat backgrounds. The color of *D. nitedula* in northern Xinjiang is similar to brown of coniferous forest or dwarf shrub of the mountains in northern Xinjiang. This significant differences in color protection takes the dormouse to survive in them habitats.

Figure 6. Comparison of the skulls between the new species and *D. nitedula* in northern Xinjiang. T04 is *D. nitedula* in northern Xinjiang and N07 is the new species *D. yarkandensis* sp..

- (a) Ventral view of maxillary for *D. yarkandensis* sp. (b) Ventral view of maxillary for *D. nitedula*.
(c) Dorsal view of maxillary for *D. yarkandensis* sp. (d) Dorsal view of maxillary for *D. nitedula*.

2. Comparison with other three species in *Dryomye*

2.1 Comparison of morphology

The adult of new species displays a lighter color of bodily hair on the back than that of other three species of *Dryomye*, and the black spot, which spread on both sides of head from the rear of

niethammeri. Also considering the results of differences among habitats, we identified that the species of Tarim Basin is a new species, and its molecular genetics identification is going to further research. As a new species, it still remains empty for its distribution range, population situation and biological characteristics. It is urgent to develop further research on the new species from viewpoint of protection biology.

Distribution: The new species specimens had been obtained from this point in Tarim Basin only at present, other areas did not investigate in Xinjiang (figure 7b).

Biology data: Missing.

Check samples: 11 specimen of *D. nitedula* from northern Xinjiang, 6 deposited in Institute of Zoology, Chinese Academy of Sciences, 21247 ♂ in Altai county, 21752 ♀ in Fukan county, 26659 ♀ in Manashi county, 26708 ♀ in Nileke county, 27482 ♀ and 27481 ♀ in Sawuer mountain; 5 specimens deposited in the Herbarium of Xinjiang CDC, T3 ♀, T4 ♀, T5 ♂, T31 ♀ and T32 ♂ from Jinghe county of northern Xinjiang.

Reference sample data: from previous work (Holden, 1996).

D. niethammeri: n=3, Pakistan, 3 ♀.

D. laniger: n =21, Turkey, 5 ♂, 16 ♀.

D. nitedulai:n=85, Afghanistan n=10 (5♀, 5♂), Austria 2♀, Albania 1♀, Croatia n=2 (1 ♂, 1?), Georgia1?, Greece1♀, Hungary, n=2 (1♀, 1♂), Iran n=13 (6♀, 1♂, 6?), Italy1♂, Kazakhstan2♂, Lebanon 1?, Pakistan, n=9 (6♂, 3♀), Israel1♀, Poland2♂, Romanian=5 (3♀, 1♂, 1?), Russia2♀, Sweden1♂, Turkey n=23 (11♀, 10♂, 2?), Former-Yugoslavia, n=7 (3♀, 3♂, 1?).

Acknowledgment

First of all, we would like to thank Professor Yong MA in Institute of Zoology, the Chinese Academy of Sciences, for kind guidance on this article. For permission to conduct research in Xinjiang, we would like to thank Zhenghai CHENG for his contributions to information and collecting samples from Tarim Basin. The data were measured and the samples were raised in our lab with the help of students, especially Xinhui LI and Xiaoyan LIAO in Xingjiang Agricultural University.

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