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New records of two *Sorex* species (Soricidae) from South Korea

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Eight species of soricine shrews have been listed as occurring on the Korean Peninsula: *Sorex araneus* Linnaeus, *S. caecutiens* Laxmann, *S. gracillimus* Thomas, *S. isodon* Turov, *S. mirabilis* Ognev, *S. minutissimus* Zimmermann, *S. tundrensis* Merriam, and *S. unguiculatus* Dobson (Jones and Johnson 1960; Won 1968; Corbet 1978; Hoffmann 1987; Yoshiyuki 1988; Han 1994; Won and Smith 1999), although the inclusion of *S. araneus*, *S. tundrensis*, and *S. unguiculatus* should be carefully re-investigated. So far, only two of these species, *S. caecutiens* and *S. minutissimus*, have been reported from South Korea (Republic of Korea). Recently, however, we captured specimens of *S. mirabilis* and *S. isodon* on Mt. Odae, Kangwon-do, South Korea (Table 1), and identified a specimen captured fortuitously at Mt. Chombong, Kangwon-do (Paek and Jeong 1998) as *S. mirabilis*.

Measurement definitions

Eight external measurements were recorded (Table 2). These were: body weight, BW; total length, TL; tail length, T; forefoot length without claws, FF (su), and with claws, FF (cu); hind foot length without claws, HF (su), and with claws, HF (cu); and ear length, E. Definitions and methods of measuring these characters basically followed Abe et al. (1994). Four cranial and dental measurements were also made (see Table 2), and defined as follows: 1) Greatest length of skull, GL (the length from the anterior medial to the posteriormost points of the skull); 2) Width of brain case, WB (the maximum width of the brain case); 3) Rostral width, RW (the width between the outer margins of the right and left third upper unicuspid viewed from the crown side); 4) Length of upper unicuspid tooth row, UUL (the length from the anterior point of the first unicuspid to the posterior point of the fifth unicuspid, viewed from the crown). Digital callipers were used to make the GL and WB measurements, while the other cranial and dental characters were measured under a binocular microscope.

Sorex mirabilis Ognev, 1937

Sorex mirabilis is found from restricted regions of northeastern Asia (Stroganov 1957; Dolgov 1985; Hutterer 1993). On the Korean Peninsula, it has been recorded only from North Korea (Stroganov 1957; Jones and Johnson 1960; Won 1968).

Sorex mirabilis is the largest *Sorex* species in Asia, and no other species are morpho-

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Table 1. Collection locality and date of the two newly recorded soricine species from South Korea.

No.	Date	Location	Collection no.
<i>S. mirabilis</i>			
1	1 Oct. 1997	Mt. Chombong-san (800 m alt.), Yangyang-gun, Kangwon-do. N 38° 02' 35" E 128° 25' 40"	SO-99misc8
2	17 Oct. 1999	Mt. Odae-san (850 m alt.), Pyongchang-gun, Kangwon-do. N 37° 47' 03" E 128° 34' 23"	SO-99/10/17-3
3	19 Oct. 1999	ditto	SO-99/10/19-7
<i>S. isodon</i>			
4	18 Oct. 1999	Mt. Odae-san (820 m alt.), Pyongchang-gun, Kangwon-do. N 37° 46' 44" E 128° 34' 37"	SO-99/10/18-1
5	19 Oct. 1999	Mt. Odae-san (800 m alt.), Pyongchang-gun, Kangwon-do. N 37° 46' 12" E 128° 34' 37"	SO-99/10/19-2
6	ditto	Mt. Odae-san (850 m alt.), Pyongchang-gun, Kangwon-do. N 37° 47' 03" E 128° 34' 23"	SO-99/10/19-5
7	ditto	ditto	SO-99/10/19-6
8	20 Oct. 1999	ditto	SO-99/10/20-2

* Latitude and longitude were determined by GPS (Global Positioning System) in the field, except for No. 1.

Table 2. External, cranial, and dental measurements (in mm and gram) of *Sorex mirabilis* and *S. isodon* from South Korea.

No.	Sex	Age	BW	TL	T	FF(su, cu)	HF(su, cu)	E	GL	WB	RW	UUL
<i>S. mirabilis</i>												
1	uk	y	—	145*	68*	10.0, 11.6*	15.2, 17.7*	—	23.50	10.78	2.97	3.50
2	f	ow	15.7	171	73	9.7, 11.7	15.6, 17.0	10.5	22.90	10.73	2.74	3.33
3	m	y	15.3	158	69	10.3, 11.8	16.2, 17.7	—	23.45	10.77	2.93	3.47
<i>S. isodon</i>												
4	m	y	9.2	119	48	8.9, 10.8	13.6, 15.1	6.0	19.39	9.75	2.27	3.05
5	f	y	9.3	121	48	8.4, 10.0	14.3, 15.7	7.2	19.61	9.69	2.21	2.97
6	f	y	7.1	119	47	8.7, 10.1	13.0, 14.4	8.0	19.43	9.57	2.15	2.98
7	f	y	7.9	121	46	8.7, 10.5	13.0, 14.7	7.5	19.51	9.51	2.08	3.10
8	m	y	9.1	124	48	8.9, 10.5	13.6, 14.9	8.5	19.72	9.40	2.23	3.05

* Measured after being frozen and fixed in ethanol; thus, they should not be compared with other individuals directly. See text for abbreviations and definitions of the measurements. Numbers of individual corresponded with Table 1. uk=unknown sex; f=female; m=male; y=young of the year; and ow=overwintered individual.

logically similar to *S. mirabilis*. This species is characterized by: 1) large body size with a long (ca. >63 mm) and robust tail, 2) large skull size (>22 mm for the greatest length), 3) deeply bending anterior cusp and less developed posterior cusp of first upper incisor, and 4) the third unicuspid being smaller than the fourth (Yudin 1971; Corbet 1978; Dolgov 1985; Hoffmann 1987). All of the three specimens examined here possessed these diagnostic characters (Table 2, Fig. 1-A).

Sorex isodon Turov, 1924

Sorex isodon was formerly regarded as conspecific with *S. sinalis* Thomas (e.g. Corbet 1978; Dolgov 1985); however, it is now widely accepted that *S. isodon* occurs in north-eastern Asia, while *S. sinalis* is distributed only in central and western China (Hutterer 1993;

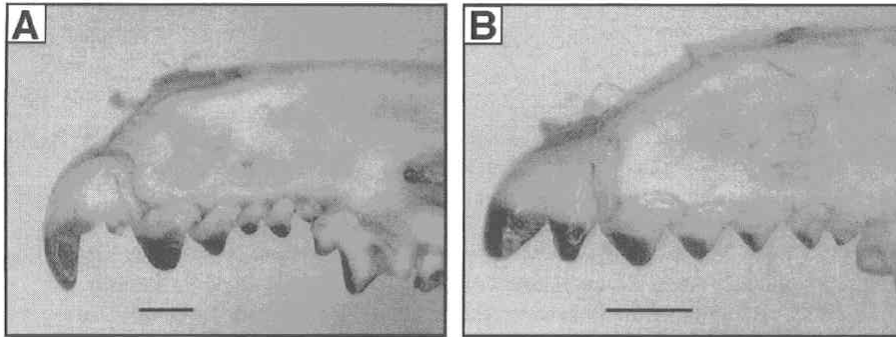


Fig. 1. Lateral left views of typical unicuspid tooth row and the first incisor of two *Sorex* species newly recorded from south Korea. A, *Sorex mirabilis* (collection number, SO-99misc8); B, *S. isodon* (SO-99/10/20-2). Horizontal bars=1 mm.

Wolsan and Hutterer 1998). *S. isodon* has only been recorded only from the northern part of peninsular Korea (Hoffmann 1987).

Sorex isodon is similar in body size to, or slightly smaller than, *S. unguiculatus*, which occurs in northeastern Asia. Because of their similarities, these two species are frequently misidentified. The most striking difference in their external features is in the length of their claws, with *S. unguiculatus* having much longer claws than *S. isodon* (Yudin 1971; Dolgov 1985; Hoffmann 1987). The major cranio-morphological characters distinguishing the two species are: 1) gradually reducing height of unicuspid from the first to the fifth upper unicuspid in *S. isodon*, while the second unicuspid is lower than, or as high as, the third one in *S. unguiculatus*, and 2) longer length of upper unicuspid tooth row relative to skull size in *S. isodon* than *S. unguiculatus* (Yudin 1971; Corbet 1978; Dolgov 1985). The relative lengths of the upper unicuspid tooth rows (UUL/GL \times 100) of the five specimens, were 15.1–15.9% (Table 2), while the average value for 391 young *S. unguiculatus* in Hokkaido was 14.6% \pm 0.40 *SD* (based on data base of *S. Ohdachi*). Considering the diagnostic characters mentioned above, we identified the five specimens obtained from South Korea as *S. isodon* (Table 2 and Fig. 1-B).

Miscellaneous information

During the survey on Mt. Odae, two *S. mirabilis* specimens were caught in Sherman live traps in rocky microhabitats with many apertures, while *S. isodon* were caught in pit-fall and Panchu pack (P-type) traps in the microhabitats including thick litter. Six *S. caecutiens* and one *Crocidura lasiura* Dobson were also captured during the four-night trapping session on Mt. Odae (17–20 October 1999). Specimens of *S. caecutiens* were captured by all three types of traps in various microhabitats.

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