

## Re-evaluation of the Status of *Chodsigoa sodalis* Thomas, 1913 (Mammalia: Insectivora: Soricidae)

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**Masaharu Motokawa, Hon-Tsen Yu, Yin-Ping Fang, Hsi-Chi Cheng, Liang-Kong Lin and Masashi Harada (1997)** Re-evaluation of the status of *Chodsigoa sodalis* Thomas, 1913 (Mammalia: Insectivora: Soricidae). *Zoological Studies* 36(1): 42-47. In 1913 Thomas described the shrew *Chodsigoa sodalis* from Taiwan based on only 1 skull. This species has been regarded as a synonym of *Soriculus (Episoriculus) fumidus* Thomas, 1913 because of insufficient information. The diagnostic features of *Soriculus (Chodsigoa) sodalis*, such as 3 upper unicuspid teeth, have been considered as a variation of *S. (E.) fumidus*. Recently we obtained 4 additional specimens from montane areas of Taiwan. In this paper, we confirm *S. (C.) sodalis* as a valid species and describe its external features for the first time.

**Key words:** *Soriculus (Chodsigoa) sodalis*, *Soriculus (Episoriculus) fumidus*, Taiwan, Taxonomy.

Thomas (1913) described 2 new shrews, *Soriculus fumidus* and *Chodsigoa sodalis*, from Alishan in central Taiwan. *Chodsigoa* Kastschenko, 1907 and *Episoriculus* Ellerman and Morrison-Scott, 1951 were treated as subgenera of *Soriculus* Blyth, 1854 by Ellerman and Morrison-Scott (1951), Hoffmann (1986), Corbet and Hill (1992), and Hutterer (1993) whom we tentatively follow in this paper, although they were regarded as distinct genera by Repenning (1967) and Jameson and Jones (1977). Differences in external, cranial, and dental features among these 3 subgenera (or genera) have been reported by Ellerman and Morrison-Scott (1951), Repenning (1967), and Hoffmann (1986). Since Ellerman and Morrison-Scott (1951), *S. fumidus* has been considered as a member of *Episoriculus* (Repenning 1967, Jameson and Jones 1977, Hoffmann 1986, Corbet and Hill 1992, Hutterer 1993).

While *Soriculus (Episoriculus) fumidus* is well

represented in collections, the description of *Soriculus (Chodsigoa) sodalis* was based on a single skull without skin (Thomas 1913). The holotype of *S. (C.) sodalis* has 3 upper unicuspid teeth which differ from the 4 of *S. (E.) fumidus*. However, the 4th unicuspid of *S. (E.) fumidus* is much smaller than the other 3 and is missing occasionally (Hanamura et al. 1980, Hoffmann 1986). Moreover, no specimens of *S. (C.) sodalis* other than the holotype had been obtained since 1913. Ellerman and Morrison-Scott (1951) left the status of *S. (C.) sodalis* uncertain. Then, Jameson and Jones (1977) and Hoffmann (1986) considered the holotype skull of *S. (C.) sodalis* an aberrant specimen of *S. (E.) fumidus*, regarding the former as a synonym of the latter. Corbet and Hill (1992) found some other qualitative differences between the holotype skull of *S. (C.) sodalis* and skulls of *S. (E.) fumidus*, but they tentatively retained *S. (C.) sodalis* in *S. (E.) fumidus* because the former was represented by

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just 1 skull. Recently, Yu (1993) collected 2 specimens which differ from *S. (E.) fumidus*, and thought that they might be *S. (C.) sodalis*. Hutterer (1993) included *S. (C.) sodalis* in *S. (E.) fumidus* with the comment, “additional specimens now suggest that *sodalis* may prove distinct (Hoffmann, in litt.)” In this paper, we report the rediscovery of *S. (C.) sodalis* in the montane areas of Taiwan and provide considerable details of the species based on the additional specimens.

## MATERIALS AND METHODS

We examined 4 additional specimens of *Soriculus (Chodsigoa) sodalis* from Nantou County, Taiwan. Among them, 2 specimens were collected from Le-Le hut by HTY, one from Tsuifeng by HCC, and one from Tunpu by YPF (Fig. 1). The former 3 specimens were preserved in ethanol and their skulls were extracted from the specimens. The last specimen was prepared as a skull and skin. The following external measurements were taken from fresh specimens: body weight (BW in g), head and body length (HB: either taken directly or by subtracting the tail length from the total length), tail length (T), hind foot length (HF: including claw), and ear length (E). Ten cranial measurements were taken with dial calipers to the

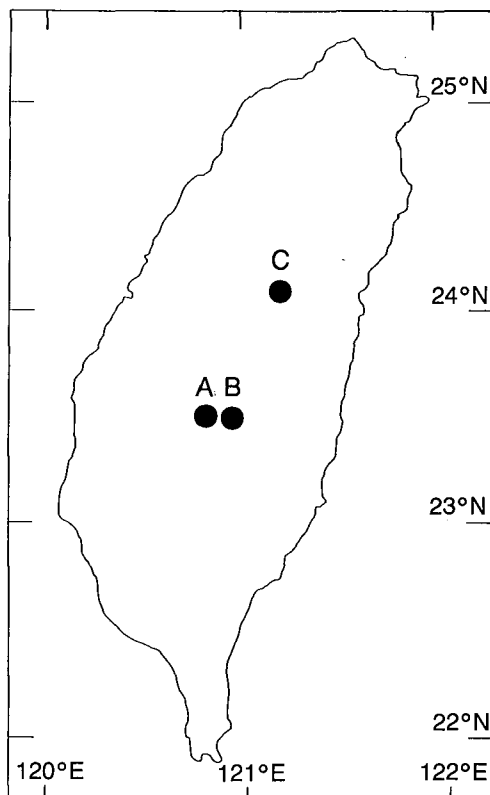


Fig. 1. Map of Taiwan showing the localities of the specimens of *Soriculus (Chodsigoa) sodalis* examined in the present study. A, Alishan ( $N = 1$ , holotype); B, Le-Le hut ( $N = 2$ ) and Tunpu ( $N = 1$ ); C, Tsuifeng ( $N = 1$ ).

Table 1. Measurements of *Soriculus (Chodsigoa) sodalis* and *Soriculus (Episoriculus) fumidus* (in mm). See text for key to abbreviations of measurements.

Measurement	<i>S. (C.) sodalis</i>				<i>S. (E.) fumidus</i>		
	<i>n</i>	Mean	(range)	Holotype <sup>a</sup>	<i>n</i>	Mean	(range)
BW	4	5.20	(4.2-5.6)	—	4	5.75	(5.6-6.0)
HB	4	68.00	(65.0-71.0)	—	4	67.75	(66.0-70.0)
T	4	68.88	(64.0-73.0)	—	4	44.75	(42.0-46.0)
E	3	9.37	(8.5-10.0)	—	4	8.95	(8.6-9.4)
HF	4	14.48	(13.5-15.0)	—	4	12.90	(12.6-13.4)
CBL	2	18.20	(18.0-18.4)	17.5	3	17.87	(17.7-18.0)
BB	3	8.77	(8.6-8.9)	8.5	3	9.13	(9.0-9.2)
IOB	3	4.43	(4.4-4.5)	4.5	3	4.30	(4.3)
HOB	3	4.17	(4.1-4.2)	4.7	3	5.07	(5.0-5.1)
UTR	4	7.85	(7.6-8.3)	7.7	3	8.03	(7.9-8.1)
LI1	4	1.33	(1.2-1.4)	1.4	3	1.47	(1.4-1.6)
P4M2	4	4.38	(4.1-4.9)	4.1	3	4.47	(4.4-4.5)
ML	4	11.23	(10.9-11.4)	—	3	11.70	(11.6-11.8)
LTR	4	7.25	(7.0-7.6)	—	3	7.37	(7.2-7.5)
MH	4	3.73	(3.5-3.9)	—	3	3.80	(3.7-3.9)

<sup>a</sup>from the original description by Thomas (1913).

nearest 0.1 mm by MM: condylo-basal length (CBL), greatest breadth of braincase (BB), interorbital breadth (IOB), height of braincase (HOB), length of upper tooth row (UTR), length of 1st upper incisor (LI1), length from anterior edge of 4th upper premolar to posterior edge of 2nd upper molar (P4M2), mandibular length from condyle to tip of 1st incisor (ML), length of lower tooth row from tip of 1st incisor to posterior edge of 3rd molar (LTR), and mandibular height at coronoid process (MH). Data for the holotype of *S. (C.) sodalis* housed in the Natural History Museum in London (BM(NH)), whose former name was the British Museum (Natural History), were taken from photographs provided by Dr. P. D. Jenkins. Dental terminology follows Jenkins (1984). Materials are deposited in the Museum of Vertebrate Zoology at the University of California, Berkeley (MVZ); the Zoological Museum, National Taiwan University, Taipei (NTUZM); Taiwan Endemic Species Research Institute, Chichi (TESRI); and the Department of Zoology, Kyoto University (KUZ).

***Soriculus (Chodsigoa) sodalis* (Thomas, 1913)**

*Chodsigoa sodalis* Thomas 1913: 216; Ellerman and Morrison-Scott 1951: 61.

*Episoriculus fumidus* Jameson and Jones 1977: 474 (in part).  
*Soriculus (Episoriculus) fumidus* Hoffmann 1986: 468 (in part);  
 Corbet and Hill 1992: 32 (in part); Hutterer 1993: 123 (in part).

*Soriculus* sp. Yu 1993: 418.

*Holotype*: BM (NH) 12.11.23.2, an adult skull from Mt. Arizan, central Formosa (= Alishan, Chiayi County, Taiwan, 23°31'N, 120°47'E). Alt. 8 000 ft collected by W. Goodfellow.

*Measurements*: Table 1.

*Description of the species*: A small and slender shrew with HB 65.0-71.0 mm, T 64.0-73.0 mm, and BW about 5 g (Fig. 2); body covered with long hairs (4-5 mm in length in mid-dorsum), blackish dark gray dorsum, dark gray ventrum, without boundary between dorsal and ventral coloration in winter pelage; snout dark grayish, with long vibrissae; tail dark olive brown, relatively long (about 100% of HB); tail annulations conspicuous; fore and hind feet relatively large, lighter in color, covered with short whitish hairs; ear large.

Cranium and mandible (Fig. 3) straight profile, slightly concave over orbital region; narrow and flattened braincase; maxillary covering infraorbital canal broad; broad rostrum; straight and broad posterior margin of palate; less developed sagittal and lambdoid crests; relatively long mandible; low and curved ascending ramus; large condylar process.

Sixteen teeth in upper dentition (Fig. 4); the tip of cusps reddish pigmented; anterior cusp of 1st upper incisor slender and proodont; posterior cusp small and narrow. Three upper unicuspid (4th absent) similar in height; oval in crown view;

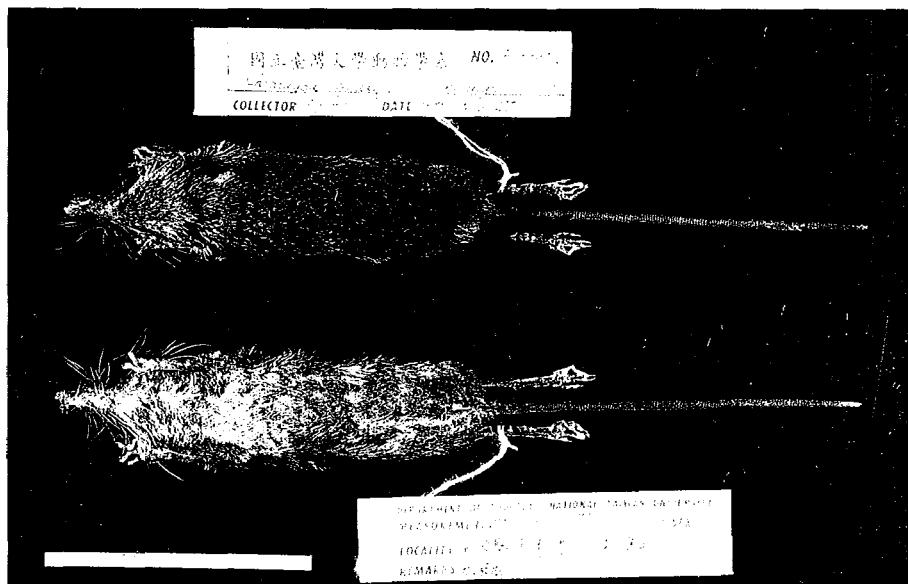


Fig. 2. Dorsal (upper) and ventral (lower) pelage of *Soriculus (Chodsigoa) sodalis* (NTUZM-FS 6001). The bar represents 5 cm.

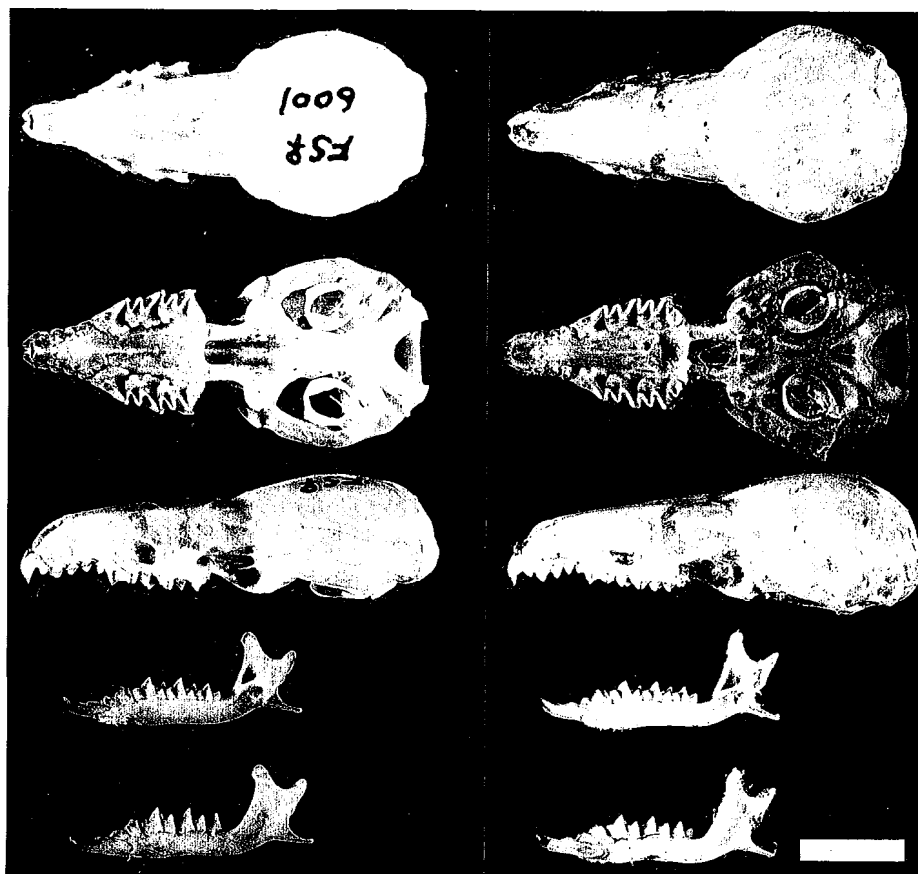
anterior wider than next 2. Parastyle of 4th upper premolar conspicuous and similar in height to 3rd upper unicuspid in labial view; talon posteriorly and lingually expanded and narrow; posterior margin broad and deeply concave; small protocone not expanded anterolingually; narrow distostyle in contact with 1st upper molar only at tip. Talons of 1st and 2nd upper molars expanded lingually and posteriorly, exceeding the level of metastyle; posterior margin broad but shallowly concave; 1st upper molar slightly larger than 2nd. Third upper molar shortened, metacone not expanded posteriorly.

Twelve teeth in lower dentition (Fig. 3). First lower incisor short; slightly curved; tapering gradually to tip forming a prominent cusp on posterior edge; lingual enamel extension reaching level of protoconid of 2nd lower incisor; the lateral extension reaching level of posterior margin of 2nd lower incisor. Second lower incisor slightly lengthened anteroposteriorly; posterolingual ridge poorly devel-

oped, without protostylid. Protostylid of 4th lower premolar present on posterior ridge; metaconid on posterolingual ridge developed. First and 2nd lower molars relatively short in crown view, lingual and buccal cingula weakly developed. Talonid and talonid basin of 3rd lower molar reduced anteroposteriorly.

*Comparison:* This species has been confused with *S. (E.) fumidus*, but many differences are found between these 2 species (Table 1; Figs. 3, 4). In external characters, this species has a much longer tail reaching ca. 100% of HB (versus ca. 65% in *S. (E.) fumidus*), larger hind foot and ear, and more slender body than *S. (E.) fumidus*. The tail of *S. (C.) sodalis* is covered by shorter and sparser hairs, and tail annulations are conspicuous; whereas tail of *S. (E.) fumidus* is covered by numerous short hairs, and annulations are inconspicuous.

As for cranial and dental characters, this species can be distinguished from *S. (E.) fumidus*



**Fig. 3.** Crania and mandibles of *Soriculus (Chodsigoa) sodalis* (NTUZM-FS 6001) (left) and *Soriculus (Episoriculus) fumidus* (KUZ-M 999) (right). Dorsal, ventral, and left lateral views of crania; lingual and lateral views of mandibles are shown (from upper to bottom). The bar represents 5 mm.



Fig. 4. Left upper dentition of *Soriculus (Chodsigoa) sodalis* (NTUZM-FS 6001) (upper) and *Soriculus (Episoriculus) fumidus* (KUZ-M 999) (lower). The bar represents 2 mm.

by the absence of 4th upper unicuspid; more concave posterior margin of 4th upper premolar, and 1st and 2nd molars; longer, more slender, and sharply hooked anterior cusp of 1st upper incisor, with relatively small posterior cusp; and more flattened braincase. These features are regarded as derived states of *Chodsigoa* from *Soriculus* and *Episoriculus* (Hoffmann 1986). This species also differs from *S. (E.) fumidus* in its shorter and broader palate; narrower braincase; relatively longer upper unicuspid; less developed protocone of 4th upper premolar; narrower talons of 1st and 2nd upper molars; more shortened metacone of 3rd upper molar; lower and more curved ascending ramus; and less developed paraconid of lower molars.

**Distribution:** Known from montane areas (1 560-2 438 m) of Taiwan. This species is sympatric with *S. (E.) fumidus* in Tsuifeng (2 300 m) and Alishan (8 000 ft = 2 438 m, Thomas 1913).

**Specimens examined:** *Soriculus (Chodsigoa) sodalis*: Le-Le hut, 5.5 km Batongguan Historical trail, Xinyi Township, Nantou County, Taiwan, 1 560 m (23°30'N, 120°55'E): MVZ 181108 (female), 181115 (male) (reported as *Soriculus* sp.

by Yu 1993); Tunpu, 6.5 km Batongguan Historical trail, Nantou County, Taiwan, 1 560 m (23°30'N, 120°55'E): NTUZM-FS 6001 (female); Tsuifeng, Nantou County, Taiwan, 2 300 m (24°06'N, 121°12'E): TESRI-M 55 (female); *Soriculus (Episoriculus) fumidus*: Tsuifeng, Nantou County, Taiwan, 2 300 m (24°06'N, 121°12'E): TESRI-M 56 (female), 57 (female), 58 (male), KUZ-M 995 (male).

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## 細尾長尾鼯分類地位之重新檢討

本川雅治<sup>1</sup> 于宏燦<sup>2</sup> 方引平<sup>2</sup> 鄭錫奇<sup>3</sup> 林良恭<sup>4</sup> 原田正史<sup>5</sup>

英國哺乳動物學家奧菲德湯瑪斯(Oldfield Thomas)在1913年只根據一個頭骨標本命名臺灣的新種鼯鼯——細尾長尾鼯 *Soriculus (Chodsigoa) sodalis*。但資料不足，多數分類學者都將其視為臺灣煙尖鼠 *Soriculus (Episoriculus) fumidus* Thomas, 1913 的同種異名(synonym)。且由於細尾長尾鼯的主要特徵，上顎具有三顆單尖齒(unicuspid teeth)，和臺灣煙尖鼠的特徵重疊(三顆或四顆單尖齒)，因此前者被視為後者的變異之一。近來我們自臺灣山區採得四隻和臺灣煙尖鼠外貌截然不同的鼯鼯，本文確認其為細尾長尾鼯，並首次描述其外部特徵。

關鍵詞：細尾長尾鼯，臺灣煙尖鼠，分類，臺灣。

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