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Melogale moschata.

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Melogale Geoffroy Saint-Hilaire, 1831

Melogale Geoffroy Saint-Hilaire, 1831:129. Type species *Melogale personata.*

CONTEXT AND CONTENT. Order Carnivora, Family Mustelidae, Subfamily Melinae (Wozencraft, 1993). The genus includes four species, *Melogale everetti* (Thomas, 1895), *M. moschata* (Gray, 1831), *M. orientalis* (Horsfield, 1821), and *M. personata* (Geoffroy Saint-Hilaire, 1831).

Melogale moschata (Gray, 1831)

Chinese Ferret-badger

Helictis moschata Gray, 1831:94. Type locality, "China." Restricted by Allen (1929:7) to "Canton, Kwangtung Province, South China, where the original specimen was secured by John Reeves" [Guangzhou, Guangdong Sheng, People's Republic of China].

CONTEXT AND CONTENT. Content same as for genus. Six subspecies currently are recognized (Ellerman and Morrison-Scott, 1966; Wozencraft, 1993):

M. m. ferreogrisea (Hilzheimer, 1905:298). Type locality listed by Hilzheimer (1906:176) as "Gekauft in Hankau" [Hankou, Hupeh Sheng, People's Republic of China].

M. m. millsi (Thomas, 1922*a*:432). Type locality, "*Hab.*—Naga Hills, Assam. Type from Mokokchung, 5,000′" [Mokokdung, Assam, India, 26°24′N, 94°32′E, ca. 1,500 m].

M. m. moschata (Gray, 1831:94), see above.

M. m. sorella (Allen, 1929:8). Type locality, "Futsing, Fukien, China" [Fuqing, Fujian Sheng, People's Republic of China, 25°43′N, 119°22′E].

M. m. subaurantiaca (Swinhoe, 1862:355). Type locality, "Formosa" (*modesta* Thomas is a synonym).

M. m. taxilla (Thomas, 1925:500). Type locality, "Ngai-Tio . . . at 4,800 feet [ca. 1,450 m], approximately at 22°40′N, 103°30′E, some fifty miles [80 km] south of Möng-tsze" (Thomas, 1925: 496) [Ngai Thau, Vietnam].

There is a great deal of confusion concerning the use of the name *Helictis*, to which this species was first assigned. The primary source of this confusion is the mistaken date of publication listed for *Melogale* (Geoffroy Saint-Hilaire, 1834), which in fact was published in 1831, and predated the publication of *Helictis* Gray (1831) by several months (Long, 1981; Wozencraft, 1993). This mistake was corrected by Ellerman and Morrison-Scott (1966), who also considered *Helictis* and *Melogale* as two distinct genera. Long (1978, 1981), Pocock (1941), and Everts (1968), considered the four species of ferret-badgers to belong to a single genus, *Melogale.*

DIAGNOSIS. The four species of ferret-badgers in East Asia are similar externally, but have very different cranial and dental characters. *Melogale moschata* (Fig. 1) can be distinguished from other species of ferret-badgers by several characters: P4 is one-fourth the total length of the upper cheek teeth; the outer edge of P4 is slightly concave; P1 is slightly smaller than P2; and the lower carnassial (m1) has the anterior trigon well developed and the three cusps are of equal size, whereas the heel is basin-like with a sharp-edged rim not showing distinct cusps (Fig. 2). The last lower molar (m2) is reduced yet distinct, round in cross section, and has outer and inner cusps. In contrast, in *Melogale personata* P4 is one-third the length of the cheek teeth and its outer edge is convex rather than slightly concave, and P1 is disproportionately smaller than P2 (Gao Yaoting et al., 1987; Pocock, 1941). In general, the molar teeth of *Melogale* are smaller and have narrower crowns relative to other species of ferret-badgers (Bonhote, 1903). The temporal ridges are low and are either parallel or slightly bowed out over the brain case; they are less prominent and more widely separated in *M. moschata* than in *M. personata* (Allen, 1938). The baculum of *M. moschata* is trifid with three terminal processes set in a symmetrical triangle: one slender, medial process and two thickened, hook-shaped lateral processes (Allen, 1938; Gao Yaoting et al., 1987; Pocock, 1941). In contrast, the baculum of *M. personata* ends in two asymmetrical processes (Gao Yaoting et al., 1987; Pocock, 1941).

GENERAL CHARACTERS. Members of the genus *Melogale* generally are more slender than true badgers but more heavily built than weasels. Body mass of *M. moschata* generally ranges from 0.8 to 1.6 kg (Gao Yaoting et al., 1987; Zheng and Yu, 1983). The limbs are short; the snout is long and cartilaginous and projects well beyond the lower jaw. The rhinarium is subcircular with no philtrum dividing the upper lip. The facial vibrissae are abundant and long. The external pinna is similar to that of *Mustela.* The bursa, tragus, and anti-tragus are well developed, although the supratragus is less valvular. The feet are not as broad as those of true badgers. The digits are webbed to the digital pads. The soles are naked to the heel. The claws are long, sturdy, slightly curved and nonretractile. The plantar pads are four-lobed, strongly arched, and are greater in length than width; all pads are transversely striated; and there are two small carpal pads and two elongated, continuous metatarsal pads (Gao Yaoting et al., 1987; Pocock, 1921).

The pelage is longish and coarse; general color of the upper parts is chocolate brown; hairs of the dorsum are pale basally; bleached tips of the longer hairs give the coat a silvery tone. The underparts are usually buffy, but sometimes yellowish or apricot; the hairs are pale chocolate basally except on the throat, where hairs are white to the root. White facial markings are variable, generally covering the sides of the face below the eye and in front of the ear, and continuous with the yellowish-white of the lips, chin, throat, and venter; there is a squarish white spot between the eyes in the median line; and a narrow, whitish stripe runs medially from the occiput, extending up to but rarely beyond the shoulders. In the other three species of ferret-badgers, this stripe is more continuous along the mid-dorsal line. The tail is bushy, pale chocolate all around with a white tip, and measures about half the length of the head and body (Allen, 1938; Gao Yaoting et al., 1987; Pocock, 1941; Zheng and Yu, 1983). There is no subcaudal pouch (Pocock, 1921).

Greatest length of the skull averages 77 mm in males and 75 mm in females; the cranial dimensions of males are only slightly larger than those of females (Allen, 1938). External, cranial, and dental measurements (mean, in mm) of adult male (n = 4) and female (n = 10) *M. moschata moschata*, respectively, from Hainan are as follows: greatest length of skull, 76.7, 74.8; basal length, 68.0, 65.6; palatal length, 33.8, 32.9; zygomatic width, 43.4, 43.1; mastoid width, 34.5, 34.8; width across molars, 21.5, 20.7; orbit to

FIG. 1. *Melogale moschata* (photograph by Gwilym S. Jones).

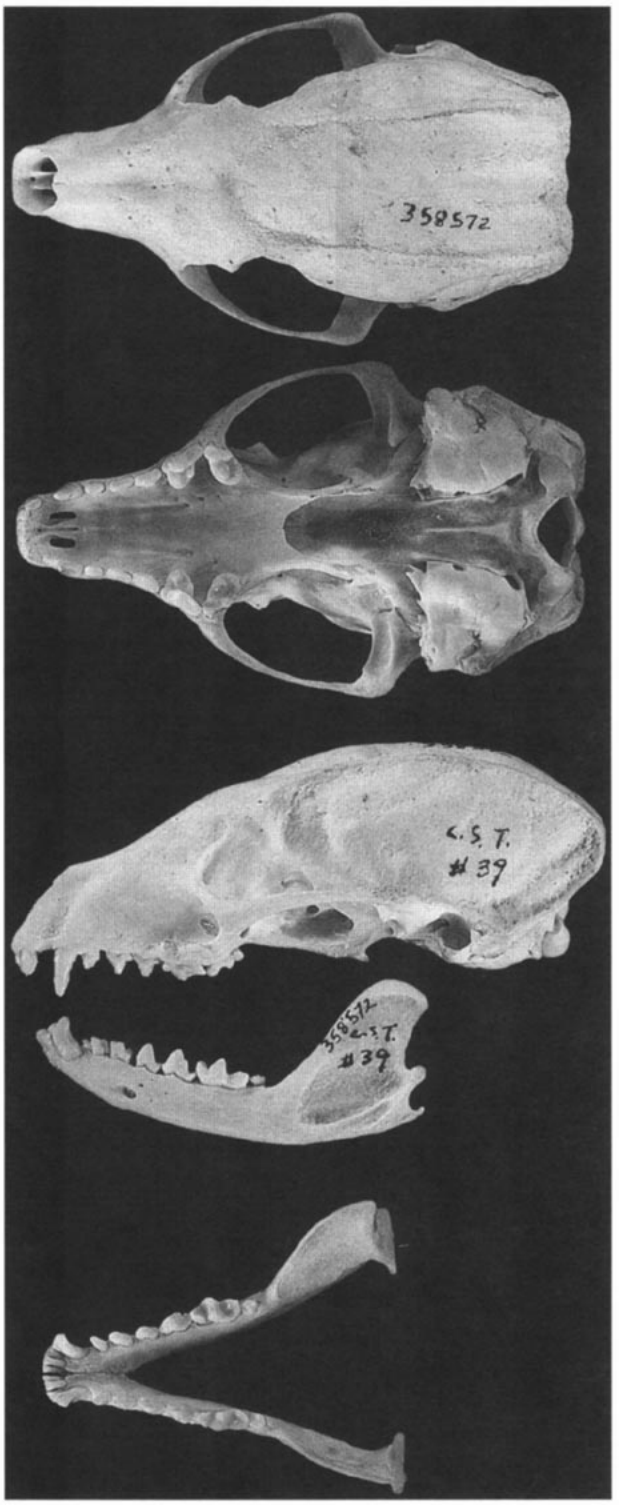

FIG. 2. Dorsal, ventral, and lateral views of the skull and lateral and dorsal views of the mandible of *Melogale moschata* (male, USNM 358572). Greatest length of skull is 75.0 mm.

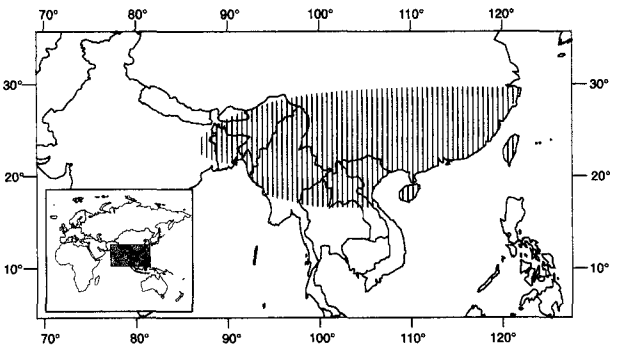

FIG. 3. Distribution of *Melogale moschata* in east Asia.

end of rostrum, 26.7, 25.8; upper cheek teeth, 22.6, 22.4; lower cheek teeth, 27.2, 26.6 (Allen, 1938). External and cranial measurements (mean and range, in mm) of adult *M. moschata moschata* (n = 28, sexes pooled) from mainland China are the following: total length, 385.6 (341–418); length of tail, 163.4 (140–192); length of hind foot, 57.9 (49–65); length of ear, 31.9 (27–37); zygomatic width, 44.9 (41.5–47.5); interorbital width, 19.2 (17.7–20.3); and length of mandible, 27.4 (25.1–29.8; Zheng and Yu, 1983). External measurements (mean and range, in mm) of adult male (n = 15) and female (n = 10) *M. moschata moschata*, respectively, from southern China are as follows: total length, 380.1 (340–418), 354.0 (315–400); length of tail, 150.3 (136–168), 155.0 (131–170); length of hind foot, 60.4 (55–65), 54.6 (49–61); and length of ear, 31.7 (26–38), 30.8 (24–34.4; Gao Yaoting et al., 1987). Cranial and dentary measurements (mean and range, in mm) of adult male (n = 15) and female (n = 7) *M. moschata moschata*, respectively, from southern China are the following: greatest length of skull, 79.3 (78.2–81.3), 78.1 (76.3–79.4); basal length, 70.3 (65.3–71.7), 68.1 (66.5–70.0); palatal length, 34.2 (33.0–35.9), 32.8 (32.3–33.8); zygomatic width, 46.1 (44.4–48.5), 43.3 (40.9–45.9); interorbital width, 20.6 (19.7–21.2), 20.2 (19.5–21.2); mastoid width, 36.5 (34.9–37.5), 35.7 (34.8–36.9); and length of mandible, 23.6 (22.2–24.8), 25.0 (22.2–27.5; Gao Yaoting et al., 1987). External measurements (mean and range, in mm) of adult male (n = 5) and female (n = 7) *M. moschata ferreogrisea*, respectively, from southern and western China are the following: total length, 379.4 (350–417), 372.1 (340–403); length of tail, 166.0 (160–175), 175.1 (150–211); length of hind foot, 60.4 (60–61), 61.0 (58–65); and length of ear, 32.0 (30–38), 33.3 (28–36; Gao Yaoting et al., 1987). Cranial and dentary measurements (mean and range, in mm) of adult male (n = 9) and female (n = 5) *M. moschata ferreogrisea*, respectively, from southern and western China are the following: greatest length of skull, 80.7 (78.6–82.9), 79.8 (78.0–81.9); basal length, 70.8 (68.0–73.8), 70.4 (67.9–75.5); palatal length, 35.4 (34.8–36.1), 35.8 (35.4–36.2); zygomatic width, 43.5 (41.0–45.2), 44.5 (41.9–45.6); interorbital width, 18.8 (18.2–19.3), 18.8 (18.1–19.2); mastoid width, 36.4 (34.2–37.8), 35.8 (34.1–38.2); and length of mandible, 24.4 (23.6–25.5), 24.3 (23.6–25.4; Gao Yaoting et al., 1987). External measurements (mean and range, in mm) of adult male (n = 3) and female (n = 4) *M. moschata taxilla*, respectively, from mainland China and Hainan are the following: total length, 401.7 (385–430), 334.3 (305–362); length of tail, 154.0 (115–192), 158.8 (145–176); length of hind foot, 58.3 (54–61), 54.1 (51–58); and length of ear, 29.0 (25–32), 28.0 (26–29; Gao Yaoting et al., 1987). Cranial and dentary measurements (mean and range, in mm) of adult male (n = 3) and female (n = 5) *M. moschata taxilla*, respectively, from mainland China and Hainan are the following: greatest length of skull, 79.0 (75.2–82.9), 74.9 (71.5–77.4); basal length, 70.6 (67.2–74.5), 64.7 (60.4–69.0); palatal length, 34.1 (32.4–35.1), 31.9 (29.2–37.0); zygomatic width, 46.2 (46.0–46.3), 39.0 (36.6–42.2); interorbital width, 20.2 (19.1–20.9), 18.8 (17.9–19.3); mastoid width, 37.0 (36.5–38.0), 34.7 (32.6–38.0); and length of mandible, 23.3 (22.7–24.3), 22.7 (19.1–25.4; Gao Yaoting et al., 1987).

The auditory bullae are thin-walled and are partitioned internally to form two anteroposterior chambers (Pocock, 1941). The coronoid process of the dentary is recurved, a feature not shared by other mustelids (Long, 1981). Other anatomical descriptions are provided by Gray (1831), Swinhoe (1862), and Thomas (1895, 1922*a*, 1922*b*, 1925). Herán (1971) described a low rate of dental abrasion in the genus *Melogale* relative to the other genera in Subfamily Melinae and other mustelids.

DISTRIBUTION. *Melogale moschata* occurs throughout southern China, Taiwan, Hainan, the northern portions of Vietnam, Laos, Thailand, and Burma, Bangladesh, and northeastern India (Fig. 3). *Melogale moschata* is known to occur at elevations below 2,000 m in the Nam Tamai valley of upper Burma (Pocock, 1941)

and the Naga Hills of Assam, India (Thomas, 1922*a*). There are no records of fossil occurrences.

FORM AND FUNCTION. The dental formula is i 3/3, c 1/1, p 4/4, m 1/2, total 38. Garrod (1879) reported on the soft anatomy of a single specimen of *M. moschata*. The tongue is covered with filiform papillae; the small intestine measures ca. 213 cm in length, the large intestine ca. 17 cm; there is no cecum. The lungs consist of four lobes on the right side, and two on the left; relative sizes were not noted. The enlarged right central lobe of the liver is deeply fissured and exposes the gall bladder on the diaphragmatic side.

The brain was described by Garrod (1879) as being typical of mustelids, although one peculiarity was noted: there is no crucial fissure, because the hippocampal gyrus is located on the superior aspect of the brain. Garrod (1879) remarked that this arrangement is unique among carnivores but occurs in several small-sized ruminant ungulates. The superior gyrus ceases at the superior posterior angle of the hemisphere and the anterior limb of the inferior gyrus is extremely narrow. A small sulcus divides the transverse portion of the middle gyrus from its posterior limb. The calcarine sulcus is not visible dorsally, and the precrucial sulcus is more fully developed in *M. moschata* than in *M. personata* (Beddard, 1905).

Two pea-sized anal glands open into the rectum near the sphincter (Garrod, 1879). These small anal glands show no abnormal development and it is not known whether they serve a defensive function. There are four inguinal mammae (Allen, 1938); the uterus is bicornuate (Garrod, 1879). Swinhoe (1862:356) described the eyes as "small and brown, and much sunken in the inner corner of the lids." The senses of smell and hearing are thought to be acute (Marshall, 1967).

ONTOGENY AND REPRODUCTION. Mating occurs in March, and a litter of 2–4 young is born in May or June (Gao Yaoting et al., 1987; Pocock, 1941). The neonates are blind and well-furred, with the same color and pattern as the adults; the eyes remain closed for at least two weeks. There is one record of a female who was still nursing two nearly full-grown young in June (Pocock, 1941).

ECOLOGY. *Melogale moschata* inhabits tropical and subtropical forests and wooded hillsides, but also occurs in grasslands and cultivated areas such as rice fields (Allen, 1938). Chinese ferret-badgers often live in close proximity to humans (Marshall, 1967).

Melogale moschata is omnivorous. Live prey consists of small birds, small rodents, lizards, insects, and earthworms; they also feed on fruit and berries (Gao Yaoting et al., 1987; Pocock, 1941). They are mainly terrestrial in their foraging habits, using their strong digging claws and probing snouts to dig for roots and earthworms (Gao Yaoting et al., 1987; Prater, 1980). However, Lekagul and McNeely (1977) suggested that snails and large tree-dwelling insects provide the incentive for their occasional arboreal forays. Ferret-badgers often are welcomed into native huts because of their usefulness in exterminating cockroaches and other insect pests (Pocock, 1941).

Ferret-badgers are seldom caught in live traps due to their wariness in approaching unfamiliar objects. In China they are caught by foot snares for their fur, which is used for collars and jackets. In some regions, particularly near Canton, they are snared for food (Marshall, 1967). There are no published records of predation on *M. moschata* by any animals other than humans.

Melogale moschata is uncommon in zoos, perhaps because they are difficult to maintain. If captured when young, however, they can become quite tame (Marshall, 1967). Brambell (1975) listed the Chinese ferret-badger among species that thrived in the small mammal house of the London Zoo, Regent's Park.

BEHAVIOR. *Melogale moschata* is nocturnal, crepuscular and mainly terrestrial. In a study of diel activity rhythms, Sheng (1982) found the animals to be active throughout the night, with peaks in activity at dusk and dawn. The general pattern of activity was the same in winter as in spring, although total activity was lower in winter. From March to mid-April the animals were active outside their burrows for an average of 40 min during peak hours of activity (dusk to dawn). From mid-December to mid-January the animals were active outside their burrows for an average of 30 min during nighttime hours. For a 24-hour period in the spring, males were active outside their burrows for an average of 8 h 20 min, and females were active for an average of 7 h 42 min. During the winter these values decreased to <6.5 hours for members of each sex. During the daylight hours the animals typically sleep in burrows or in natural shelters such as rock crevices. Taylor (1989:392) categorized *M. moschata* as "fossorial carnivores that do not typically initiate their own burrow systems but modify pre-existing ones."

The subspecies *M. m. subaurantiaca* which occurs only in Taiwan is reported to be an agile climber and often sleeps curled up on tree branches (Swinhoe, 1862). The mainland forms apparently are more terrestrial, but the slightly curved claws and the transversely striated pads on the feet suggest an aptitude for tree-climbing.

GENETICS. There are no published data on the karyology of *M. moschata*. There are two known reports of albino specimens of *M. m. subaurantiaca* from Taiwan (Jones and Tseng, 1968).

REMARKS. Long (1978) regarded *Melogale* as near the basal lineage of Recent badgers despite the facts that the prominent temporal ridges are unique among mustelids, and *Taxidea* is the only other badger with an upper carnassial (P4) larger than the adjacent molar (M1). *Melogale* retains four premolars in each jaw as does *Martes*, which is also considered a primitive mustelid genus and also may have been close to the ancestor of true badgers (Long, 1978; Neal, 1986). Pocock (1941:390) distinguishes the ferret-badgers from subfamily Mustelinae by structural characters "adapted for less active, less predatory, more fossorial habits." The specific epithet is derived from the Latin word *moschatus*, meaning "perfumed with musk" (Brown, 1956). The colloquial Chinese name for the animal, kay-che-bah, means "fruit civet" (Swinhoe, 1862). Other common Chinese names include baiman, baimei, baibizhu, shanhuan, and shanlai (Gao Yaoting et al., 1987).

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