

A synopsis of East Asian moles of the genus *Mogera* (Lipotyphla: Talpidae) with emphasis on Vietnamese populations

Alexei V. Abramov*, Dinh The Dung & Bui Tuan Hai

ABSTRACT. This paper presents a synoptic revision of the genus *Mogera* (Lipotyphla: Talpidae), based on morphological and genetic data. A total of ten species are recognized, which are represented by two lineages: the northern, or “Japanese”, lineage and the southern, or “Chinese”, lineage. Both lineages contain continental and insular species. The Japanese lineage includes the continental species *M. robusta* and the insular species *M. wogura*, *M. tokudae*, *M. imaizumii*, and *M. etigo*, while the Chinese lineage includes the continental species *M. latouchei* and the insular species *M. hainana*, *M. kanoana*, *M. insularis*, and *M. uchidai*. Information on morphology, genetic data, distribution, natural history, and taxonomy is provided for each species. The distribution of *M. latouchei* in Vietnam was analysed based on available information and museum specimens.

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Обзор восточноазиатских кротов рода *Mogera* (Lipotyphla: Talpidae) с акцентом на вьетнамские популяции

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РЕЗЮМЕ. Представлен краткий обзор рода *Mogera* (Lipotyphla: Talpidae), основанный на морфологических и генетических данных. Известно в общей сложности 10 видов, которые представляют две линии — северную, или “японскую”, и южную, или “китайскую”, обе линии содержат континентальные и островные виды. “Японская” линия включает континентальный вид *M. robusta* и островные *M. wogura*, *M. tokudae*, *M. imaizumii*, *M. etigo*; “китайская” линия включает континентальный вид *M. latouchei* и островные *M. hainana*, *M. kanoana*, *M. insularis*, *M. uchidai*. Для каждого вида представлена информация о морфологии, генетических данных, распространении и естественной истории, а также таксономические комментарии. Распространение *Mogera latouchei* во Вьетнаме проанализировано на основе доступной информации и музейных образцов.

КЛЮЧЕВЫЕ СЛОВА: Talpidae, *Mogera*, таксономия, распространение, местообитания, Вьетнам.

Introduction

The Asian fossorial moles of the genus *Mogera* Pomel, 1848 are distributed across eastern and south-eastern Asia, from the Far East of Russia and the Japanese islands, through mainland China, Hainan and Taiwan islands (China) to northern Vietnam.

The number of species in the genus *Mogera* and its taxonomic content are still controversial. This has varied

depending on the interpretation of several morphological characters at species and genus levels. According to previous revisions (Stroganov, 1948; Gureev, 1979), only three *Mogera* species were recognized: two in mainland eastern Asia (*M. robusta* in the northern part of the area and *M. latouchei* in the southern part), and one insular species, *M. wogura*. The latter species is distributed throughout the Japanese islands except Hokkaido and has spread to the Korean Peninsula and the southern

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part of the Russian Far East (near Khasan Lake). Further researches led by Japanese scientists (Abe, 1995; Kawada *et al.*, 2001, 2007) have significantly increased the number of insular *Mogera* species. According to recent checklists, the genus *Mogera* consists of up to nine species (Hutterer, 2005; Kawada *et al.*, 2007; Krystufek & Motokawa, 2018); however, the taxonomic content of the genus differs in these reviews (see Table).

All phylogenetic analyses clearly support the monophyly of *Mogera* (Tsuchiya *et al.*, 2000; Shinohara *et al.*, 2004, 2014; Kawada *et al.*, 2007; Zemlemerova *et al.*, 2013). Phylogenetic data for all known East and Southeast Asian *Mogera* taxa (excluding *M. uchidai*) are now available using mitochondrial and nuclear gene sequences. The phylogenetic relationships revealed by various studies differ slightly based on the combination of genes used (Fig. 1).

Here, we present a taxonomic synopsis of the genus *Mogera*, focusing on the available information regarding the Vietnamese populations.

Material and methods

This synopsis is based on literature-derived data and data from museum collections. Collections from seven zoological depositaries were studied: Institute of Biology of the Vietnam Academy of Science and Technology (Hanoi, Vietnam), VNU University of Science (Hanoi, Vietnam); Zoological Institute of the Russian Academy of Sciences (Saint Petersburg, Russia); Zoo-

logical Museum, Moscow State University (Moscow, Russia); Natural History Museum (London, UK); the National Museum of Nature and Science (Tokyo, Japan); Museum of the Faculty of Agriculture, Hokkaido University (Sapporo, Japan); Taiwan Biodiversity Research Institute; and Taichung National Museum of Natural and Science.

Synopsis of the genus *Mogera*

Family Talpidae G. Fischer, 1814

Genus *Mogera* Pomel, 1848

Type species: *Talpa wogura* Temminck, 1842

Insular species of *Mogera*

1. *Mogera imaizumii* (Kuroda, 1957) — small Japanese mole

Terra typica: Shiobara, Tochigi Prefecture, Honshu, Japan.

Distribution. Japanese islands — northeastern part of Honshu, southwestern Honshu, Shikoku, and some adjacent small islands.

Morphology. Head and body length = 121.0–159.0 mm; tail length = 14.0–22.0 mm; tail is 10–15% of the head and body length (Kawada & Yokohata, 2009a).

Genetics. Karyotype is $2n = 36$, $FNa = 54$ (Kawada *et al.*, 2001). Based on molecular data, the species is a sister species to the *M. wogura* + *M. robusta* clade (Shinohara *et al.*, 2008; Zemlemerova *et al.*, 2019).

Table. Taxonomic content of *Mogera* according to different authors.

| Stroganov, 1948; Gureev, 1979 | Corbet, 1978 | Corbet & Hill, 1992 | Abe, 1995 | Hutterer, 2005 | Kawada <i>et al.</i> , 2007 | Krystufek & Motokawa, 2018 | This study |
|---------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------|------------------------------------------|----------------------------------------|
| <i>wogura</i> (incl. <i>insularis</i> , <i>hainana</i> , <i>coreana</i>) | <i>wogura</i> (incl. <i>insularis</i>) | <i>wogura</i> | <i>wogura</i> (incl. <i>robusta</i> , <i>coreana</i>) | <i>wogura</i> (incl. <i>robusta</i> , <i>coreana</i>) | <i>wogura</i> (incl. <i>robusta</i> , <i>coreana</i>) | <i>wogura</i> | <i>wogura</i> |
| <i>robusta</i> | <i>robusta</i> (incl. <i>tokudae</i>) | <i>robusta</i> | | | | <i>robusta</i> | <i>robusta</i> (incl. <i>coreana</i>) |
| | | | <i>minor</i> (incl. <i>imaizumii</i>) | <i>imaizumii</i> | <i>imaizumii</i> | <i>imaizumii</i> | <i>imaizumii</i> |
| | | | <i>tokudae</i> (incl. <i>etigo</i>) | <i>tokudae</i> (incl. <i>etigo</i>) | <i>tokudae</i> | <i>tokudae</i> | <i>tokudae</i> |
| | | | | | <i>etigo</i> | <i>etigo</i> | <i>etigo</i> |
| | | <i>insularis</i> (incl. <i>latouchei</i> , <i>hainana</i>) | <i>insularis</i> (incl. <i>latouchei</i> , <i>hainana</i>) | <i>insularis</i> (incl. <i>latouchei</i> , <i>hainana</i>) | <i>insularis</i> | <i>insularis</i> (incl. <i>hainana</i>) | <i>insularis</i> |
| <i>latouchei</i> | | | | | <i>latouchei</i> | <i>latouchei</i> | <i>latouchei</i> |
| | | | | | <i>hainana</i> | | <i>hainana</i> |
| | | | | | <i>kanoana</i> | <i>kanoana</i> | <i>kanoana</i> |
| | | | | <i>uchidai</i> | <i>uchidai</i> | <i>uchidai</i> | <i>uchidai</i> |

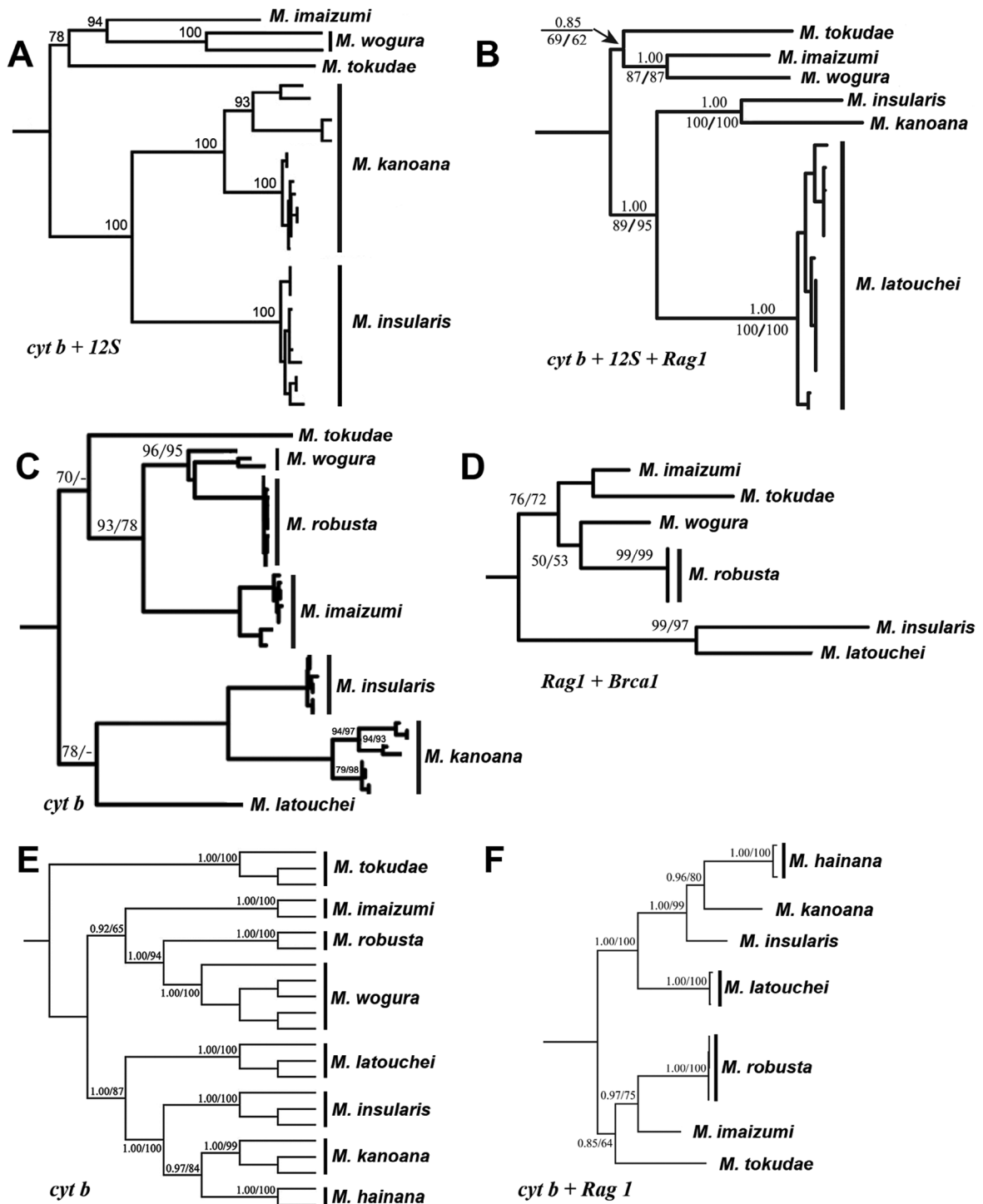


Fig. 1. Phylogenetic hypotheses of the genus *Mogera* based on molecular data. A — from Kawada *et al.* (2007): neighbour joining tree constructed from the *cyt b* (1140 bp) and *12S* (~840 bp) gene sequences. Numbers at nodes are bootstrap values (percentages of 1000 replications). B — from Shinohara *et al.* (2014): maximum-likelihood (ML) tree constructed from the *cyt b* (1140 bp), *12S* (~830 bp), and *Rag1* (1010 bp) gene sequences without partitioning. Bootstrap values in non-partitioned ML, partitioned ML analyses, and posterior probabilities in Bayesian analysis are shown on each node, respectively. Branch lengths are given as the ML distance with the selected model. C–D — maximum likelihood (ML) trees from Zemlemerova *et al.* (2013), constructed from: C — the *cyt b* (1140 bp), D — 1990 bp sequence combined from the nuclear genes *Brca1* and *Rag1*. Numbers at nodes are bootstrap values in ML/MP methods, respectively. E–F — partitioned Bayesian trees from Tu *et al.* (2022), constructed from: E — the *cyt b* (1140 bp), F — the combined datasets of *cyt b* (1140 bp) and *Rag1* (1001 bp). Numbers at nodes represent Bayesian posterior probabilities and bootstrap values.

Natural history. It occurs from sea level to mountains up to 2000 m above sea level, but is most abundant in steep mountains and lowland fields with deep, fine-textured soil and sufficient moisture (Abe, 1968). In southwestern Japan, the species is peripatric and occasionally sympatric with *M. wogura* (Kawada & Yokohata, 2009a).

2. *Mogera wogura* (Temminck, 1842) — Japanese western mole

Terra typica: Japan. Thomas (1905) restricted it to Yokohama (Kanagawa Prefecture, Honshu). Abe (1995) believed that a different species occurred near Yokohama, which he named *Mogera minor*. According to Abe (1995), the true *M. wogura* is distributed across Kyushu, Shikoku, and the southern part of Honshu (as well as the Russian Far East, Korea, and northeastern China), and its type locality should be restricted to “Nagasaki Prefecture or elsewhere in western or southern Kyushu where small-bodied moles are found”.

Distribution. Japanese islands — southwestern Honshu, Shikoku, Kyushu, Goto, Tsushima, and surrounding small islands.

Morphology. Head and body length = 125.0–185.0 mm, tail length = 14.5–27.0 mm (Kawada & Yokohata, 2009b). Northern populations are large than the southern ones.

Genetics. Karyotype is $2n = 36$, $FNa = 52$ (Kawada *et al.*, 2001). Based on molecular data, this species is a close relative of *M. robusta* (Zemlemerova *et al.*, 2019).

Natural history. It is found in various habitats, including forests, grasslands, pastures, farms, and agricultural fields at middle and low elevations. It is peripatric and sometimes sympatric with *M. imaizumii*. It is one of the most common wild mammal species in Japanese cities and towns (Kawada & Yokohata, 2009b).

3. *Mogera tokudae* Kuroda, 1940 — Sado mole

Terra typica: Japan, Sado Island.

Distribution. Japanese islands — known only from Sado Island.

Morphology. Head and body length = 149.0–167.0 mm; tail length = 22.0–28.0 mm (Kawada & Yokohata, 2009c).

Genetics. Karyotype is $2n = 36$, $FNa = 60$ (Kawada *et al.*, 2001). Based on molecular data, the species is a sister species to *M. etigo* (Tsuchiya *et al.*, 2000), which is sometimes considered to be a subspecies of it.

Natural history. It is found in alluvial plains with soft soil and steep mountains.

4. *Mogera etigo* Yoshiyuki et Imaizumi, 1991 — Echigo mole

Terra typica: Inugaeshi-shinden, Shirone-shi, Echigo Plain, Niigata Prefecture, Honshu, Japan.

Distribution. Japanese islands — known only from Echigo Plain (western Honshu),

Morphology. Largest *Mogera* among Japanese species. Head and body length = 162.0–182.0 mm; tail length = 19.0–30.0 mm (Kawada & Yokohata, 2009d).

Genetics. Karyotype is $2n = 36$, $FNa = 54$ (Kawada *et al.*, 2001).

Comments. It was previously considered a subspecies of *M. tokudae*, which is distributed across Sado Island near the Echigo Plain in Honshu.

5. *Mogera uchidai* (Abe, Shiraishi et Arai, 1991) — Senkaku mole

Terra typica: west coast of Uotsuri-jima Island, Senkaku Islands, Ryukyu Islands, Japan.

Distribution. Japanese islands — known only from Uotsuri-jima Island of the Senkaku Islands. This island is located approximately 160 km northeast of Taiwan.

Morphology. Known only one type specimen. Head and body length = 129.9 mm; tail length = 12.0 mm.

Genetics. Karyotype is unknown. No genetic data are analyzed.

Natural history. Information about its habitats and ecology is lacking. Uotsuri-jima is a very small island (approximately 4 km²) with relatively well-developed cloud forests in the mountainous central region (Mount Narahara, 362 m), which is probably the main habitat of *M. uchidai*. The ecosystem of Uotsuri-jima Island has been devastated by the introduced feral goat (*Capra aegagrus*) population, which has been present since 1978 (Yokohata *et al.*, 2003).

Comments. The species was originally attributed to a new genus, *Nesosaptor* Abe, Shiraishi et Arai, 1991. This genus was mainly established on the basis of the dental formula and the presence of two central cusps on the third lower premolar, as well as the morphology of the tympanic bulla (Abe *et al.*, 1991). *Nesosaptor* has 38 teeth since it lacks one pair of lower incisors and two pairs of premolars (one in the upper jaw and one in the lower jaw), compared to the plesiomorphic condition of 44 teeth in *Talpa* Linnaeus, 1758 and *Euroscaptor* Miller, 1940, and 42 teeth in *Mogera* (Abe *et al.*, 1991). Based on morphological analyses, Motokawa *et al.* (2001) suggest that *N. uchidai* is most similar to the Taiwanese species *M. insularis*, and propose synonymizing the genus *Nesosaptor* with *Mogera*. However, the dentition of the holotype was considered abnormal, and *M. uchidai* was defined as a valid endemic species of Uotsuri-jima Island.

6. *Mogera insularis* (Swinhoe, 1863) — Formosan mole

Terra typica: Taiwan Island, China.

Distribution. Taiwan Island.

Morphology. Head and body length = 112.0–134.0 mm; tail length = 6.5–11.5 mm.

Genetics. Karyotype $2n = 32$, $NFa = 58$ (Kawada *et al.*, 2001). A sister species of *Mogera kanoana*.

Natural history. It occurs in the lowlands of western Taiwan.

Comments. *Mogera hainana* from Hainan Island, *M. kanoana* from Taiwan, and *M. latouchei*, which is found in mainland China and Vietnam, were previously considered subspecies of *M. insularis* (Hutterer, 2005), but are now recognized as distinct species. Kawada *et*

al. (2007) suggested that the border between the two Taiwanese species may lie along the western edge of the Central Mountains.

7. *Mogera kanoana* Kawada, Shinohara, Kobayashi, Harada, Oda et Lin, 2007 — Kano's mole

Terra typica: Tatchia, Yushan National Park, Nantou Province, Taiwan Island, China.

Distribution. Mountains of Taiwan, found in Mt. Alishan (Chiayi Province), Sofong (Hualian Province), and the Kenting National Park (Pingtung Province) (Kawada *et al.*, 2007).

Morphology. Head and body length = 113.0–133.5 mm; tail length = 8.5–13.5 mm.

Genetics. Karyotype $2n = 32$, $NFa = 58$, identical to that of *M. insularis* (Kawada *et al.*, 2007). Molecular data suggest that *M. kanoana* is most closely related to *M. insularis*, the genetic distance between these two species for *cytb* and *12S* is 7.5% and 2.7%, respectively (Kawada *et al.*, 2007).

Natural history. It occurs in both mountainous and lowland areas of Taiwan. The geographic borders of the distributions of *M. insularis* and *M. kanoana* in Taiwan are unknown. According to Kawada *et al.* (2007), one population of *M. kanoana* is located in the central mountains and two populations are found in the eastern lowlands.

Comments. Based on craniological measurements and mtDNA analysis, Kawada *et al.* (2007) proposed that Taiwanese moles should be classified as two distinct species: *M. insularis* in the northern and western lowlands, and *M. kanoana* in the central mountains and eastern and southern Taiwan.

8. *Mogera hainana* Thomas, 1910 — Hainan mole

Terra typica: Mount Wuchi, Hainan Island, China.

Distribution. Hainan Island.

Morphology. Head and body length = 120.0–134.0 mm; tail length = 9.0–12.0 mm.

Genetics. Karyotype is unknown. The genetic distance between this species and other *Mogera* species is rather high, ranging from 9.4% to 14.4% (Tu *et al.*, 2022). Molecular data suggest that *M. hainana* is a sister species of *M. kanoana* and *M. insularis*. Mitogenome data revealed that it diverged from *M. insularis* recently (Tu *et al.*, 2022).

Natural history. It is distributed from sea level to low mountains and is found in diverse habitats, including natural forests and cultivated fields (Tu *et al.*, 2022).

Mainland species of *Mogera*

9. *Mogera robusta* Nehring, 1891 — Ussuri mole

Terra typica: Vladivostok, Primorsky Krai, Russia.

Distribution. Russian Far East, Korean Peninsula, northeastern China.

Morphology. Head and body length = 142.0–196.0 mm; tail length = 16.0–33.0 mm.

Genetics. Karyotype $2n = 36$, $NFa = 58$ (Kawada *et al.*, 2007).

Natural history. Lives in a variety of habitats but prefers broadleaf forests in river and stream valleys. The species is also common at the edges of forests, on deforestation sites, and in harems. It usually avoids coniferous forests and treeless habitats, and occurs from sea level up to 350–400 m.

Comments. Some authors have considered it to be a subspecies of *M. wogura* (Abe, 1995; Hutterer, 2005; Koh *et al.*, 2012; Kirihara *et al.*, 2013; He *et al.*, 2014). However, based on morphological characteristics, other researchers recognize *M. robusta* as a distinct species (Stroganov, 1948; Okhotina, 1966; Corbet, 1978; Krystufek & Motokawa, 2018). Comprehensive morphological and genetic analyses of Far Eastern populations (Zemlemerova *et al.*, 2019) support the species status of *M. robusta*. The authors suggest that the small-sized form *coreana* from the Korean Peninsula should be considered a subspecies of *M. robusta* rather than *M. wogura*. The split between *M. wogura* s. str. and *M. robusta* dates back to the Middle Pleistocene (0.30–1.0 Myr), while *M. r. coreana* separated from *M. r. robusta* in the Upper Pleistocene (0.04–0.18 Myr) (Zemlemerova *et al.*, 2019).

10. *Mogera latouchei* Thomas, 1907 — La Touche's mole

Terra typica: Kuantun, Fujian Province, China.

Distribution. Southern and southeastern China, northern Vietnam. Probably also distributed in Laos (Abramov, 2021).

Morphology. Specimens from Vietnam: head and body length = 112.0–127.0 mm; tail length = 12.0–15.5 mm. Specimens from southern China are smaller (Allen, 1938): head and body length = 87–115 mm, tail length = 15–20 mm.

Genetics. Karyotype $2n = 30$, $NFa = 52$ (Kawada *et al.*, 2008). According to published data, *M. latouchei* has the lowest diploid number in the Talpidae family (Kawada *et al.*, 2008, 2010).

Natural history. In Vietnam, the species is found in open grasslands and agricultural fields at elevations ranging from 200 m in former Bac Giang Province to 1400 m in Lao Cai Province. It is reported to be common in the hill country of southern China, as well as in high mountains (Hoffmann & Lunde, 2008). A wide co-occurrence with *Euroscaptor* spp. has been reported in southern China (Hoffmann & Lunde, 2008). In Vietnam, the distribution areas of *M. latouchei* and three species of *Euroscaptor* (*E. orlovi* Zemlemerova, Bannikova, Lebedev, Rozhnov et Abramov, 2016, *E. kuznetsovi* Zemlemerova, Bannikova, Lebedev, Rozhnov et Abramov, 2016, and *E. subanura* Kawada, Nguyen Truong Son et Dang Ngoc Can, 2012) overlap, but these species of mole were never found in the same location. For example, the *Euroscaptor orlovi* species was recorded at an elevation above 1700 m in Sa Pa District (Lao Cai Province), whereas all *Mogera* specimens were collected there at elevations between 900 and 1400 m.

Comments. This taxon was long considered a subspecies of the Taiwanese *M. insularis* (Abe, 1995; Hut-

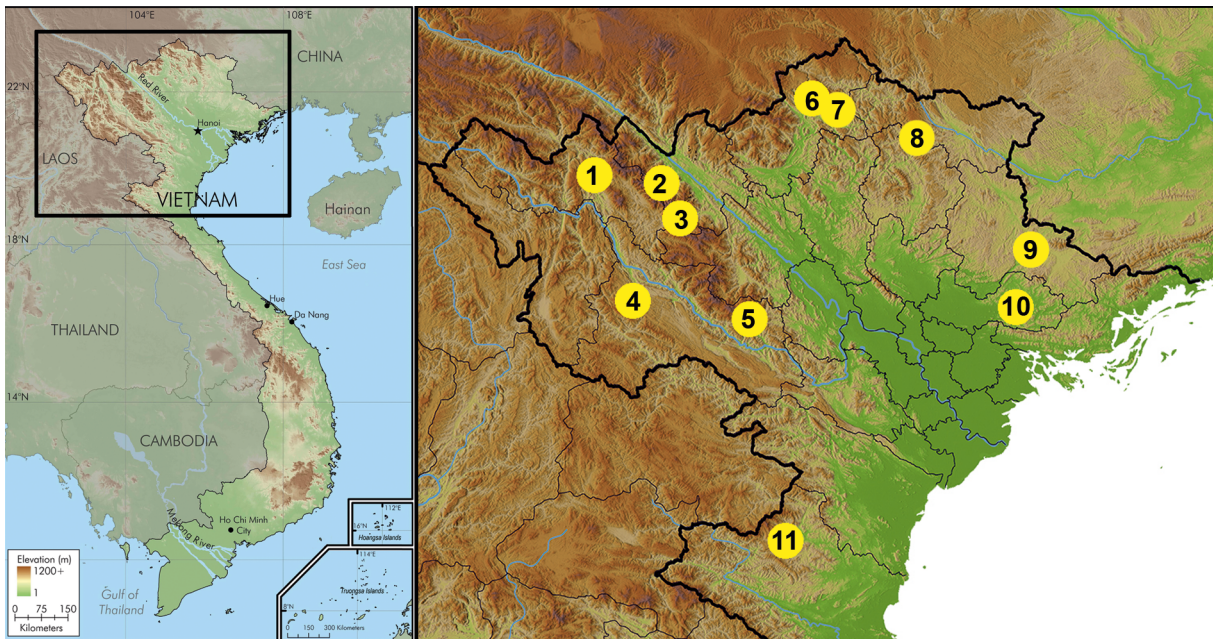


Fig. 2. Distribution of *Mogera latouchei* in Vietnam.

1 — Lai Chau Prov., Sin Ho; 2 — Lao Cai Prov., Sa Pa., Ban Ho; 3 — Lao Cai Prov., Van Ban; 4 — Son La Prov., Thuan Chau, Co Ma; 5 — Son La Prov., Phu Yen; 6 — Tuyen Quang Prov. (former Ha Giang Prov.), Thanh Van; 7 — Tuyen Quang Prov. (former Ha Giang Prov.), Khau Ca; 8 — Cao Bang Prov., Nguyen Binh; 9 — Lang Son Prov., Cao Loc, Mau Son; 10 — Bac Ninh Prov. (former Bac Giang Prov.), Son Dong, Tay Yen Tu; 11 — Nghe An Prov., Que Phong, Pu Hoat.

terer, 2005; He *et al.*, 2017). However, other authors believed it to be a distinct species (Stroganov, 1948; Kawada *et al.*, 2007). Based on molecular data, Zemlemerova *et al.* (2013) confirmed the species rank of *M. latouchei*.

***Mogera* in Vietnam**

For a long time, the only mole species recorded from Vietnam was the single genus *Euroscaptor* (formerly listed as *Talpa* in Southeast Asia) (Osgood, 1932; Delacour, 1940; Miller, 1940; Corbet & Hill, 1992). In 2003, a mole species belonging to the genus *Scaptonyx* Milne-Edwards, 1872 was discovered in Ha Giang Province in northern Vietnam (Lunde *et al.*, 2003).

The first confirmed records of *Mogera* in Vietnam date from 2005. Two specimens of *M. latouchei* were collected in the former Van Ban District, Lao Cai Province, in April 2005, during a biodiversity survey conducted by the Joint Vietnam-Russia Tropical Science and Technology Research Center (Abramov *et al.*, 2009). In November 2005, three specimens were collected near Sa Pa Town, also in Lao Cai Province (Kawada *et al.*, 2009). However, the first specimen of Vietnamese *Mogera* was indeed collected much earlier. The Natural History Museum (London, UK) holds a mole specimen (BMNH 33.4.1.147) collected by the Jean Delacour and Willoughby P. Lowe expedition in November 1929. This specimen was identified as *Talpa klossi* Thomas, 1929 (now *Euroscaptor*) by Osgood

(1932) and subsequent researchers. However, morphological investigation revealed that this specimen belongs to *Mogera latouchei* (Abramov, pers. observ., 2007; Kawada *et al.*, 2009).

Through extensive research by the Joint Vietnam-Russia Tropical Science and Technology Research Center and the Institute of Biology at the Vietnam Academy of Science and Technology over the last two decades, our knowledge of the distribution of *Mogera latouchei* in Vietnam has increased significantly (see Fig. 2).

Shinohara *et al.* (2014) analyzed the mitochondrial and nuclear gene sequences (Fig. 1B) of 13 *M. latouchei* specimens from Vietnam. Specimens from Lao Cai and Cao Bang formed a cluster, whereas specimens from Son La formed a distinct lineage on the phylogenetic tree. However, the analysis did not detect any significant genetic diversity among the samples studied (Shinohara *et al.*, 2014). Tu *et al.* (2022) analyzed additional samples from Son La and Lao Cai, revealing the same pattern of differences between these localities. A combined analysis of the *cytb* (936 bp), 12S (845 bp) and *Rag1* (1010 bp) genes revealed a significant difference between the Vietnamese populations from Lao Cai and Cao Bang, and the Chinese populations from the Xiaoxi Nature Reserve in Hunan Province and Fanjing Mountain in Guizhou Province. Genetic distances for the *cytb* gene between these Chinese and Vietnamese populations varied from 4.0% to 4.4% (Xiao *et al.*, 2023).

Discussion

Recent molecular phylogenetic studies have suggested that the species richness of insular *Mogera* may be the result of multiple migrations from the Asian mainland to coastal islands, as well as vicariance events (Tsuchiya *et al.*, 2000; Shinohara *et al.*, 2004, 2014; Kawada *et al.*, 2007; Kirihara *et al.*, 2013).

All molecular data support the existence of two main *Mogera* lineages: the northern “Japanese” lineage and the southern “Chinese” lineage. Shinohara *et al.* (2014) estimated the diversification of these lineages to have occurred around 8.0 Myr (10.9–6.1 Myr). The Japanese lineage begins with *M. robusta* in eastern mainland Asia and has diversified into several species found on the Japanese islands (*M. tokudae*, *M. etigo*, *M. imaizumii*, and *M. wogura*). Shinohara *et al.* (2005, 2014) proposed that *M. tokudae* (including *M. etigo*), *M. imaizumii*, and *M. wogura* diverged on the mainland and migrated to the Japanese Islands from the Korean Peninsula in that order during distinct Pleistocene glacial periods. The Chinese lineage comprises the mainland species *M. latouchei* and a few insular species (*M. hainana*, *M. kanoana*, and *M. insularis*). We also assume that the enigmatic *M. uchidai* belongs to this lineage.

There are morphological and genetic differences between the Vietnamese and Chinese populations of *M. latouchei*, which possibly indicate two distinct but closely related species within the continental Chinese *Mogera* lineage. Additional comprehensive studies are required to provide robust evidence for accurate taxonomic assignment.

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References

- Abe H. 1968. Classification and biology of Japanese Insectivora (Mammalia) II. Biological aspects // Journal of the Faculty of Agriculture, Hokkaido University. Vol.55. P.429–458.
- Abe H. 1995. Revision of the Asian moles of the genus *Mogera* // Journal of the Mammalogical Society of Japan. Vol.20. P.51–68. DOI: 10.11238/jmammsocjapan.20.51
- Abe H., Shiraishi S. & Arai S. 1991. A new mole from Uotsuri-jima, the Ryukyu Islands // Journal of the Mammalogical Society of Japan. Vol.15. P.47–60. DOI: 10.11238/jmammsocjapan1987.15.47
- Abramov A.V. 2021. An annotated checklist of the insectivores (Mammalia, Eulipotyphla) of Laos // Zootaxa. Vol.5006. No.1. P.13–25. DOI: 10.11646/zootaxa.5006.1.5
- Abramov A.V., Rozhnov V.V., Shchinov A.V. & Nguyen Truong Son. 2009. Distribution of rare and lesser-known insectivores (Soricomorpha) in Vietnam // Proceedings of the 3rd National Scientific Conference on Ecology and Biological Resources. Hanoi: Institute of Ecology and Biological Resources. P.9–11.
- Allen G.M. 1938. The Mammals of China and Mongolia. Part 1. New York: American Museum of Natural History. 620 p.
- Corbet G.B. 1978. The Mammals of the Palaearctic Region: a Taxonomic Review. London: British Museum (Natural History). 314 p.
- Corbet G.B. & Hill J.E. 1992. The Mammals of the Indomalayan Region: a Systematic Review. Oxford: Oxford University Press. 488 p.
- Delacour J. 1940. Liste provisoire des mammifères de l’Indochine française // Mammalia. Vol.4. No.1. P.20–29.
- He K., Shinohara A., Jiang X.-L. & Campbell K.L. 2014. Multilocus phylogeny of talpine moles (Talpini, Talpidae, Eulipotyphla) and its implications for systematics // Molecular Phylogenetics and Evolution. Vol.70. P.513–521. DOI: 10.1016/j.ympev.2013.10.002
- He K., Shinohara A., Helgen K.M., Springer M.S., Jiang X.L. & Campbell K.L. 2017. Talpid mole phylogeny unites shrew moles and illuminates overlooked cryptic species diversity // Molecular Biology and Evolution, Vol.34. No.1. P.78–87. DOI: 10.1093/molbev/msw221
- Hoffmann R.S. & Lunde D. 2008. Order Erinaceomorpha, Order Soricomorpha // Smith A.T. & Xie Y. (eds.). A Guide to the Mammals of China. Princeton: Princeton University Press. P.292–327.
- Hutterer R. 2005. Order Soricomorpha // Wilson D.E. & Reeder D.M. (eds.). Mammal Species of the World. 3rd edn. Baltimore: Johns Hopkins University Press. P.220–311.
- Kawada S. & Yokohata Y. 2009a. *Mogera imaizumii* (Kuroda, 1957) // Ohdachi S.D., Ishibashi Y., Iwasa M.A. & Saitoh T. (eds.). The Wild Mammals of Japan. Kyoto: Shoukadoh Book Sellers. P.34–35.
- Kawada S. & Yokohata Y. 2009b. *Mogera wogura* (Temminck, 1842) // Ohdachi S.D., Ishibashi Y., Iwasa M.A. & Saitoh T. (eds.). The Wild Mammals of Japan. Kyoto: Shoukadoh Book Sellers. P.36–37.
- Kawada S. & Yokohata Y. 2009c. *Mogera tokudae* Kuroda, 1940 // Ohdachi S.D., Ishibashi Y., Iwasa M.A. & Saitoh T. (eds.). The Wild Mammals of Japan. Kyoto: Shoukadoh Book Sellers. P.40–41.
- Kawada S. & Yokohata Y. 2009d. *Mogera etigo* Yoshiyuki & Imaizumi, 1991 // Ohdachi S.D., Ishibashi Y., Iwasa M.A. & Saitoh T. (eds.). The Wild Mammals of Japan. Kyoto: Shoukadoh Book Sellers. P.38–39.
- Kawada S., Harada M., Obara Y., Kobayashi S., Koyasu K. & Oda S. 2001. Karyosystematic analysis of Japanese talpine moles in the genera *Euroscaptor* and *Mogera* (Insectivora, Talpidae) // Zoological Science. Vol.18. No.7. P.1003–1010. DOI: 10.2108/zsj.18.1003
- Kawada S.I., Shinohara A., Kobayashi S., Harada M., Oda S. I. & Lin L.K. 2007. Revision of the mole genus *Mogera* (Mammalia: Lipotyphla: Talpidae) from Taiwan // Systematics and Biodiversity. Vol.5. No.2. P.223–240. DOI: 10.1017/S147200006002271
- Kawada S.-I., Nguyen Truong Son & Dang Ngoc Can. 2008. Karyological diversity of talpids from Vietnam (Insectivora, Talpidae) // Dang Ngoc Can, Endo H., Nguyen Truong Son, Oshida T., Le Xuan Canh, Dang Huy Phuong, Lunde D.P., Kawada S.-I., Hayashida A. & Sasaki M. (eds.). Checklist of Wild Mammal Species of Vietnam.

- Hanoi: Primate Research Institute, Inuyama, Japan, Institute of Ecology and Biological Resources. P.384–389.
- Kawada S.-I., Nguyen Truong Son & Dang Ngoc Can. 2009. Moles (Insectivora, Talpidae, Talpinae) of Vietnam // Bulletin of the National Museum of Nature and Science. No.35. P.89–101.
- Kawada S.I., Oda S.-I., Endo H., Lin L.-K., Nguyen Truong Son & Dang Ngoc Can. 2010. A comparative karyological study of Taiwanese and Vietnamese *Mogera* (Insectivora, Talpidae) and classification // Memoirs of the National Science Museum, Tokyo. Vol.46. P.47–56.
- Kirihara T., Shinohara A., Tsuchiya K., Harada M., Kryukov A.P. & Suzuki H. 2013. Spatial and temporal aspects of occurrence of *Mogera* species in the Japanese islands inferred from mitochondrial and nuclear gene sequences // Zoological Science. Vol.30. P.267–281. DOI: 10.2108/zsj.30.267
- Koh H.S., Jang K.H., Han E.D., Jo J.E., Jeong S.K., Ham E.J., Lee J.H., Kim K.S., In S.T. & Kweon G.H. 2012. Lack of genetic divergence between *Mogera wogura coreana* from Korea and *M. w. robusta* from northeastern Russia (Soricomorpha: Mammalia), reexamined from 12S rRNA and cytochrome *b* sequences // Animal Cells and Systems. Vol.16. P.408–414. DOI: 10.1080/19768354.2012.694824
- Krystufek B. & Motokawa M. 2018. Family Talpidae (moles, desmans, star-nosed moles and shrew moles) // Mittermeier R.A. & Wilson D.E. (eds.). Handbook of the Mammals of the World. Vol.8: Insectivores, Sloths and Colugos. P.552–619.
- Lunde D.P., Musser G.G. & Nguyen Truong Son. 2003. A survey of the small mammals from Mt. Tay Con Linh II, Vietnam, with the description of a new species of *Chodsigoa* (Insectivora: Soricidae) // Mammal Study. Vol.28. P.31–46.
- Miller G.S. 1940. Notes on some moles from Southeastern Asia // Journal of Mammalogy. Vol.21. No.4. P.442–444.
- Motokawa M., Lin L.-K., Cheng H.-C. & Harada M. 2001. Taxonomic status of the Senkaku mole, *Nesosaptor uchidai*, with special reference to variation in *Mogera insularis* from Taiwan (Mammalia: Insectivora) // Zoological Science. Vol.18. P.733–740. DOI: 10.2108/zsj.18.733
- Okhotina M.V. 1966. [Far Eastern Mole and its Trapping]. Moscow: Nauka. 136 p. [in Russian].
- Osgood W.H. 1932. Mammals of the Kelley-Roosevelts and Delacour Asiatic expeditions // Field Museum of Natural History. Publication No.132. Zoology Series. Vol.18. No.10. P.193–339.
- Shinohara A., Suzuki H., Tsuchiya K., Zhang Y.-P., Luo J., Jiang X.-L., Wang Y.-X. & Campbell K.L. 2004. Evolution and biogeography of talpid moles from continental East Asia and the Japanese Islands inferred from mitochondrial and nuclear gene sequences // Zoological Science. Vol.21. P.1177–1185. DOI: 10.2108/zsj.21.1177
- Shinohara A., Campbell K.L. & Suzuki H. 2005. An evolutionary view on the Japanese talpids based on nucleotide sequences // Mammal Study. Vol.30. P.S19–S24. DOI: 10.3106/1348-6160(2005)30[S19:AEVOTJ]2.0.CO;2
- Shinohara A., Kawada S., Harada M., Koyasu K., Oda S.-I. & Suzuki H. 2008. Phylogenetic relationships of the short-faced mole, *Scaptochirus moschatus* (Mammalia: Eulipotyphla), among Eurasian fossorial moles, as inferred from mitochondrial and nuclear gene sequences // Mammal Study. Vol.33. P.77–82. DOI: 10.3106/1348-6160(2008)33[77:PROTSM]2.0.CO;2
- Shinohara A., Kawada S.I., Nguyen Truong Son, Koshimoto C., Endo H., Dang Ngoc Can & Suzuki H. 2014. Molecular phylogeny of East and Southeast Asian fossorial moles (Lipotyphla, Talpidae) // Journal of Mammalogy. Vol.95. No.3. P.455–466. DOI: 10.1644/13-MAMM-A-135
- Stroganov S.U. 1948. [Systematics of moles (Talpidae)] // Trudy Zoologicheskogo Instituta AN SSSR. Vol.8. P.286–405 [in Russian].
- Thomas O. 1905. On some new Japanese mammals presented to the British Museum by Mr. R. Gordon Smith // Annals and Magazine of Natural History. Vol.7. No.15. P.487–495.
- Tsuchiya K., Suzuki H., Shinohara A., Harada M., Wakana S., Sakaizumi M., Han S.-H., Lin L.-K. & Kryukov A. 2000. Molecular phylogeny of East Asian moles inferred from the sequence variation of the mitochondrial cytochrome *b* gene // Genes & Genetic Systems. Vol.75. P.17–24. DOI: 10.1266/ggs.75.17
- Tu F., Zhai X., Zhao W. & Wang J. 2022. New mitogenome of the Hainan mole *Mogera hainana* and taxonomic implications based on molecular data // Mammal Study. Vol.47. No.1. P.1–7. DOI: 10.3106/ms2021-0008
- Xiao R., Ren M., Xu W., Wang C., Tian Y., Zhang Z., Zhang Y., Liu Z., Huang X. & Wu T. 2023. A new record of *Mogera* in the Xiaoxi National Nature Reserve, Hunan // Sichuan Journal of Zoology. Vol.42. No.2. P.199–205. DOI: 10.11984/j.issn.1000-7083.20220210
- Yokohata Y. 2009. *Mogera uchidai* (Abe, Shiraishi & Arai, 1991) // Ohdachi S.D., Ishibashi Y., Iwasa M.A. & Saitoh T. (eds.). The Wild Mammals of Japan. Kyoto: Shoukadoh Book Sellers. P.42–43.
- Yokohata Y., Ikeda Y., Yokota M. & Ishizaki H. 2003. The effects of introduced goats on the ecosystem of Uotsuri-Jima, Senkaku Islands, Japan, as assessed by remote-sensing techniques // Biosphere Conservation: for Nature, Wildlife, and Humans. Vol.5. P.39–46.
- Zemlemerova E.D., Bannikova A.A., Abramov A.V., Lebedev V.S. & Rozhnov V.V. 2013. New data on molecular phylogeny of the East Asian moles // Doklady Biological Sciences. Vol.451. No.1. P.257–260. DOI: 10.1134/S0012496613040200
- Zemlemerova E.D., Abramov A.V., Kryukov A.P., Lebedev V.S., Min M.S., Lee S.-J. & Bannikova A.A. 2019. Genetic and morphologic diversity of the moles (Talpomorpha, Talpidae, *Mogera*) from the continental Far East // Journal of Zoological Systematics and Evolutionary Research. Vol.57. No.3. P.662–678. DOI: 10.1111/jzs.12272