

Morphological and Biological Characteristics of The European Badger (*Meles Meles* L.) In the Southern Aral Sea Region

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Abstract: The European badger (*Meles meles* L.) is an ecologically adaptable carnivorous mammal widely distributed across Eurasia. However, its morphological and biological characteristics in the Southern Aral Sea region remain poorly studied. This study analyzes field observations from the Lower Amudarya State Biosphere Reserve, where several badger burrows and footprints were recorded. The burrow entrances measured approximately 35–40 cm in width, while footprints ranged from 6–8 cm in length. The presence of both single and multiple burrow exits indicates complex shelter structures adapted to environmental conditions. Furthermore, the species demonstrates seasonal underground inactivity during winter, which serves as an important survival strategy. These findings highlight the ecological adaptability of *Meles meles* and emphasize the importance of protected areas for maintaining regional biodiversity.

Keywords: *Meles meles*, European badger, Southern Aral Sea region, morphology, burrow structure, ecology.

Introduction: The European badger (*Meles meles* L.) represents one of the most widespread representatives of the Mustelidae family across Eurasia [2, 537-549]. Nevertheless, despite its broad geographic distribution, the ecological and biological characteristics of this species remain insufficiently studied in certain environmentally transformed regions, particularly in the Southern Aral Sea area. In recent decades, this region has undergone dramatic ecological changes associated with the desiccation of the Aral Sea, landscape degradation, soil salinization, and the transformation of natural ecosystems. Consequently, the study of mammalian fauna, including medium-sized carnivores such as the badger, has become increasingly important for understanding biodiversity dynamics and ecosystem resilience.

The European badger is known for its remarkable ecological plasticity, which allows it to inhabit a wide

range of environments, including forests, steppes, agricultural landscapes, and semi-desert territories. However, in arid and ecologically unstable landscapes such as the Southern Aral Sea region, the survival and behavior of the species depend largely on its morphological and biological adaptations. These adaptations include powerful digging limbs, a robust body structure, and a well-developed system of underground burrows that provide shelter, thermoregulation, and reproductive security [5, 70-73]. Field observations conducted on 4 March 2026 in the Lower Amudarya State Biosphere Reserve provide valuable insights into the presence and ecological characteristics of the species in this region. During the expedition, researchers identified several burrows attributed to *Meles meles*. Although the animals themselves were not observed directly because they remained underground during the winter period, the morphological features of the burrows and footprints

provided reliable evidence of their presence. The recorded coordinates of the observation site were approximately 41.93006°N and 60.47570°E, which corresponds to a protected sector of the reserve where anthropogenic disturbance is relatively limited.

One of the most informative morphological indicators recorded during the field survey was the structure of the burrows. The width of the burrow entrances measured approximately 35–40 cm, although slight variation was noted depending on the presumed size of the individual animal. Such dimensions correspond to the typical morphology of badger dens described in zoological literature and indicate the presence of a medium-sized fossorial carnivore with strong digging capacity. Moreover, the observed burrows displayed structural diversity. Some burrows possessed a single entrance, while others contained an additional exit opening. This structural complexity suggests that the species constructs multifunctional den systems, which may serve as both permanent shelters and emergency escape routes.

The presence of multiple exits in badger burrows has important ecological implications. Firstly, such architectural complexity increases the safety of the animal, allowing it to escape from predators or disturbances. Secondly, additional openings improve ventilation and regulate internal burrow temperature. Thirdly, they may facilitate the long-term use of the same den system by several generations of badgers, as is commonly observed in stable populations. Therefore, burrow morphology can be considered an important component of the species' ecological strategy in environments characterized by temperature fluctuations and habitat instability.

Another important morphological sign recorded during the expedition was the size of the footprints found near the burrow entrances. The footprints measured approximately 6–8 cm in length, with variation reflecting differences in the size of individual animals. These tracks are consistent with the anatomical structure of badger paws, which are adapted for digging and therefore relatively broad and powerful compared to those of many other carnivorous mammals. The measurement of tracks provides indirect but valuable information about the presence of the species, particularly during seasons when direct observation is difficult.

In addition to morphological characteristics, the field observations also provide insights into the biological behavior of the species in the Southern Aral Sea region. At the time of the expedition, the badgers were not visible above ground because they remained inside their burrows during the winter season. Although the

European badger does not undergo true hibernation, it is known to reduce its activity significantly during colder periods and may remain underground for extended intervals. This seasonal behavioral pattern represents an important adaptation that allows the species to conserve energy and avoid unfavorable environmental conditions.

In the harsh ecological context of the Southern Aral Sea region, winter inactivity likely plays a crucial role in survival. The underground burrow environment provides a relatively stable microclimate, protecting the animal from temperature fluctuations and strong winds typical of desert landscapes. Furthermore, remaining underground during winter reduces the need for extensive foraging when food resources are scarce. Consequently, the biological strategy of seasonal inactivity can be considered an adaptive mechanism that enables the species to persist in environmentally stressed habitats.

The spatial occurrence of badger burrows within the Lower Amudarya State Biosphere Reserve is also noteworthy from an ecological perspective. According to reserve specialists, the species had not been observed in this area for a considerable period in the past. However, in recent years badgers have begun to appear again within protected territories. This observation may indicate gradual ecological stabilization or improved habitat conditions resulting from conservation measures.

Protected areas often function as refugia for wildlife, particularly in regions where surrounding landscapes are heavily transformed by human activity. In the case of the Southern Aral Sea region, the biosphere reserve provides relatively undisturbed habitats where natural vegetation, soil structure, and prey availability remain more stable than in surrounding agricultural or degraded territories. Therefore, the presence of badgers within the reserve suggests that protected landscapes may play a key role in maintaining regional biodiversity.

Moreover, the European badger performs important ecological functions within terrestrial ecosystems. As an omnivorous species, it consumes a variety of food resources including invertebrates, small vertebrates, fruits, and plant material. This diverse diet allows the badger to occupy a flexible ecological niche and contributes to the regulation of various animal populations. In addition, its burrowing activity influences soil structure and aeration, thereby indirectly affecting vegetation and microhabitat formation. Consequently, the species can be considered an ecosystem engineer that contributes to habitat heterogeneity [4, 33-37].

The practical significance of the badger should also be emphasized. Because the species leaves distinctive signs such as burrows, tracks, and soil disturbances, it can be monitored relatively easily without direct capture or disturbance. This makes it a useful subject for long-term ecological monitoring programs in protected areas. In addition, studying the distribution and behavior of badgers can provide valuable information about ecosystem health, habitat connectivity, and the effectiveness of conservation strategies.

Overall, the available evidence indicates that the European badger demonstrates considerable ecological adaptability in the Southern Aral Sea region. Its morphological features—particularly strong digging limbs and the ability to construct complex burrow systems—allow it to survive in landscapes characterized by climatic variability and ecological transformation. At the same time, its biological strategies, including seasonal reduction of activity and omnivorous feeding behavior, further enhance its capacity to persist in challenging environments.

CONCLUSION

In conclusion, the observations from the Lower Amudarya State Biosphere Reserve confirm the presence of *Meles meles* in the Southern Aral Sea region and provide important information about its morphological and biological characteristics. The recorded burrow dimensions, footprint measurements, and seasonal behavior demonstrate the species' adaptation to local environmental conditions. Furthermore, the apparent reappearance of badgers in protected territories highlights the importance of conservation areas in maintaining mammalian biodiversity in regions undergoing ecological change. Future studies should therefore focus on long-term population monitoring, dietary analysis, and habitat mapping in order to better understand the ecological role and conservation status of the European badger in the Southern Aral Sea landscape.

REFERENCES

1. Mullineaux, E. (2016). Badgers. In BSAVA Manual of Wildlife Casualties (pp. 210-227). BSAVA Library.
2. Feore, S., & Montgomery, W. I. (1999). Habitat effects on the spatial ecology of the European badger (*Meles meles*). *Journal of Zoology*, 247(4), 537-549.
3. Yormatova, D. Y., & Xushvaqtova, X. S. (2018). *Ekologiya va tabiatni muhofaza qilish*. Toshkent-2018.
4. Балобонов В.М. К экологии барсука обыкновенного// Труды Харьковского зоопарка

Вып. 2. - Харьков, 1958. - С. 33-37.

5. Закнроп Л. К морфологии и экологии барсука в юго-восточном Кызылкуме// Экология, охрана и акклиматизация млекопитающих в Узбекистане. - Ташкент, 1991. - С. 70-73.