Animal Molecular Breeding 2023, Vol.13, No.2, 1-6
http://animalscipublisher.com/index.php/amb

A Review Open Access

The Origin and Evolution of Cats

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Animal Molecular Breeding, 2023, Vol.13, No.2 doi: 10.5376/amb.2023.13.0002
Received: 13 Jul., 2023
Accepted: 26 Jul., 2023
Published: 05 Aug., 2023

Preferred citation for this article:
Xuan J., 2023, The origin and evolution of cats, Animal Molecular Breeding, 13(2): 1-6 (doi: 10.5376/amb.2023.13.0002)

Abstract Cats are one of the oldest domesticated animals in the world, with their origins dating back to the Neolithic period around 11,000 years ago. The ancestors of cats originated in Africa and spread to Europe and Asia around 11,000 years ago. The earliest cat species was the primitive "Pseudaelurus," which underwent a long evolutionary process over time and gradually differentiated into different subspecies and breeds. In the Miocene, about 25 million years ago, cat species underwent significant differentiation, resulting in the emergence of large saber-toothed tigers and small modern Felidae. In the late Miocene, about 10 million years ago, modern cat species began to gradually differentiate into different subspecies and breeds. Studies suggest that the domestication of cats may have originated in Egypt around 4,000 BC, and over time, cats gradually became pets and companions to humans.

Keywords Cat; Origin; Evolution; Domestication

Cats (Felines, *Felis catus*) are animals closely related to humans, and their relationship with humans can be traced back thousands of years. In the history of human civilization, cats have been widely used to control mice and other pests, and have also become pets and companion animals for humans. Over time, more and more breeds and subspecies of cats have emerged, and their appearance and temperament have undergone significant changes.

The origin and evolutionary history of cats is a long and complex process involving multiple aspects such as biology, environment, genetics, and culture. Studies have shown that the ancestors of cats originated in Africa and were introduced to Europe and Asia during the Neolithic era, approximately 11,000 years ago. The earliest feline species was the primitive "Pseudaelurus", which, over time, underwent a long process of evolution and gradually differentiated into different subspecies and breeds.

In the evolution of cats, feline species underwent multiple evolutions and differentiations. The earliest feline species were small, arboreal animals whose teeth and sense of smell adapted to eating insects and small mammals. Over time, the size and ecological environments of feline species changed significantly. In the Miocene, approximately 25 million years ago, feline species underwent significant differentiation, which resulted in the appearance of large saber-toothed tigers and small modern feline species. In the Late Miocene, approximately 10 million years ago, modern feline species gradually differentiated into different subspecies and breeds, such as lions (*Panthera leo*), leopards (*Panthera pardus*), tigers (*Panthera tigris*), leopard cat (*Prionailurus bengalensis*), pumas (*Puma concolor*), and wildcats (*Felis silvestris*).

The domestication history of cats can be traced back to around 4,000 BC in Egypt. At that time, Egyptians liked to keep cats to control mice and other pests. Over time, cats gradually became pets and companion animals for humans. In Europe and Asia, cats were also widely used to control mice and other pests. Today, there are more and more breeds and subspecies of cats, and their appearance and temperament have undergone significant changes. For example, Persian cats, Siamese cats, and Burmese cats are common pet cats. These cats have significant differences in appearance and temperament. For instance, Persian cats have long and soft fur and gentle personality, while Siamese cats are lively and independent in temperament.

This review will expound the origin and evolutionary process of cats, as well as their domestication history and current status. Through in-depth understanding of the origin and evolution of cats, we can better understand their biological characteristics and habits, and provide a scientific basis for harmonious coexistence between humans and cats.

1 The Origin of Cats

Cat is an ancient animal, and there are still some mysteries and controversies about its origin to this day. However, through the analysis of multiple research methods such as fossil records, genetics, and archaeology, scientists have begun to reveal the origin of cats.

According to research, the earliest feline species appeared in the Paleocene, approximately 50 million years ago, mainly distributed in North America and Europe area. These feline species were small in size, lived in trees, and mainly fed on insects, small mammals, and birds. Among them, the earliest feline species were called "Pseudaelurus", which were small in size, had sharp canine teeth and claws, and were adapted to prey on small mammals (Vella and Shelton, 2017) (Figure 1). However, some studies suggest that the origin of cats may date back to the late Cretaceous about 100 million years ago, rather than the Paleocene, which is about 50 million years ago.

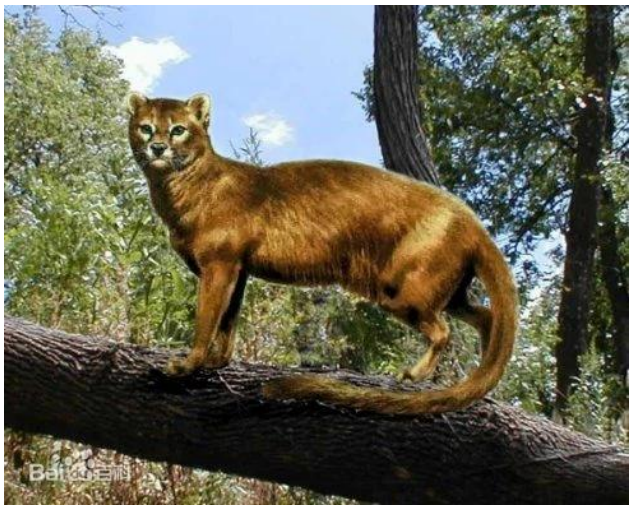

Figure 1 Pseudaelurus

In addition to scientific research, cats have rich mythological legends in various cultures. For example, in ancient Egyptian culture, cats were regarded as sacred animals, and people believed that cats possessed magical powers and wisdom. According to legends, the cat guardian goddess Bastet in ancient Egypt was transformed into a cat-headed human image (Figure 2), protecting humans from evil invasion. In European culture, cats are seen as symbols of witches and magic, believed to bring good luck and protect the safety of families.

Figure 2 The goddess of cats in ancient Egypt-Bastet

In conclusion, the origin of cats still remains some mysteries and controversies to this day, but through the analysis of multiple research methods, we have gained a preliminary understanding of the origin of cats. At the same time, cats have rich mythological legends in various cultures, reflecting people's worship and awe of this mysterious and sacred animal.

2 The Evolution of Cats

The evolutionary history of cats is a relatively complex process, involving multiple evolutions and differentiations (Figure 3). From the early origin of feline species to the differentiation and evolution of modern feline species, the evolution of cats has mainly gone through three stages: early, middle, and recent. The evolutionary process of these stages is mainly influenced by factors such as environment, climate, food, and natural selection (Bradshaw, 2013). In studying the evolutionary history of cats, scientists mainly reveal the evolutionary history of cats through the analysis of multiple research methods such as fossil records, genetics, and archaeology. The evolutionary history of cats has great significance for our understanding of the process of animal evolution, changes in ecological environments, and the relationship between humans and nature.

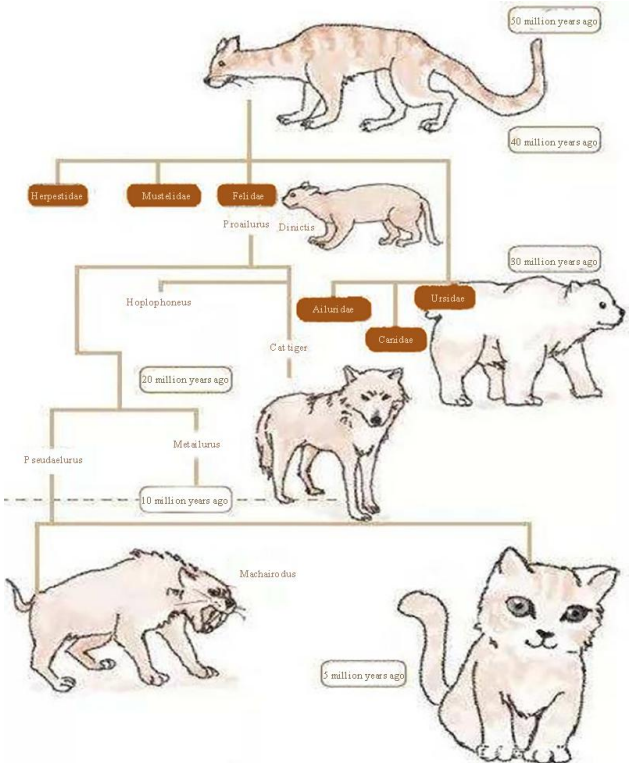

Figure 3 The evolution of cats

2.1 Early evolution

The early origin of feline species can be traced back to the Paleocene, approximately 50 million years ago. The earliest feline species were called "Pseudaelurus", which were small in size, had sharp canine teeth and claws, and were adapted to prey on small mammals. These feline species were small in size, lived in trees, and mainly fed on insects, small mammals, and birds (Bradshaw, 2016). In the Oligocene, about 35 million years ago, feline species gradually spread to regions including North America, Europe, Asia, and Africa.

2.2 Mid-term evolution

In the Miocene, about 25 million years ago, feline species experienced important differentiation, and large saber-toothed tigers and small modern feline species appeared (O'Brien and Johnson, 2007). Saber-toothed tigers were a large extinct feline species with a massive body, long and sharp canine teeth, and strong claws, adapted to prey on large mammals. Modern feline species, on the other hand, are characterized by their small body size, sharp claws, swift movements, keen eyesight, and sensitive hearing.

2.3 Recent evolution

In the late Miocene, about 10 million years ago, modern feline species began to differentiate into different subspecies and breeds, such as lions, leopards, tigers, leopard cats, pumas, and wildcats. Wildcats are believed to be one of the ancestors of modern feline species (Figure 4). Genetic studies on wildcats have shown that they are hybrids produced by mating between African wildcats and European wildcats.

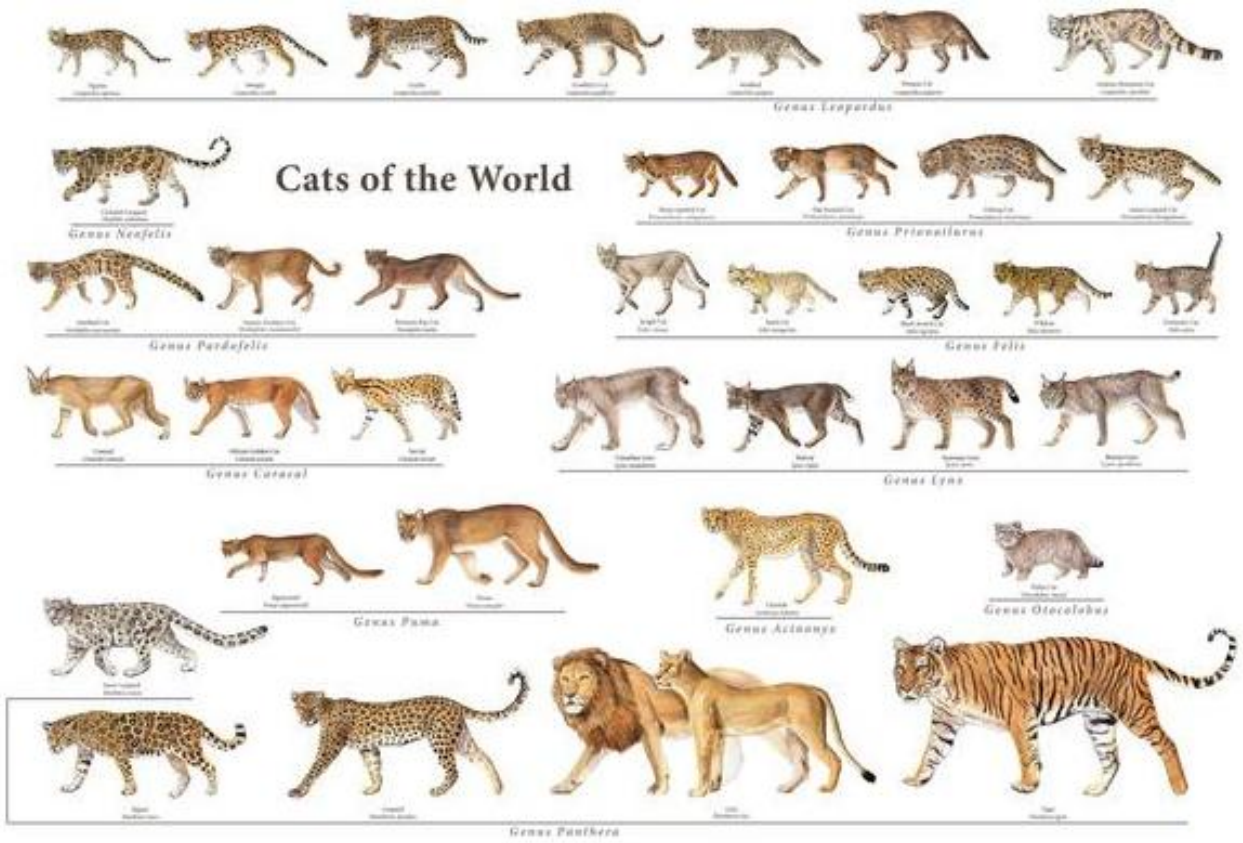

Figure 4 Recent evolution of cats

3 Domestication of Cats

The domestication process of cats is a relatively natural process rather than an intentional domestication by humans. The process of domestication may have been due to wildcats being attracted to human settlements in search of food and establishing relationships with humans (Driscoll and Clutton-Brock, 2010).

The earliest domestication of cats may have occurred in the Middle East about 10,000 years ago. Some scientists have proposed a hypothesis that cats were domesticated during the agricultural revolution in the Middle East. At that time, humans began to cultivate crops, attracting a large number of rodents, and wildcats were attracted to human inhabited area, thus establishing a relationship with humans. Supporters of this hypothesis believe that the main reason for the domestication of cats was to catch mice and other pests, protecting human food and property.

Other scientists have proposed a different hypothesis that the domestication of cats was caused by human social behavior. Humans accumulated a lot of garbage around their settlements, attracting many rodents and insects (Lord, 2008). Wildcats were attracted to these places, began to contact with humans, and gradually became docile. Supporters of this hypothesis believe that the main reason for the domestication of cats was that they could use resources of human being rather than catching mice and other pests.

Regardless of the hypothesis, the domestication process of cats was a relatively slow process that may have taken thousands of years to complete. During this process, wildcats gradually adapted to human lifestyle and began to accept human feeding (Turner and Bateson, 2014). As time went on, the morphology and behavioral characteristics of wildcats changed, and they became more docile and close to humans (Figure 5).

Figure 5 Domestication of cats

Some scientists found that some genetic variations occurred during domestication by comparing the genomes of wildcats and domestic cats. For example, many genetic mutations related to social behavior and diet have appeared in the genome of domesticated cats, which may be related to the adaptation of domesticated cats to human lifestyle over time.

In conclusion, the domestication process of cats was a relatively slow and natural process that may have taken thousands of years to complete (Zeder, 2012). The main reason for the domestication of cats may have been to use resources of human being rather than catching mice and other pests. During this process, wildcats gradually adapted to human lifestyle and some genetic mutations occurred, making them more suitable for living with humans.

4 Conclusion

Felines are a highly adaptable group of mammals that have developed unique morphological and life habits during their long evolutionary history. This review describes the origin and evolution of felines, from early feline species to modern domestic cats, summarizing the evolution process of change and adaptability that have occurred in their morphology, behavior, and ecology over time.

This review begins by introducing the origin and early evolutionary history of felines, including the appearance of Pseudaelurus in the Paleogene and the emergence of large saber-toothed tigers and small modern felines in the Miocene. Subsequently, this review details the changes and adaptive developments of felines in the recent evolution stage, including the emergence of wildcats and the process of gradual domestication into domestic cats. Additionally, it introduces possible genetic variation and changes in morphology, behavior, and other aspects that may occur during the domestication process.

This review also explores in detail the morphological and behavioral characteristics of cats, including their body size, sharp claws, swift movements, keen eyesight and exceptional hearing, among other traits. Additionally, it expounds the ecological adaptability of felines, including their adaptive evolution in predatory behavior, dietary preferences, and other aspects.

In summary, this review provides us with a deeper understanding of the origin and evolutionary history of felines, as well as a detailed discussion of the evolution process of their morphology, behavior, and ecological adaptability. Through an understanding of the evolutionary process of felines, we can better understand their interaction with the environment and, consequently, better protect and manage these valuable animal resources.

Authors' contributions

XJ was the project leader of this paper and was responsible for conceptualizing, writing the first draft, revising, and finalizing the manuscript. The author read and approved the final manuscript.

Acknowledgments

This study was supported by the Funding for Cuixi Innovation Research & Development Project of Cuixi Academy of Biotechnology, Zhuji.

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