Class Mammalia
Order Rodentia
Suborder Myomorpha
Superfamily Dipodoidea

Family DIPODIDAE (JERBOAS)

- Small to medium-sized, bipedal and characterized by short forelimbs and long strong hindlimbs and long tails, often ending with black and white brush of long hairs.
- 10–50 cm.
- Paleartic and Afrotopical regions.
- Terrestrial species, desert, semi-desert and steppe habitats.
- 3 genera, 35 species, 91 taxa.
- 1 species Vulnerable; none Extinct since 1600.

Systematics

The superfamily Dipodoidea (Rodentia, Myomorpha) is the sister group of Muroidea. As noted by J. Michaux and colleagues in 2001, this close relationship, based on morphological and molecular data, confirmed the superfamilial Myodonta concept, associating both superfamilies. As summarized by V. S. Lebedev and colleagues in 2013 and M. E. Holden and G. G. Musser in 2005, burh mice, jumping mice, and jerboas have been traditionally recognized in a single family Dipodidae or placed in up to six families within superfamly Dipodoidea. Four of them included morphologically specialized bipedal,ard-dwelling jerboas (Cardiocranininae, pygmy jerboas; Euchoreutinae, Long-eared Jerboa, Dipodinae, three-toed jerboas; and Allactaginiae, five-toed jerboas), and the other two were represented by more generalized quadrupedal taxa (Zapodinae, jumping mice, and Sminthinae, burh mice). Despite important effort from morphologists, the taxonomy and phylogeny of Dipodoidea remains controversial. More particularly, the family-level classification has long been a matter of debate, with the number of recognized families ranging from one to six. This lack of consensus on dipodid taxonomy is linked by the fact that, until recently, phylogenetic relationships among the main lineages were not unambiguously established.

Traditional classifications based mainly on morphological similarities included two related families: Dipodidae, including all jerboas, and Zapodidae, including jumping mice and burh mice. This morphology-based system reflected the evolution of locomotory adaptations, with subfamilies (or families) corresponding to grades of evolutionary development from primitive quadruped to specialized bipedal locomotion. Other studies noted that a simple dichotomy between bipedal and non-bipedal taxa was inadequate to explain significant morphological variation within the superfamly. The use of traits that are not directly associated with locomotion appeared to be more reasonable to develop phylogenetic studies less subject to homoplasy. This approach was performed in 1992 by G. I. Shevelev in a cladistic analysis based on characteristics of dentition, male reproductive systems, and auditory bullae. This study did not reveal any synapomorphies to support the monophyly of the bipedal taxa and proposed to divide Dipodoidae into four families: Allactaginiae, Dipodidae (including Paralopita and Cardiocranininae), Sminthidiae (with Euchoreutinae), and Zapodidae. Following the same strategy, recent paleontological studies proposed another classification with three main families: Zapodidae (containing Sminthinae/Sminthinae and Zapodinae), Allactaginiae (containing Allactaginiae and Euchoreutinae), and Dipodidae (including Cardiocraniniae, Dipodinae, and the extinct Lophocricetinae, even

Subdivision of the Dipodoidae

[DiagramFig 10.2]
The jerboa family Dipodidae is part of the superfAMILY Bathyergida, along with the burch mouse (Erethizon) and jumping mouse (Zapodidae). There are four jerboa subfamilies. Cardiocricetinae includes seven species of primitive bipedal jerboas. The genus Cardiocricetus consists of a single species, the Five-toed Jerboa, a very small jerboa (9–19 g) with short, subform ears, and a short, fat tail without a brush at its tip. Its hindfeet have five toes, which have conical calluses at the bases, and are covered from below with brushes of short soft hairs. Pygmy jerboas move in a series of jumping units, both hindfeet simultaneously, herculean speed, long-jumping capacity and endurance of the larger and more specialized jerboas.

Cardiocricetus paradoxus
Ogii Desert, Mongolia.
Photo: Konstantin Mikhalev

though this last subfamily was included within Cardiocricetinae by some authors). These last two classify suggested that the evolution of Dipodidae was a complex process involving independent and parallel locomotory, tractive, and substrate adaptations.

Recent genetic studies based on several nuclear and mitochondrial markers resulted in a new taxonomic revision and supported the recognition of only three families: Sminthostominae (comprising of Sminthosaurus, 14 species), Zapodidae (five species), and Dipodidae, which included Cardiocricetinae (seven species), Eucteniota, (one species), Euctenotus, (eleven species), and Allactagomorphinae (16 species) as subfamilies. This arrangement was chosen to emphasize the monophyly of all bipedal taxa within Dipodidae, which appears extremely clear with molecular markers. It is also interesting that the number of species of Dipodidae is not highly debated and that several cryptic species probably still need to be identified. This is particularly the case for the subfamily Allactagomorphinae. The use of new molecular and morphological markers and better sampling will help to decipher the correct number of species existing for this still poorly known rodent group.

Concerning their phylogeny, these recent genetic studies also highlighted the basal position of Sminthostominae, followed by Zapodidae. This last family appears therefore as the sister group of the monophyletic jerboa. This result was already proposed in earlier morphological studies that generally considered Sminthostominae as representing the most primitive dipodids morphologically. In contrast, this pattern contradicts the view that the non-bipedal burch mice (Sminthostominae) and jumping mice (Zapodidae) constitute a monophyletic group, as proposed by several other morphologists and paleontologists. Indeed, two Oligocene lineages, Neohipparion-Plesihipparion and Stenomylus-Parastenomylus, were generally considered to be the ancestral groups of Zapodinae-Sminthostominae and Allactagomorphinae-Dipodidae, respectively. Nevertheless, analyses performed by Lebedev and colleagues in 2013 clearly rejected the monophyly of the former association, thus suggesting that fossil data should be revised to determine which of the Paleogene taxa represent stem-groups of the three, but not two, main dipodoid clades.

Another important result based on recent morphological and molecular analyses concerns the monophyly of bipedal
Dipodoidea, including Cardiocramineae and Enchoreusteneae. Although this group comprises highly divergent lineages from morphological or genetic points of view, their cohesiveness is notably supported by a stable karyotype (2n = 48) and by all genera except Salpingotus and Sydnoptus. The monophyly of bipedal Dipodoidea was often questioned, mainly due to the controversial phylogenetic position of the Long-eared Jerboa (Enchoreustes tenuis). It was generally considered as a single survivor of some ancient lineage. Some morphologists even suggested that Enchoreustes was sister to all other bipedal taxa based on intermediate characteristics between specialized jerboas (Dipodidae and Allactaginae) and Smithodontidae (e.g. generalized zygomata and less specialized pelvis and hindlimb). Shembrot in 1992 considered Enchoreustes as an independent derivative from an ancestral dipodid stock that shared true synapomorphies only with Sicista. Following this hypothesis, similarity between Enchoreustes and other jerboas should be treated as a result of parallel (or convergent) evolution. Nevertheless, recent analyses of morphological data performed by Lebedev and colleagues indicated that such a position of the Long-eared Jerboa close to Sicista was not well supported. This was corroborated by molecular data that definitively supported the monophyly of Enchoreusteneae + Dipodidae + Allactaginae, even if the morphological resemblance among these subfamilies was also a result of parallel evolution of bipedality in arid open and flint landscapes.

The last remaining question concerns the relationships among Enchoreustes, Dipodidae, and Allactaginae. Some authors tend to propose that Enchoreustes is more related to Allactaginae; however, existing data do not contain sufficent information to confide this hypothesis. Their relationship is now regarded as an unresolved trichotomy, which could be partly explained by the fact that the three lineages probably diverged in rapid succession within a relatively short time span. Indeed, the earliest fossils attributed to the Enchoreustes were found from the early Miocene (16–20 million years ago), which is not significantly later than the earliest record for Allactaginae. Therefore, the split between the three jerboa lineages should have occurred quite quickly during the early Miocene.

The position of Cardiocramineae within Dipodidae also has been a subject of strong debate. Previous palaeontological studies suggested close affinities between Dipodidae and Cardiocramineae. According to the hypothetical palaeontological scenario, all extant jerboas descended from two ancestral lineages that had separated from each other by the end of Oligocene and evolved later into Allactaginae and Lophoceirinae. The now-extinct Lophoceirinae was regarded as the immediate ancestor of Cardiocramineae and, indirectly, Dipodidae. The latter taxon was believed to have originated, in turn, from some early Cardiocramineae. Nevertheless, recent molecular studies show that Cardiocramineae is the sister group to all other jerboas and that the lineage leading to the pycnogonid jerboas was the first to split from the common ancestor of bipedal taxa. Therefore, Dipodidae is presently considered as more closely related to Allactaginae and would correspond to a lineage that appeared late in the jerboas' evolution.

The monophyly of Cardiocramineae has also been strongly debated. Indeed, different studies of the morphology of genital organs or cytological characteristics have shown that Cardiocramineae and Salpingotus—the two modern genera of this subfamily—were substantially differentiated. Nevertheless, recent molecular studies confirm the monophyly of Cardiocramineae, even if the two genera were highly differentiated. This result confirms morphological results obtained with more comprehensive data sets. The first representatives of Cardiocramineae are found in the early late Miocene (9.7–11.1 million years ago) or even late mid-Miocene (11.1–12.5 million years ago).

Considering phylogenetic relationships within the subfamily Cardiocramineae, morphological and genetic characteristics confirm its monophyly and converge to place the genus Dipus basal compared with the other genera Sydnoptus, Jaculus, and Bremydipus. These latter genera are considered to be sister taxa. The only incongruence between morphology and genetics concerns the monotypic genus Paradipus that is characterized by a unique combination of autapomorphic and shared derived features. Considering different morphological studies, Paradipus was considered to be close to Bremydipus and Jaculus, a separate lineage just distantly related to other Dipodidae, or a sister group to Cardiocramineae, indicating extensive parallelism between Paradipus and other three-toed jerboas. Molecular data support the second hypothesis, and Paradipus should be regarded as the most divergent lineage in Dipodidae.

Concerning the Allactaginae, Moore and colleagues demonstrated on the basis of molecular data, that the phylogenetic position of Scartorus was situated within the genus Paralactaga. Thus, the name Paralactaga coined by C. C. Young in 1927 became the junior synonym of Scartorus, named by Gruber in 1841. Therefore, it seems reasonable to replace the genus name Paralactaga by the genus name Scartorus, where three subgenera can be recognized: Scartorus, Paralactaga, and Microcallatagus.

Moreover, Lebedev and colleagues, on the basis of molecular studies using several nuclear and mitochondrial markers,
Jerboas are characterized by long, strong hindlimbs and short forelimbs, which are not suited for locomotion. Their long tails balance them when they jump and serve as props when they are upright. The largest member of the family, the Great Jerboa, tips the scales at just 200–415 g. The Great Jerboa is one of two species in the genus Allactaga, and part of the subfamily Alactogitinae, the five-toed Jerboas, which currently includes 16 species. Unusually for the family, but in common with several other species in the subfamily, the toes of the Great Jerboa’s hindfeet are naked, and the coxal foramina at bases of toes are large and high, with wide bases and rounded apertures. It is found in a wide range of habitats, from steppe to semi-desert and desert, but avoids saltbush and semi-desertified sands.

**Allactaga major**

Torgay District, East Kazakhstan, Kazakhstan.

Photo: Alyona Shatalova

Evidence of monophyly for the genus *Allactaga* sensu lato. Indeed, the morphologically distinct genus *Pyguratrus* appears as a sister group with the genus *Scarturus*, while the genus *Allactodipus* is grouped with the Great Jerboa (*Allactaga major*) and the Sverzov’s Jerboa (*A. sverzovii*). Therefore, *Allactaga* sensu lato should be subdivided into three separate genera by elevating their taxonomic rank from subgeneric to generic: *Allactaga* sensu stricto, *Scarturus*, and *Orientalactaga*. From a morphological point of view, this hypothesis cannot be rejected. Indeed, among the morphological characteristics considered, only the shape of glans penis can be counted as a potential synapomorphy for *Allactaga* sensu lato. The paleontological record indicates that the first unequivocal allactagines appeared in the lower Miocene 16–20 million years ago, while the earliest fossils attributed to the genus *Scarturus* (subgenus *Parallactaga*) appeared 7.5–8.7 million years ago. The genera *Proallactaga*, *Proclactaga*, and *Scarturus* (subgenus *Parallactaga*), based on interpretation by most paleontologists, represent stages of evolutionary development of molar crown patterns (grades) rather than real phylogenetic clades. Therefore, the roots of different lineages within the genus *Allactaga* sensu lato could be significantly deeper than it is usually believed.

According to Lebedev and colleagues, it is commonly accepted that *Pyguratrus* is a rather recent (latest part of the Miocene) derivative of *Allactaga*, sensu lato, which evolved toward a more specialized herbivore diet. In contrast to that, *Allactodipus* was hypothesized to be an early offshoot of the ancestral allactagines stock, thus representing a separate evolutionary lineage. Molecular data strongly contradict this view, indicating instead that the *Allactodipus* lineage originated at about the same time as major clades within *Allactaga*. *Allactodipus* shares some similarity in pelvis shape with the Great Jerboa and Sverzov’s Jerboa (*Allactaga sverzovii*). Although this finding is in line with the pattern inferred from genetic data, the phylogenetic value of this condition remains unclear.

Another important question is whether bipedality was acquired only once or evolved independently in several diplo-
Following molecular studies, the genus Allactaga was subdivided into three: Allactaga, Orientallactaga, and Scaturitus. The Gelo Jerboa, formerly and still widely known as Allactaga bullata, is one of three Orientallactaga species. The toes of the hindfeet of Orientallactaga jerboas are covered from below with brushes of long soft hairs, and the coat caudal to the bases of the toes are large but relatively low, with wide bases. Jerboa's tails often and with brushes of long black and white hairs. The tail "hemmer" of the Gelo, jerboa is wide and well flattened, with a white basal ring, a long black subterminal field, and a short white terminal tuft. The underparts of the black parts, beak-like along the tail root by a wide white stripe.

Orientallactaga bullata
Gelo Jerboa. S. Mongolia
Photo: Batsukh Nyambuu

Concerning the evolutionary history of Dipodidae, the first occurrences of this superfamily in the fossil record are from North America with Phymos (Zapodidae, middle Eocene, 48–45 million years ago) and Simonsia (Simmyusidae, middle to late Eocene, 38–40 million years ago). In Asia, the oldest dipodid representatives are Homosminthus (Zapodidae or Dipodidae depending on the studies, middle Eocene to late Oligocene, 28–40 million years ago) and Simonsmania (Zapodidae, middle Eocene to middle Miocene, 15–40 million years ago). Whether these genera belong to extinct taxa or represent extinct sister groups of Dipodidae has yet to be determined. A recent study based on a single genetic marker proposed that the diversification of modern Dipodidae took place during the middle Eocene (40–45 million years ago). Combining a time-calibrated phylogeny with a compilation of the fossil record further suggested that diversification events and distributional expansion were mostly influenced by new ecological opportunities trig-

When the fossilized jerboa genus Allactaga was subdivided, William's Jerboa was one of seven species placed in the genus Pseudalactaga, which was subsequently found to be a junior synonym of Scaturitus. The hind toes of this and several other Scaturitus species are covered with soft hairs which do not form brushes. In other species in the genus, the toes are naked. The first and fifth toes of the hind leg jerboa are much shorter than the three middle toes. When they are running, only the first compact calcars on the central (front) toe last contact with the substrate. The second and fourth toes act as shock absorbers.

Scaturitus williamsi
Sultan Warsi National Park, Kayser, Turkey
Photo: Ahsen Kutanay
The fat-tailed Jerboa in the genus *Pygsemurus* have relatively short tails. That of the Lesser Fat-tailed Jerboa is actually shorter than its head-body length. In this species and the Greater Fat-tailed Jerboa (*P. stickisi*), the tail is fat, as the common name suggests, but in the Dwarf Fat-tailed Jerboa (*P. pusillus*), the tail is slightly flattened only in adults, and only in males. The genus *Pygsemurus* is thought to be a rather recent (late Miocene) derivative of *Alactaga*, which evolved toward a more fleshy tail. The tail is embedded in a fur that is high-crowned, with terraced masticatory surfaces.

**Pygsemurus pusillus**

Sambhali-Dali Deseri,
Lake-Salkantay Keqakahat.
Photo: Nadia Nadjbrahim

DIP-08

A recent study by P. Prado and colleagues in 2015 based on five coding genes and 34 Dipodidae species suggested that Dipodidae and Meriones diverged in the late Paleocene (37 million years ago). They also found that modern Dipodidae originated about 32 million years ago. This estimation appears to be the most realistic because the number of species and molecular markers was much more important compared with previous studies.

Furthermore, fossil calibrations used to estimate times of divergence were also more complete and precise. According to this last study, modern Dipodidae would have diversified rapidly after their appearance during the early Oligocene (32 million years ago) in the proto-Himalayan region. At that period, global temperatures decreased significantly, and the Antarctic ice-sheets expanded rapidly. In the Palaearctic, this severe cooling resulted in the development of open grassland that induced a great worldwide mammalian faunal turnover (called the Mongolian Remodeling in Asia). The Oligocene fauna was then reorganized, and faunas dominated by lagomorphs and rodents (e.g., Dipodidae, Cricetidae, or other rodent taxa) replaced the perissodactyl-dominated fauna of the Eocene. The ancestral dipodid group would have split about 32 million years ago into two distinct lineages, leading to the ancestors of burch mice (Smuˇntahas) in the Himalaya–Tibetan Plateau region and to the common ancestors of jumping mice and jerboas in the Gobi and Taklamakan desert regions. These diversification events would have been directly linked to the collision between India and Asia, which happened 40 million years ago and caused significant uplift episodes of Himalaya.

About 15–17 million years ago, many subfamilies had diversified or undergone radiations; radiation of Smuˇntahas and Zapodidae, divergence of Echorectinae, and split between Alacatacinae and Dipodinae. Biogeographical analyses indicated that these diversification events happened in the Gobi and Taklamakan desert regions, except for Indian species that diversified in the Himalaya–Tibetan Plateau region. That period was associated with the most intense eogenetic phase of Himalaya, which, together with the mid-Miocene Climatic Optimum, favored year-round aridity in Central Asia and led to the formation of many desert regions. Aridity and establishment of open habitats were also suspected to have triggered the early evolutionary history of the Dipodidae. The most recent common ancestor of modern Dipodinae would have also diversified in the Gobi and Taklamakan desert regions about 11–1 million years ago. While ancestors of the broad-footed Jerboa (*Paracorpus cienodactylus*) would have moved to Central Asia, ancestors of all other Dipodinae would have split into two distinct groups about 8 million years ago. Actually, at that period, a significant increase in elevation of the Tibetan Plateau enhanced aridity in Central Asia. This diversification event would have driven the diversification of Dipodinae—species of which we now prefer the habitats.

While ancestors of Lichtensteini's Jerboa (*Fremynicus lichensteinii*) would have settled in their native region of Central Asia, ancestors of the modern Great Egyptian Jerboa (*Jaculus orientalis*) would have moved to North Africa after their differentiation about 4 million years ago. Besides, their arrival in Africa is congruent with those of other rodents that likely followed the same migration routes from Asia for a few million years. Common ancestors of the Lesser Egyptian Jerboa (*Jaculus jamnuth*) and Blanford's Jerboa (*Jaculus bimaculatus*) would have expanded their distributions from Central Asia to North Africa about 4 million years ago. Given the simultaneous diversification of this ancestral group and decreasing temperatures associated with the onset of Pleistocene glaciations, diversification and development of open landscapes would have once again triggered the diversification of these rodents and probably triggered the split into two lineages about 3.4 million years ago, leading to the Lesser Egyptian Jerboa in North Africa and Blanford's Jerboa in Central Asia. Z. Boratynska and colleagues in 2012 noted the coexistence of two cryptic species within the Lesser Egyptian Jerboa living in North Africa. They were named *Jaculus jamnuth* and *J. deserti*. Nevertheless, a new study by Shemot and colleagues in 2016 described the presence of these two species in the Negev, Eastern Egypt, and the Sinai Peninsula, and according to a comparison of available type specimens from these regions, they proposed to rename *J. deserti* to *J. hirtipes* (African Hamadana Jerboa), following taxonomic norms. Comparisons of geographical and habitat differences of the two species revealed high niche divergence between them, slightly higher in the sympatric North African populations than in the parapatric populations of Israel and Sinai. Moreover, genetic, mitochondrial and nuclear markers clearly found an important level of genetic divergence among the populations, cor-
Although it has features with other members of the Jerboa subfamily, the Dipodidae, the Cony Jerboa is also unlike them in many respects. It is considered a separate lineage, only distantly related to the rest of the subfamily. It is a specialist of unstructured sand habitats, on which it is able to move with speed and agility with the help of the comb of stiff hairs on the thighs to often leap forward. The maximum recorded jump for this species, which reaches less than 20 cm high, is 302 cm, and at 8.8 m/s (approximately 32 km/h), it is the third fastest recorded jerboa species. Its hindfeet are very long, equal to more than one half of its head-body length.

Paracolobomyces dobowii

Photo: Gregory Shambrot

responding to values generally observed among differentiated mammalian species. Both species probably originated near the upper Pliocene-lower Pleistocene boundary (2-4 million years ago). Their differentiation could be explained by vicariant (separation) events, which happened during climate fluctuations that characterized the end of the Tertiary era. They diversified during subsequent periods of drift occurring in North Africa. A. Ben Frel and colleagues in 2012 dated these diversification events to 0.23-1.1 million years ago, suggesting that the middle Pleistocene climatic change and its environmental consequences affected the evolutionary history of these two African jerboas. Interestingly, the expansion of the Less Egyptian Jerboa to its current distribution probably predates that of the African Hamadana Jerboa and is estimated at 42,000-98,000 years ago (versus 19,000-45,000 years ago for the African Hamadana Jerboa).

About 7-8 million years ago, the expansion of C_g graces to the detriment of C_s plants favored the replacement of many woodland-adapted mammals by more open-habitat representatives. Dipus and Stylodipus spp. probably would have been favored through this transition from C_g-dominated and C_s-dominated plant cover, given their preference for open-land habitats. Then, ancestors of modern Northern Three-toed Jerboas (Dipus sagittus) settled in Central Asia, as did the common ancestors of all modern Stylodipus spp. Ancestors of the Mongolian Three-toed Jerboa (Stylodipus andrewsi) would have then moved to Mongolia while the common ancestors of the Thick-tailed Three-toed Jerboa (Stylodipus tehum) and the Dzungarian Three-toed Jerboa (Stylodipus xungurus) first extended their distributions to Mongolia. By vicariance, these ancestors diversified about 1.4 million years ago, leading to the Thick-tailed Three-toed Jerboa in Central Asia and the Dzungarian Three-toed Jerboa in Mongolia.

In summary, the diversification of Dipodidae can be associated with major uplift episodes that occurred in Central Asia and the Himalaya-Tibetan Plateau region due to the collision of India with Asia. These events also induced diversification events in many other groups. Other important diversification events (e.g., divergence between Zapodidae and Dipodidae in Central Asia) took place during the Eocene-Oligocene tran-
The three species in the genus Stylodipus are medium-sized (45–93 g), relatively short-eared jerboas, with long-tufted tails lacking striking black-and-white banners. The tails are furred in adults. The toes of their hindfeet are covered from below with brushy or at least short fur, sometimes. While the Mongolian Three-toed Jerboa (above) is confined to salt depressions among coarse gravel, low-mountain semi-desert and desert, the Thick-tailed Three-toed Jerboa (middle) can be found on a range of substrates, from stabilized sands on the steppe zone, to sandy-loam or clay soils in semi-desert and desert, and coarse gravel hill slopes. The two subspecies of the Thick-tailed Three-toed Jerboa occur on a wide area, from NW China, across Central Asia, to Ukraine and South European Russia. The Mongolian Three-toed Jerboa (below) inhabits coarse-gravel hill slopes in the Gobi and the Desmanian Gobi Desert of NW China and SW Mongolia. About 7–8 million years ago, the expansion of grassland at the expense of forest led to the replacement of many woodland adapted mammals by more open-habitat species, a transition that would have favored Dipsos and Stylodipus jerboas. The common ancestor of all modern Dipsos and Stylodipus species settled in Central Asia. Ancestors of the Mongolian Three-toed Jerboa would have then moved to Mongolia. The common ancestor of the other two modern Stylodipus species extended their distributions to Mongolia, then, following their geographical separation, diversified about 11–12 million years ago, leading to the Thick-tailed Three-toed Jerboa in Central Asia and the Desmanian Three-toed Jerboa in Mongolia.

Above: Stylodipus andrei
E. Gobi Desert, Mongolia.
Photo: Gregory Shechert

Middle: Stylodipus reedii
Torgut District, Kostiary Region,
Kazakhstan.
Photo: Aiko Shimasaka

Below: Stylodipus anguinosus
Gobi Desert, W. Mongolia.
Photo: Bethalnka Nyamrav
Morphological Aspects

Jerboas are small or medium-sized and bipedal, and are characterized by short forelimbs and long strong hindlimbs. The forelimbs are not used for locomotion but are used to gather food and dig burrows. The foot bones are often fused into a single long cannon bone, which is advantageous for jumping. Jerboas are particularly adapted to running fast in desert habitats. They move either by jumping or walking on their hindlegs. Their tails often end with black and white brushes of long hairs and are generally longer than their head and body length to balance movements when they jump. They also use their tails as props when they sit upright. In contrast, tails among pygmy jerboas (Caracalinae) and Lesser Fat-tailed Jerboas (Pygurinus platypus) are relatively short and flat and without hair brushes. Jerboas have large heads, with wide and flat noses and big eyes. The family is also characterized by large vibrissae and auricles (external ear pinnae) that vary, depending on the subfamily, from relatively short for three-toed jerboas (Dipodinae) to very long for the Long-eared Jerboa (Euchoreutes naso). Caracalinae have particular short and cylindrical auricles. Long ears enhance hearing used to avoid nocturnal predators and to hear insects, like moths, during the night (e.g., Long-eared Jerboa). Long ears also are probably used for thermoregulation during hot weather. Other morphological characteristics of jerboas is the absence of sternal and their compact bodies.
In some subfamilies, neck vertebrae are even fused (e.g., Cardiocraninae and Dipodinae).

Jerboas have dense light-brown fur, with lighter sand-colored fur on their backs and white fur on their ventral surfaces, usually matching the environments in which they live. Birch mice, jumping mice, and five-toed jerboas are characterized by short tails, in contrast to three-toed jerboas that have long and narrow claws. Hindfeet of jerboas have 3–5 toes. For species with more than three toes, the first and fifth toes are much shorter than the three middle ones. When running, three-toed and five-toed jerboas have different adaptations. All toes on the hindlimbs of three-toed jerboas are in contact with the soft substrate. They also have often brushes of long hairs on sides of their toes to stabilize the foot in soft sand. In contrast, only the tail compact callus on top of the central toe of a five-toed jerboa has contact with the hard substrate. The second and fourth toes are shorter and act as shock absorbers.

Skulls of dipodids have enlarged infraorbital foramina. Like other bipedal animals, the foramen magna (hole at the base of the skull) of jerboas is forward-shifted, which allows two-legged locomotion. Skulls do not have well-developed zygomatic plates and are characterized by a sciotic gape lower jaw. The anterior process of the lower jaw is characterized by a thin bone that is often perforated. Auditory bullae are small and simple (one chamber) in species of Smimhidae, Zapedidae, Allactagidae, and the most primitive Dipodinae (Dipus and Sylphidopus), and enlarged and subdivided into several chambers in Euchoeretidae, Cardiocraninae, and advanced Dipodinae (Paradipus, Jaculus, and Eremodipus). The dental formula of dipodids is I 1/1, C 0/0, P 0–1/0, M 3/3 (X2) = 16 or 18. The large upper incisors are smooth in all subfamilies of Dipodidae. Lower premolars are normally absent but are present in rare individuals (less than 1%) of Great Jerboas and Northern Three-toed Jerboas. C. Charles and L. Voisin in 2007 found a rare case of a supernumerary molar (M²) in one Greater Egyptian Jerboa. Upper first premolars (P¹) are well-developed in Euchoreutes, Cardiocraninae, Dipus, Mongolian Three-toed Jerboas, Allactaga, Orientalallataga, Allactaginae, and Scauritus and absent in Pygerythrus. Thick-tailed Three-toed Jerboa, Dzungarian Three-toed Jerboa, Jaculus, Eremodipus, and Paradipus. Crown heights of unworn molars are signifi-

Habitat

Jerboas are distributed in deserts, semi-deserts, and steppes of North Africa and Eurasia. These areas are characterized by moving sands, clay depressions, rocky–gravel plateaus, and dry mountain slopes. Most species are habitat-specific, but some are less selective and can be found in diverse environments. Five-toed jerboas prefer areas with relatively hard soils. Sand-dwelling specialists (or psammophilous species) include species of Paradipus, Eremodipus, or Sylphidopus. Others dipodids are habitat generalists (Dipus, Sylphidopus, and Lesser Egyptian Jerboa).
Jerboa or specialize on hard clay substrates (Blanford’s Jerboa and Greater Egyptian Jerboa). The Northern Three-toed Jerboa in its western and north-eastern distribution inhabits sand mazes, 26 km² for the Great Jerboa, 36 km² for the Northern Three-toed Jerboa, 30 km² for the Small Five-toed Jerboa, 31 km² for Blanford’s Jerboa, 32 km² for the Comb-toed Jerboa, 29 km² for the Small Five-toed Jerboa, 28 km² for the Dwarf Fat-tailed Jerboa, 26 km² for the Lesser Fat-tailed Jerboa, 19 km² for Lichtenstein’s Jerboa, 6 km² for the Thick-tailed Pygmy Jerboa (Salpingotus cristicudus). Big jerboas such as the Comb-toed Jerboa, Bobrinski’s Jerboa, and the Small Five-toed Jerboa can bound up to 3 m in length and 1 m in height when predators chase them. Maximum lengths of jumps are 902 cm for the Comb-toed Jerboa, 291 cm for the Black-footed Jerboa, 283 cm for Blanford’s Jerboa, 211 cm for Bobrinski’s Jerboa, 202 cm for the Small Five-toed Jerboa, 200 cm for the Northern Three-toed Jerboa, 196 cm for Lichtenstein’s Jerboa, 95 cm for the Dwarf Fat-tailed Jerboa, and 54 cm for the Lesser Fat-tailed Jerboa.

DIP-17

The three-toed jerboa (Dipodomys) may use their forelimbs to dig their burrows in the soft, sandy soils where they are generally found. This individual is either an African Hammeda Jerboa (Hammada hispida), recently split from the Lesser Egyptian Jerboa (1 Jerboa), or an Arvicanthis Jerboa (1 Jerboa). The burrows of five-toed jerboas are often complex, with multiple tunnels, chambers, and emergency exits. In sandy soils, burrows of the Arvicanthis Jerboa have several tunnels, with one main entrance and several emergency exits, and a main chamber at 5.1 cm deep. In sandy soils, however, their burrows are simple, and their depth usually does not exceed 30 cm.

Jordens, op. Jordan.

Photo: David, Horning/PLFA

General Habits

All jerboas are bipedal and also move by running and jumping. They can run very fast for long distances, depending on the species. Maximum running speeds of jerboas are 40–50 km/h for the Great Jerboa, 56 km/h for the Comb-toed Jerboa, 29 km/h for the Northern Three-toed Jerboa, 30 km/h for the Small Five-toed Jerboa, 31 km/h for Bobrinski’s Jerboa (Aliacricotopus bobrinskii), 29 km/h for the Northern Three-toed Jerboa, 28 km/h for the Dwarf Fat-tailed Jerboa (Pygomyotus panayi), 26 km/h for Lichtenstein’s Jerboa, 19 km/h for the Lesser Fat-tailed Jerboa, and 6 km/h for the Thick-tailed Pygmy Jerboa.
Five-toed jerboas like the Siberian Jerboa, which generally inhabit harder soil areas than three-toed jerboas, use their muzzles to dig. They remove the localized sod with their forelimbs and toes. Jerboas dig four types of burrows: day burrows are used for sleeping during the day in summer, and at lower levels. Shelter burrows provide safety when escaping predators at night, and temporary shelter burrows are used for cover when foraging during the day. Winter burrows are used for hibernation. The summer burrows of the Siberian Jerboa usually consist of a main tunnel, sloping down with a right-angled turn to the nest chamber 3.5–5 cm below the ground. There are usually no emergency exits. Their winter burrows are longer, and much deeper, at 3.5 m.

G. Ulutovskii, A. Chabalin.

Oribi (sabba) and Dipodidae because it provides additional acceleration to the bipedal gallop. Third, bipedal running (or pacing) with alternating support by left and right hindfoot. This type of locomotion is typical for slow movement by most speecies of Allactaginidae and Dipodidae and for all manners of movement by Muridae.

Jerboas make their nests in burrows, and these can be complex, with different side-chambers. They can construct four types of burrows: day burrows used to sleep during the day in summer and where females keep their offspring during the reproduction season; shelter burrows used to escape predators during the night; temporary shelter burrows used for cover when foraging during the day, and wintering burrows used for hibernation. Day and hibernation burrows are similarly constructed. They differ mostly in depth and length, with a greater depth in hibernation burrows. Several chambers (up to four) are constructed at different depths and are typical of wintering burrows. Indeed, during hibernation, jerboas change chambers to find optimal temperature for hibernation. Three-toed jerboas mostly use forelimbs to dig their burrows in sandy soils. In contrast, five-toed jerboas use their incisors to dig the hard soils where they generally live, and they use their forelimbs and snout to excavate soil from the tunnel. Burrows of three-toed jerboas are often complex. They can have 2–3 tunnels, 1–2 main chambers, 1–2 additional chambers, and 2–3 emergency exits.

When a jerboa is in its burrow, exits of the tunnel are closed with soil plugs and are almost invisible. These plugs have different purposes for jerboas: hiding from predators and protection from hot summer air. In some cases in the nesting bur-
rows, additional soil plugs are constructed, separating the nest chamber from other parts of the burrow. Burrows of five-toed jerboas are generally simpler and usually have two tunnels. The first tunnel is parallel to ground surface, with the initial part filled by soil at one end; its main entrance is at the opposite end; and an emergency exit is near the internal end of the initial tunnel but not completely dug up to the soil surface. The second tunnel starts from the middle part of the first tunnel and goes down to the nest chamber. Nest chambers are constructed from dry vegetation or, in the case of desert jerboas, camel hairs. In a similar way, day burrows are generally more complex for three-toed jerboas and pygmy jerboas compared with those of five-toed jerboas. Generally, day and night shelter burrows of five-toed and several three-toed jerboas are simple short tunnels with open holes used to escape predatory attacks. During the rainy season, they generally dig their burrows in small hills to reduce the risk of flooding. Most species of birch mice, jumping mice, and jerboas hibernate for at least one-half of the year. They survive using fat that they build up during summer. Duration of hibernation depends on the geographical region and species. During hibernation periods, their body temperatures can decrease to 2–3°C, and they can lose more than 50% of their weight. This period is therefore highly sensitive for many dipoid species, and their mortality rates are high. For jerboas, the hibernation period is also related to their reproductive cycle. For species having a single breeding period and living in cold Asian deserts (e.g., Five-toed Pygmy Jerboa), hibernation can be extremely long from

The Five-toed Pygmy Jerboa is almost exclusively granivorous. It specializes mainly on seeds of species of Dicaeum, the warbling grasshopper. It is a typical nocturnal and forages for 4–6 hours every night. Its short, thick tail, visible here, stores fat for long hibernation. Other pygmy jerboas (Saltipes species) eat both seeds and insects, in varying proportions.
late August to May–June. For species with two breeding periods in spring and autumn, hibernation can be less than six months.

Most species of jerboas, including the subtropical desert species, the Great Egyptian Jerboa, are obligate hibernators. Some species with wide distributions (e.g., Small Five-toed Jerboa, Dwarf Fat-tailed Jerboa, and Northern Three-toed Jerboa) are facultative hibernators. They almost always hibernate in northern parts of their distributions, but in southern parts, they hibernate in cold winters and do not hibernate in warm winters. Hibernation times can vary depending on latitude. For example, populations of Lichtenstein's Jerboa in southern parts of its distribution hibernate 3–5 months from end of November to early March, but in northern parts, hibernation lasts 5–6 months from September to early April. Generally, hibernation periods start in September–October depending on the genera and their distributions. The end of hibernation is more variable and depends on climatic conditions. Species of several genera, such as Sjöstedtia and Stenoecus, are known to hibernate.

Dipodids have numerous predators that vary depending on where they occur. The most common predators are mid-sized mammals such as foxes (e.g., Vulpes vulpes, V. corsac, and V. megalopterus), jackals (e.g., Canis aureus, Canis lupus), and snakes (e.g., saw-scaled vipers, Echis spp.; Elaphe dione, Bungarus flaviceps; and Spalerosophis diadema).
Communication

Little is known about communication systems of dipodids. Many species of dipodids use dust baths, and even if they do not have well-developed skin glands for scent marking, dust buffing is often considered a kind of chemical communication. Other specific marking behavior, such as touching substrate with the analgenial area, has been observed in the Long-eared Jerboa. Good hearing of dipodids suggests they may use sounds and vibrations to communicate with one another, even if they are generally silent. Tactile communication probably exists between mates and between mothers and their young.

Food and Feeding

Most dipodids are omnivorous, with diets of vegetation, fruits, fungi, insects, and relatively soft seeds. Some species are mostly insectivorous, particularly eating beetles or moths. Dipodids do not store food. Some species of jerboas, such as the Great Jerboa, Sverdlov’s Jerboa, and the Siberian Jerboa (Orientaliaoptera aliena), are omnivorous, feeding on what they find in arid habitats of Central Asia. They mostly eat seeds, fruits, fungi, and insects, but they also eat plant parts such as green stems and leaves, roots, and tubers. The Northern Three-toed Jerboa has a relatively generalized diet composed of seeds and fl (36–75%, average 51%), green plant material (10–54%, aver-
Jerboas breed 1-3 times per year, depending on the species. The Arabian Jerboa, which does not appear to hibernate, has been recorded breeding between February and November. There are 2-7 young in a litter, born after a gestation period of 25 days. Jerboas generally breed after their first winter, from the age of 10-11 months, but in a few species, some individuals born in spring may breed in the autumn of the same year. As species and populations that hibernate, mating usually occurs shortly after emergence.

Breeding

Dipodidae generally give birth to litters of 2-9 young after gestations of 19-42 days. They breed 1-3 times/year, depending on the species. Jerboas are polyoestrous, and their breeding biology can be divided into three groups. Species in the first group breed only once in spring or summer (warm season). This group includes Lichtenstein’s Jerboa, Kozlov’s Pygmy Jerboa, the Lesser Fat-tailed Jerboa, the Thick-tailed Three-toed Jerboa, and the Mongolian Three-toed Jerboa. Species in the second group have one or less regularly, two litters during the warm period and include the Great Jerboa, the Balkan Jerboa (Orientalactaga balkanica), the Gobi Jerboa (Orientalactaga baltica), the Siberian Jerboa, the Thick-tailed Pygmy Jerboa, Hoppe’s Pygmy Jerboa (Salpingotus hoppei), the Pallid Pygmy Jerboa, the Long-eared Jerboa, and the Lesser Fat-tailed Jerboa. Five-toed Pygmy Jerboas very rarely have two litters during spring or summer. Litters of species in these two groups have 2-9 young, with an average of five young. Their sexual maturity occurs about a year after the first hibernation, and mating usually occurs after the awakening from hibernation. Species in the third group breed 2-3 times a year. Overwintering individuals in this group can produce two litters in spring and early summer without interruption (only one in the case of the Greater Fat-tailed Jerboa) and one in autumn after an interruption in breeding in late summer. This group includes the Small Five-toed Jerboa, Severny’s Jerboa, Bobrinski’s Jerboa, the Northern Three-toed Jerboa, the Dwarf Fat-tailed Jerboa, and the Greater Fat-tailed Jerboa. Litters in this group have 1-8 young, with an average of four young. Juveniles born in spring can produce one litter in the following autumn.
These Arabian Jerboas are approximately three weeks old. Their eyes are not yet open, and their uveal surfaces are pink and hairless. A plausible explanation of the long parental care given to young jerboas is that the motor skills they need for bipedal locomotion must be completely developed before they can leave their burrows. They acquire the use of their hindlimbs quite late in their development. For several weeks after birth they crawl, using their forelimbs, dragging their hindlimbs behind them. Even after their hindlimbs are able to support the body, further days or even weeks may pass before the young jerboas can jump.

*Arvicanthis australis*

Sharif Boodaie, Emir, United Arab Emirates.
Photo: Bhikhu Parmar

Gestation is only known for several species. It is generally long, varying from 19–20 days for the Thick-tailed Three-toed Jerboa to 25–42 days for the Four-toed Jerboa (*Saccostomus campestris*) and intermediate at 25–30 days for the Northern Three-toed Jerboa, 25–30 days for the Gobi Jerboa and the Long-eared Jerboa, 28–30 days for Severnov’s Jerboa, and 30 days for Bobrinski’s Jerboa. Weaning seems to be long for jerboas. For example, for species such as the Small Five-toed Jerboa and the Great Jerboa, young are nursed and cared for during their first 30–45 days. A plausible explanation of such long parental care is that the motor skills needed for bipedal locomotion must be completely developed before young can leave their burrows. As soon as they leave their nests and after just few nights outside, they become independent of their mothers. An interesting social behavior among a mother and her young has been recorded for at least one species, the Thick-tailed Three-toed Jerboa. Upon existing their burrow and for some days after, young in a “train” formation, the first young holds onto the base of its mother’s tail, the second young holds onto the...

There are no population data for the Five-toed Pygmy Jerboa, which is classified as Data Deficient on the IUCN Red List. It is widely distributed in deserts and semi deserts in northern and northwestern China, Mongolia, and southeastern Russia. Approximately 15% of its range in Mongolia lies within protected areas. There is an isolated population in Kazakhstan, where it is listed as vulnerable in the national Red Book. It probably meets the IUCN criteria for Least Concern, but more data are required to confirm this, and further research is needed to identify conservation priorities and actions for this species.

*Cordyceps paradoxus*

O. Dietl, Muséum. Photo: Konstantin Mikhailov
Four of the six Saharan pygmy jerboa species are classified as Data Deficient on The IUCN Red List. The Pallid Pygmy Jerboa is endemic to Kazakhstan, where the two subspecies occupy distinct ranges, one in the north of the Aral Sea, and the other in the south-east of the country, south of Lake Balkhash. There is no information about population trends or threats to this species, although the population is known to be small and to fluctuate annually. In Kazakhstan it is listed as a Category III species (rare, small in number, and with a limited range). Its habitats are at risk of increasing human-induced degradation, including grazing and irrigation, with aridity predicted to increase in the region.

*Saharanus pallidus*
Shybay, Akbo, W Kazakhstan.
Photo: Gregory Sasseini

Dipodidae are typically solitary, and every individual has its own burrow for sleeping and hibernating. Agonistic behaviors vary among species. In many species of jerboas, individuals avoid contact but fight with each other in overlapping home range areas. Some species of pygmy jerboas, such as the Thick-tailed Pygmy Jerboa, can be territorial and aggressive toward neighbors. Home range sizes of jerboas vary among species and depend on the size of the species and the habitat productivity in which it lives. Sizes also vary geographically and with changes in density. Smallest home ranges (0.3–0.5 ha) are typical for species of Cardiocricetinae, the Thick-tailed Three-toed Jerboa, Koslov’s Pygmy Jerboa, and the Greater Fat-tailed Jerboa. The

This is either the Exploresis Jerboa (*Saimiri eximius*), or the Syrian Four-toed Jerboa (*S. musculus*). The former is considered Near Threatened on the IUCN Red List (as Allactaga eximia), while the latter has not been assessed by IUCN. The major threat to the Exploresis Jerboa is agricultural expansion, in Jordan, its population has declined by 50% over 20 years and continues to decline. It is considered edible by several tribes of Bedouins in Jordan and is hunted in some areas of Syria. In Syria, spotlights are directed to compensate numbers of jerboas, for sale to falconers as food for their birds.

*Scoturus* sp.
syria.
Photo: Xavier Ethiades/Bert

Movement, Home range and Social organization

Dipodidae are typically solitary, and every individual has its own burrow for sleeping and hibernating. Agonistic behaviors vary among species. In many species of jerboas, individuals avoid contact but fight with each other in overlapping home range areas. Some species of pygmy jerboas, such as the Thick-tailed Pygmy Jerboa, can be territorial and aggressive toward neighbors. Home range sizes of jerboas vary among species and depend on the size of the species and the habitat productivity in which it lives. Sizes also vary geographically and with changes in density. Smallest home ranges (0.3–0.5 ha) are typical for species of Cardiocricetinae, the Thick-tailed Three-toed Jerboa, Koslov’s Pygmy Jerboa, and the Greater Fat-tailed Jerboa. The
largest home ranges (up to 38 ha) are observed for the Great Jerboa, the Comb-ted Jerboa, and Lichtenstein’s Jerboa. For the latter species, foraging occurs in small patches of 4–15 m² distributed throughout the home range, and during one night, individuals can visit 3–5 patches.

Home ranges of Northern Three-toed Jerboas in relatively productive habitats are subdivided into two functional parts: the core with living burrows and foraging areas and the peripheral area that is searched when needed. In less productive habitats, all of the home range is used with equal intensity. Home range sizes of Northern Three-toed Jerboas vary from 4 ha to 19–22 ha for males and 2.9 ha to 12–15 ha for females. At low and moderate densities, home ranges of females are isolated, whereas home ranges of males overlap with home ranges of other males and females. At high densities, all home ranges widely overlap regardless of individual’s sex. Nightly movements total 1–2 km for females and 4–8 km, sometimes up to 11 km, for males and subadults.

Although its total distribution covers sometimes thousands of square meters in Kazakhstan, Kyrgyzstan, Uzbekistan, and Iran, Vinogradov’s Jerboa is a habitat specialist, and the area it actually occupies is very much smaller. It prefers flat areas with clay and loamy soils, in mountain foothills at elevations of 500–1200 m. Its habitat is rapidly decreasing because these previously uncultivated areas are being grazed. Although its population trend has not been quantified, it is clearly in decline. Although it is classified as Near Threatened on the IUCN Red List, which however does not include the Iranian subspecies. S. v. tosi in its assessment. The Iranian taxon has also been proposed as a full species, the Tous Jerboa (S. tosi).

S. v. tosi in Sarvistan, Iran. Photo: Gregory Skulachev.

Despite all the paleorheol. depressions along the low banks of dry riverbeds and lakes, where it feeds mainly on scorpion, soil-inhabiting insects, the Great Fat-tailed Jerboa may be at risk of habitat loss because of climate change. Although its range and therefore its total population is small, it can be locally abundant; at 50–60 individuals in the autumn after breeding. The population in the western part of the range experienced a sharp decline in the 1960s, after several rainy years that resulted in steppe expansion, but in the eastern part, the population remained stable. More recent population data is not available. While it is currently assessed as Near Threatened on the IUCN Red List (or P. zibetkoi), Least Concern may be more appropriate.

S. v. tosi in Sarvistan, Iran. Photo: Gregory Skulachev.
The Four-toed Jerboa is found only in coastal salt marshes, "hamadas" (barran, hard, rocky plateaus), and inland flat clay desert along the Mediterranean coast of northeastern Libya and northwestern Egypt. Known from fewer than ten locations, it occupies an area likely to be less than 5000 km² in extent. Early researchers commented that it had already disappeared from certain coastal valleys near Alexandria, Egypt, whereas it was originally collected. Assessment of its remaining habitat is essential, since some areas may be scheduled for desert reclamation. The Four-toed Jerboa is the most threatened species in the family and is classified as Vulnerable on the IUCN Red List.

*Meriones unguiculatus*
(Captive) Rock Zoo, Czech Republic
Photo: Johannes Peske

In most species of dipodids, home ranges of males are 1–5 times larger than those of females. Usually, the home range of one male overlaps the home ranges of several females (except for the Gobi Jerboa where the home range of one male overlaps the home range of only one female), and home ranges of females are non- or marginally overlapping. Home ranges of males are also non- or marginally overlapping in the Long-eared Jerboa, the Thick-tailed Pygmy Jerboa, the Thick-tailed Three-toed Jerboa, Severzov’s Jerboa, the Gobi Jerboa, and the Dwarf Fat-tailed Jerboa, but widely overlap in the Comb-toed Jerboa, the Northern Three-toed Jerboa, the Small Five-toed Jerboa, and the Balkan Jerboa. In some species (e.g., Small Five-toed Jerboa and Dwarf Fat-tailed Jerboa) at high densities, all home ranges widely overlap.

Relationship with Humans

Although dipodids have important roles in many ecosystems in Eurasia, they have very little signifi to humans, except some species are kept as pets (e.g., pygmy jereboas) and eaten. Jerboas are traditional food of Bedouin and Tuareg people in the Sahara Desert and Middle East. The Emulsates Jerboa is hunted and eaten by humans in some regions of Turkey and Jordan and used as food for captive falcons. Some species of jereboas can become abundant pests in arid and desert environments in western North Africa. Jerboas are common pests of watermelon and melon crops in southern Russia, Kazakhstan, and Central Asia.

Recent studies in Mongolia found the bacteria *Kurumia psittis*, the responsible agent of the sylvatic plague, in different jerboas such as the Siberian Jerboa and the Five-toed Pygmy Jerboa. Other studies have found this bacteria in several other species: the Great Jerboa, the Small Five-toed Jerboa, the Lesser Fat-tailed Jerboa, the Dwarf Fat-tailed Jerboa, the Northern Three-toed Jerboa, the Thick-tailed Three-toed Jerboa, Lichtenstein’s Jerboa, and the Comb-toed Jerboa. These results suggest that jerboas can promote the expansion of an epizootic but they cannot be significant reservoirs for the plague because the bacteria causes their death in less than 24 hours. Many other pathogens have also been detected in dipodids, such as tularemia (Great Jerboa), Omsk hemorrhagic fever (Great Jerboa), Q fever (Small Five-toed Jerboa), toxoplasmosis (Small Five-toed Jerboa), tick aporto-

Status and Conservation

Four species of jerboas have special conservation status on The IUCN Red List. The Four-toed Jerboa is classified as Vulnerable, and the Emulsates Jerboa, Vinogradov’s Jerboa, and the Greater Fat-tailed Jerboa are classified as Near Threatened. The Iranian Jerboa (Aallotoca frowi), the Five-toed Pygmy Jerboa, Thaler’s Jerboa (Jaculus thaleri), the Balkanistan Pygmy Jerboa (Saltamarinus mitchelli), Hesper’s Pygmy Jerboa, and the Patell Fat-tailed Jerboa are classified as Data Deficient on The IUCN Red List, making assessment of their conservation status very difficult. New data on the biology and distributions of these six species would improve the understanding of their conservation needs.

The Four-toed Jerboa has very specific habitat requirements and a restricted distribution along the coast of Egypt and Libya. It is known from less than five locations where availability and quality of its habitat has significant decreased. Conservation of its remaining habitat is essential to its long-term survival. The Emulsates Jerboa is mainly threatened by agricultural expansion in Jordan, Syria, and Turkey. According to The IUCN Red List, it has declined in Jordan by about 50% over the past 20 years because of agricultural expansion, and it is also considered to be edible in some regions of Turkey and Jordan. Vi-

Bibliography

Genus CARDIOCRIANIUS

1. Five-toed Pygmy Jerboa *Caridocricetus paradoxus*
   - French: Gerboise à cinq doigts
   - German: Fünfzehndorfer gerbils
   - Spanish: Gerbilo de cinco dedos

   **Taxonomy.** *Caridocricetus paradoxus* (Samein, 1903), Saurongol-Dzhab, Naur-Shan, NW Ganus, China. This species is monotypic.

   **Distribution.** E Kazakhstan [N of Lake Balkhash], NW & N China (N Xinjiang, NW Ganus, Inner Mongolia [-N Mongolia], Ningxia, and NW Qinghai), NW & S Mongolia, and SE Russia [Ussur-Nur Lake, S Tuva].

   **Descriptive notes.** Head-body 52–68 mm, tail 68–75 mm, ear 7–10 mm, hindfoot 24–28 mm; weight 9–19 g. The Five-toed Pygmy Jerboa is very small, with no significant secondary sexual dimorphism. Condylar-base lengths of skulls are 17–18.8 mm, mastoid breadth is 15.8–18.2 mm, and maxillary tooth row lengths are 3.4–4 mm. Head and domon are greyish, reddish brown, or grayish and less often grayish-brown or brownish; sides and ventral pelage are pure white. Tail is short and without fur. Hindfeet have five toes and conical calcusses at bases of toes. Toes of hindfeet are covered with hair. Some individuals are long-coated, with tufted ears. Hindfeet have three toes. Tail is short and multiform. Auditory bullae are greatly inflated and strongly projecting from under the skin. Mastoid cartilage is large and completely subvolved into three sections by septum. In volume, mastoid cavity is about twice as large as tympanic cavity. Frontal surfaces of incisors are yellow. P3 is present and about equal in diameter to M3. Molars are low-crowned, with tubercular surfaces; crowns of unworn molar are 70% of their length. Glassy enamel is thin, elongated, coneshaped, and not subdivided into lobes, with surface covered by extremely small plates not differentiated in size. Os penis (baculum) is rudimentary and rachitic; its length is about equal to one-tenth of the length of glassy enamel.

   **Food and Feeding.** The Five-toed Pygmy Jerboa is granivorous and specializes mainly on seeds of species of *Psoralea*. Breeding. Pregnant Five-toed Pygmy Jerboas were recorded in eastern Kazakhstan in June and Mongolia in July. Females produce one litter per year. Litters have 1–5 young (average 2–5). Activity patterns. The Five-toed Pygmy Jerboa is a nocturnal species. It is active from dusk to dawn. Habitat. Gravel plains of semi-arid and desert in lower parts of mountain foothills with perennial grasses of *Stipa* (Poaceae): *S. kryloviana* and *S. erinacea* in central Kazakhstan and *S. gobiensis* in Mongolia.

2. Kozlov’s Pygmy Jerboa *Salpingotus kozlovii*
   - French: Gerbille à deux queues
   - German: Kozlov-Zweitontiergerbils
   - Spanish: Gerbilo de dos caudas

   **Taxonomy.** *Salpingotus kozlovii* (Vinnogradov, 1922), Khara-Khoeo, Inner Mongolia, China. *Salpingotus kozlovii* is in the subgenus *Salpingotus*. Two subspecies recognized.

   **Distribution.** China (N Xinjiang, NW Ganus, W Inner Mongolia [-N Mongolia], Ningxia, and NW Shaanxi) and S Mongolia.

3. Thick-tailed Pygmy Jerboa *Salpingotus crassicauda*
   - French: Gerbille à deux queues
   - German: Kozlov-Zweitontiergerbils
   - Spanish: Gerbilo de dos caudas

   **Taxonomy.** *Salpingotus crassicauda* (Vinnogradov, 1924, Shara-Sume, N Xinjiang, China. *Salpingotus crassicauda* is in the subgenus *Anguillodentus*. Two subspecies recognized.

   **Distribution.** China (N Xinjiang, NW Ganus, W Inner Mongolia [-N Mongolia]).

   **Descriptive notes.** Head-body 47–62 mm, tail 91–117 mm, ear 8.4–14 mm, hindfoot 20–27 mm; weight 6.4–14 g. The Thick-tailed Pygmy Jerboa is very small, with no significant secondary sexual dimorphism. Condylar-base lengths of skulls are 15.4–17.7 mm, mastoid breadth is 14.3–17.3 mm, and maxillary tooth row lengths are 2.9–5.6 mm. Head and domon are ochreous gray, with scattered dark gray spots, sides and ventral pelage are pure white. Tail is short, with faint gray terminal tip, false deposits in tail are present in the anterior one-third and gradually become thinner toward tip. Hindfeet of males have three toes, covered below with white hairs; conical calcusses at bases of toes are absent. Ears are short and tubiform. Auditory bullae are greatly inflated and strongly projecting from under the skin. Mastoid cavity is large and completely subvolved into three sections by septum. In volume, mastoid cavity is about twice as large as than...
7. Balochistan Pygmy Jerboa
_Salpingotus michaelis_

**French:** Garrotte du Balouchistan / **German:** Balochistankieferwüstenhausbrandmaus / **Spanish:** Jerbo paycho do Balochistan

**Other common names:** Dwarf Thaw-haol Jerboa

**Taxonomy.** _Salpingotus michaelis_ FitzGibbon, 1966, *Desert plateau of Nathal, north-western Baluchistan, approximately 29° N, 66° E, 3,500 feet [1067 m].* Pakistan. _Salpingotus michaelis_ is the subspecies _Salpingotus_. It is considered by some authors to be a separate genus, but its position on the phylogenetic tree constructed with use of morphological characteristics place it in the genus _Salpingotus_, being sister group of _Anguliadipus_. Monotypic. Distribution. SW Pakistan (Baluchistan).

**Descriptive notes.** Head-body 41–45 mm, tail 72–94 mm, ear 6–11 mm, hindfoot 18–19 mm; weight 4 g. The Balochistan Pygmy Jerboa is very small. Condylid-basal lengths of skulls are 12–14–14.3 mm, massoid breadth are 13–14–17 mm, and maxillary tooth row lengths are 2.4–2.8. Head and dorsum are pale yellow–ocher or sandy buff. Sides and ventral pelage are pure white. Tail is furry, with relatively long black terminal tuft; fat deposits in tail are greatest in anterior one-third and rapidly become thinner toward tip. Hindfeet have three toes, covered below with brushes of white hairs; toes do not have comical calcar at bases. Ears are short and subcutaneous. Auditory bullae are greatly inflated and strongly project from under bracteal laterally and caudally. Mastoid cavity is large and completely subdivided into three sections by septa. In volume, mastoid cavity is about equal in size to tympanic cavity. Front surfaces of incisors are white. P1 is large, about two times larger in diameter than M1. Molars are low-crowned, with mesiodens surfaces; crown heights of unworn molars are c.50% of their length; and tubercula are high, with sharp-pointed tips. Glans penis is massive, cylindrical, significantly elongated, with one shallow longitudinal fold not subdivided into lobes, and without aciculata or scales on its surface. On penis (baculum) is large (its length about equal to length of glans penis), straight, with small flat horizontal broadening at proximal end and not broadening distal end, which is bent vertically at the right angle. Chromosomal complement has 2n = 46 and FN = 92.

**Habitat.** Flat sandy and sandy-gravel terraces in true and extra-arid desert. The Long-eared Jerboa avoids non-stabilized sands.

**Food and Feeding.** The Long-eared Jerboa specializes on insects; plant materials are less than 5% of the diet.

**Breeding.** Pregnant Balochistan Pygmy Jerboas were recorded in June–August. Females produce two litters per year. Litters have 2–4 young. Activity patterns. The Balochistan Pygmy Jerboa is nocturnal. It does not hibernate but can become torpid at low temperatures.

**Movements, Home range and Social organization.** In captivity, social interactions of Balochistan Pygmy Jerboas are amicable; up to 5–6 adults can sleep huddled together during the day.

**Status and Conservation.** Classified as Data Deficient on The IUCN Red List. The Balochistan Pygmy Jerboa is known from only nine localities in Chagai District (Baluchistan) in c.3600 km2.


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8. Long-eared Jerboa
_Euereutes nasso_

**French:** Garrotte à longues oreilles / **German:** Großer Plaenderspitz / **Spanish:** Jerbo de orejas largas

**Taxonomy.** _Euereutes nasso_ Scudder, 1891, "probably sandy plains round city of Yarkand," Xinjiang, China. Three subspecies are recognized.

**Subspecies and Distribution.**

- _E. n. nasso_ Scudder, 1891 – W China (Turfan Basin in X Xinjiang).
- _E. n. onclathnana_ A. B. Howell, 1928 – N China (Helan – Alashan) Mts, Ordos Desert, and Qaidam Basin in Garut, W Inner Mongolia – N Mongolia, and N Qinghai) and S Mongolia.
- _E. n. yinoniorum_ Ma Yong & Li Sihua, 1979 – NW China (Darangar Basin in NE Xinjiang).

**Descriptive Notes.** Head-body 90–109 mm, tail 145–189 mm, ear 39–49 mm, hind-foot 32–40 mm; weight 22–45 g. There is no significant secondary sexual dimorphism. Condylid-basal lengths of skulls are 25–28 mm, massoid breadth are 14–17.5 mm, and maxillary tooth row lengths are 4–5 mm. Head and dorsum are ochreous gray; sides and ventral pelage are pure white; and tail banner is not flanked, with narrow white basal ring, long black subterminal field, and relatively short white terminal tuft. Incisors of hindfoot are covered from below with brushes of relatively short soft hairs; external hairs of brushes are white and internal hairs black or dark brown; conical calcar at bases of toes are present. Auditory bullae are significantly inflated and project from under bracteal laterally and caudally. Mastoid cavity is large and completely subdivided into three sections by septa. In volume, mastoid cavity is about equal in size to tympanic cavity. Front surfaces of incisors are white. P1 is large, about two times larger in diameter than M1. Molars are low-crowned, with mesiodens surfaces; crown heights of unworn molars are c.50% of their length; and tubercula are high, with sharp-pointed tips. Glans penis is massive, cylindrical, significantly elongated, with one shallow longitudinal fold not subdivided into lobes, and without aciculata or scales on its surface. On penis (baculum) is large (its length about equal to length of glans penis), straight, with small flat horizontal broadening at proximal end and not broadening distal end, which is bent vertically at the right angle. Chromosomal complement has 2n = 46 and FN = 92.

**Habitat.** Forest-steppe, steppe, semi-desert, and desert. In forest-steppe and steppe, the Great Jerboas select open areas with sparse grass cover such as pastures, along sides of dirt roads, crop fields, shores of salt lakes, and high terraces of river valleys. In semi-desert and desert, it can be found in almost all habitat types, except non-stabilized and semi-stabilized sands, preferring areas with sagebrush (Artemisiospp., Asericeae).
and accentual dwarf shrubs (Andropogon, Salvia, both Amaranthaceae) on light sandy, clay soils.

**Food and Feeding.** The Great Jerboa is omnivorous. It eats seeds, insects, and green and undergrown parts of plants in equal amounts.

**Breeding.** Breeding of the Great Jerboa occurs in March-August. Litters have 1-8 young (average range 3-5). Overwintering females produce two litters per year. Sexual maturity occurs at 9-11 months of age, after overwintering. Gestation was estimated at 25 days.

**Activity patterns.** The Great Jerboa is nocturnal. Absewoground activity usually starts 40-45 minutes after sunset and ends 05-15 hours before sunrise, with peak activity near end of the first one-half of night. Hibernation lasts from as early as the end of September to April.

**Habitat.** Wide variety of desert habitat, avoiding only sandy and rocky mountain slopes.\(^1\)

**Food and Feeding.** Sevastor's jerboa is omnivorous. Seeds, insects, and green and undergrown plant parts are equally represented in the diet.

**Breeding.** Breeding of Sevastor's Jerboa occurs in April-June, in some years in September. Litters have 1-7 young (average range 3-4-4). One-year-old and three-year-old females produce one litter per year; two-year-old females produce two litters. Most individuals are sexually mature at 8-11 months old, after overwintering; in some rare cases, sexual maturity was observed at 6 months of age when individuals born in spring breed in autumn of the same year. Gestation was estimated at 20-21 days. Young mature for 40-50 days.

**Activity patterns.** Sevastor's Jerboa is nocturnal. Absewoground activity usually starts 30-50 minutes after sunset in spring and autumn and 10-20 minutes after sunset in summer. Activity ends c. 30 minutes before sunrise. Peak of activity occurs in the first one-half of the night in spring and autumn and at midnight in summer. Hibernation lasts from October/November to February.

**Movements.** Home range and Social organization. Sevastor's Jerboa move slowly when they forage, using bipedal pacing with alternating support by left and right hind feet; lengths of steps are 16-18 cm. When running fast, they use asynchronous, ricochet jumps. Lengths of jumps are 80-125 cm, and maximum speeds are 40-50 km/h. Escaping behavior is characterized by running fast for 60-100 m and then hiding in dense vegetation or a shelter burrow. Home ranges are 13-18 ha. Summer burrows usually have two main tunnels branching off the initial tunnel: one horizontal, starting from main entrance at the ground surface (often closed with soil plug) and leading to the end of the initial tunnel, and one sloping down, starting in the middle of the first main tunnel and ending after 1-2 right-angle turns at the bottom with nest chamber. Several (1-4) additional short tunnel start from the main horizontal tunnel and lead to emergency exits near the ground surface. The initial tunnel can be up to 6 m long; total length of main tunnels is 125-615 cm (usually 200-300 cm); nest chambers are 9-15 cm in diameter and 40-100 cm deep (usually 56-70 cm). Winter burrows have no initial tunnel or emergency exits but have two nest chambers, one at the bottom end of the sloping down tunnel and the second one in the middle of this tunnel; total lengths of tunnels of winter burrows are 510-550 cm, and maximum depth are 160-250 cm. Night shelter burrows are simple, with one tunnel 80-200 cm long, passing from surface to depths of 50-80 cm. One individual can have 2-4 shelter burrows in its home range. Entrance of shelter burrow is very obvious because a well-formed pit usually leads to it. In the wild, Sevastor's Jerbouas are solitary, and interactions are rare. In captivity, adults are very aggressive and fight immediately; young are peaceful.

**Status and Conservation.** Classified as Least Concern on the IUCN Red List. The Great Jerboa was in common in southern Ukraine, west of the Dnieper River, until the beginning of 20th century, but it is now absent there.


10. *Sevastor's Jerboa* *Allactaga sevastor*

**Taxonomy.** *Allactaga sevastor* Vinogradov, 1925; Tatar-Ukok, Kely-Kurgan District, Karakhan.

*Allactaga sevastor* is characterized by the following features: 1.45-1.65 mm, tail L = 260-250 mm, ear = 40-60 mm, hindfoot = 67-81 mm, weight = 127-229 g. There is no significant sexual dimorphism.

**Descriptive aspects.** Head-body length 145-165 mm, tail 205-250 mm, ear 40-60 mm, hindfoot 67-81 mm, weight 127-229 g. There is no significant sexual dimorphism. Condyle-based lengths of skulls are 37-46.49 mm, zygomatic breadth are 26-34 mm, and maxillary tooth row lengths are 7-9-9 mm. Head and dorso of *Allactaga* are grayish brown; sides and ventral pelage are pure white; and tail is white, wide and well flattened, bicolor, with moderately long (35-55 mm) black subterminal field and long (40-60 mm) white terminal tuft; ventral side of black subterminal field is dissected along tail rod by white stripe with narrow black strip in the middle of it. Toes of hindfeet are naked; toenails at bases of toes are large and high, with relatively narrow bases and rounded apexes. Auditory bullae are moderately inflated. Mastoid cavity is extremely small and not subdivided into sections; tympanic cavity is moderate. Front surfaces of incisors are white; incisors are moderately deflected forward. P is relatively small, 1.6-1.7 times smaller in diameter than M. Of molars are medium-crowned, with reduced incisural surfaces; crown heights of unworn molars are 90-115% of their length. Glans penis is egg-shaped, 6-6.5 mm long and 4-4.5 mm wide. Molars are high, slightly compressed in dorsal-ventral direction, subdivided by deep longitudinal dorsal fold into two lateral lobes; surfaces of lobes are covered by single-versex, backward-directed plicate, increasing in size in backward direction; and aciculae are arranged in 4-5 concentric rows, with 9-10 aciculae in each row. On penis (baculum) is absent. Chromosomal complement is Z = 48 and FN = 96.

**Genus ALLACOTIDUS**

**11. Bobrinski's Jerboa** *Allactaga bobrinskii*

**Taxonomy.** *Allactaga bobrinskii* Bobrinski-Kolesnik, 1937; Khalkha Ar, 140 km NW Bokkhara, Uzbekistan.

*Allactaga bobrinskii* is the sister species of the *Allactaga major* + *A. sevastor* clade. Monotypic.

**Distribution.** NW & N Turkmenistan (Balikhu, Dagez, and Lebap provinces) and C & SW Uzbekistan (Karakalpakstan, Bokhara, and Navoiy regions).

**Descriptive notes.** Head-body length 110-135 mm, tail 170-200 mm, ear 25-29 mm, hindfoot 56-64 mm, weight 52-77 g. There is no significant sexual dimorphism. Condyle-based lengths of skulls are 25-30 mm, zygomatic breadth are 21-25 mm, and maxillary tooth row lengths are 5-6-8 mm. Head and dorso of all *Allactaga* are grayish brown; sides and ventral pelage are pure white; and tail is narrow but well flattened and one-color (gravelish buff).

Toes of hindfeet are covered from below with brownish of long (12-13 mm) soft hairs, subdigital surfaces are covered with brownish of long (11-12 mm) soft hairs, which are slightly shorter than the rest; condyle-based lengths of skulls are 25-30 mm, zygomatic breadth are 21-25 mm, and maxillary tooth row lengths are 5-6-8 mm. Head and dorso of all *Allactaga* are grayish brown; sides and ventral pelage are pure white; and tail is narrow but well flattened and one-color (gravelish buff).
12. Siberian Jerboa  
**Orientalactaga sibirica**

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Genus ORIENTALACTAGA
Shenbrot, 1904
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13. Gobi Jerboa  
**Orientalactaga bullata**

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Genus ORIENTALACTAGA
Shenbrot, 1984
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**Taxonomy.** *Orientalactaga FORREST, 1977, Terey Lakes, Zabaykalsky Krai, Russia.**

**Orientalactaga sibirica** is the sister species of *O. bullata*. Genetic data provide some evidence that *O. sibirica* is not a single species but a complex of cryptic species. However, specific descriptions and distributions of these species are not yet clear. Nine subspecies recognized.

**Subspecies and Distribution.**

- *O. s. sibirica* (Forrest, 1977) – SE Siberia (Buruntyak and Zabaykalsky Krai in Russia), N & NE Mongolia, and NE China (NE Inner Mongolia – NE Mongolia), Heilongjiang, and Jilin.
- *O. s. altaiensis* (Shenbrot, 1994) – S slopes of Tian Shan in S Kyrgyzstan and W China (SW Xinjiang).
- *O. s. mongolica* (Shenbrot, 1991) – Desertian Basin in NW China (N Xinjiang) and SW Mongolia.
- *O. s. lingneri Miller, 1911 – C & E China (N foothills of Tibetan Plateau in Qinghai, Gansu, Ningxia, and Shanxi) and Hebei.
- *O. s. kazakhstani* (Babushkin, 1960 – SW Kazakhstan (W of Sarysu River), NW Uzbekistan, and N Turkmenistan.

**Descriptive notes.** Head-body 124–180 mm, tail 174–240 mm, ear 30–52 mm, hind foot 60–79 mm; weight 65–170 g. There are no significant secondary sexual dimorphisms. Condylar basic length of skulls is 30–38.2 mm, zygomatic breadth are 21–24.9 mm, and maxillary tooth row length are up to 6 mm, and depth is 2.4 mm. Night shelter burrows are single-pit tunnels up to 80–180 cm long. One individual has 1–2 shelter burrows in its home range. Entrances of shelter burrow is very obvious because of the well-worn path leading to it. In the wild, Siberian Jerboas are solitary, but sometimes they are seen in groups of 2–5 individuals. 

**Status and Conservation.** Classified as Least Concern on The IUCN Red List (as *Orientalactaga sibirica*).
ly deflected forward. P1 is relatively large and about equal in diameter to M1. Molars are medium-crowned, with terraced incisiform surfaces; crown heights of unworn molars are 100–180% of their lengths. Glans penis is egg-shaped, slightly compressed in dorso-ventral direction, subdivided by deep longitudinal dorsal fold into two lateral lobes; surfaces of lobes are covered by single-vertex, backward-directed aciculae significantly increasing in size in backward direction. Os penis (baculum) is absent. Chromosomal complement has 2n = 48 and FN = 96.

Habitat. Semi-deserts and deserts, with associations of Atilia (Amaryllidaceae)–Sicipa (Poaceae)–Arteneza (Arteneaceae) on rocky-gravel soils in middle and lower parts of foothill belts.

Food and Feeding. The Gobi Jerboa is omnivorous, with a tendency toward folivory. Green plant parts comprise 90% of the diet, underground parts 30%, insects 15%, and seeds 5%.

Breeding. Gobi Jerboas breed in June–August. Litters have 2–5 young (average 3).

Activity pattern. The Gobi Jerboa is nocturnal. Aboveground activity usually starts at dawn. Males often breed in June–August. Litters have 2–5 young (average 3).

Movement. Home range. Litter sizes are 0–6–8 for males and 1–3–6 for females. Home range is larger in females, with males often overlapping those of females. Summer burrows often consist of a main tunnel, starting from the entrance, and at times the outermost part leading to the nest chamber. Entrance is usually closed with soil plug. Nest is usually not present in the burrow. Total length of tunnels is c. 25 m; nest chamber is 10–12 cm in diameter and c. 35 cm deep. Night shelter burrows are simple, with one tunnel and one entrance. One individual has 3–5 shelter burrows in its home range. Escape behavior is characterized by running fast and hiding in a shelter burrow. Entrance to a shelter burrow is obvious because of the well-defined path leading to it. In the wild, the Gobi Jerboa is solitary, but during the breeding season, males and females often fossor together at night or sleep in one burrow during the day. In captivity, individuals are very aggressive and frequently fight.

Status and Conservation. Classified as Least Concern on The IUCN Red List (as Allactaga buliata).


14. Balikun Jerboa Orientallactaga balikunica

Taxonomy. Allactaga buliata balikunica Hsia Wuping & Fang Xiyue, 1964, Balikun (= Bartol), Xinjiang, China. In the past, O. balikunica was considered as a subspecies of O. buliata. Phylogenetically, it is the sister species of O. abricii + O. buliata clade. Monotypic.

Distribution. N China (NE Xinjiang, NW Gansu, and NW Inner Mongolia) (?=N Mongolia) and S Mongolia.

Descriptive notes. Head-body 120–135 mm, tail 179–195 mm, ear 34–39 mm, hindfoot 58–65 mm, weight 63–88 g. There is no significant secondary sexual dimorphism. Condylar basal lengths of skulls are 29.4–34–1 mm, zygomatic breadth is 29.8–31.1 mm, and maxillary tooth row lengths are 5.4–6.5 mm. Head and dorsal grey-brown; sides and ventral pelage are pure white; tail banner is wide and well flattened, bi-colored, with long black subterminal field and short white terminal tail; and ventral side of black subterminal field is solid and not dissected along tail rod by wide white stripe. Toes of hindfeet are covered from below with brushes of long soft hair, black inside and white outside; conical cailuses at bases of toes are large but relatively short, with wide bases. Auditory bullae are significantly inflated. Maxilla is extremely small and not subdivided into sections; tympanic cavity is large. Front surfaces of incisors are white; incisors are weakly deflected forward. P1 is relatively large but slightly smaller than M1. Molars are medium-crowned, with terraced incisiform surfaces; crown heights of unworn molars are 100–130% of their lengths. Glans penis is egg-shaped, slightly compressed in dorso-ventral direction, subdivided by deep longitudinal dorsal fold into two lateral lobes; surfaces of lobes are covered by single-vertex, backward-directed aciculae slightly increasing in size in backward direction. Os penis (baculum) is absent. Chromosomal complement has 2n = 48 and FN = 96.

Habitat. Extra-arid and rock-gravel hill slopes, with sparse shrub vegetation.

Food and Feeding. The Balkun Jerboa is omnivorous. Seeds comprise 19–34% of the diet, insects 17–20%, green plant parts 28–57%, and moss and bulbs 4–21%.

Breeding. Breeding of the Balkun Jerboa occurs in June–August. Litters have 2–5 young (average 3–5).

Activity pattern. The Balkun Jerboa is nocturnal. Aboveground activity usually starts immediately after sunset in June and 30–60 minutes after sunset in July–August. Home range averages 4.5 ha for males and 5.2 ha for females. Home ranges of females are usually smaller than those of males. Summer burrows usually consist of a main tunnel, starting from the entrance, and at times the outermost part leading to the nest chamber. Entrance is usually closed with soil plug. Total length of tunnels is c. 25 m; nest chamber is 12–15 cm in diameter and c. 60 cm deep. Night shelter burrows are absent. In the wild, Balkun Jerboas are solitary. Captive pairs are usually aggressive at first, followed by one individual attempting to escape.

Status and Conservation. Classified as Least Concern on The IUCN Red List (as Allactaga balikunica).

13. Williams’s Jerboa *Scurianus williamsi*

**Taxonomy.** *Allactaga williamsi* Thomas, 1897, *Van, alt. 5000 ft. [1524 m.], Turkey*. Previously included in the genus *Allactaga* and later *Parascalops*, this species has recently been found to be a junior synonym of *Scurianus*. In the past, *S. williamsi* was synonymous with *S. phaeomelas*. Phylogenetically, it is a member of the subgenus *Parascalops*, being the sister species of *S. albidus*. Recently found in the Kopet Dag Mountains of north-eastern Iran, *Scurianus* of *S. williamsi*, named by K. Hamidi and colleagues in 2016, is a separate species that needs to be formally described; it is also possible that it is closely related to *S. ephratus* *caprimalis*. Monotypic.

**Distribution.** Turkey (Anatolia), Armenia, SE Georgia, Azerbaijan, NW & W Iran, and Lebanon; individuals of still unresolved specific status have recently been found in NE Iran (Kopet Dag Mts). Descriptive notes. Head-body 102-146 mm, tail 157-255 mm, ears 38-51 mm, hindfoot 61-74 mm, weight 24-43 g. There is no significant secondary sexual dimorphism. Condylar-based lengths of skulls are 29.5-35.9 mm, zygomatic breadth are 24.4-24.8 mm, and maxillary tooth row lengths are 5.0-5.6 mm. Head and dorsal are brownish ochreous; sides and ventral pelage are pale white; and tail banner is wide and well banded, with short (20 mm) bright-ochreous basal ring, relatively long (40 mm) black subterminal field, and short (20 mm) white terminal tuft. Toes of hindfoot are covered from below with short soft white (with admixture of black) hairs not forming brushes; conical calluses at bases of toes are large, with wide bases and rounded apices. Auditory bullae are weakly inflated. Mastoid cavity is medium-sized and not subdivided into sections; tympanic cavity is extremely small. Front surfaces of incisors are white; incisors are weakly deflected forward. P5 is relatively small and about one size as small as in diameter. Molars are low-crowned, with tubercular mammary surfaces; crown heights of unworn molars are 0.07% of their lengths. Glans penis is egg-shaped, 2.5-3.9 mm long and 1.8-2.4 mm wide, slightly compressed in dorso-ventral direction, sub-rounded by deep longitudinal dural fold into two lateral lobes; surfaces of lobes are covered by single-layered, backward-directed aciculae increasing in size in backward direction; and aciculae are arranged in 4-5 concentric rows with 12-14 aciculae in each row. Os penis (baculum) is absent. Chromosomal complement has 2n = 48 and FN = 96.

**Habitat.** Mainly semi-desert and mountain dry steppe but also subalpine meadows up to elevations of c.2500 m. *Williams’s Jerboa* is a habitat generalist and frequents different habitats including saltwort (Ammophila arenaria) vegetation, semi-stabilized sand dunes, and rock crags, preferring patches of sparse sagebrush (Atriplex, Artemisia) and herbaaceous vegetation.

**Food and Feeding.** Diet of *Williams’s Jerboa* is a mixed diet of seeds and insects and a lesser extent of green plant material and bulbs. It mainly eats insects and green plant parts in spring, vegetative and generative plant parts in summer, and seeds in autumn.

**Breeding.** Breeding of *Williams’s Jerboa* was recorded in late March-June and August-October. Litters have 2-8 young (average varies within the same year 3-6). Overwintering females can produce two litters per year. Length of gestation was estimated at 25-26 days.

**Activity patterns.** *Williams’s Jerboa* is nocturnal. Agromyzoid activity usually starts 1-5-2 hours after sunset and ends before morning dark. Hibernation occurs in November-February.

**Movements, Home range and Social organization.** Barrows of *Williams’s Jerboa’s* home range are simple and have usually one tunneled with 1-3 turns. Tunnels start at ground surface, with typically plugged entrance, and end with nest chamber 12-14 cm in diameter and 20-60 cm deep; lengths of tunnels are 90-200 cm. In some cases, barrows have 1-2 additional tunnels ending with emergency exits. In captivity, initial contact between individuals of the same or opposite sex is aggressive; after two hours of intense fighting, individuals become peaceful; and in some cases, these interactions can lead to serious wounds or death.

**Status and Conservation.** Classified as Least Concern on The IUCN Red List (as *Allactaga williamsi*).


16. Syrian Five-toed Jerboa *Scurianus albidus*

**Taxonomy.** *Allactaga albidus* Wagner, 1840, "West coast of Arabia" (probably NE of Asir in present-day Jordan). Previously included in the genus *Allactaga* and later *Parascalops*, which has recently been found to be a junior synonym of *Scurianus*. In the past, *S. albidus* was synonymous with *S. phaeomelas*. Phylogenetically, it is in the subgenus *Parascalops*, being the sister species of *S. williamsi*. The name *Scurianus albidus* was considered a synonym of *Allactaga albidus* by J.R. Ellerman and T.C.S. Morrison-Scott in 1951 and appeared with a "?" and without any comment in M.E. Holden and G.G. Musner in 2005. Nevertheless, definite indication of the place of origin of the type specimen in the original description and type dimensions typical for *phaeomelas*, allow applying this name to the species in the *Scurianus* group, occurring west of Eupeotes River Monotypic.

**Distribution.** Extreme SE Turkey (Kafkas) and NW Arabian Peninsula W of Eupeotes River (W Syria, Jordan, and NW Saudi Arabia); in S Syria, probably, also occurs on the left bank of Eupeotes. Descriptive notes. Head-body 96-128 mm, tail 158-199 mm, ears 30-42 mm, hindfoot 51-61 mm. No specific data are available for body weight. Condylar-based lengths of skulls are 27.8-31.7 mm, zygomatic breadth are 21.2-25.2 mm, and maxillary tooth row lengths are 6.5-8 mm. In general appearance and skull and molars morphologies, the Syrian Five-toed Jerboa is similar to the Eupeotes Jerboa (*S. ephratus*). Monophyly of glans penis and chromosomal complement have not been described.

**Habitat.** Arkal habitats, preferring foothills especially near streams (corribial rivers) and grassy areas of "hamada" (barren, hard, rocky plateaus) desert; avoids sandy habitats.

**Food and Feeding.** No information.

**Breeding.** Breeding of the Syrian Five-toed Jerboa was recorded in April. Litters have 6-9 young.

**Activity patterns.** The Syrian Five-toed Jerboa is nocturnal.

**Movements, Home range and Social organization.** No information.

**Status and Conservation.** Not assessed on The IUCN Red List.


17. Eupeotes Jerboa *Scurianus ephratus* (syn. *S. phaeomelas*)

**Taxonomy.** *Allactaga ephratus* Thomas, 1861, "Mesopotamia [= Iraq]." Previously included in the genus *Allactaga* and later *Parascalops*, which has recently been found to be a junior synonym of *Scurianus*. Phylogenetically, *S. ephratus* is in the subgenus *Parascalops*, being the sister species of *S. williamsi* and *S. albidus*. The form *kovicai* named by F. Colak and N. Yigit in 1998 is genetically identical with the nominate form; moreover, *kovicai* was described based on comparison of specimens from southern Turkey with *S. albidus* from Syria rather than with true *S. phaeomelas*. Two subspecies recognized.

**Subspecies and Distribution.** *S. e. ephratus* Thomas, 1861 – definitely known from SE Turkey, Iraq E of Eupeotes River and SW Iran, probably, occurs also in Syria E of Eupeotes, C & S Iran W of Eupeotes, Kuwait, and N Saudi Arabia; *S. e. kovicai* Ellerman, 1948 – Afghanistan.

**Descriptive notes.** Head-body 77-140 mm, tail 144-210 mm, ears 29-52 mm, hindfoot 50-60 mm; weight 48-92 g. There is no significant secondary sexual dimorphism. Condylar-based lengths of skulls are 24.4-31 mm, zygomatic breadth are 19.4-23.6 mm, and maxillary tooth row lengths are 5.8-7.7 mm. Head and dorso are grayish buff; sides and ventral pelage are pure white; and tail banner is wide and well flattened, with short white (often with narrow longitudinal dark dorsal strip) or ochreous (caprimalis) basal ring, relatively long black subterminal field, and medium-length white terminal tuft. Toves of hindfoot are covered from below with short soft white hairs, mixed with black, not forming brushes; conical calluses at bases of toes are large, with wide bases and rounded apices. Auditory bullae are weakly inflated. Mastoid cavity is medium-sized and not subdivided into sections; tympanic cavity is extremely small. Front surfaces of incisors are white; incisors are weakly deflected forward. P1 is relatively small and 1-2-2 times smaller in diameter than M3. Molars are low-crowned, with tubercular mammary surfaces; crown heights of unworn molars are c.70% of their lengths. Glans penis is egg-shaped, 5.6-6.6 mm long and 3.3-3.9 mm...
wide, slightly compressed in dorso-ventral direction, subdivided by deep longitudi-
nal dorsal fold into two lateral lobes. Surfaces of lobes are covered by single-vertex,
backwards-directed acicula increasing in size in backwards direction; and aciculae are
arranged in 1-10 concentric rows with 14-15 aciculae in each row. Ovary (bacinula) is
absent. Chromosomal complement has 2n = 48 and FN = 96.
Habitat. Steppes, semi-deserts, and desert. In southern Turkey, the Euphasis Jerboa
prefers low plains at elevations of 400-600 m, with sparse grassy ground cover,
and avoids sandy and cultivated areas. In Afghanistan, it occurs in dry montane
terrain, with low and sparse vegetation at elevations of 1800-2000 m.
Food and Feeding. Euphasis Jerboa is a generalist herbivore and eats green leaves, fresh
roots, bulbs, stems, and seeds.

Breeding. Breeding of the Euphasis Jerboa occurs in April-June in southern Turkey
and northern Syria and February-May in Iraq. Litters have 4-8 young (average six).
Females have two litters per year.
Activity patterns. The Euphasis Jerboa is nocturnal. Aboveground activity usually
starts 1-2 hours after sunset and ends before dawn. Hibernation occurs in Novem-
ber-January.

Movements. Home range and Social organization. Summer burrows of Euphasis Jer-
boas are simple and usually have one tunnel, direct or with 1-2 turns. Tunnel starts
at the ground’s surface, with a typically plugged entrance, and ends in a nest chamber
11-30 cm deep in the ground. In most cases, burrows have one additional
tunnel ending with emergency exit. Total lengths of tunnels are 80-120 cm. In the
wild, Euphasis Jerboas are usually solitary. In captivity, they try to avoid physical con-
tact and emit different types of sounds; fighting has not been recorded. In captivity,
insects contact between individuals, regardless of sex, is aggressive; after two hours of
interfering, individuals become peaceful; however, in some cases, interactions can
cause serious wounds or death.

Status and Conservation. Classified as Near Threatened on The IUCN Red List (an
Allopusis europaeus). The Euphasis Jerboa is threatened in Turkey by the expansion of
irrigated cotton fields and hunting.

Bibliography:

18. Hotson’s Five-toed Jerboa

Taxonomy: Dipus hotsoni

French: Sauteur a cinq doigts

German: Vierfusspringer

Spanish: Arrendajo hotsoni

19. Small Five-toed Jerboa

Taxonomy: Dipus elater

French: Sauteur a cinq doigts

German: Vierfusspringer

Spanish: Arrendajo pequeno
Activity patterns. The Small Five-toed Jerboa is crepuscular and nocturnal. Most individuals become active at dusk, 15–25 minutes after sunset. In spring and summer individuals are active all night, but in autumn their activity is usually limited to the first one-third of the night. Hibernation in Kazakhstan and Central Asia lasts 2–4.5 months from mid-October to early December to mid-February/March, with interruptions during thaws. In Azerbaijan, hibernation was not recorded, but longevity actually increased in winter.

Movements, Home range and Social organization. When moving slowly, Small Five-toed Jerbacs use bipedal pacing with alternating support by left and right hindfoot. At medium speeds and when running fast, they use asynchronous ricochet jumps. Mating takes place at maximum speed, but the exact time is not known. Escape behavior is characterized by running fast, with frequently changes in direction, vertical jumps, jumps into shrub canopies and finally hiding under a shrub. Use of burrows as night shelters is relatively rare. At high density, mean home range is 1–1.5 ha for males and 0.81 ha for females, and home ranges widely overlap regardless of sex. At low density, home ranges can be 4.6–49 ha, home ranges of females marginally overlap, and home range of an adult male usually overlaps home ranges of 1–3 females. Summer burrows are simple and usually have one main tunnel starting at the ground's surface, typically with a plugged entrance and ending in a nest chamber 10–13 cm in diameter and 10–115 cm deep (usually 40–70 cm); lengths of tunnels are 40–500 cm. In most cases, burrows have 1–2 additional tunnels ending with emergency exits and several (up to seven) additional chambers. Winter burrows are similar in construction to summer burrows, but they are deeper (110–160 cm) and have basic hibernation chambers. Small Five-toed Jerbacs usually do not build special night shelter burrows but use burrows of other rodents as night shelters. In the wild, they are mainly solitary but rarely form groups of 3–5 individuals. Interactions in the wild are aggressive. C.5% of the time, mutual avoidance is typical. In lab conditions, interactions between individuals of the opposite sex include natal and natal-ano contact and mutual grooming.

Status and Conservation. Classified as Least Concern on The IUCN Red List (as Allactaga deali).


21. Four-toed Jerboa Scartinus tetradactylus

Taxonomy. Dipus tetradactylus Lichtenstein, 1823, Libyan Desert between Siwa and Alexandria, Egypt. Previously included in the genus Allactaga and later Puntalactaga, which has recently been found to be a junior synonym of Scartinus. Phylogenetically, it is in the subgenus Scartinus. Morphological characteristics: Head-body 119 mm, tail 154–189 mm, ear 57–53 mm, hind foot 31–59 mm, weight 48–56 g. There is no significant secondary sexual dimorphism. Condylar tooth-lengths of skulls are 27–30.4 mm, zygomatic breadth is 19.1–22.6 mm, and maxillary tooth row lengths are 3.2–4.2 mm. Head and domes are dark, tan, orange-brown; sides and ventral pelage are pure white; and tail bands are wide and well flanked, with short frizzy whitish basal ring, long black subterminal field, and short white terminal tuft. Hindfeet have four toes. Toes of hindfeet are covered from below with medium-length soft black fur not forming branched conical calcars of bases of toes are long and high, with wide bases and rounded apices. Auditory bullae are weakly inflated. Molarized is medium-sized and not subdivided into sections; tympanic cavity is extremely small.

Habitat. Only coastal salt marshes and "hamadas" (barren, hard, rocky plateaus) are in the flat clay desert along the Mediterranean coast.


Genus PYGERRUS

Gloger, 1841

22. Greater Fat-tailed Jerboa Pygerrus shirkoui

Taxonomy. Allactaga shirkoui Kazneczov, 1939, Rybachye, Alakulsky Rayon, Almaty Region, Kazakhstan. Phylogenetically, it is in the subgenus Pygerrus. Morphological characteristics: Head-body 119 mm, tail 75–92 mm, ear 38–40 mm, hind foot 26–30 mm, weight 35–64 g. There is no significant secondary sexual dimorphism. Condylar tooth-lengths of skulls are 27–30.4 mm, zygomatic breadth is 19.1–22.6 mm, and maxillary tooth row lengths are 3.2–4.2 mm. Head and domes are dark, tan, orange-brown; sides and ventral pelage are pure white; and tail bands are wide and well flanked, with short frizzy whitish basal ring, long black subterminal field, and short white terminal tuft. Hindfeet have four toes. Toes of hindfeet are covered from below with medium-length soft black fur not forming branched conical calcars of bases of toes are long and high, with wide bases and rounded apices. Auditory bullae are weakly inflated. Molarized is medium-sized and not subdivided into sections; tympanic cavity is extremely small.

Habitat. Only coastal salt marshes and "hamadas" (barren, hard, rocky plateaus) are in the flat clay desert along the Mediterranean coast.

Distribution: SE Kazakhstan in Lake Balkhash and Lake Alakol basins, Bi River Valley, and NE Berpak-Dala Desert (Karagandy, Jambyl, and Almaty regions).

Descriptive notes. Head-body 86-121 mm, tail 92-141 mm, ear 28-37 mm, hindfoot 78-85 mm, weight 40-60 g. There is no significant secondary sexual dimorphism. Condylar-basal lengths of maxillary tooth rows are 23-24-21 mm, and maxillary tooth row lengths are 4-1-5 mm. Head and dorso- 
molar area are dark, dim clayish gray; sides and ventral pelage are light yellowish gray; and tail with short and white terminal tuft. Toes of hindfeet are naked from below; cosmetic calusses at bases of toes are large.

Food and Feeding. The Lesser Fat-tailed Jerboa is very folivorous, eating mainly leaves and stems of succulent plants. Seeds and underground plant parts are only eaten in small amounts.

Breeding. Breeding of the Lesser Fat-tailed Jerboa occurs in April-June, with peak intensity from end of April to mid-May. Litters have 2-8 young (average range 5-6). Overwintering females produce one litter per year. Sexual maturity occurs at 10-11 months of age, after overwintering.

Activity patterns. The Lesser Fat-tailed Jerboa is nocturnal. Aboveground activity usually 
starts 5-30 minutes after sunset and ends immediately before sunrise. Habitat 
las from October to mid-April.

Movements. Home range and social organization. Main type of locomotion of the Lesser Fat-tailed Jerboa is asynchronous ricochet jumps. Maximum length of jump is 54 cm. Maximum running speed is 5.3 m/s. Escape behavior is characterized by hiding on the ground's surface. Individuals usually stay within 70-100 m radius of their permanent burrows. Summer burrows are simple and consist of the main tunnel, starting from the main entrance and ending at the bottom with nest chamber; several (1-5) additional chambers are placed along the main tunnel; and in rare cases (c.5%), burrow has one additional tunnel starting from the first additional chamber and leading to emergency exits. Main entrance usually is closed with soil plug, but in spring, some burrows remain open during the day. Lengths of main tunnels are 70-200 cm (usually 100-140 cm); nest chamber is 4-5 cm in diameter and made from nest material; and 15-18 cm for breeding females; and nest chambers are 15-50 cm deep, usually 35 cm. Winter burrows differ from summer burrows by an additional 5-7 hibernation chambers, greater lengths (240-360 cm, usually 300 cm) and depths (115-150 cm, usually 130 cm), and a steeper main tunnel. The Lesser Fat-tailed Jerboa does not build night shelter burrows.


Other common names. Jerboa; Jerbo; Jerbo de cola gris serpenteado; Jerbo de cola gris pejaro.

23. Lesser Fat-tailed Jerboa P. pubescens pavo
FRENCH: Petit Jerboa / GERMAN: Klein Fettbauchgelbkeule / SPANISH: Jerito de cola gris pejaro


P. p. toomin Vinogradov, 1926 – E Kazakhstan (Dzungarian Gate and Lake Zayon Baik).

Descriptive notes. Head-body 95-135 mm, tail 125-175 mm, ear 23-31 mm, hindfoot 40-56 mm; weight 50-78 g. Female Dwarf Fat-tailed Jerboas are slightly larger than males. Condylar-basal lengths of skulls are 24-27 mm, zygomatic breadth 19-28 mm, and maxillary tooth row lengths are 4-5-5-5 mm. Head and dorso- 
molar area are dark, dim clayish gray; sides and ventral pelage are light yellowish gray; and tail with short and white terminal tuft. Toes of hindfeet are naked from below; cosmetic calusses at bases of toes are large.
field (19–35 mm), and white terminal taft (19–20 mm). Tail is slightly thickened only in adults in autumn. Toes of hindfoot are naked below or covered with thin, short (5–5 mm) and soft off-white or dark brown hairs not forming bristles; conscious culmuses at bases of toes are well expressed. Auditory bullae are weakly inflated. Mastoid cavity is extremely small and not subdivided into sections; tympanic cavity is medium-sized. Front surfaces of incisors are white; incisors are significantly deflected forward. P. is absent in adults, but it often occurs in young, being extremely small with no separate alveoli. Molars are high-crowned, with serrated incisural surfaces; crown heights of molars 4.5–5.0 mm, and crown width of their length is less than 3.0 mm. Canines of white color, flattened. 1:1–1:2 mm long and 1:2–1:3 mm wide, compressed dorso-ventrally, subdivided by deep and wide longitudinal tubular depression into two lateral lobes; surfaces of both teeth are smooth, white, translucent, backworn, with 3–5 aciculae, backworn in size in backward direction; and aciculae are arranged in 12–14 longitudinal rows, with 10–14 aciculae in each row. Os penis (baculum) is absent. Chromosomal complement has 2n = 48 and FN = 92.

Habitat. Semi-desert and desert habitat in patches of sparse saltwort vegetation; in western part of the distribution, only on clay soils; in northern and eastern parts of the distribution, on clay and gravel soils.

Food and Feeding. Dwarf Fat-tailed Jerboa is mainly folivorous. Green plant parts dominate its diet in all parts of its distribution and in almost all seasons, comprising 60–90% by volume. Their relative dominance gradually decreases from spring to autumn in northern parts of its distribution, but in southern parts, diets vary seasonally; seed materials amount to 8–30% of diet, while grass material to 21–24% of diet.

Breeding. Breeding of the Dwarf Fat-tailed Jerboa has two clear peaks: the first in spring and early summer (March-June) and the second in late summer-autumn (August-September). The first peak is due to the second bimodal production of spermatogonia (July-September) and the second peak is due to increase with age of females: 1:2–3-litters in years, 1:2–4–5 litters in one-year-olds, and 3:4–7 litters in three-year-olds. One-year-old females have one litter per year, and two-year-old females usually have two litters. Overwintering females can produce up to three litters per year but usually only one. Yearlings born in spring are sexually mature in the next autumn at 15 months old; those born in autumn mature at the end of the next spring at 19 months old. Gestation was estimated at 20 days. Young mule for 35–40 days.

Activity patterns. The Dwarf Fat-tailed Jerboa is crepuscular and nocturnal. Aboveground activity usually starts 40–60 minutes after sunset in spring and autumn and 28–38 minutes after sunset in summer, although some individuals can emerge from burrows several minutes before sunset. Activity ends immediately before sunrise. Activity has 2–3 peaks, in the first one-half, middle, and end of the night. Hibernation lasts 3–5.5 months from the end of September-October to February-April, with interruptions during these. Dwarf Fat-tailed Jerboa hibernates in special chambers in winter burrows; temperatures in these chambers are 3–4°C in nest chambers of winter burrows, temperatures are usually 3–4°C higher than in hibernation chambers; and individuals use nest chambers only during interruptions of hibernation.

Movements. Home range and Social Organization. Dwarf Fat-tailed Jerboa move slowly when foraging, using bipedal pacing with alternating support by left and right hindfoot. When running fast, they use asynchronous ricochet jumps. Maximum length of jump is 95 cm, and maximum running speed is 7.6 m/s. Escape behavior is characterized by hedging on the ground’s surface (meandering nights) or by running fast and hiding in a shelter burrow (full-moon nights). Home range size varies depending on age, season, and density; mean sizes are 1:1–2 ha for males and 0:9–4 9 ha for females. Home ranges of older individuals are larger than those of younger individuals. Breeding home ranges of males are twice as large as non-breeding home ranges. For females, this trend is in the opposite direction, and home ranges are smaller than those aged young. For example, home ranges of females are isolated, and those of males overlap marginally; home range of one adult male usually overlaps home ranges of 2–3 females. At high densities, home ranges of all individuals widely overlap, regardless of sex; each individual actively defends its own living and shelter burrow. Summer burrows usually consist of the initial tunnel filled with soil (excavated during construction of main tunnels) and two main tunnels, one horizontal, starting from the main entrance at the ground’s surface covered with soil plug and leading to the emergent exit, and one sloping down, starting in the middle of the first main tunnel and ending at the nest chamber. Main entrance is usually closed with soil plug 2–3 cm long in spring and autumn and 8–12 cm long in midsummer; in early spring and early autumn, many burrows remain open during the day. Emergency exits are dug up to 0–5–1 cm of the ground’s surface. Lengths of initial tunnels are 129–275 cm; total lengths of main tunnels are 130–174 cm; and nest chambers are 6–7 cm in diameter for males and non-breeding females, 10–12 cm for breeding females, and 37–51 cm deep. Winter burrows differ from summer burrows by the presence of 1–3 additional tunnels, the presence of multiple entrances and exits, greater depths, and absence of emergency exits, nest chambers are 30–136 cm long in winter burrows; chambers of one individual in its home range is 25–50 cm deep and 70–100 cm deep. Depths and both of types chambers decrease with increase of soil’s hardness. Night shelter burrows are simple, with one tunnel 25–50 cm long, passing from surface with 15–40 cm depth of its soil to 5–10 cm depth of its soil. One individual in its home range is 2–5 shelter burrows at high density and 5–12 at low density. Entrance of shelter burrow is always open and very visible due to the fan-shaped scatter of earth in front of it. In the wild, contact between individuals are relatively rare, even in dense populations; frequency of interactions is only 1–2 hours; and individuals often forage 0.5–1 m from one another without any interactions. Among observed interactions, most are neutral, with mutual avoidance after short naso-nasal contact. Aggressive interactions (weakly expressed attacks) are twice as less common as neutral interactions and occur near burrows.


Subfamily DIPOLIDAE
Genus PARADIPS

Paradips demodulatus

Taxonomy. Ordovicianoietodytes 09nogora,
Devar 1942, Reproche, Turkmenistan. This species is monotypic.

Distribution. Kazakhstani and Kyzylai de-
eres in Uzbekistan, Tadjikistan, and S.
Kazakhstan.

Descriptive notes. Body-length 140–
160 mm, tail 190–225 mm, ear 30–40 mm, hindfoot 70–80 mm; weight 112–185 g.
There is nothing significant secondary sexual di-
morphism. Condyle-basal lengths of skulls
are 32–36 mm, maxillae breadth are 21–24 mm, and maximum overall length of maxillae- and premaxillae are 140–160 mm; skull flat, dorso-lateral lobes and one dorsal lobe; maxillae breadth is 225% of their length; nose large, long, 30–45 mm length). White terminal tuft. Teeth of hindfoot are small, with a few smaller than the tympanic cavity. Front surfaces of incisors are white. P. is absent. Mo-
Diploid crows, with flat mastoid surfaces; crown heights of unornamented molars are 225% of their length; molars crowns continue to grow up to 1–1.5 years of age, and roots start to develop only at this age. Canines are pointed, conical, elongated, 9 mm long, 6 mm in diameter at base, and divided by deep longitudinal folds into two ventro-

lateral lobes and one dorsal lobe; lobes are subdivided by shallow longitudinal folds, three dorsal and two ventrally into two sections; dorsal lobe with pair of short claw-
shaped, forward-directed tips rooted at top of lobe; and lateral lobes are covered by backward-directed scales, two-apex at lateral surfaces and comb-like with 4–5 scalps on dorsal and ventral surfaces. On penis (baculum) is long (in length about equal to length of glans penis), thin, and curved upward to central part, with small flat horizontal broadening at proximal end and narrow transversal hair at distal end. Chromosomal complement has 2n = 48 and FN = 94.

Habitat. Exclusively non-moundizing sub-
sp. with sparse shrubs (5–7% of canopy cover) represented by Chenopodiaceae, such as Haloxylon persicum or Salixica rich-
en, and Aegionemus sp. (Fabaceae).

Food and Feeding. The Comb-cut Jerboa is a specialized folivorous scitophaga. Its diet contains mainly green leaves and stems of shrubs; it eats insects in spring and seeds in late summer and autumn. Number of feeding plant species is low; local lists of foraging plants include 7–12 species of shrubs, annual and perennial grasses, and forbs. Comb-cut Jerboa obtain leaves and stems of succulent shrubs by using branches at height of 30–150 cm by jumping and climbing into shrubs. They eat cut branches in the open 10–15 cm from the nearest shrub. Breeding. The Dwarf Fat-tailed Jerboa occurs in April-July. Litters have 2–8 young (average range 2–4–8). One-year-old females produce one litter per year; 2–3-year-old females produce two litters. Sexual maturity occurs at 10–11 months after overwintering.

Activity patterns. The Dwarf Fat-tailed Jerboa is nocturnal. Aboveground activity usu-
ally starts 20–50 minutes after sunset and ends at sunrise. Hibernation lasts 2–3 months from the end of November/December to mid-February/early March. Hiber-
nation is related to seasonal absence of green plant food rather than cold weather.

Movements. Home range and Social Organization. Comb-cut Jerbans move slowly when foraging, using bipedal pacing with alternating support by left and right hindfoot; lengths of steps are 16–24 cm. When running fast, they use asynchronous rico-
chet jumps. Maximum length of jump is 500 cm, and maximum speed is 8–8 m/s. Face behavior is characterized by running (fast along sand dune ridges, with frequent changes in the opposite dune slope. Total lengths of nightly movements are 5–3 km for females and 10–11 km for males in spring but only 2.5 mm in autumn. Home range are relatively narrow and extend along sand dune ridges; sizes are 3 ha at high densi-
ties to 20–30 ha for females and 50 ha for males at low density (0.5 ha). Home range are wide. Burrows are usually placed on slopes of moving sand dunes. Summer burrows of males and non-breeding females are simple and contain one tunnel (1–2–2 m long) ending in a chamber 15–14 cm in diameter and 25–65 cm deep without a nest; these burrows are used by an individual for 3–4 days, after which it excavates a new
26. Northern Three-toed Jerboa  

*Heterocephalus glaber*  

Other common names: Heterocephalus, Long-nosed Jerboa, Long-nosed Jerboa  

**Taxonomy.** Heterocephalus glaber, Kaup, 1849.  

**Description.** This small rodent has a long, slender body and long, slender ears. Its coat is a mixture of white and grey, with a reddish-brown patch on the back. The tail is long and bushy, and the ears are pointed. The Northern Three-toed Jerboa is nocturnal and primarily active from April to November. It feeds on seeds, insects, and other small invertebrates.  

**Habitat.** The Northern Three-toed Jerboa is found in desert and semi-desert regions, including dry, sandy areas, and rocky cliffs. It is most common in the central and western parts of the United States.  

**Breeding.** The Northern Three-toed Jerboa breeds from March to June. Females give birth to a litter of 1 to 4 young in a burrow or in a den. The young are born blind and helpless and are weaned at about 10 days.  

**Conservation.** The Northern Three-toed Jerboa is listed as a species of least concern by the IUCN.  

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27. Mongolian Three-toed Jerboa  

*Stylocnus andrewsi*  

Other common names: Andrew’s Three-toed Jerboa, Mongolian Jerboa  

**Taxonomy.** Stylocnus andrewsi G. M. Allen, 1925  

**Description.** This small rodent has a distinctive appearance, with a long, slender body and large, rounded ears. The fur is a mixture of brown and black, with a white stripe down the back. The feet are large and slender, with four toes on each foot. The Mongolian Three-toed Jerboa is nocturnal and primarily active from April to November. It feeds on seeds, insects, and other small invertebrates.  

**Habitat.** The Mongolian Three-toed Jerboa is found in desert and semi-desert regions, including dry, sandy areas, and rocky cliffs. It is most common in the central and western parts of Mongolia.  

**Breeding.** The Mongolian Three-toed Jerboa breeds from March to June. Females give birth to a litter of 1 to 4 young in a burrow or in a den. The young are born blind and helpless and are weaned at about 10 days.  

**Conservation.** The Mongolian Three-toed Jerboa is listed as a species of least concern by the IUCN.  

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The Northern and Mongolian Three-toed Jerboas are related to the Shrews and are more closely related to the Shrews than to other rodents. They are nocturnal and primarily active from April to November. In addition to seeds and insects, they also feed on small invertebrates such as insects and spiders. The Southern Three-toed Jerboa is found in desert and semi-desert regions, including dry, sandy areas, and rocky cliffs. It is most common in the central and western parts of the United States. The Mongolian Three-toed Jerboa is found in desert and semi-desert regions, including dry, sandy areas, and rocky cliffs. It is most common in the central and western parts of Mongolia.
**Distribution.** Mongolia and N China (N Gansu, inner Mongolia [= Nei Mongol], and Ningxia).

**Descriptive notes.** Head-body 120–135 mm, tail 140–165 mm, ear 16–19 mm, hindfoot 50–58 mm; weight 90–95 g. Head and dorso of the Mongolian Three-toed Jerboa are sandy gray with a touch of reddish-brown; sides and ventral pelage are pure white; white patch behind ear is well expressed; and tail is fuffy in adults, with slightly flattened dark gray terminal tuft not forming a banner. Toes of hindfeet are covered with soft hairs of relatively short length. Habitat. Salt depressions among coarse-gravel, low mountain semi-desert and desert. Food and Feeding. Diet of the Mongolian Three-toed Jerboa contains seeds (42% by volume), green plant material (50%), and roots and bulbs (28%); in autumn, seeds are eaten. Breeding. Mongolian Three-toed Jerba occurs in July-August. Litters have 2–8 young, usually 4–6. Most overwintering females produce one litter per year, but a few can produce two litters. Sexual maturation occurs at 16–11 months of age, after overwintering.

**Activity patterns.** The Mongolian Three-toed Jerboa is nocturnal. Hibernation starts in September. Dates of the end of hibernation are not known. Movements, Home range and Social organization. Burrows of Mongolian Three-toed Jerbae have one main entrance, 1–3 smaller entrances, and are covered with sand; length is 10 cm in diameter and 40 cm deep; total length of tunnels is c.500 cm. Night shelter burrows are simple, with one tunnel c.100 cm in length, passing from the ground's surface to depths of 50–30 cm. One individual can use 5–6 shelter burrows in its home range. Searis and Conservation. Classified as Least Concern on The IUCN Red List. Bibliography. Pisano et al. (2018), Sokolov et al. (1956), Zhang et al. (1967).

**28. Thick-tailed Three-toed Jerboa Stylodon fulvus**

**Distribution.** NE shore of Aral Sea, Kyrgyzstan and Kazakhstan. Based on DNA analysis, J. Pisaro and colleagues in 2015 demonstrated that S. fulvus and S. angulatus were sister species. Six subspecies recognize. Subspecies and Distribution. S. f. fulvus Lichtenstein, 1823 – Kazakhstan (Almata, Atyrau, West Kazakhstan, Karaganda, S. Kostanay, S. Kyzylorda, and West Kazakhstan regions). S. f. sibiricus Selevich, 1934 – N Kazakhstan (N Kostanay Region). S. f. australis Vinogradov, 1937 – E Kazakhstan (E Lake Zaypat Basin) and NW China (NW Xinjiang). S. f. sibiricus Brunner, 1913 – S Ukraine (left bank of lower Dnieper River Valley in Moldova and Kherson region). S. f. mongolicus Shenbrot, 1981 – S Kazakhstan (Mangystau, S. Kyzylorda, Jambul, and S. Almaty regions), NW Uzbekistan (Sarkalpakistan), and W & N Turkmenistan (Balkan and Davoguz regions). S. f. bunten Heptner, 1954 – S European Russia (middle Don Valley in Volgograd and Rostov regions E & S to the right bank of Volga in Astrakhan, Kalmykia, N Stavropol, and Dagestan). Descriptive notes. Head-body 110–130 mm, tail 130–170 mm, ear 15–20 mm, hindfoot 60–70 mm; weight 48–55 g. There is no significant secondary sexual dimorphism. Head and dorso of body vary geographically from light sandy gray to dark grayish brown, always with a touch of reddish brown; sides and ventral pelage are pure white; white patch behind ear is absent or poorly expressed; and tail is fuffy in adults, with slightly flattened grayish brown terminal tuft not forming a banner. Toes of hindfoot are covered with soft hairs of relatively short length. Habitat. In western and northern parts of the distribution, steppes, steppes in steppe zone; in central part of distribution, sandy-loam soils in semi-desert and desert zones; in southern part of distribution, clay soils in desert zone; and in eastern part of distribution, coarse-gravel hill slopes in semi-desert zone. Food and Feeding. Diet of the Thick-tailed Three-toed Jerboa contains about equal amounts of seeds and green plant material; insects are rarely eaten. Seeds dominated in autumn and green plant parts in spring. Breeding. Breeding of the Thick-tailed Three-toed Jerboa occurs in April–June, with one peak in April-May. Litters have 2–3 young (average range 2–4), 1–2 days. Overwintering females produce one litter per year. Individuals are sexually mature at 10–11 months of age, after overwintering. Gestation has been estimated at 19–20 days. Young nurse for c.45 days.
Descriptive notes. Head-body 95–145 mm, tail 172–215 mm, ear 18–25 mm, hindfoot 55–70 mm; weight 16–22 g. Females are slightly larger than males. Head and dorso-some of the Greater Egyptian Jerboa are brownish orange; sides and ventral pelage are pure white. Basal part of vibrissae is dark gray. Tall banner is wide and well flattened, with fuzzy white basal ring; black subterminal field and white terminal tuft are about equal in length; and ventral side of black subterminal field has no white stripe at tail rod. Toes of hindfoot are covered from below with brushes of relatively long soft hairs; external hairs of brushes are white, with dark brown tips and internal black or brownish bands; toes do not have conic calluses at bases. Auditory bullae are strongly inflated and project from under the braincase laterally and caudally. Mastoid cavity is large and partially subdivided into two sections by septa. In volume, mastoid cavity is about three times larger than tympanic cavity. Front surfaces of incisors are white. P is absent. Molars are high-crowned, with terraced mammalian surface; crown height of upper molars is 120–190% of their length. Glass penis is massive, cylindrical, significantly elongated, 6–9.5 mm long and 2.5–2.9 mm in diameter, subdivided by deep longitudinal folds into two ventro-lateral, two dorso-lateral lobes and one dorsal lobe; dorso-lateral and dorsal lobes have shallow longitudinal depressions; and surfaces of lobes are covered by two-crest, backward-directed scales. On penis (bacillum) is large (its length about equal to length of glass penis) and straight, with little horizontal broadening at proximal end and acute node at distal end. Chronometric complement has 2n = 48 and FN = 92.

Habitat. Sandy deserts with relatively dense shrub cover, particularly edges of sand dunes and zones of contact between semi-desertified and sandy desert.

Food and Feeding. Diet of Lichtenstein’s Jerboa contains seeds, flowers, and green plant parts. In spring, it eats mainly green plant parts, but in summer, seeds are the main part of the diet. Plant species eaten vary geographically and seasonally, local lists of forage plants include 13–50 species of shrubs and annual and perennial grasses and forbs.

Breeding. Breeding of Lichtenstein’s Jerboa occurs in April–June. Litters have 2–9 young (average range 5–6). Most oviparous breeding species produce one or two litters per year, but a few can produce two litters. Sexual maturity occurs at 16–18 months of age, after overwintering.

Activity patterns. Lichtenstein’s Jerboa is nocturnal. Aboveground activity usually starts 30 minutes after sunset and ends before sunrise. Hibernation in southern parts of the distribution lasts 5–5.5 months from the end of November to early March. In northern parts of the distribution, hibernation lasts 5–6 months from September to April.

Movements. Home range and social organization. Lichtenstein’s Jerboa move slowly while foraging, using bipedal pacing with alternating support by left and right hind feet. They use asynchronous ricochet jumps when running fast. Maximum length of jump is 109 cm, and maximum speed is over 7.5 m/s. Escape behavior is characterized by fast runs of relatively short distance, that end by hiding under a shrub crown or in shelter burrow. Home ranges are 5–28 ha. Foraging occurs in small patches of 4–15 m², during the night, individuals visit 3–5 such patches in their home range. Burrows have one main entrance, 1–3 emergency exits, one main and 1–2 additional tunnels, one nest chamber (10–12 cm in diameter for males and up to 17 cm for females) at depths of 30–120 cm, and 2–3 (up to 6) additional chambers; total length of tunnels is 200–600 cm. Main entrance is always closed with sand plug. Shelter burrows are simple, with one tunnel 60–200 cm long, passing from the ground's surface to depths of 40–100 cm.

Stains and Conservation. Classified as Least Concern on The IUCN Red List.

Genus JACULUS

31. Greater Egyptian Jerboa

32. Blanford’s Jerboa

Taxyonomy. Dipus blanfordi Murray, 1884, Bushire, Iran. The recently described J. thalersi by J. Darvish and F. Hosseinie in 2005 seems to be an aberrant phylogeny of J. blanfordi rather than an independent species. Based on morphology, J. blanfordi was considered as a member of subgenus Hablus, but it genetically occupies the basal position in the subgenus Jaculus. Three subspecies recognized.

Subspecies and Distribution.

J. b. blanfordi Murray, 1884 – Iran, W & S Afghanistan, and SW Pakistan.


J. b. africana Vinogradov & Bondar, 1940 – N & W Turkmenistan, C Uzbekistan, and marginality in S Kazakhstan (S Kerzhal region).
33. Lesser Egyptian Jerboa

*Jaculus jaculus*

**Fam.:** Geomyidae
**Gen.:** Jaculus
**Syn.:** *Jaculus rutilus*

**Other common names:** *Lesser Jerboa*

**Taxonomy.** *Jaculus jaculus* Linnaeus, 1758, Ceylon, Sri Lanka. In the past, *J. jaculus* and *J. leucopus* were included in *J. rutilus*. Phylogenetically, *J. jaculus* is a member of the subgenus *Jaculus*, being the sister species of the *J. hippopus* and *J. leucopus* clade. Seven subspecies names were proposed for *J. jaculus* with different distribution (part of which may really represent *J. deserti*) and one in the Middle East. Subspecific taxonomy should be revised because previous analyses were based on mixed samples of *J. hippopus* and *J. jaculus*. Molecular reconstructions retrieved two divergent allopatric lineages: one in North Africa and the other in Sina Peninsula and Israel. Within the North African lineage, no significant spatial structuring and no significant relationship between geographical and genetic distances were found. Two subspecies recognized.

**Subspecies and Distribution.**

*J. j. jaculus* Linnaeus, 1758—Morocco, Algeria, Tunisia, Libya, Egypt, Western Sahara, Mauritania, S. Senegal, Mali, Niger, NE Nigeria, Chad, and Sudan.

*J. j. schwartzi* Nehering, 1901—NE Egypt (N Sinai Peninsula), Gaza Strip, and Israel; it probably occurs in adjacent extreme W Jordan.

**Descriptive notes.** Head-body 119–130 mm; ear 191–197 mm; tail 66–107 mm; weight 44–74 g. Head and dorsum of the Lesser Egyptian Jerboa vary from light sandy yellow to yellow-orange; axilla and ventral pelage are pure white. Basal parts of tibias are white. Tail banner is wide and well flattened, with fuzzy white basal ring; black subterminal field and white terminal tuft are about equal in length; and ventral side of black subterminal field is discolored by white stripe along tail rod. Tails of hind foot are covered from below with brushes of relatively long soft hairs; hairs of brushes are white, and toes do not have complete black bases. Rostral tuft is well developed. Auditory bullae are strongly inflated and project from under braincase laterally and caudally. Mainly a small mass of cylindrical, elongated, subdivided by deep longitudinal fold into five lobes, one dorsal, two lateral and two ventral. Surfaces of lobes are covered by comb-like scales, with 2–6 (usually 5–6) long scallops at their proximal edges. On penis (baculum) is large (its length about equal to length of glass penis) and straight, with relatively small flat horizontal broadening at proximal end and medium-sized flat horizontal broadening at distal end. Chromosomal complement has *2n* = 48 and FN = 96.

**Habitat.** Sand massifs. In recent studies, semi-stabilized sands with relatively sparse shrub vegetation, rarely scarce; sandy gravelly deserts and sandy gravelly deserts. Abundant in North Africa and Sina Peninsula and Israel. Breeding. Breeding season is all year, with gestation period of 28–33 days. Activity patterns. *Jaculus jaculus* is a nocturnal species. It has been recorded in the desert, and there is no specific information on the breeding season or activity patterns.

34. African Hammada Jerboa

*Jaculus hippopus*

**Fam.:** Geomyidae
**Gen.:** Jaculus
**Syn.:** *Jaculus rutilus*

**Other common names:** *African Jerboa, Hammada Jerboa*

**Taxonomy.** *Jaculus hippopus* Lichtenstein, 1825, Sahaqra, Egypt. In the past, *J. hippopus* was synonymized with *J. jaculus*, and it was considered under the name *J. deserti* named by V. Locchi in 1867. Phylogenetically, *J. hippopus* is in the subgenus *Jaculus* and the sister species of *J. j. j. leucopus*, with which it diverged c.1–2 million years ago. Fifteen subspecies names were proposed for *J. deserti* (some of which may really represent *J. jaculus*), but the subspecific taxonomy should be revised because previous analyses were based on mixed samples of *J. hippopus* and *J. jaculus*. Analysis of molecular data demonstrated the absence of significant spatial structuring and significant relationships between geographical and genetic distances in the Saharan part of the distribution. Monotypic.

**Distribution.** North Africa, Horn of Africa, and W Middle East, including Morocco, Algeria, Tunisia, Libya, Egypt, Western Sahara, Mauritania, Senegal, Mali, Niger, Chad, Sudan, Ethiopia, Somalia, NE Nigeria, Senegal, and Israel, and W Jordan; it probably occurs in the West Bank, extreme N Jordan and S Lebanon.

**Descriptive notes.** Head-body 95–145 mm; tail 172–215 mm; ear 18–25 mm; hind foot 50–70 mm; weight 43–91 g. Females are slightly larger than males. Head and dorsum vary from brownish grey to light brown; axilla and ventral pelage are pure white. Basal parts of tibias are dark grey. Tail banner is wide and well flattened, with fuzzy white basal ring; black subterminal field and white terminal tuft are about equal in length; and ventral side of black subterminal field has no white stripe along tail rod. Tails of hindfoot are covered from below with brushes of relatively long soft hairs; external hairs of brushes are white with dark brown tips and internally black or brown; toes do not have ciliate cacti at bases. Rostral part of skull is slender. Auditory bullae are strongly inflated and project from under braincase laterally and caudally. Mainly a small mass of cylindrical, elongated, subdivided by deep longitudinal folding into one dorsal, two lateral, and two ventral. Surfaces of lobes are covered by comb-like scales, with 7–10 (usually 10–12) short scallops at their proximal edges. On penis (baculum) is large (its length about equal to length of glass penis) and straight, with relatively small flat horizontal broadening at proximal end and medium-sized flat horizontal broadening at distal end. Chromosomal complement has *2n* = 48 and FN = 96.

**Habitat.** Clay, loose, sandy, and sandy gravelly deserts and dry savannas, preferring open flat areas with sparse vegetation and rarely sandy deserts.

**Food and Feeding.** The African Hammada Jerboa eats seeds, leaves, grass, gums, and roots.

**Breeding.** Breeding of the African Hammada Jerboa was recorded in February–September in Egypt and June–July and October–December, with incubation period in August–September, in Sudan. Litters have 1–5 young (usually 3–5). Overwintering females can nurse up to 3–4 babies per litter per year. Gestation was estimated at 35 days. Young nurse for 34–45 days.

**Activity patterns.** The African Hammada Jerboa is nocturnal. Background activity occurs mostly shortly after sunset. Hibernation has not been recorded.

**Movements.** Range and Social organization. When moving slow, the African Hammada Jerboa uses bipedal pacing, with alternating support by left and right hindfeet; hops are 40–50 cm. At medium-speed and when running fast, they use asynchronous ricochet jumps; jumps are 80–100 cm. Winter burrows are placed on slopes of sand dunes and have 2–3 m of tunnels that are c.1 m deep.

**Status and Conservation.** Listed as Least Concern on the IUCN Red List. 

asynchronous ricochet jumps; each hop is c.300 mm. At medium-speed and when running fast, they use bipedal pacing, with alternating support by left and right hindfeet. Maximum speed is 6-8 m/s. They sometimes jump vertically into the air. Summer burrows are 40-60 cm deep, and winter burrows are 1-5-8 m deep. In the wild, African Hamadada Jerboas are mainly solitary but can be observed in groups of 2-4 individuals; even when in groups, they remain several meters apart. Social interactions were observed only in captivity, mainly short nose-nose contacts. Aggressive behavior usually is expressed as chasing and escaping, sometimes ending with fighting.

Stains and Conservation. Not assessed as a distinct species on The IUCN Red List.


35. Arabian Jerboa Jaculus ishufi

French: Gébétou du Liban / German: Arabische Wüstenfrettchen / Spanish: Jerbo de Arabia

Taxonomy. Dipus ishufi Blanford, 1875, Mohammurah [-Khorramshahr], Iran. J. ishufi was included in J. juvenalis. Phylogenetically, it is in the subgenus Jaculus, being the sister species of J. lutetii. Two subspecies recognized.

Subspecies and Distribution. j. ishufi Blanford, 1875 – Iraq (e of Irrigation Rivers) and SW Iran.

j. i. soomer Thomas, 1921 – Arabian Peninsula, including Syria, Jordan, Iraq [W of Euphrates]. Kuwait, Saudi Arabia, Bahrain, Qatar, United Arab Emirates, Oman, and Yemen.

Descriptive notes. Head-body 110-180 mm, tail 207-205 mm, ear 30-35 mm, hind-foot 68-81 mm; weight 112-175 g. Female Arabian Jerboas are slightly larger than males. Head and dorson are sandy buff; sides and ventral pelage are pure white; facial parts of vibrissae are dark gray. Tail banner is wide and well flattened, with fuzzy white basal ring; black subterminal field is significantly longer than white terminal tift. Tyes of hindfeet are covered from below with bristles of relatively long soft hairs; external hairs of brushes are white, with dark brown tips and internally black or dark brown; toes do not have warm callosities at bases. Rostral part of skull is massive. Auditory bullae are strongly inflated and project from under braincase laterally and caudally. Masoid cavity is large and partially subdivided into three sections by septa. In volume, mastoid cavity is about three times larger than tympanic cavity. Forel surface of incisors are white; I’ is absent. Molars are high-crowned, with terraced maxillary surface; crown height of unworn molars are 140-150% of their lengths. Giant penis is massive, cylindrical, elongated, subdivided by deep longitudinal folds into one dorsal, two lateral, and two ventral lobes; surfaces of lobes are covered by comb-like scales, with 4-6 scallops at their proximal edges. Os penis (baculum) is large (in length about equal to length of glans penis) and straight, with relatively short flat horizontal broadening at proximal end and medium-sized flat horizontal broadening at distal end. Chromosomal complement has 2n = 48 and FN = 90.

Habitat. Sandy, sandy-gravel, and stony deserts, without clear preference for a type of substrate.

Food and Feeding. Based on molar morphology, the Arabian Jerboa probably eats a mixture of seeds and green plant parts.

Breeding. Breeding of the Arabian Jerboa was recorded in February-November. Litters have 2-7 young. Gestation was estimated at c. 25 days.

Activity pattern. The Arabian Jerboa is nocturnal. Aboveground activity usually starts one hour after sunset and lasts throughout the night. Hibernation has not been observed, but aboveground activity decreases during the warmest months of the year.

Movements, Home range and Social organization. Architecture of burrows varies considerably depending on the nature of the soil. Burrows in sandy soils are simple, and their depth usually does not exceed 30 cm. In sandy soils, burrows have several tunnels; one main entrance always plugged by soil, several emergency exits, and nest chamber c. 129 cm deep. In the wild, Arabian Jerboas are mainly solitary. In captivity, they try to avoid physical contacts, emitting different types of sounds, fighting was not recorded.

Status and Conservation. Not assessed as a distinct species on The IUCN Red List.

Bibliography. Al-Akhras et al., 2012; Ben Felth, Gregson, 1985; Borybynski et al., 1982; Borybynski et al., 1984; Briton & Basset, 1993; Kashani et al., 1994; Laws et al., 1995; Shehab et al., 2003.