

Mohammad Abu Baker and Zuhair Amr

The Rodents (Mammalia: Rodentia) of Wadi Ramm, Southern Jordan: New Records and Notes on Distribution

Abstract: Thirteen species of rodents representing four families (*Dipodidae*, *Gliridae*, *Muridae* and *Gerbillidae*) were recorded in the southern desert of Wadi Ramm, Jordan. Species accounts including external and cranial measurements and comments on their distribution and diurnal activity are given. New distribution records for the known range of *Eliomys melanurus*, *Sekeetamys calurus*, *Gerbillus andersoni* and *Meriones libycus* are included.

Keywords: Rodents, Mammalia, Wadi Ramm, Jordan, *Dipodidae*, *Gliridae*, *Muridae* and *Gerbillidae*

القوارض الثدييات في وادي رم، جنوب الأردن:
تسجيلات وملاحظات حول علاقتها مع بيئتها
محمد أبو بكر، زهير عمر

المستخلص: تم تسجيل 13 نوع من القوارض التي تنتمي إلى أربعة عائلات (البرابيع والجربيع والفئران الحقيقية والنسائيات) من الصحراء الجنوبية من منطقة وادي رم في جنوب الأردن. كذلك تم إعطاء نبذات لكل نوع متضمنة القياسات الخارجية والجمجمية وتعليقات حول توزيعها وبيئتها. تضمن البحث على تسجيلات جديدة لمدى توزع الأنواع *Eliomys melanurus* و *Sekeetamys calurus* و *Gerbillus andersoni* و *Meriones libycus*.

كلمات مدخلية: القوارض، الثدييات، وادي رم، الأردن، تسجيل

Introduction

Wadi Ramm desert (also called Hisma Basin) is located in the southern part of Jordan about 60 km northeast of Aqabah (29° 35' N, 35° 26' E). It lies along the northwestern edges of the Arabian Desert and stretches to the northern borders of Saudi Arabia.

Despite the extensive literature on the mammals of Jordan that has been published over the past two decades, the rodent fauna of the southern mountainous desert of Wadi Ramm remains largely unknown. Allen (1915) reported on the presence of *Gerbillus gerbillus* (Olivier, 1801) from southern Wadi Arabia around Aqabah. Kock and Nader (1983) reported on a specimen of *Gerbillus nanus* (Blandford, 1875) from 14 km south of Aqabah. Atallah and Harrison (1967) collected *Gerbillus andersoni* (de Winton, 1902) south of Ra's an Naqb. Qumsiyeh (1996) first recorded *Gerbillus cheesmani* (Thomas, 1919) from the Disi area, and

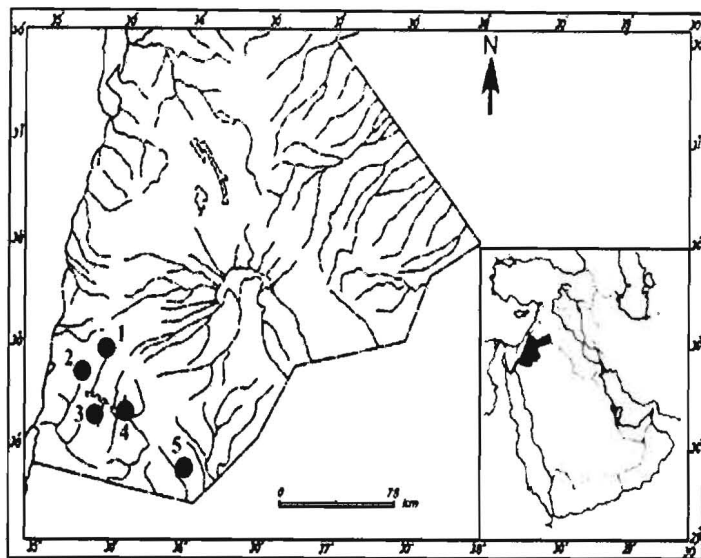
Benda and Sadlova (1999) collected both *Gerbillus nanus* (Blandford, 1875) and *Meriones crassus* (Sundevall 1842) from the desert of Wadi Ramm. Most recently, Abu Baker and Amr (2003a) reported on four species of the genus *Gerbillus* namely; *G. andersoni* (de Winton, 1902), *G. cheesmani* (Thomas, 1919), *G. dasyurus* (Wagner, 1842) and *G. nanus* (Blandford, 1875) from the southern desert of Wadi Ramm. The present study contributes to the taxonomy and distribution of the rodent fauna of Wadi Ramm Desert of Jordan.

Materials and methods

Study area

The area consists of isolated tracts of huge, precipitous, sandstone and granite mountains, reaching up to 1,754 m at Jabal Ramm, the highest mountain in the area, separated by flat, sandy corridors or *wadis*. Further to the east, a closed network of small *wadis* with numerous small mountains and rocky outcrops are present (Map 1).

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Map (1): Map of southern Jordan showing the study area.

Legend

- | | | |
|------------------|---------------|--------------|
| 1. Ra's an Naqab | 2. Quweira | 3. Wadi Ramm |
| 4. Disah | 5. Mudawwarah | |

The majority of Wadi Ramm is under the influence of the Sudanian biogeographical penetration; it is characterized by warm winters and very hot summers. The temperature ranges from 15-45°C. Rainfall ranges from 50-100 mm/year. Three vegetation types are identified in the area: the sand dune vegetation, dominated by shrubs and smaller bushes of *Haloxylon persicum* (Bunge), *Retama raetam* (Forskål) Webb et Berth, *Calligonum comosum* (L'Her), *Neurada procumbens* L. and *Hammada scoparia* (Pomel) Iljin (sand dunes fixatives); the Acacia and Sudanian rocky vegetation which consists of *Acacia raddiana* (Savi), *Anabasis articulata* (Forskål) Moq., *Caralluma* sp., *Fagonia* sp., *Gymnocarpus decandrum* (Forskål) and *Helianthemum lippii* (L.) Dum.-Courset. The hammada vegetation is not a dominant vegetation type in the area; nevertheless the presence of some of its components indicates this type. The main species of this type include *Anabasis articulata* (Forskål) Moq, *Retama raetam* (Forskål) Webb et Berth, *Tamarix* spp., *Achillea fragrantissima* (Forskål) Schultz Bip., *Artemisia herba-alba* (Asso) and *Zilla spinosa* (L.) Prantl. Remnants of the Mediterranean element are presented in Wadi Ramm and indicated by the scattered juniper and pistacia trees high over the mountains in the area (Borzatti von Löwenstern, *et al.* 2000).

Collection of specimens

Animals were collected from different sites that represent all vegetation types and habitats throughout the study area. Trapping sites were selected based on their substrate and vegetation differences. Rodents were trapped using Sherman folding live-traps (23 x 9 x 9 cm) set for one or two consecutive nights in each site. Jerboas were spotted at night by car lights or hand torches and caught with regular insect nets.

Abbreviations used

- | |
|----------------------------------|
| APF: Anterior palatal foramen |
| BB: Braincase breadth |
| BL: Basal length |
| CBL: Condylbasal length |
| DL: Diastema length |
| E: Ear length |
| GSL: Greatest skull length |
| HB: Head and body length |
| HF: Hind foot length |
| IC: Intero-orbital constriction |
| M: Mandible length |
| MD: Mandibular diastema |
| MDT: Mandibular tooth row length |
| MXT: Maxillary tooth row length |
| PPF: Posterior palatal foramen |
| T: Tail length |
| TBL: Tympanic bullae length |
| TBW: Tympanic bullae width |
| Wt: Body weight in grams |
| ZB: Zygomatic breadth |

Results and Discussion

Thirteen species of rodents belonging to four families (Dipodidae, Gliridae, Gerbillidae and Muridae) were recorded from the southern desert of Wadi Ramm. Both Dipodidae and Gliridae were represented by a single species, *Jaculus jaculus* (Linnaeus, 1758) and *Eliomys melanurus* (Wagner, 1839) respectively. Family Gerbillidae includes eight species in four genera (*Gerbillus*, *Meriones*, *Psammomys* and *Sekeetamys*), while family Muridae includes two species in one genus (*Acomys*).

Family Dipodidae*Jaculus jaculus* (Linnaeus, 1758) (Plate 1)

Material examined:

JUSTM565

(Skin, Skull) male, Wadi Ramm, 18.11.2000

JUSTM568

(Skin, Skull) male, Wadi Ramm-Disi road, 18.11.2000

Measurements: n=2

HB	92	-	111	(101.5)
T	155	-	161	(158)
HF	57	-	58	(57.5)
E	18	-	22	(20)
Wt.	30	-	45	(37.5)
GSL	31.2	-	33.5	(32.35)
CBL	29.7	-	30.4	(30.1)
BL	22.3	-	25.4	(23.8)
BB	16.7	-	17.8	(17.3)
IC	11.4	-	11.8	(11.6)
ZB	20.2	-	23.3	(21.7)
DL	7.9	-	8.8	(8.35)
MXT	5.0	-	5.2	(5.1)
APF	4.3	-	4.3	(4.3)
PPF	1.2	-	1.3	(1.25)
TBL	13.9	-	15.6	(14.75)
TBW	9.2	-	9.4	(9.3)
M	14.2	-	16.0	(15.1)
MD	3.6	-	3.9	(3.75)
MDT	4.7	-	5.2	(4.95)

The three-toed jerboa is a common rodent in Wadi Ramm desert. It was collected and observed in open flat areas with scattered vegetation (hammada) as well as open sand dunes. It is a strictly nocturnal rodent encountered during different periods at nighttime extending from dusk to midnight. *Jaculus jaculus* coexisted mostly with *G. nanus*, *G. cheesmani* and *M. crassus*.

The three-toed jerboa is a common rodent in all arid habitats in Jordan; it was reported and collected by the authors from the sandy deserts of Wadi Araba, Jafr and in other localities in the northeastern desert (Abu Baker and Amr 2003b). It inhabits a wide variety of habitats including *sabkha*, sandy deserts and alluvial desert depressions (Büttiker and Harrison 1982; Bauer 1988). It has been reported as one of the commonest rodents in the deserts of the Arabian Peninsula (Lewis, *et al.* 1965). *J. jaculus* comprised 17% of the diet of the desert eagle owl in the Dahik area and 2.1% of the diet of the little owl at Safawi (Al-Melhim, *et al.* 1997; Rifai, *et al.* 2000).

Family Gliridae*Eliomys melanurus* (Wagner, 1839) (Plate 1)

Material examined:

JUSTM268

(Skin, Skull), male, Wadi Ramm, 20.6.1999

Measurements: n=1

HB	94.4	ZB	18.0
T	105	DL	6.4
HF	24.5	MXT	5.6
E	27.6	APF	4.0
Wt.	28	PPF	1.1
GSL	31.2	TBL	12.0
CBL	30.6	TBW	7.3
BL	25.3	M	14.4
BB	19.7	MD	4.0
IC	4.6	MDT	5.3

The dormouse was trapped only once in a rocky edge of a densely vegetated closed *wadi*. This record extends the known range for this species to the south from the closest known records from the semi-arid juniper forests of Dana Nature Reserve (personal observations), which perhaps represent an isolate d relict population in the remnants of the Mediterranean elements of juniper forests over the mountains of Wadi Ramm.

It was observed on several occasions jumping on wild fig (*Ficus pseudo-sycomorus* Decne) trees along the sides of rocky cliffs. The occurrence of the Asiatic garden dormouse in this desert habitat is noteworthy since it is originally an arboreal rodent. It was previously reported from the Mediterranean mountains of Moab (Bodenheimer, 1958) as well as the arid and semi-arid habitats in Azraq, Jawa and Al Wisad (Atallah, 1978; Searight, 1987; Abu Baker and Amr, 2003b). It was also reported from the arid mountains of Sinai and the rocky hills of Negev (Osborn and Helmy, 1980; Krasnov, 1996) and the southern mountains of Saudi Arabia (Nader, *et al.* 1983). The Arabian garden dormouse became adapted to semi-arid non-arboreal life style about 1.2 million years ago (Bates, 1996). *E. melanurus* was reported to feed on geckos, insects, centipedes, snails and mammalian remains (Atallah, 1978).

Family Muridae*Acomys cahirinus* (Desmarest, 1819) (Plate 1)

Material examined:

JUSTM561

(Skin, Skull), male, Wadi Ramm, 15.6.2000

JUSTM563

(Skin, Skull), male, 20 km N. Quweirah, 18.11.2000

Measurements: n=2

HB	92	-	98	(95)
T	116			
HF	20.5	-	22	(21.2)
E	20.0	-	20.1	(20.0)
Wt.	27	-	28	(27.5)
GSL	31	-	32	(31.5)
CBL	29	-	29.8	(29.4)
BL	26.2	-	26.4	(26.3)
BB	13.0	-	13.2	(13.1)
IC	4.9	-	5.0	(4.95)
ZB	14.7	-	14.7	(14.7)
DL	8.0	-	8.4	(8.2)
MXT	4.9	-	4.9	(4.9)
APF	6.7	-	7.1	(6.85)
PPF	1.1	-	1.2	(1.15)
TBL	6.0	-	6.3	(6.2)
TBW	4.5	-	4.6	(4.55)
M	15.6	-	15.6	(15.6)
MD	3.9	-	4.3	(4.1)
MDT	4.4	-	4.4	(4.4)

This is a true pterophylic species associated with rocky terrain, in addition to steppe-desert habitats of Wadi Ramm. Burrows are constructed along the edges of sandstone and granite mountainsides. Other burrows are located near crevices and fissures that extend longitudinally. It has been collected from diversified habitats, including mesic and xeric biotopes along Wadi Araba, the Jordan Valley and the Mediterranean mountain range (personal observations).

Contrary to the golden spiny mouse, *A. russatus*, this species is strictly nocturnal. The activity patterns of these two species suggest a competitive exclusion of *A. russatus* by *A. cahirinus* in areas where both species coexist (Kronfeld, *et al.* 1994). In arid regions, the Cairo spiny mouse, *A. cahirinus*, feeds in part on animal matter including living land snails (Degen, *et al.* 1986; Abramsky, *et al.* 1990). The presence of piles of crushed land snails at their burrow entrances indicates their preference for this food item.

Acomys russatus (Wagner, 1840) (Plate 1)

Material examined:

JUSTM564

(Skull), male, Wadi Ramm, 29.4.2000

Measurements: n=1

GSL	29.8	APF	7.0
CBL	29	PPF	0.9
BL	25.3	TBL	7.5
BB	13	TBW	4.5
IC	4.8	M	15.0
ZB	14.7	MD	3.5
DL	7.4	MDT	4.9
MXT	5.1		

The golden spiny mouse, *Acomys russatus*, was found to be strictly a rock inhabitant. On several occasions, individuals of the golden spiny mouse were seen during daytime. The activity of the *A. russatus* is known to shift to daytime in areas where it coexists with the Cairo spiny mouse, *A. cahirinus* (Kronfeld, *et al.* 1994). *Acomys russatus* is nocturnal in areas where *A. cahirinus* is absent, while it is active in the morning hours and late afternoon in habitats shared with *A. cahirinus* (Shkolink, 1971). Young individuals were caught in July suggesting that they were born in June.

A. russatus is distinguished from *A. cahirinus* by its yellowish-golden back color, shorter tail length than head and body length and its black pigmented skin. The melanistic form, *Acomys russatus lewisi* was recorded from several localities from the Northeastern lava desert (Atallah, 1967; Atallah, 1978; Searight, 1987; Al-Melhim, *et al.* 1997; Abu Baker and Amr, 2003b).

Atallah (1967) treated this form as a distinct species (*A. lewisi*) based on bacular morphology, whereas Qumsiyeh, *et al.* (1986) considered the two species as conspecific in having the same chromosome number. Bates (1994) considered *A. lewisi* as a synonym for *A. russatus*. *Acomys lewisi* is darker in colour and apparently is confined to the northeastern black lava deserts. Atallah (1970) described *Acomys russatus harrisoni* from Ain Faschkha in Palestine. Its subspecific status is doubtful as indicated by Harrison and Bates (1991).

Family Gerbillidae*Gerbillus andersoni* de Winton, 1902 (Plate 1)

Material examined:

JUSTM396

(Skin, Skull) female, Ra's an Naqb, 22.10.2001

JUSTM438

(Skin, Skull) male, Ra's an Naqb, 15.1.2002

JUSTM439

(Skin, Skull) female, Ra's an Naqb, 19.1.2002

Measurements: n=3

HB	88	-	90	(89.33)
T	126	-	128	(127.00)
HF	29	-	30	(29.67)
E	13	-	14	(13.3)
Wt.	21	-	32	(27.7)
T/HB	140	-	142	(141.1)
GSL	28.1	-	29	(28.63)
CBL	24.4	-	25.6	(5.17)
BL	22.5	-	23.5	(23.03)
BB	13.4	-	13.4	(13.4)
IC	5.2	-	5.7	(5.53)
ZB	15.9	-	16	(15.95)

DL	6.9	-	7.3	(7.133)
MXT	3.7	-	3.8	(3.73)
APF	4.6	-	5.2	(4.83)
PPF	1.7	-	2	(1.8)
TBL	10.2	-	10.5	(10.37)
TBW	5.4	-	5.6	(5.5)
M	3	-	3.4	(3.2)
MD	13.6	-	14.1	(13.9)

The record of *G. andersoni* by Atallah and Harrison (1967) from south of Ras an Naqb as *G. gerbillus bonhotei* was later revised by Harrison (1972) and was considered as *G. andersoni* according to osteologic features. Qumsiyeh (1996) considered the specimens from 22 km north of Al Quwayrah as being more agreeable with *G. cheesmani* rather than *G. andersoni* or *G. gerbillus*. Lay (1983) considered this record as "requiring more corroboration".

The presence of *G. andersoni* in Jordan was confirmed through morphological variables and comparative cytogenetical evidence of the three hairy-footed gerbils from Jordan; *G. andersoni*, *G. cheesmani* and *G. gerbillus* (Abu Baker and Amr, 2003a).

Gerbillus cheesmani Thomas, 1919 (Plate 1)

Material examined:

- JUSTM317*
(Skin, Skull) female, Wadi Ramm, 14.9.2000
- JUSTM318*
(Skin, Skull) male, Ra's an Naqb, 14.9.2000
- JUSTM319*
(Skin, Skull) female, Ra's an Naqb, 14.9.2000
- JUSTM325*
(Skin, Skull) male, Wadi Ramm, 29.11.2000
- JUSTM326*
(Skin, Skull) female, Wadi Ramm, 13.12.2000
- JUSTM361*
(Skin, Skull) male, Mudawwarah, 20.9.2001
- JUSTM364*
(Skin) male, Mudawwarah, 20.9.2001
- JUSTM369*
(Skin) female, Ra's an Naqb, 27.9.2001
- JUSTM371*
(Skin, Skull) female, Ra's an Naqb, 29.9.2001
- JUSTM372*
(Skin, Skull) male, Wadi Ramm, 29.9.2001
- JUSTM378*
(Skin, Skull) male, Ra's an Naqb, 7.10.2001
- JUSTM381*
(Skin, Skull) female, Mudawwarah, 11.10.2001
- JUSTM383*
(Skin, Skull) male, Mudawwarah, 12.10.2001

- JUSTM384*
(Skin, Skull) male, Mudawwarah, 13.10.2001
- JUSTM385*
(Skin, Skull) female, Mudawwarah, 13.10.2001
- JUSTM386*
(Skin, Skull) male, Mudawwarah, 13.10.2001
- JUSTM390*
(Skin, Skull) male, Ra's an Naqb, 17.10.2001
- JUSTM391*
(Skin, Skull) female, Ra's an Naqb, 17.10.2001
- JUSTM416*
(Skin, Skull) male, Ra's an Naqb, 14.11.2001
- JUSTM417*
(Skin, Skull) female, Ra's an Naqb, 15.11.2001
- JUSTM418*
(Skin) female, Ra's an Naqb, 15.11.2001
- JUSTM393*
(Skin, Skull) female, Ra's an Naqb, 22.10.2001
- JUSTM394*
(Skin, Skull) female, Ra's an Naqb, 22.10.2001
- JUSTM407*
(Skin, Skull) female, Ra's an Naqb, 29.10.2001
- JUSTM413*
(Skin, Skull) male, Mudawwarah, 9.11.2001
- JUSTM414*
(Skin, Skull) ?, Ra's an Naqb, 9.11.2001
- JUSTM421*
(Skin, Skull) male, Ra's an Naqb, 14.11.2001
- JUSTM422*
(Skin, Skull) female, Ra's an Naqb, 17.11.2001
- JUSTM423*
(Skin, Skull) female, Ra's an Naqb, 24.11.2001

Measurements: n=29

HB	81	-	103	(90.97)
T	117	-	140	(126.29)
HF	30	-	32	(30.68)
E	12	-	13	(12.37)
Wt.	17	-	35	(23.9)
T/HB	121.57	-	156.32	(140.15)
GSL	26.4	-	30.5	(28.87)
CBL	23.1	-	27	(25.1)
BL	21.4	-	24.9	(23.1)
BB	13.1	-	14.1	(13.6)
IC	4.8	-	6	(5.38)
ZB	14.4	-	16.4	(15.46)
DL	6.3	-	7.5	(7.14)
MXT	3.3	-	3.8	(3.55)
APF	3.5	-	4.8	(4.17)
PPF	1.5	-	2.1	(1.79)
TBL	10.5	-	12	(11.34)
TBW	5.3	-	6.2	(5.75)
M	12.7	-	14.8	(13.72)
MD	2.9	-	3.7	(3.24)
MDT	3.1	-	3.6	(3.4)

The distribution of this species is confined to soft wind-blown sand dune areas. In the present study, *G. cheesmani* was reported from almost from all localities throughout the study area. In Wadi Ramm area, Cheesman's gerbil occurs among vegetation communities of *Haloxylon persicum*, *Hammada salicornica* and *Anabasis articulata* shrubs. Although specimens were trapped in higher numbers among *H. salicornica* and *A. articulata* communities, it was found to be the only rodent inhabiting *H. persicum* vegetation. It was caught in high numbers in flat sandy sheets south of Ruwaishid with *Seidlitzia rosmarinus* as the dominant vegetation, where as in Al Wisad, the red sand dunes are dominated with *H. salicornica* (Abu Baker and Amr, 2003b).

G. cheesmani ranges widely over the Arabian Peninsula. Specimens from Iraq and Kuwait have been assigned to the subspecies *G. c. cheesmani*,

where as specimens from Saudi Arabia have been considered as *G. c. arduus* (Harrison 1972; Harrison and Bates, 1991). The later subspecies has paler back color and longer hind feet and tail (T/HB in *G. c. arduus* nearly 150% against 130% in *G. c. cheesmani*) (Harrison, 1972; Harrison and Bates, 1991). The presence of both nominates was earlier proposed by Abu Baker and Amr (2003a) as the species occurs in two separate populations in Jordan; the northeastern population (found in Al Wisad and Dumaythat, south of Ruwaishid) with an average T/HB 132% and the southern populations (found in Wadi Ramm area and Mudawwarah) with an average T/HB 140.1%.

The geographic ranges of both *G. andersoni* and *G. cheesmani* are separated from their closest relative in Jordan, *G. gerbillus* by the southern mountains of Petra, Ra's en Naqb and Al Aqabah mountains (Abu Baker and Amr, 2003a).



Plate 1: From upper left to right: *Jaculus jaculus*, *Eliomys melanurus*, *Acomys cahirinus*, *Acomys russatus*, *Gerbillus andersoni* and *Gerbillus cheesmani*.

Gerbillus dasyurus (Wagner, 1842) (Plate 2)

Material examined:

JUSTM320

(Skin, Skull) female, Disi, 20.9.2000

JUSTM324

(Skin, Skull) male, Al Quwayrah, 24.11.2000

JUSTM363

(Skin, Skull) female, Mudawwarah, 20.9.2001

Measurements: n=3

HB	76	-	81	(79.33)
T	112	-	120	(116)
HF	24	-	26	(24.66)
E	12	-	14	(13)
Wt.	16	-	20	(17.66)
T/HB	147.37	-	148.15	(147.76)

This gerbil prefers rocky areas with low vegetation cover. It avoids sandy soil and occurs in association with *A. cahirinus*, *A. russatus*, *Sekeetamys calurus* and *E. melanurus*. Darker forms of this species were reported from the eastern lava desert where it coexisted with the melanistic golden spiny mouse *A. r. lewisi* (Abu Baker and Amr, 2003b).

Hatough-Bouran (1990) presented a thorough study on the burrow system of the Wagner's gerbil inhabiting Shawmari Wildlife Reserve. She found that the run-off *wadis* were the most preferred habitat rather than the Hammada type vegetation.

It has been recorded from several localities throughout Jordan penetrating into the semi-arid Mediterranean regions (Abu Baker and Amr, 2003a). Harrison and Bates (1991) commented on the various subspecies of this form along its range of distribution; however, their characteristics and delimitations are rather uncertain.

Gerbillus henleyi (de Winton, 1903) (Plate 2)

Material examined:

JUSTM365

(Skin, Skull) male, Mudawwarah, 22.9.2001

JUSTM380

(Skin, Skull) male, Mudawwarah, 11.10.2001

JUSTM404

(Skin, Skull) female, Mudawwarah, 29.10.2001

JUSTM434

(Skin, Skull) female, Mudawwarah, 18.12.2001

JUSTM435

(Skin, Skull) male, Mudawwarah, 19.12.2001

Measurements: n=5

HB	61	-	68	(63.4)
T	86	-	98	(92.8)
HF	19	-	21	(20)
E	7	-	10	(8.8)
Wt.	7	-	10	(8.8)
GSL	20.9	-	22.1	(21.5)
CBL	18.4	-	19	(18.7)
BL	17	-	17.7	(17.35)
BB	10.7	-	10.9	(10.8)
IC	3.7	-	3.9	(3.8)
ZB	11.5	-	11.8	(11.65)
DL	4.8	-	5.4	(5.1)
MXT	2.5	-	2.5	(2.5)
APF	3.1	-	3.4	(3.23)
PPF	1.3	-	1.4	(1.3)
TBL	8.1	-	9	(8.5)
TBW	4.6	-	4.8	(4.7)
M	9.6	-	10.2	(9.9)
MD	1.9	-	2.2	(2.0)
MDT	2.3	-	2.5	(2.4)

Gerbillus henleyi is the smallest rodent collected from the study area. It was found in the hammada areas with scarce vegetation cover of *Anabasis articulata*. The pygmy gerbil is mostly associated with the sand jird, *Meriones crassus*, where it was collected from Al Jafr and Mudawwarah area in southern Jordan, and the three-toed jerboa, *J. jaculus*.

The skull of the pygmy gerbil is distinguished by the moderately smooth and strongly inflated braincase in relation to skull length and rostrum. Body coloration and skull proportions are identical to *G. h. mariae* from Syria (Harrison and Bates, 1991; Kock, 1998). It differs from *G. h. jordani*, from Tunisia by being more grayish and having the gray hair bases longer (Dieter Kock, personal communication). This conclusion is also shared by Harrison and Bates (1991).

This species is widely distributed over Africa and the Arabian Peninsula from Algeria to Egypt and Sinai, to the Arabian Peninsula, up to Jordan, Palestine and Syria (Osborn and Helmy, 1980, Lay, 1983, Harrison and Bates, 1991, Kock, 1998). In Jordan it was reported from Al Jafr, Mudawwarah, Shawmari and Faydat ad Dahikiyah (Abu Baker and Amr, 2003a).

Gerbillus nanus Blandford, 1875 (Plate 2)

Material examined:

JUSTM309

(Skin, Skull) female, Wadi Ramm, 5.9.2000

JUSTM323

(Skull) male, Disah, 18.11.2000

JUSTM362

(Skin, Skull) male, Mudawwarah, 20.9.2001

JUSTM402

(Skin, Skull) female, Ra's an Naqb, 27.10.2001

JUSTM424

(Skin, Skull) male, Ra's an Naqb, 24.11.2001

JUSTM425

(Skin, Skull) male, Ra's an Naqb, 24.11.2001

JUSTM431

(Skin, Skull) male, Mudawwarah, 3.12.2001

Measurements: n=7

HB	79	-	86	(82.57)
T	116	-	126	(120.33)
HF	11	-	25	(24.71)
E	11	-	13	(12)
Wt.	17	-	22	(18.66)
T/HB	136.04	-	157.5	(144.89)
GSL	26	-	28.1	(27)
CBL	22.2	-	24.3	(23.4)
BL	20.4	-	22.6	(21.67)
BB	12.2	-	13.2	(12.5)
IC	4.3	-	5	(9.47)
ZB	13.7	-	15.2	(14.3)
DL	5.9	-	6.6	(6.2)
MXT	3.3	-	3.8	(3.5)
APF	3.9	-	4.3	(4.14)
PPF	1.6	-	2	(1.68)
TBL	9.8	-	11.5	(10.54)
TBW	5.2	-	6.1	(5.53)
M	12	-	12.9	(12.4)
MD	2.1	-	3.1	(2.75)
MDT	3.1	-	3.4	(3.26)

The Baluchistan gerbil, *G. nanus*, was collected from sand dunes around mud flats and salty terrains dominated by *Anabasis articulata*. It was found to coexist with *G. cheesmani*, and either one of the large-sized jirds, *M. crassus* or *M. libycus*. This species was collected in high numbers from the salty dunes and mudflats of Hazim, Dahik, and Azraq areas in the eastern desert of Jordan (Abu Baker and Amr, 2003b).

Collected specimens had less inflated or smaller tympanic bulla than the *G. nanus arabium* collected from Al Aqabah area (Kock and Nader, 1983; Harrison and Bates, 1991). Specimens collected in the present study could be assigned to the eastern Saudi population of *G. nanus nanus*. The well-developed tympanic bulla of *G. nanus* distinguishes it from other related species in Jordan (*G. dasyurus*).

Meriones libycus Lichtenstein, 1823 (Plate 2).

Material examined:

JUSTM559

(Skin, Skull), male, Wadi Ramm, Disi Agricultural Station, 18.11.2000

Measurements: n=1

HB	147.0	ZB	21.3
T	161.0	DL	10.7
HF	41.0	MXT	6.3
E	20.0	APF	7.4
Wt.	105	PPF	1.8
GSL	42.2	TBL	16.6
CBL	41.3	TBW	8.8
BL	36.0	M	20.4
BB	16.7	MD	5.3
IC	8.0	MDT	5.9

A single specimen of the Libyan jird, *Meriones libycus*, was collected from Disi Agricultural Station in an area of soft, sandy substrate dominated by *Anabasis articulata* and *Haloxylon persicum*. Both *G. cheesmani* and *G. nanus* were collected from the same area. This species was observed during the early morning hours at Al Wisad area and caught in groups around the same borrow system which had several openings (Abu Baker and Amr, 2003b). This species is characterized by a yellowish-brown dorsum and pigmented claws and the well developed terminal tuft of the tail, which distinguishes it from *M. crassus*.

The Libyan jird is common all over the Syrian Desert, sharing its habitat with other related species. It is known in Wadi Arabah, the eastern desert and southern Jordan (Qumsiyeh, 1996; Amr, 2000).

Meriones crassus Sundevall, 1842 (Plate 2)

Material examined

JUSTM566

(Skin, Skull) female, Mudawwarah, 11.9.2001

Measurements: n=1

HB	125.0	ZB	21.4
T	121.0	DL	10.3
HF	32	MXT	4.3
E	19.0	APF	7.0
Wt.	45	PPF	2.5
GSL	40.3	TBL	16.8
CBL	37.3	TBW	9.1
BL	33.0	M	19.2
BB	15.0	MD	5.0
IC	6.4	MDT	4.8

The sand jird, *M. crassus*, is a very common rodent in the study area. It was collected from a wide range of habitats including hammad and *Acacia* vegetation. This large jird was associated

with *G. nanus*, *J. jaculus* and *P. obesus*. A pregnant female was collected from Mudawwara area during October, and later gave birth to four (two males and two females). The skull of this species is readily distinguished by its appreciable projection of the well-developed tympanic bulla, with their posterior margins extending well beyond the occipital condyles.

M. crassus is widely distributed throughout the arid habitats of the northeastern desert, the southern desert and Wadi Arabah (Qumsiyeh, 1996; Amr 2000; Abu Baker and Amr, 2003b). Colonies of this jird dominate the sand dunes of the Hazim area; it was collected from low lands between the Harra rocky vegetation and the open areas. It was associated with either one of the small sized gerbils, *G. henleyi* and *G. nanus*. Skull remains were recovered from eagle owl pellets at Dahik (Rifai et al. 2000) and the little owl from Safawi area (Al-Melhim, et al. 1997).

Psammomys obesus Cretzschmar, 1828 (Plate 2).

Material examined:

JUSTM557

(Skin, Skull) male, 20 km NW Quweira, 18.11.2000;

RSCN (RUM017)

(Skin) female, Wadi Ramm, 16.7.1999.

Measurements: n=2

HB	171	-	177	(174)
T	118	-	125	(121.5)
HF	35	-	38	(36.5)
E	9	-	13	(11)
Wt.	135	-	165	(150)

n=1

GSL	44.8	APF	6.1
CBL	44.1	PPF	1.3
BL	39.3	TBL	17.0
BB	16.6	TBW	9.4
IC	7.2	M	26.1
ZB	26.5	MD	7.4
DL	14	MDT	6.9
MXT	7.6		

The presence of this colonial rodent, *P. obesus*, was immediately confirmed by the existence of the large sized mounds around burrow openings among *Anabasis articulata* shrubs. Colonies consist of extensive burrow systems with various openings, in areas with relatively hard substrate dominated by *Anabasis articulata*.

It was seen active during the daytime in several localities through out the study area. Amr and Saliba

(1986) reported on the activity, feeding habits, burrow system and association of *P. obesus* with other animals.

Sekeetamys calurus (Thomas, 1892) (Plate 2).

Material examined:

JUSTM556

(Skin, Skull) male, Wadi Ramm, 28.9.2000

JUSTM558

(Skin, Skull) male, Wadi Ramm, 26.11.2000

JUSTM562

(Skin) male, Wadi Ramm, 8.4.2003

Measurements: n=3

HB	100.0	-	114.0	(105.0)
T	136.0	-	140.0	(137.3)
HF	30.0	-	33.0	(32.0)
E	20.0	-	20.0	(20.0)
Wt.	35.0	-	48.0	(39.6)
GSL	33.9	-	39.3	(35.9)
CBL	32.3	-	37.8	(34.4)
BL	26.8	-	32.0	(28.8)
BB	15.2	-	16.2	(15.7)
IC	5.8	-	6.5	(6.1)
ZB	17.6	-	19.9	(18.7)
DL	7.9	-	9.6	(8.5)
MXT	5.2	-	5.7	(5.4)
APF	5.1	-	7.0	(6.0)
PPF	2.4	-	2.6	(2.5)
TBL	13.2	-	15.0	(13.9)
TBW	7.5	-	7.9	(7.6)
M	16.6	-	18.7	(17.5)
MD	3.9	-	4.7	(4.2)
MDT	4.8	-	5.4	(5.0)

Three individuals (two males, one female) of the bushy-tailed jird, *S. calurus*, were collected from a mountain cliff at the northern end of Jabal Um Ishreen. This record extends the known range of *S. calurus* in Jordan further south from its previous reports in Wadi Araba (Amr, 2000). It was recorded from Al Aqabah (Atallah and Harrison, 1967) resulting in a continuous distribution between records from Sinai (Haim and Tchernov, 1974; Osborn and Helmy, 1980) and Saudi Arabia (Nader, 1974).

The species is readily distinguished from other members of the family Gerbillidae by its squirrel-like, bushy tail with white tips (one specimen did not show a white tail tip). The skull is elongated with an inflated tympanic bullae extending beyond

the supraocciput. This species is strictly a rock dweller, inhabiting mountain slopes in arid regions of Sinai, eastern Egypt, western Arabian Peninsula, southern Palestine and southwestern Jordan (Zahavi and Wahrman, 1957; Haim and Tchernov, 1974; Harrison and Bates, 1991; Qumsiyeh, 1996). It is a good climber and perhaps it lives under rocky boulders. During the course of the present study, a female was mated to one of the males in the

laboratory in May 1999. Litters of 3 (two males, one female) and 4 individuals (two males, two females) were obtained. The bushy-tailed jird is a nocturnal species (Harrison and Bates, 1991).

Accounts on the biology and population ecology of *S. calurus* in the Negev Desert and the Judean Desert, southern Palestine were previously reported by Shargal, *et al.* (1998) and Shenbrot, *et al.* (1999).



Plate 2: From upper left to right: *Gerbillus dasyurus*, *Gerbillus henleyi*, *Gerbillus nanus*, *Meriones libycus*, *Meriones crassus* and *Sekeetamys calurus*.

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