

# Study of rodents' fauna of the Jiroft, Kerman Province in southeast of Iran

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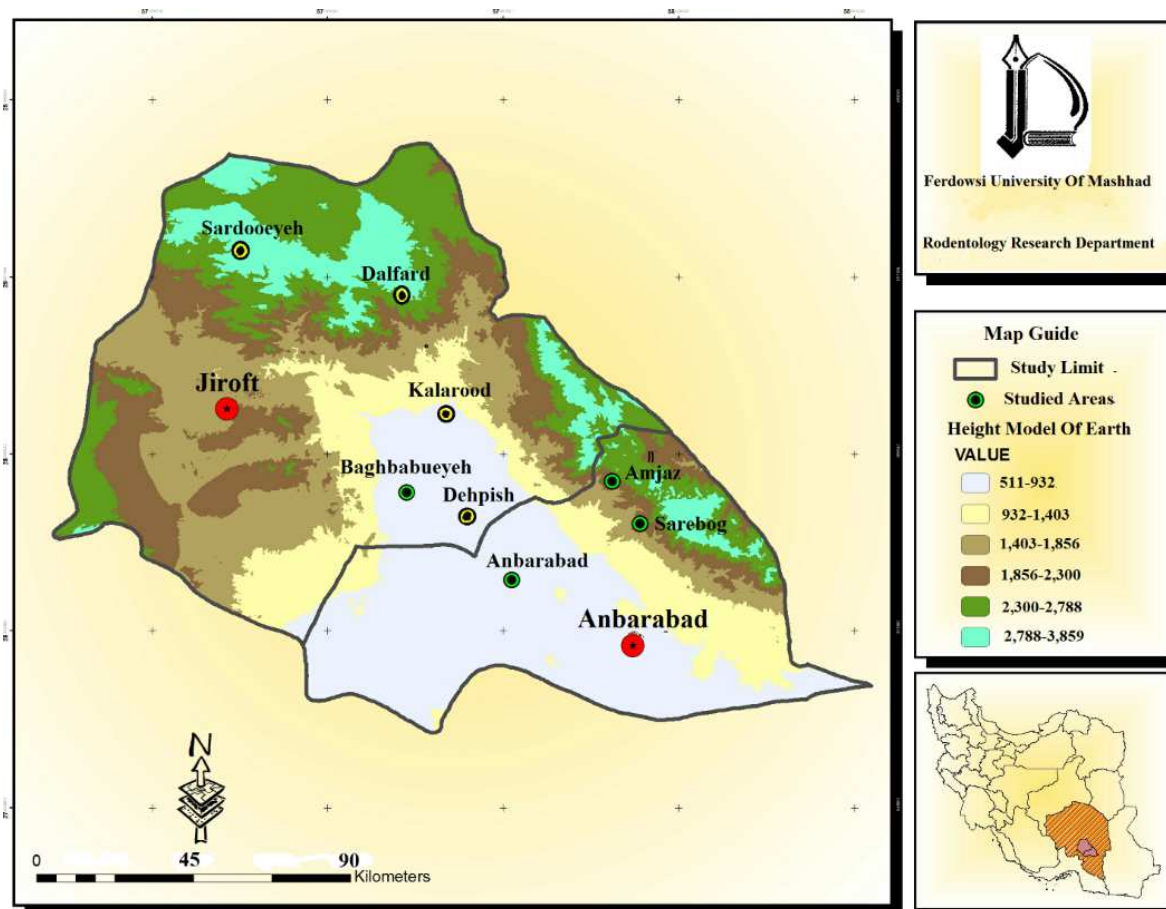
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In this study, rodent's assemblages from Jiroft and Anbarabad townships in the southeast Iran, were studied. A total of 54 specimens were collected and identified during the period of June 2011 until September, 2012. The collected specimens consist of 9 species belonging to 9 genera and two families including: Muridae (*Golunda ellioti*, *Acomys dimidiatus*, *Tatera indica*, *Nesokia indica*, *Meriones persicus*, *Mus musculus*, *Apodemus wetherbyi*, *Rattus rattus*), Cricetidae (*Cricetulus migratorius*). Standard external morphological and morphometric characteristics, including cranial and dental characters are given. The family Muridae with eight species, showed the highest diversity among the families represented here. *Tatera indica* showed the high frequency compare to other species examined in this study.

**Key words:** Fauna, Jabalbarez Mountains, *Golunda ellioti*

## INTRODUCTION

Iran comprises a variety of geographic and climatic habitats. It is located in the Palearctic region and forms a bridge between the Middle East and Indian subcontinents. It is evident that faunal diversity of Iran is far greater than what is reported by naturalists such as Ellerman (1948), Etemad (1978), so far, and the identification of some certain new species necessitates a biosystematics approach such as molecular and population studies. Documentation of the mammalian fauna of Iran is important for providing a base of data about mammalian diversity in this region. Rodents have been shown to play key roles in the structure and function of many complex ecological systems (Ostfeld et al., 1966; Elkinton et al., 1966) as a result of their role in various levels of trophic interactions as primary herbivores, insectivores, and seed predators. Rodents also serve as the main prey source for many mammalian, reptilian, and avian predators (Calandriello, 1999). Consequently, rodents play a crucial role in food web dynamics. Long term monitoring of rodent populations may allow us to anticipate change in predator populations (Hanski et al., 1993). Khajeh and Meshkani (2010) studied intraspecies variations Indian gerbil, *Tatera indica* Hardwicke, 1807 in eastern border of Iran, Azarpira et al., (2012), studied rodents fauna in Anjerk prohibited huntig area in Kerman provinc, Ashrafzadeh et al. (2012) studied intraspecies variations Indian gerbil, *Tatera indica* Hardwicke, 1807 in Hormozgan province, Khajeh et al. (2015) studied rodents fauna of Jaz Murian depression, Southeast Iran. Southern Iran includes the southern regions of Zagros and northern coast of Persian Gulf representing the provinces of Fars, Kohkyluyeh and Boyer Ahmad, Hormozgan and Bushehr. Sometimes Khuzestan and Kerman are also included in this regions. Kerman Province is the largest province of Iran after Sistan va Baluchestan province. Jiroft is one of the Kerman cities that is in southern part of this province and has an area of 13799 square kilometers. Jiroft has three different



**FIGURE 1.** Collecting sites of specimens in Jiroft and Anbarabad townships.

climates that contains: cold mountain (sardoieyeh area), temperate mountain (Dalfard & JabalBarez areas) and hot and humid (Jiroft plain area). The city height, is at least 511 meters in Jiroft plain to 3859 meters in Sardooeyeh heights. Anbarabad city is among southern cities of Kerman province and has an area of 4656 square kilometers. Anbarabad has two different climates that includes: temperate mountain (Amjaz area), hot and humid (Anbarabad plain area). As a result, these cities are among areas that have high weather and geographic variety.

#### **MATERIAL AND METHODS**

In this study, rodents were captured from Jiroft and Anbarabad in the southeast Iran, were studied (Fig. 1). A total of 54 specimens belonging to 9 species were collected using snap-traps and Sherman live-traps. The standard voucher specimens (skins, skulls and tissue specimens) were deposited in the Zoology Museum of Ferdowsi University of Mashhad (ZMFUM). Corbet (1978) identification key and Wilson and Reeder (2005) were used for identifying species.

**Measurements:** Four standard external and 11 cranial variables of each specimen were measured by ruler and vernier calipers to the nearest 0.05 mm, respectively. Each individual was also weighted to the nearest gram. Abbreviation used are: W: weight, HBL: head and body length, TL: tail length, FL: hind foot length, OL: occipitonasal length, CL: condylobasal length, ZB: zygomatic breadth, BB: breadth of braincase, LF: length of nasal, LIF: Length of Incisive foramina, LB: length of tympanic bullae, HB: height of braincase, BR: breadth of rostrum, LD: length of diastema, LM: length of mandible.

**RESULTS**

A total of 57 specimens were collected in the study area including 9 species belonging to 9 genera and two families (Table 1). The distribution map of the studied species are presented in figure 1. Detailed morphometric data and the morphological characteristics of the specimens were presented in tables 2, 3, 4. The data show that weight, Head and body length in *Nesokia indica* is greater from other species and in *Apodemus wetherbyi* is smaller from other species.

**TABLE 1.** Rodents species collected from Jiroft and Anbarabad townships.

| Family     | Genus                                 | Species                       |
|------------|---------------------------------------|-------------------------------|
| Muridae    | <i>Golunda</i> Gray, 1837             | <i>Golunda ellioti</i>        |
|            | <i>Acomys</i> Geoffroy, 1838          | <i>Acomys dimidatus</i>       |
|            | <i>Tatera</i> Lataste, 1882           | <i>Tatera indica</i>          |
|            | <i>Meriones</i> Illiger, 1811         | <i>Meriones persicus</i>      |
|            | <i>Nesokia</i> Gray, 1842             | <i>Nesokia indica</i>         |
|            | <i>Mus</i> Linnaeus, 1758             | <i>Mus musculus</i>           |
|            | <i>Apodemus</i> Kaup, 1829            | <i>Apodemus wetherbyi</i>     |
|            | <i>Rattus</i> Fisher, 1803            | <i>Rattus rattus</i>          |
| Cricetidae | <i>Cricetulus</i> Milne-Edwards, 1867 | <i>Cricetulus migratorius</i> |

**SPECIES LIST****Superfamily Muroidea Illiger, 1811****Family Muridae Illiger, 1811****Subfamily Murinae Illiger, 1811****Genus *Mus* Linnaeus, 1758*****Mus musculus* Linnaeus, 1758**

Type locality: Sweden, Uppsala County, Uppsala.

**Material examined:** Jiroft, Kalarood (28°39'53.87"N, 57°43'46.36"E), 3♀, Jiroft, Poshteloh, (28°37'45.35"N, 57°44'46.61"E), 2♀, 1♂, Jiroft, Malekabad (28°38'46.10"N, 57°44'29.49"E), 2♀, 1♂, Anbarabad (28°27'48.43"N, 57°51'03.33"E), 1♂, Anbarabad, Sarebog (28°37'07.42"N, 58°03'07.97"E), 1♀, 2012-2013. Collector. Y. Amir afzali.

Distribution: distributed over the world's continents and islands (except Antarctica), Lay (1967) surveyed and revised the range of the house mouse in Iran. Fars: Shiraz, Lurestan: Faraman; Kerman: Pishin, Kalagan, Bampur, Dizak, Mashish; Khuzistan: Deh Diz, Bakhtyari Mountains, 160 km northeast of Ahvaz; Isfahan: 45 km south of Isfahan, Sistan; Kurdistan: Saqiz; Azerbaijan: 10 km southwest of Urmia, Qazvin; Mazandaran: south coast of the Caspian Sea, Elburz Mountains near Damavand; Damghan: 5.6 km north of Semnan; Khorasan: Dasht; Golestan: Kaleh Peninsula, Turkmen Desert, Dar Kaleh, Pahlavi Dezh. Etemad (1978) stated that *Mus musculus* was found throughout Iran except in the Lout and Kavir plain (Fig. 2-A).

**Superfamily Muroidea Illiger, 1811****Family Muridae Illiger, 1811****Subfamily Murinae Illiger, 1811****Genus *Golunda* Gray, 1837*****Golunda ellioti* Gray, 1837**

Type locality: India, Dharvar.

**Material examined:** Jiroft, Baghbabuyeh (28°33'16.40"N, 57°43'47.44"E), 3♀, 1♂, Anbarabad, (28°27'48.43"N, 57°51'03.33"E), 1♂, Anbarabad, Sarebog (28°37'07.42"N, 58°03'07.97"E), 2♀, Anbarabad, Amjaz (28°39'09.20"N, 58°03'31.97"E), 2♀, 1♂, 2012-2013. Collector. Y. Amir afzali.

Distribution: This species has a wide distribution range and is reported from Iran, Pakistan, Nepal, N and NE India south through Indian peninsula to Sri Lanka (Fig. 2-B).

**Superfamily Muroidea Illiger, 1811**

**Family Muridae Illiger, 1811**

**Subfamily Murinae Illiger, 1811**

**Genus *Rattus* Fischer, 1803**

***Rattus rattus* Linnaeus, 1758**

Type locality: Sweden, Uppsala County, Uppsala.

**Material examined:** Jiroft, Baghbabuyeh (28°33'16.40"N, 57°43'47.44"E), 2♀, Jiroft, Khatoonabad, (28°35'54.64"N, 57°43'2.94"E), 1♀, 1♂, 2012-2013. Collector. Y. Amir afzali.

Distribution: Native to Indian Peninsula and introduced worldwide in temperate zones and parts of the tropical and sub-antarctic zones; southernmost limit is the sub-antarctic Macquarie Isles where *Rattus rattus* was introduced by sealers during the 19th century.

Lay (1967) reported this species in Gilan: Rasht, Kerman; Golestan: Dar Kaleh and Qarnabad village, south coast of the Caspian Sea; Persian Gulf: Tunb Island. Etemad (1978) reported *Rattus rattus* from Astara to Gorgan and Chah Bahar to Abadan and Minab (Fig. 2-C).

**Superfamily Muroidea Illiger, 1811**

**Family Muridae Illiger, 1811**

**Subfamily Murinae Illiger, 1811**

**Genus *Nesokia* Gray, 1842**

***Nesokia indica* Gray, 1830**

Type locality: India (uncertain).

**Material examined:** Jiroft, Baghbabuyeh (28°33'16.40"N, 57°43'47.44"E), 1♀, 1♂, Anbarabad, Sarebog (28°37'07.42"N, 58°03'07.97"E), 1♂, Jiroft, Dehpish (28°37'18.59"N, 57°45'0.02"E), 1♀, 2012-2013. Collector. Y. Amir afzali.

Distribution: Modern range covers Bangladesh, N India (Bihar, west Bengal, Punjab, Haryana, Delhi, Uttar Pradesh, Gujarat and Rajasthan), Pakistan, Afghanistan, Iran, Iraq, Syria, Saudi Arabia, Jordan, NE Egypt, NW China (Xinjiang, south of Tian Shan), Turkmenistan, Uzbekistan, and Tajikistan. Lay (1967) revised the distribution range of bandicoot rat in Iran and reported the species had been recorded in Kerman: Kalagan; in Golestan: Bandar Gaz, Dar Kaleh, Turkmen Desert, Mian Kaleh Peninsula; in Khorasan: Guladagh, Sabzewar; in Mazandaran: Mashed Sar; in Qazvin: Hesarak; and in Isfahan: Mahallat; Lurestan: Qasr Shirin. He trapped specimens in Qazvin, Gorgan, Damghan, Khuzistan, Fars, Kerman, Iranshahr, Azad Shahr, and the vicinity of Gonbad Kavoods. *Nesokia indica* has been recorded in Varamin, Sabzewar, Tous, Bushehr, Babolsar, Guladagh in Bojnord, Toos and Sabzewar (Fig. 2-D).

**Superfamily Muroidea Illiger, 1811**

**Family Muridae Illiger, 1811**

**Subfamily Murinae Illiger, 1811**

**Genus *Apodemus* Kaup, 1829**

***Apodemus witherbyi* Thomas, 1902**

Type locality: S Iran, Fars Province, Shul.

**Material examined:** Anbarabad, Amjaz (28°39'09.20"N, 58°03'31.97"E), 1♀, 2012-2013. Collector. Y. Amir afzali.

Distribution: Plains, mountain and plateau steppes, and highland semi-deserts (not found in desert depressions) from E of the Dnepr River in the S Ukraine, Crimea, N Caucasus, S Caucasus (Georgia, Armenia, and Azerbaijan), Anatolian Turkish steppe and Bozcaada Isle, Palestine, NW

Jordan, throughout most of C and N Iran in provinces of Azerbaijan, Kurdistan, Ilam, Lurestan, Isfahan, Fars, Semnan, Tehran, C and E Mazandaran, N and E Khorasan, Koppe Dagh Mountains of SW Turkmenistan and eastward in WC Pakistan; probably also occurs in Afghanistan, NE Iraq, Lebanon and adjacent SW Syria. Corbet (1978) described it as *Apodemus sylvaticus* in northern Iran. Not recognized by Lay (1967) (Fig.2-E).

**Superfamily Muroidea Illiger, 1811**

**Family Muridae Illiger, 1811**

**Subfamily Gerbilinae**

**Genus *Meriones* Illiger, 1811**

***Meriones persicus* Blanford, 1875**

Type locality: Iran, Kohrud, 116 km North of Isfahan.

**Material examined:** Anbarabad, Amjaz (28°39'09.20"N,58°03'31.97"E), 1♀, 2012-2013. Collector. Y. Amir afzali.

Distribution: Iran, adjacent regions of Transcaucasia, Turkey, Iraq, Turkmenistan, Afghanistan and Pakistan (West of the Indus River).

Lat (1967) states for the Persian jird to be widespread in Iran, with the exception of the Caspian forests, also missing from the border of Persian Gulf (Fig.2-F).

**Superfamily Muroidea Illiger, 1811**

**Family Muridae Illiger, 1811**

**Subfamily Gerbilinae**

**Genus *Tatera* Lataste, 1882**

***Tatera indica* Hardwicke, 1807**

Type locality: between Benares and Hardwar, United Province, north of India.

**Material examined:** Jiroft, Baghbabuyeh (28°33'16.40"N,57°43'47.44"E), 5♀, 3♂, Jiroft, Dehpish (28°37'18.59"N, 57°45'0.02"E), 3♀, 2♂, Jiroft, Khatoonabad, (28°35'54.64"N, 57°43'2.94"E), 4♀, 1♂, 2012-2013. Collector. Y. Amir afzali.

Distribution: An extensive range from southeast Anatolia in Turkey, Syria, Iraq and Kuwait through Iran, Afghanistan, and Pakistan into most of Indian Peninsula, North to the Terai region of Southern Nepal, and also in Sri Lanka. This species has been recorded from Kerman: Kahnuj, Bam; in Yazd: Mehriz; in Hormozgan: Bandar abbas, Rudan; in Fars: Kazerun; in Sistan va Baluchestan: Saravan, Khash, Nikshahr, in Khorasan: Torbat Jam (Fig.2-G).

**Superfamily Muroidea Illiger, 1811**

**Family Muridae Illiger, 1811**

**Subfamily Deomyinae, Thomas, 1888**

**Genus *Acomys* Geoffroy, 1838**

***Acomys dimidiatus* Cretzschmar, 1826**

Type Locality: Egypt, Sinai.

**Material examined:** Anbarabad, Sarebog (28°37'07.42"N, 58°03'07.97"E), 2♀, 2012-2013. Collector. Y. Amir afzali.

Distribution: Sinai Peninsula of Egypt, Jordan, Israel, Lebanon, Syria, Saudi Arabia, Yemen, Oman, United Arab Emirates, S Iraq, S Iran, and S Pakistan. The range is basically east of the distribution of the morphologically similar North African *A. cahirinus*. The *Acomys dimidiatus* has been reported in Hormozgan: Minab, Geno; in Sistan va baluchestan: Chabahr; in Bushehr (Fig. 2-H).

**Superfamily Muroidea Illiger, 1811**

**Family Cricetidae Fischer, 1817**

**Subfamily Cricetinae Fischer, 1817**

**Genus *Cricetulus* Milne-Edwards, 1867**

***Cricetulus migratorius* Pallas, 1773**

Type locality: W Kazakhstan, lower Ural River.

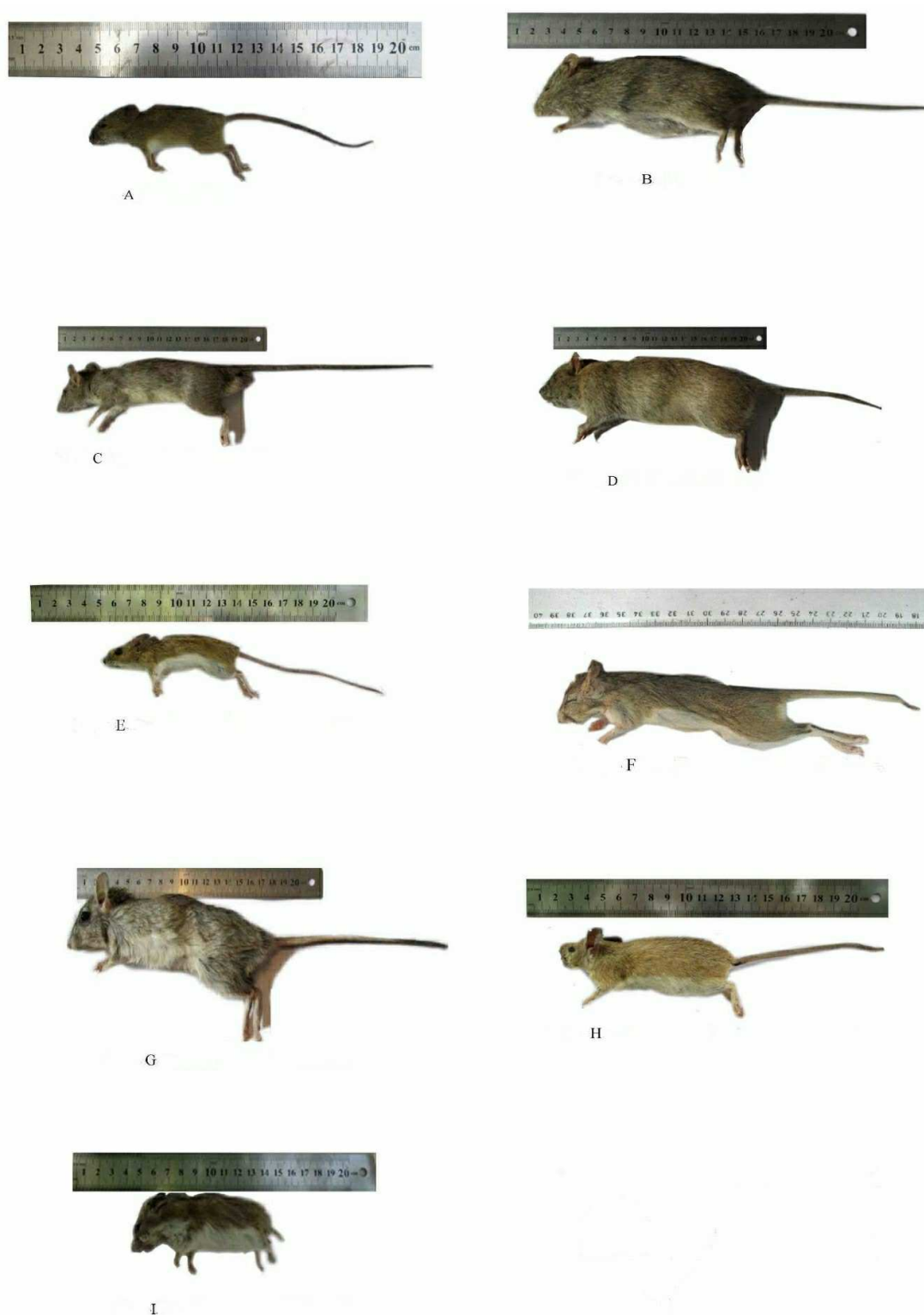
**Material examined:** Anbarabad, Amjaz (28°39'09.20"N, 58°03'31.97"E), 1♀, 1♂, 2012-2013. Collector. Y. Amir afzali.

Distribution: SE Greece, NW Romania, SE Bulgaria, and S European Russia, eastwards through Kazakhstan to S Mongolia and N China; southwards through Turkey and Transcaucasia to Palestine, Lebanon, Iraq, Iran, Afghanistan, Pakistan, and N India.

The gray hamster has been reported in Kerman: Mashish; Kurdistan: Saqiz, Sanandaj, Sameleh; in Fars: Shiraz; in Azerbaijan: Menzil, Astara, west of Maku, Mushabad, SW Urmia, W of Sarab; in Zanjan: Soltanieh; in Isfahan: Zard Kuh, Kohrud; in Tehran: Doab, Tehran; in Mazandaran: Sama, Kaleh Sefid, Naghadeh, Tuiserkhan, Aghbolagh Morched, Lurestan, Kermanshah; in Golestan: 16 km. southeast of Gorgan, Turkmen Plains; in Damghan: 5.6 km north of Semnan; in Khorasan: 3 km E of Dasht; in Lurestan: Faraman (Fig. 2-I).

**DISCUSSION**

The current study recorded 9 species belonging to 9 genera and two families of Muridae and Cricetidae. The high diversity of genus and species was found for the family Muridae. *Tatera indica* showed the high frequency compare to other species in this study. In this research eighteen specimens of *Tatera indica* were captured and two of them were found at 1800 m in Jabalbarez mountains. *Tatera indica* was found in a range of dry or arid habitats. In South Asia, it occurs in dry deciduous forests, scrub forests, grasslands, rocky areas, hot deserts, arid and semi-arid regions and uncultivated areas. It has been found to occupy undisturbed barren open areas. In Turkey, it appears to prefer uncultivated arid and semi-arid habitats with soft soil and dry river slopes. Harrison and Bates (1991) indicated that the species can be found in agricultural country not far from water, including heavily grazed areas. In this research 11 specimens of *Golunda ellioti* from four localities in Jiroft and Anbarabad, Kerman, were captured. This species has a wide distribution range and is reported from Iran, Pakistan, Nepal, India and south through Indian peninsula to Sri Lanka. In these areas first record of *Golunda ellioti* Gray, 1837 (Muridae, Rodentia) from southeast of Iran has been reported by Nazari and Farid (1991). Darvish et al. (2012) further record of *G. ellioti* from these areas. There is no report of their existence in any place of Iran the nearest report place is Karachi port in Pakistan, where has approximate distance of 1100 kilometers with the studied areas in this research. The presence of *G. ellioti* in South of Kerman Province in Southeastern Iran is interesting and this indicates that this species has extended its distribution from the Indian subcontinent much farther to the west. The Eastern or Arabian spiny mouse (*Acomys dimidiatus*) also is another species that reported in these areas. It has a wide range, having been found in Middle Eastern deserts as well as being prevalent in riverine forests in Africa. This is the only species of spiny mouse which may have black coloration. In this research we obtained specimens of it in height of 1400 meters of Jabalbarez mountains. Wilson and Reeder (2005) have introduced total of 20 species of this genus in the world. This species in arid and semi arid habitats, including rocky areas lives. It seems that the droughts of the recent years has force this species to expand their distribution northward, where there is relatively more humid. Southeastern Iran a point of overlap among ranges of species with extreme variation in regional topography and penetration of species from other regions. It is an area of contact between two cradles of endemism, Southeastern Iran and Western Pakistan. High mountains of Jabalbarez in Kerman province in southeast of Iran, separates the west of Pakistan and Baluchistan of Iran from central part of Iran. Nevertheless, some species can turn the mountains and enter to Iran plateau. One of the important factor that plays an important role in distribution of rodents of southeast of Iran is the weather. The all ecologic, climatic and geographic conditions have provided many local and specific areas and have made the southeast Iran as a zone of specification for rodents.



**FIGURE 2.** Collected specimens in Jiroft and Anbarabad townships. A, *Mus Musculus* Linnaeus, 1758. B, *Golunda ellioti* Gray, 1837. C, *Rattus rattus* Linnaeus, 1758. D, *Nesokia indica* Gray, 1830. E, *Apodemus witherbyi* Thomas, 1902. F, *Meriones persicus* Blanford, 1875. G, *Tatera indica* Hardwicke, 1807. H, *Acomys dimidiatus* Cretzschmar, 1826. I, *Cricetulus migratorius*, Pallas, 1773.

**TABLE 2.** Standard external measurements (Mean  $\pm$  SD, in mm) of species of rodents in Jiroft and Anbarabad townships.

| Taxa                          | N  | HBL               | TL                | FL               | EL               | W                 |
|-------------------------------|----|-------------------|-------------------|------------------|------------------|-------------------|
| <b>Muridae</b>                |    |                   |                   |                  |                  |                   |
| <i>Mus musculus</i>           | 11 | 70 $\pm$ 5.87     | 74 $\pm$ 6.72     | 17 $\pm$ 1.40    | 15.50 $\pm$ 2.18 | -                 |
| <i>Acomys dimidiatus</i>      | 2  | 87 $\pm$ 35.35    | 97.5 $\pm$ 9.19   | 18.50 $\pm$ 0.70 | 19.50 $\pm$ 0.70 | 35 $\pm$ 14.14    |
| <i>Tatera indica</i>          | 18 | 139 $\pm$ 20      | 138 $\pm$ 20.82   | 37.5 $\pm$ 1.60  | 21 $\pm$ 2.60    | 115 $\pm$ 33.41   |
| <i>Meriones persicus</i>      | 1  | 120               | 151               | 35               | 18               | -                 |
| <i>Apodemus witherbyi</i>     | 1  | 58                | 100               | 21               | 17               | 17                |
| <i>Golunda ellioti</i>        | 11 | 118.5 $\pm$ 21.02 | 102 $\pm$ 14.78   | 21.5 $\pm$ 3.57  | 18.5 $\pm$ 1.20  | 67.5 $\pm$ 10.30  |
| <i>Nesokia indica</i>         | 4  | 172 $\pm$ 23.59   | 114.5 $\pm$ 22.22 | 36 $\pm$ 2.51    | 17.5 $\pm$ 2.44  | 192.5 $\pm$ 93.75 |
| <i>Rattus rattus</i>          | 4  | 163.2 $\pm$ 23.5  | 196.2 $\pm$ 17.57 | 32.25 $\pm$ 1.89 | 19.5 $\pm$ 1.73  | 116 $\pm$ 11.57   |
| <b>Cricetidae</b>             |    |                   |                   |                  |                  |                   |
| <i>Cricetulus migratorius</i> | 2  | 117.5 $\pm$ 3.53  | 30 $\pm$ 10.60    | 14 $\pm$ 1.41    | 17.5 $\pm$ 3.53  | 18.5 $\pm$ 7.0    |

**TABLE 3.** Standard cranial measurements (Mean  $\pm$  SD, in mm) of species of rodents in Jiroft and Anbarabad townships.

| Taxa                          | N  | OL                | CL               | ZB               | IB              | BB               | LN               | LIF             | LB               | HB               | BR              | LD               | LM               |
|-------------------------------|----|-------------------|------------------|------------------|-----------------|------------------|------------------|-----------------|------------------|------------------|-----------------|------------------|------------------|
| <b>Muridae</b>                |    |                   |                  |                  |                 |                  |                  |                 |                  |                  |                 |                  |                  |
| <i>Mus musculus</i>           | 11 | 21.46 $\pm$ 1.219 | 21.04 $\pm$ 1.42 | 10.67 $\pm$ 0.77 | 3.50 $\pm$ 0.18 | 9.36 $\pm$ 0.23  | 7.52 $\pm$ 0.83  | 4.66 $\pm$ 0.39 | 4.11 $\pm$ 0.98  | 6.78 $\pm$ 0.73  | 3.63 $\pm$ 0.28 | 5.34 $\pm$ 0.50  | 12.77 $\pm$ 0.82 |
| <i>Acomys dimidiatus</i>      | 2  | 29.61 $\pm$ 2.56  | 27.79 $\pm$ 2.63 | 12.58 $\pm$ 1.86 | 4.62 $\pm$ 0.28 | 12.71 $\pm$ 0.49 | 11.76 $\pm$ 1.53 | 6.97 $\pm$ 0.14 | 5.42 $\pm$ 0.08  | 8.35 $\pm$ 0.43  | 4.26 $\pm$ 0.45 | 7.39 $\pm$ 1.12  | 17.46 $\pm$ 1.99 |
| <i>Tatera indica</i>          | 18 | 40.12 $\pm$ 3.30  | 36.48 $\pm$ 2.99 | 19.08 $\pm$ 1.68 | 6.64 $\pm$ 0.28 | 17.66 $\pm$ 0.59 | 16.35 $\pm$ 1.97 | 7.09 $\pm$ 0.63 | 11.64 $\pm$ 0.73 | 13.59 $\pm$ 1.14 | 6.13 $\pm$ 0.61 | 10.00 $\pm$ 1.37 | 23.16 $\pm$ 1.96 |
| <i>Meriones persicus</i>      | 1  | 37.13             | 33.55            | 16.74            | 6.28            | 17.58            | 14.38            | 6.48            | 11.00            | 11.49            | 4.85            | 9.50             | 20.81            |
| <i>Apodemus witherbyi</i>     | 1  | 25.75             | 24.03            | 11.43            | 4.35            | 11.95            | 9.10             | 4.65            | 4.77             | 7.85             | 4.47            | 6.41             | 14.87            |
| <i>Golunda ellioti</i>        | 11 | 31.17 $\pm$ 1.63  | 30.11 $\pm$ 1.80 | 15.09 $\pm$ 0.90 | 4.58 $\pm$ 0.22 | 13.02 $\pm$ 0.48 | 12.34 $\pm$ 0.72 | 5.72 $\pm$ 0.40 | 5.78 $\pm$ 0.29  | 9.88 $\pm$ 0.36  | 5.59 $\pm$ 0.35 | 7.80 $\pm$ 0.70  | 19.68 $\pm$ 1.19 |
| <i>Nesokia indica</i>         | 4  | 41.89 $\pm$ 3.83  | 42.87 $\pm$ 4.14 | 26.44 $\pm$ 2.57 | 6.97 $\pm$ 0.41 | 18.79 $\pm$ 0.69 | 12.92 $\pm$ 1.50 | 5.23 $\pm$ 0.69 | 7.81 $\pm$ 0.55  | 14.96 $\pm$ 1.88 | 7.67 $\pm$ 0.35 | 13.53 $\pm$ 1.65 | 32.64 $\pm$ 2.97 |
| <i>Rattus rattus</i>          | 4  | 35.19 $\pm$ 5.84  | 34.56 $\pm$ 5.45 | 16.03 $\pm$ 3.49 | 5.61 $\pm$ 0.83 | 15.08 $\pm$ 1.36 | 12.39 $\pm$ 2.45 | 6.25 $\pm$ 1.06 | 6.20 $\pm$ 0.84  | 10.57 $\pm$ 1.43 | 5.96 $\pm$ 1.19 | 9.16 $\pm$ 2.10  | 21.99 $\pm$ 4.44 |
| <b>Cricetidae</b>             |    |                   |                  |                  |                 |                  |                  |                 |                  |                  |                 |                  |                  |
| <i>Cricetulus migratorius</i> | 2  | 28.91 $\pm$ 2.03  | 27.52 $\pm$ 2.14 | 14.19 $\pm$ 1.01 | 4.46 $\pm$ 0.12 | 12.00 $\pm$ 0.40 | 11.59 $\pm$ 1.56 | 5.71 $\pm$ 0.15 | 5.03 $\pm$ 0.28  | 8.50 $\pm$ 0.17  | 5.21 $\pm$ 0.31 | 7.99 $\pm$ 0.94  | 18.28 $\pm$ 1.31 |



**TABLE 4.** Dental measurements (Mean  $\pm$  SD, in mm) of species of rodents in Jiroft and Anbarabad townships.

| Taxa                          | N  | M1/L            | M1/W            | M2/L            | M2/W            | M3/L            | M3/W            | M/1L            | M/1W            | M/2L            | M/2W            | M/3L            | M/3W            |
|-------------------------------|----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>Muridae</b>                |    |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| <i>Mus musculus</i>           | 11 | 1.74 $\pm$ 0.09 | 1.04 $\pm$ 0.03 | 0.87 $\pm$ 0.05 | 0.85 $\pm$ 0.07 | 0.58 $\pm$ 0.04 | 0.61 $\pm$ 0.03 | 1.38 $\pm$ 0.09 | 0.84 $\pm$ 0.03 | 0.91 $\pm$ 0.04 | 0.86 $\pm$ 0.04 | 0.59 $\pm$ 0.05 | 0.57 $\pm$ 0.05 |
| <i>Acomys dimidiatus</i>      | 2  | 2.19 $\pm$ 0    | 1.51 $\pm$ 0.02 | 1.43 $\pm$ 0.04 | 1.48 $\pm$ 0    | 0.93 $\pm$ 0.04 | 0.83 $\pm$ 0    | 1.93 $\pm$ 0.02 | 1.20 $\pm$ 0.07 | 1.36 $\pm$ 0    | 1.22 $\pm$ 0.12 | 0.96 $\pm$ 0.09 | 0.85 $\pm$ 0.13 |
| <i>Tatera indica</i>          | 18 | 1.88 $\pm$ 0.1  | 3.39 $\pm$ 0.23 | 1.95 $\pm$ 0.17 | 1.68 $\pm$ 0.09 | 1.43 $\pm$ 0.09 | 1.13 $\pm$ 0.22 | 1.81 $\pm$ 0.08 | 2.77 $\pm$ 0.14 | 1.92 $\pm$ 0.11 | 1.76 $\pm$ 0.12 | 1.22 $\pm$ 0.12 | 1.01 $\pm$ 0.13 |
| <i>Meriones persicus</i>      | 1  | 2.37            | 1.98            | 1.37            | 2.10            | 0.97            | 1.51            | 2.12            | 1.43            | 1.66            | 2.09            | 1.38            | 1.42            |
| <i>Apodemus witherbyi</i>     | 1  | 1.73            | 1.11            | 1.12            | 0.96            | 0.77            | 0.88            | 1.58            | 0.88            | 1.06            | 1.01            | 0.91            | 0.83            |
| <i>Golunda ellioti</i>        | 11 | 2.45 $\pm$ 0.35 | 2.64 $\pm$ 0.49 | 1.98 $\pm$ 0.12 | 1.86 $\pm$ 0.13 | 1.66 $\pm$ 0.23 | 1.50 $\pm$ 0.29 | 2.12 $\pm$ 0.46 | 2.16 $\pm$ 0.52 | 1.95 $\pm$ 0.07 | 1.66 $\pm$ 0.09 | 1.48 $\pm$ 0.31 | 1.27 $\pm$ 0.31 |
| <i>Nesokia indica</i>         | 4  | 3.69 $\pm$ 0.67 | 3.84 $\pm$ 1.16 | 2.74 $\pm$ 0.52 | 2.27 $\pm$ 0.24 | 2.08 $\pm$ 0.11 | 1.85 $\pm$ 0.35 | 2.82 $\pm$ 0.7  | 2.86 $\pm$ 0.68 | 2.36 $\pm$ 0.36 | 2.33 $\pm$ 0.34 | 2.33 $\pm$ 0.28 | 2.51 $\pm$ 0.46 |
| <i>Rattus rattus</i>          | 4  | 1.77 $\pm$ 0.03 | 2.98 $\pm$ 0.39 | 1.71 $\pm$ 0.07 | 1.69 $\pm$ 0.01 | 1.40 $\pm$ 0.08 | 1.59 $\pm$ 0.05 | 1.59 $\pm$ 0.15 | 2.64 $\pm$ 0.11 | 1.64 $\pm$ 0.03 | 1.73 $\pm$ 0.05 | 1.59 $\pm$ 0.16 | 1.44 $\pm$ 0.1  |
| <b>Cricetidae</b>             |    |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| <i>Cricetulus migratorius</i> | 2  | 1.86 $\pm$ 0.01 | 1.10 $\pm$ 0.04 | 1.32 $\pm$ 0.03 | 1.14 $\pm$ 0.09 | 0.98 $\pm$ 0    | 1.00 $\pm$ 0.02 | 1.61 $\pm$ 0.01 | 0.95 $\pm$ 0    | 1.33 $\pm$ 0.02 | 1.02 $\pm$ 0.07 | 1.16 $\pm$ 0.13 | 0.91 $\pm$ 0.04 |

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### LITERATURE CITED

- Agrawal, V.C., 2000. Taxonomic studies on Indian Muridae and Hystricidae (Mammalia: Rodentia). Records of the Zoological survey of India 180, 1-177.
- Ashrafzadeh, M., Shahi, T., Karami, M., Darvish, J., 2011. Intraspecific variations within *Tatera indica* Hardwicke, 1807 (Muridae, Rodentia) populations in Hormozgan province, Iran. Journal of Natural Environmental, Iranian Journal of Natural Resources, 64: 347-361.
- Azarpira, M., Mdjzadeh, S.M., Darvish, J., 2012. A faunistic study of rodents (Mammalia: Rodentia) in Anjerk prohibited hunting area, Kerman province. Iranian Journal Biology 25, 240-251.
- Calandriello, C.J., 1999. The rodent fauna of long pin key, Everglades National Park: Acomparition habitat types. Master of Science in Biology Thesis. Florida International University.
- Corbet, G.B., 1978. The mammals of the Palearctic region; A taxonomic review, British Museum, London, England.
- Darvish, J., Amir afzali, Y., Hamidi, K., 2012. Further record of *Golunda ellioti* Gray, 1837 from south East of Iran with notes on its postcranial skeleton. Iranian Journal of Animal Biosystematics, 1, 79-82.
- Darvish, J., Siahsarvie, R., Mirshamsi, O., Kayvanfar, N., Hashemi, N., Sadeghie shakib, F., 2006. Diversity of the rodents of northeastern Iran. Iranian Journal of Animal Biosystematics, 2, 57-76.
- Elkinton, J.S., Healy, W.M., Buonaccorsi, J.P., Boettner, G.B., Hazzard, A.M., Smith, H.R, Leibhold, A.M., 1966. Interaction among gypsy moths, withe-footed mice and acorns. Ecology 77, 2332-2342.
- Ellerman, J.R., 1948. Key to the rodents of south-West Asia in the British meuseum collection. British Meuseum, London, England.
- Ellerman, I.R., 1966. The families and genera of living rodents. Wbeldon & Wesley, Ltd.
- Etemad, E., 1978. Mammals of Iran. Vol. I, Rodents and key to their identification. National Society of Natural Sources and Human Environment Protection Publications. Iran, Tehran.
- Golabzadeh, M., 2010. Kerman tourism. Valli Publications. Iran, Kerman.
- Goodwin, G.G., 1940. Mammals collected by the Legendre 1938 Iran expedition. American Museum Novitates.
- Hanski, I.P., Turchin, E., Korpimaki, E., Henttonen, H., 1993. Population oscillation of boreal rodents: regulation by mustelid predators lead to chaos. Nature 364, 232-235.

- Hardwicke, 1807. (Muridae, Rodentia) in Eastern border of Iran. Pakistan Journal of Biological Sciences 13(2), 59-65.
- Khajeh, A., Meshkani, J., 2010. A study of intraspecies variations of Indian Gerbil, *Tatera indica* Hardwicke, 1807 (Muridae, Rodentia) in Eastern border of Iran. Pakistan Journal of Biological Science 13, 59-65.
- Khajeh, A., Darvish, J., Razmi, G.H., 2015. A contribution on rodents fauna of the Jaz Murian depression, Southeast Iran. Biodiversity Journal 7, 203-214.
- Lay, D.M., 1967. A study of the mammals of Iran resulting from the street expedition of 1962-1963. Fieldiana Zoology 54, 1-282.
- Misonne, X., 1959. Analyse zoogeographique des mammiferes de l'Iran. Mémoires d'Institut Royal des Sciences Naturelles de Belgique, deuxième série. 59, 1-157.
- Moraveti, M., Nazari, F., Malikov, V.G., 2010. Manual detection harmful rodents agriculture. Institute of Plant Research. Iran, Tehran.
- Nazari, F., Farid, A., 1991. *Golunda ellioti* a new record for Iran. Applied entomology 58, 81-86.
- Ostfeld, R.S., Jones, C.G., Wolf, J.O., 1996. Of mice and mast. *Bioscience*, 46: 323-330.
- Roberts, T.J., 1977. The Mammals of Pakistan. Oxford University Press, Karachi.
- Wilson, D.E., Reeder, D.M., 2005. Mammal species of the world: a taxonomic and geographic reference. 3rd ed. John Hopkins University Press, Baltimore.