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Diversity of the Rodents of Northeastern Iran

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Samplings were done in different locations of northeastern Iran and different specimens were collected during two years. The specimens belong to 26 different species attributing to 6 families: Scuridae (*Spermophilus fulvus*), Cricetidae (*Microtus transcaspicus, Microtus paradoxus, Blanfordimys afghanus, Chionomys nivalis, Ellobius talpinus, Ellobius fuscocapillus, Cricetulus migratorius*), Calomyscidae (*Calomyscus sp.* Seems to be *C. uratensis*), Muridae (*Mus musculus, Apodemus witherbyi, Nesokia indica, Rattus norvegicus, Rattus pyctoris, Gerbillus nanus, Meriones libycus, Meriones crassus, Meriones meridianus, Meriones persicus, Tatera indica, Rhombomys opimus*), Gliridae (*Dryomys nitedula*) and Dipodidae (*Allactaga elater, Allactaga hotsoni, Jaculus blanfordi, Jaculus thaleri*). Standard external characters as well as cranial and dental ones were given.

Key words: Northeast Iran, Rodents, Fauna, Kopet-Dag Mountains, Binaloud Mountains.

INTRODUCTION

It is evident that faunal diversity of Iran is far greater than what is reported by naturalists so far, and the identification of some certain new species necessitates a biosystematic approach. There is very little English published information relating to the rodents of the northeastern Iran; however there are a few ones in Persian. We shall present records of rodent species from Northeastern Iran which has not been recorded so far. The data contribute towards understanding the actual intact fauna of northeast Iran. Such information is fundamental to the testing hypotheses of faunal relationships and postulated biogeographic histories. Documentation of the mammalian fauna of Iran is important for providing a base of data about mammalian diversity in this region, information that supports the argument for setting aside habitats for conservation, in face of strong developmental pressures.

MATERIAL AND METHODS

Totally 800 specimens, belongs to 25 species, were studied (Fig 1, 2 and 3). The materials were examined during August 1998 to September 2000. The standard voucher specimens (skins, skulls and complete skeletons, or full fluid specimens) were deposited in the Zoology Museum of Ferdowsi University of Mashhad (ZMF).

Measurements: Four standard external and 10 cranial variables of each specimen were measured by ruler to the nearest millimeter and by 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, *EL*: ear length, *GL*: Greatest length of skull, *ZB*: zygomatic breadth, *IC*: Interorbital constriction, *BB*: breadth of braincase, *DBC*: depth of braincase,

NL: nasal length, *DL*: maxillary diastema length, *ML*: length of mandible, *UML*: upper molars tooth row length, *LML*: lower molars tooth row length.

Species accounts: The arrangement of families, genera, and species follow the taxonomic accounts given in Corbet (1978) and Wilson and Reeder (1993, 2005). Information about the type locality and distribution of the all genera and species are quoted from Wilson and Reeder (2005) while the thereafter records are also added.

Family Scuridae

Genus *Spermophilus* Cuvier, 1825

1-Spermophilus fulvus (Lichtenstein, 1828) Yellow ground Squirrel

Type locality: Near the Kuvandzhur River, East of Mugodzhary Mts, Kazakhstan (Wilson and Reeder 1993; 2005).

Distribution: Kazakhstan from Caspian sea and Volga river to Lake Bakhash, south through Uzbekistan,Western Tajikistan and Turkmenistan to North East of Iran and North Afghanistan, also in West Xinjiang of China (Wilson and Reeder 2005)

Expedition localities: This species has been recorded from south of Mashhad (Blanford 1876), Quchan (Satunin 1909), Qua´en (Thomas 1905), the road from Mashhad to Fariman (Misonne 1959), Mashhad to Sarvellayat, Nishabur, Shirvan, and Bojnourd (Etemad 1978). In this project it was captured from Mashhad (36° 17´ N, 59° 35´ E), Sarakhs (36° 18´ N, 60° 37´ E), Quchan (37° 26´ N, 56° 35´ E) and Torbat-Jam (35° 41´ N, 61° 05´ E; Fig 1.).

External characters: Upper parts yellowish-cream with gray shading; under parts lighter than back and tending to white; tail has long hairs with black subapical band; soles are bare.

Cranial characters: Nasal region relatively short, with widely separated zygomatic arches and broad and short braincase; parietal crests converging backwards in old age (as also noted by Vinogradov and Argyropulo, 1941).

Family Cricetidae

Subfamily Arvicollinae

Genus *Microtus* Schrank, 1798 Grass voles

2- Microtus transcaspicus (Satunin, 1950) Middle-East Vole

Type locality: Ashkhabad, Turkmenistan (Wilson and Reeder 1993; 2005).

Distribution: South Turkmenistan, North Afghanistan and North East of Iran, as well as Laleh-Zar and Hazar Mountains in the southern Iran (previously as *M. kermanensis*; Wilson and Reeder, 2005)

Expedition localities: Etemad, 1978 recorded this species from Moghan village in the Southern Mashhad (as a subspecies of *M. arvalis).* We captured it from Moghan in the Southwestern Mashhad (36° 07´ N, 59° 22´ E), Zoshk in the Northwestern Mashhad (36° 20´ N, 59° 07´ E), Mareshk in the North of Mashhad (36° 49´ N, 59° 35´ E), and Hossain Abad of Shirvan (37° 24´ N, 57° 49´ E; Fig. 2).

External characters: Upper parts are brown, buff with a gray base; sides of body are yellow with brown shading; under parts are light gray and a slate gray base (see table 1 for external measurements).

Cranial characters: Interorbital space broad with the little marked median crest; tympanic bulla is relatively large and round; third upper molar sometimes is more complicated (see table 2 for cranial measurements)

3-Microtus paradoxus (Ognev and Heptner, 1928) Paradox Vole

Type locality: South of Turkmenistan, Chuli Valley, near Ashkhabad (Wilson and Reeder 1993; 2005).

Distribution: South of Turkmenistan and Northeastern Iran in the North of Khorasan Province (Wilson and Reeder 2005; Siahsarvie et al. in press)

Expedition localities: Goodwin (1940) recorded this species (as *M. socialis*) from Gowadeh in Bojnord. We captured the specimens from Tandoreh National park in Dargaz (37° 25´ N, 59° 11´ E), as well as Palkanlou village (37° 36´ N, 57° 55´ E), Hossein Abad (37° 24´ N, 57° 49´ E), and Devin (37° 08´ N, 58° 03´ E) of Shirvan (Fig. 2).
External characters: Similar to the Middle-East vole, but with a smaller tail which is almost uniformly light brown to white (see table 1 for external measurements).
Cranial characters: Skull is broad and flattened; interorbital space without median crest, almost flat or with a longitudinal groove; tympanic bullae are inflated and their mastoid parts markedly projecting at the side of the occipital; supplementary projecting angles exist on the inner side of the first and second lower molars (see table 2 for cranial measurements).

Genus *Blanfordimys*, Argyropulo 1993
4-Blanfordimys afganus (Thomas, 1912) Afghan Vole
Type locality: Gulran, Northwest of Afghanistan (Wilson and Reeder 1993; 2005).
Distribution: High steppes and semi-deserts in South Turkmenistan, Uzbekistan, Tajikistan and Central Afghanistan; isolated populations in the Great Balkan Mountains on the east coast of Caspian Sea (Siahsarvie et al. 2005; Wilson and Reeder 2005), also in the Northeastern Iran (Siahsarvie et al. 2005)
Expedition localities: This species was captured from Toghi valley (37° 30´ N, 59°12´ E) and Ghazan prairie regions (and 37° 19´ N, 58° 44´ E), both in the National Park of Tandoreh; elevations of Nehel of Zoshk on the Binaloud Mountains (36° 16' N, 59° 07' E). We also recorded this species from Gol-khandan near Dargaz (37° 30' N, 60° 37' E) and Kal-e-chaghouki of Mashhad (36° 03´ N, 59° 45´ E) by examining the pellets of predatory birds (Siahsarvie et al. 2005; Fig. 2)
External characters: The body is flat, coloration of the upper part is light brown in hair extremities and coaly at the base; the ventral hairs are dirty white; the tail is small and clear brown in which the under side is lighter than the upper side; Tandoureh National Park specimens always with a small black line in the extremity of the tail which is absent in Binaloud specimens (Siahsarvie et al. 2005; see table 1 for external measurements).
Cranial characters: The skull with small snout; bulla large; mastoids extremely inflated and very large; supraorbital ridge is knob shaped, squamosal with two dorsal and ventral branches; palatine foramina long and reaching the extremity of molars; on lower M/1, anterior loop is pinched from the rest of paraconid (Golenishchev and Sablina 1991; Siahsarvie et al. 2005; see table 2 for cranial measurements).

Genus *Chionomys*, Miller 1908
5- Chionomys nivalis (Martins, 1842) Snow Vole
Type locality: Berner Oberland, Switzrland (Wilson and Reeder, 1993; 2005).
Distribution: Mountains of South Europe from Spain to Tatra, Carpathian and Balkans; East to Turkey, West Caucasus, Lebonan, West Syria, Zagros and Elborz mountains of West and North Iran and Kopeh Dag of South Turkmenistan (Wilson and Reeder, 2005; Darvish et al. 2005), also in Binaloud Mountains in the Northeastern Iran (Darvish et al. 2005).
Expedition locality: This species had not been reported from the province, and for the first time Darvish et al. (2005) recorded it from the altitude of Nehel near Zoshk village in the Northwest of Mashhad (36° 20´ N, 50° 11´ E; Fig. 2).
External characters: upper parts is bright brown; underparts almost white with grayish tint; tail is about half of the head and body length, and uniformly pale (see table 1 for external measurements).
Cranial characters: Crests of skull weakly developed; profile of skull with a slight depression in interorbital region; braincase markedly higher than the rostrum (Vinogradov and Argyropulo, 1941),

third upper molar with two reentrant angles on the inner side and two or three on the outer side (the data are based on only three specimens; Darvish et al. 2005; see table 2 for cranial measurements).

Genus *Ellobius* Fisher 1814, Mole Voles

6-Ellobius talpinus (Pallas, 1770) Northern Mole Vole

Type locality: West bank of Volga river, Russia (Wilson and Reeder, 1993; 2005).

Distribution: Steppes of south Ukraine and Crimea through Kazakhstan to North of Balkhash Lake, and in Turkmenistan, South to North Afghanistan and Iran (Wilson and Reeder, 2005).

Expedition localities: This species has been recorded from sandy areas in Sarakhs (Harrington, 1978). We captured this species from Chakudar village (36° 14´ N, 60° 39´ E) near Mosdouran which exist as a parapatric species with Southern Mole-vole *Ellobius fuscocapillus* Blyth, 1843 (Fig. 2).

External characters: Upper part is soft and velvety with bright brown color; half the bases are black; the hairs on top of the head and snout are gray; Ventral hairs are gray and yellowish–brown; tail is short and covered with whitish hairs whose bases are yellowish brown (see table 1 for external measurements).

Cranial characters: Incisors are long, markedly projecting; eyes are very small; zygomatic arches widely separated and broadened in the middle; rostrum relatively long and narrow; braincase short; Mandible is with markedly developed alveolar process which forms a sheath for the root of the lower incisor (Vinogradov and Argyropulo 1941; Tarahomi et al. 1999; see table 2 for cranial measurements).

7-Ellobius fuscocapillus (Blyth, 1843) Southern Mole Vole

Type locality: Quetta, Baluchistan region, Pakistan (Wilson and Reeder, 1993; 2005).

Distribution: Western Pakistan and Afghanistan through Iran and South Turkmenistan (Wilson and Reeder, 2005).

Expedition localities: It has been recorded from Mashhad (Misonne, 1959) and in this study, we captured it from Mashhad (36° 17' N, 59° 35' E), and Sarakhs (36° 09' N, 60° 32' E; Fig. 2).

External characters: The same as Northern Mole Vole, but the hairs on the head are darker, and the external measurements are smaller than those of *E. talpinus* (see table 1 for external measurements).

Cranial characters: Skull is much longer, with more elongated rostrum than *E. talpinus* and with very small incisive foramina; skull of adults with well developed longitudinal crest which reaches to the margin of the occipital region; Interorbital absent (fused to occipital) and its margin are not recognizable even in semi-adult specimens. Third upper molar with a more elongated crown than in *E.talpinus*; there are three projecting angles on the outer side of this tooth (Vinogradov and Argyropulo 1941; Tarahomie et al 1999; see table 2 for cranial measurements).

Subfamily Cricetinae

Genus *Cricetulus* Milne-Edward, 1867

8-Cricetulus migratorius (Pallas, 1773) Gray Dwarf Hamster

Type locality: Lower Ural River, West Kazakhstan (Wilson and Reeder 1993; 2005).

Distribution: Steppes from Southern European Russia (Southeastern Greece, Northwestern Romania and Southeastern Bulgaria; eastwards through Kazakhstan to Southern Mongolia and North China. North almost to Moscow; Southwards through Turkey and Transcaucasia to Palestine, Jordan, Lebanon, Iraq, most of Iran, central Afghanistan and North India (Wilson and Reeder 2005).

Expedition localities: This species distributed throughout Khorasan province, and recorded from East of Dasht, South of Sharabad, North of Maine (Goodwin 1940; Lay 1967); Mashhad, Moghan and Tabas (Etemad 1978).We captured this species from Dargaz (37° 26´ N, 59 °35´ E), Sarakhs

(36° 20´ N, 60° 32´ E), Torbat Heidareieh (34° 58´ N, 59° 35´ E), Gonabad (34° 21´ N, 58° 41´ E), and Ferdows (34° 04´ N, 58° 15´ E; Fig. 2).
External characters: Upper parts are gray while individual hairs are black at base; under parts are white; tail is shorter than body length and is covered by cream-color hairs. Color, as well as size, presents remarkable variations (see table 1 for external measurements).
Cranial characters: Skull is more elongated than other species, with relatively small, more oblong tympanic bullae (Vinogradov and Argyropulo 1941; see table 2 for cranial measurements).

Family Calomyscidae
Genus *Calomyscus* Thomas, 1905
***9- Calomyscus* sp.**
Expedition localities: For the first time Goodwin (1939), by examining the materials from Khorhkod Mountains in Birjand, recorded the Khorasan specimens as *C. elburzensis*. Ellerman and Morrison-Scott (1951) reported them as a subspecies of *C. bailwardi elburzensis*. We captured this species in the altitudinal region of Mosdouran (36° 09´ N, 60 °32´ E), Bojnord (37° 49´ N, 56° 26´ E), Shirvan (37° 34´ N, 57° 51´ E) and Mashhad (36° 17´ N, 59° 35´ E; Fig. 3).
External characters: Upper parts are buff; tips and bases of hairs are black; under parts, lores, and under eyes are completely white (see table 1 for external measurements).
Cranial characters: Cheek pouches are rudimentary; the skull is without crests and with large braincase and very narrowly separated zygomatic arches; pterygoid plates broad and flat (Vinogradov and Argyropulo 1941; see table 2 for cranial measurements).
Based on our karyological studies (2n=32, not shown here), it seems that the Khorasan specimens (in the sampled areas) belong, neither to *C. elburzensis* nor to *C. bailwardi*. It suggests that they must be the same species as *C. uratensis*.

Family Muridae
Subfamily Murinae
Genus *Mus* Linnaeus, 1758
10- Mus musculus Linnaeus, 1758 House Mouse
Type locality: Uppsala, Sweden (Wilson and Reeder 1993; 2005).
Distribution: Nearly worldwide through its close association with humans. In the Palaearctic, it is absent only in the Northeast of Siberia (Wilson and Reeder 2005).
Expedition localities: This species distributed throughout the Northeastern Iran except desert areas (Lay 1967; Etemad 1978). In this study, we captured the house mouse in all localities indoors or outdoors (Fig. 4).
External characters: General color varies according to the locality; from light to dull wood brown, tips of hairs are light brown and two thirds of bases slate-gray; under parts white or creamy-withe.
Cranial characters: Nasal region is short; incisive foramina are long; braincase is relatively small and flattened; interparietal is broad and slightly narrows to the sides, where it is almost truncated; the inner tubercle of the first loop of the first and second upper molars is markedly curved backwards; there are no traces of the third row of tubercles on the outer side of the crowns of the first two lower molars (Vinogradov and Argyropulo 1941; Bonhomme et al. 1994; Din et al. 1996).

Genus *Apodemus* Kaup, 1829
11- Apodemus witherbyi (Thomas, 1902) Steppe Field Mouse
Type locality: Shul, Fars Province, South Iran (Wilson and Reeder, 2005).
Distribution: South Ukraine, Crimea, North and South Caucasus, Anatolian Turkish steppe, South to North Palestine and Northwest Jordan, most of Iran, Southwest Turkmenistan, eastwards in West Central Pakistan.

Expedition localities: This species has been recorded from Dasht, Golladagh (Goodwin, 1940; Lay, 1967), South of Sharabad (Lay 1967), and in this study was captured from Bojnord (37°30´ N, 56° 32´ E), Shirvan (37° 36´ N, 57° 48´ E) Chenaran (36° 35´ N, 58° 56´ E), Mashhad (36° 39´ N, 59° 40´ E), Moghan (36° 07´ N, 59° 22´ E), Zoshk (36° 20´ N, 59° 17´ E), Sarakhs (36° 26´ N, 61° 06´ E), and Torbat Heidarieh (35° 22´ N, 59° 31´ E; Fig. 4).
External characters: Upper parts are light brown to russet or with a yellowish tinge; the based of the hairs are black and the tips are yellowish brown; under parts are whitish and have an orange spot between forelimbs; tail is longer than body; muzzle pointed; ears and eyes are large (see table 1 for external measurements).
Cranial description: Braincase large, rounded and convex; there are no crests at the margins of the interorbital space, and its outlines are regularly concave inwards; coronal suture is an arch which is rarely angular; interpariatal pointed laterally; there is a well developed inner tubercles in the third loop of the first and second upper molars; there is an additional (third) tubercle in the first lower molar; third molars not reduced in size (Vinogradov and Argyropulo 1941; Javidkar et al 2005; Siahsarvie and Darvish, in press; see table 2 for cranial measurements).

Genus *Nesokia* Gray, 1842
12-Nesokia indica (Gray, 1830, *in* 1830-1835) Short-tailed Nesokia
Type locality: India (uncertain, Wilson and Reeder, 1993; 2005)
Distribution: Bangladesh, North India, Pakistan, Afghanistan, Iran, Iraq, Syria, Saudi Arabia, Palestine, North East Egypt, North West China, Turkmenistan, Uzbekistan, and Tajikistan(Wilson and Reeder 2005).
Expedition localities: This species has been recorded from Goladogh in Bojnourd (Goodwin 1940, Etemad 1978) Toos, and Sabzewar (Etemad 1978; Ellerman 1948). In this study we captured it from Zoshk (36° 20´ N, 59° 11´ E), Sarakhs (36° 26´ N, 61° 06´ E), Torbat Heidarieh (35° 37´ N, 59° 18´ E), Kashmar (35 °04´ N, 58° 39´ E), Gonabad (34° 21´ N, 58° 41´ E), and Ferdows (34° 16´ N, 59 °16´ E; Fig 4).
External characters: Upper part is ochre buff with grey shading, three-quarters bases of hairs are slate grey; under part is lighter and more buff than the dorsal side; tail is covered with scales and a few hairs (see table 1 for external measurements).
Cranial characters: Skull is high, especially in the middle, and broad with well developed crests; Incisive foramina short, about one third of the length of the diastema; bony palate is narrow with deep palatine grooves; upper incisors are massive and large, at the base they are broader than the nasals; molars are large whose occlusal surfaces are flat; the tubercles are marked only in early youths and not arranged in an acute loop as seen in *Mus*, *Rattus* and *Apodemus*, but for an almost straight transverse line (Vinogradov and Argyropulo 1941; see table 2 for cranial measurements).

Genus *Rattus* Fisher, 1803
13. *Rattus norvegicus* (Berkenhout 1769) Brown Rat. .
Type Locality: Great Britain (Wilson and Reeder 1993; 2005).
Distribution: Original distribution assumed to be Southeast Siberia, North China (Heilongjiang), and Hondo region of Japan, but introduced worldwide where it is more common in colder climates of higher North and South latitudes (Wilson and Reeder 2005).
Expedition localities: It had not been reported from Northeastern Iran before this study, and for the first time we recorded it from Mashhad (36° 17´ N, 59° 30´ E; Fig 4)
External characters: Dorsal part of the body is covered with coarse, brownish fur which usually lightens to a gray or tan color nearing the underside; tail is bald and shorter than the body length; ears are typically shorter than those of the related species, and do not cover up the eyes when pulled down (see table 1 for external measurements).

Cranial characters: Molars are lophodont; temporal ridges on braincase are straight and almost parallel; the occipital condyles are the most posteriorly porjecting point of the skull. (Yigit et al., 1998; see table 2 for cranial measurements).

14-Rattus pyctoris (Hodgson 1845) Himalayan Rat, previously was ascribed to *R. turkestanicus* (Satunin, 1930)
Type locality: Nepal (Wilson and Reeder 1993; 2005).
Distribution: South East Kazakhstan, Kyrgyzstan, East Uzbekistan, and Tajikistan; North East of Kerman Province in Iran, North Afghanistan, North Pakistan, North India , Nepal and South China. (Wilson and Reeder 2005)
Expedition localities: This species has been recorded from Moghan (Etemad, 1978), and South of Khorasan Province (Ziaie 1990).We captured this species from Zoshk village (36° 20´ N, 59° 11´ E), Jagargh (36° 18´ N, 59° 19´ E), Khary village (36° 18´ N,59° 25´ E), and Golmakan in the South of Chenaran (36° 29´ N, 59° 09´ E; Fig 4).
External characters: Upper parts are light brown with shading of gray; bases of hair are slate gray and the tips are russet or yellowish-tinged; under parts are whitish all over; ear densely covered with fine hairs; tail densely covered by hair and is shorter than head and body that is distinctly bicolor; lower side of the tail with non-pigmented scaly rings and white hairs (see table 1 for external measurements).
Cranial characters: Maximum zygomatic width is in middle or in posterior one third; parietal region is a little inflated; crests of frontals at the margin of orbits fused with the parietal crests without interval; anterior margin of interparietal connects to the lateral crests of the squamosal (Vinogradov and Argyropulo 1941; Seidmousavi et al. 2001); rostrum is wide and short; molars are chunky and wide; the first upper one has a reduced anterolabial cusp (t3) relative to the adjacent two cusps forming the anterior lamina (Musser and Carleton 2005; see table 2 for cranial measurements).

Subfamily Gerbilinae (gerbils)
Genus *Gerbillus* Demarest, 1804
15- Gerbillus nanus (Blanford, 1875) Baluchistan Gerbil
Type locality: Pakistan, Gedrosia (Wilson and Reeder 1993; 2005).
Distribution: From the Baluchistan region of North West India, Pakistan, South Afghanistan, and Iran through the Arabian Peninsula, Iraq, Jordan, and North Africa to Morocco and Mauritania, and South in the Sahara to at least Niger, and North East of Mali (Wilson and Reeder, 2005).
Expedition localities: The Northernmost part of recording this species was from Tabas (Etemad, 1978) while in this study, for the first time, we captured it from Kashmar (35° 11´ N, 58° 20´ E), and from latitudes as northern as Jajarm (36° 58´ N, 56° 27´ E; Fig 4)
External characters: A medium sized gerbil with predominantly naked hind-foot plantar; upper parts are brownish-buff with gray shading; hairs are long-soft and slate gray in three quarters of bases; flanks are lighter but under parts whitish overall (see table 1 for external measurements).
Cranial characters: Well developed tympanic bulla; posterior margin of mastoid chamber exceeds the level of supraoccipital bone, the second row of the first upper molar has two cusps where the lingual is connected to the first row and the labial one is attached to the third row (Abu Baker and Amr 2003; see table 2 for cranial measurements).

Genus *Meriones* Illiger, 1811
16-Meriones libycus (Lichtenstein, 1823) Libyian jird
Type locality: Egypt, near Alexandria (Wilson and Reeder 1993; 2005).

Distribution: North Africa from Western Sahara (Rio de Oro) to Egypt, throughout Saudi Arabia, Jordan, Iraq, Syria, Iran, Afghanistan to East through Turkmenistan, Uzbekistan, and South Kazakhstan and Western China (Wilson and Reeder 2005)
Expedition localities: This specie has been recorded from Mashhad, Sabzewar, Lotf Abad of Sarakhs, Kashmar (Etemad 1978), Bojnord, Sarakhs (Peter and Mostashfi 1957), Dasht, Maraveh Tapeh, Hossein Abad of Shirvan, Gillandar and Aviz (Heptner 1940). In this study, we captured the specimens from Sarakhs (36° 26´ N, 61° 06´ E), Mashhad (36° 17´ N, 59° 35´ E), Shirvan (37° 16´ N, 58° 02´ E), Bojnord (37° 56´ N, 57° 07´ E), Gonabad(34° 41´ N, 58° 13´ E), Kashmar (35 °11´ N, 58° 22´ E), Torbat Heidarieh (35° 22´ N, 59° 31´ E), Khaf (34° 19´ N, 60° 40´ E), and Torbat Jam(35° 15´ N, 60°37´ E; Fig 4).
External characters: Hind foot plantar is hairy with a naked heel patch; dorsal hairs are golden, one third gray at the base; ventral hairs are white, gray to the base except on the chin and throat where they are pure white; hairy ears measuring 10% of the head and body length; black claws; black skin over the plantar pads; tail (excluding tuft) is longer than the head and body length and has a black terminal tuft (see table 1 for external measurements).
Cranial characters: The squamosal root of the zygomatic arch ends close to or in contact with the anterior portion of the auditory bullae; the malleus is visible through the opening of the auditory meatus (Harrison and Bates 1991); the posterior portion of the suprasquamosal triangle is either closed or virtually closed, being variable and not age-related (see table 2 for cranial measurements).

17- Meriones crassus (Sundevall, 1842) Sundevall's Jird
Type locality: Sinai, Egypt (Wilson and Reeder 1993; 2005).
Distribution: North Africa from Algeria and Nigeria to Egypt and Sudan and throughout Arabia and Iran to Afghanistan (Wilson and Reeder, 2005).
Expedition localities: This species has been recorded from Maine and Rum of Mashhad (Peter 1957). In this study, we captured it from Torbat Heidarieh (35° 21´ N, 59° 33´ E; Fig 4).
External characters: Body size is small, but it is relatively large in comparison to some other gerbils; fur is soft and dense and shows a pattern of counter-shading coloration, with a sandy color and black spots on the dorsal side and solid white on the ventral side (Harrison et al., 1991); claws are ivory-white; upper lip, inside of the limbs, and the bottoms of the feet, are white as well; tail has a black tip (Harrison and Bates 1991) and is about the length of the body (Koffler 1972; see table 1 for external measurements).
Cranial characters: Tympanic bullae is very large, the mastoid is extremely hypertrophized and reaches behind the occipital; as in *M. persicus* the osicles of the middle ear are covered with a tympanic membrane downward and they are not visible from outside the ear opening; suprameatal triangle is a very large equilateral, in which the base is completely open; zygomatic arch is strong and the interparietal bone is square like (Etemad, 1978; see table 2 for cranial measurements).

18-Meriones meridianus (Pallas, 1773) Midday Jird
Type locality: Dosang, Astrakhnskaya Oblast, Southeastern Russia (Wilson and Reeder, 1993; 2005).
Distribution: from lower Don River and North of Caucasus to Mongolia and North China, South to East Turkey, East Iran, and North Afghanistan. Also there is an apparently isolated population South of the Caucasus in Armenia (Wilson and Reeder 2005).
Expedition localities: This species has been recorded from Hares Abad Desert Park (South of Sabzewar; Etemad, 1978), Mandachi on the Northeast of Bejestan (Heptner, 1940), and Sarakhs (Peter and Mostashfi 1957). In this study the specimens were captured from Kariz bala of Torbat Heidarieh (35° 17´ N, 59° 38´ E), and Golian of Shirvan (37° 14´ N, 57° 54´ E; Fig 4).

External characters: Upper parts yellowish brown or brownish buff, two thirds bases of hairs are slate gray, tail longer than total body and have a tuft on black hairs at end (see table 1 for external measurements).
Cranial characters: Tympanic bullae are very large, larger than the other species; the part of the tympanic bulla which is forming the anterior wall of the auditory meatus forms a large rounded inflation; this inflation encloses a large cavity which communicates with the main cavity of tympanic bulla (see table 2 for cranial measurements).

19-Meriones persicus (Blanford, 1875) Persion jird
Type locality: Iran, Kohrud, 116 km North of Isfahan (Wilson and Reeder 1993; 2005).
Distribution: Iran, adjacent regions of Transcaucasia, Turkey, Iraq, Turkmenistan, Afghanistan and Pakistan (West of the Indus River; Wilson and Reeder, 2005)
Expedition localities: This species has been recorded from Bojnord, Sarakhs, Sabzevar, Kashmar, Gonabad (Etemad 1978), Moghan (Misonne 1959), and Dasht (Goodwin 1939). In this study, we captured it from Shirvan (37° 24´ N, 57° 56´ E), Bojnord (37° 30´ N, 56° 32´ E), Gonabad (34° 31´ N, 58° 10´ E), Dargaz (37° 27´ N, 59° 06´ E), Zoshk (36° 20´ N, 59° 11´ E), and the vicinities of Mashhad (36 °12´ N, 59° 40´ E; Fig 4)
External characters: This species is characterized by naked soles; the dorsal pelage is mottled with gray hairs and has red tips; the ventral are creamy-white to the base; sub adults ending in a dark and heavy tuft; claws are ivory with brown tips (see table 1 for external measurements).
Cranial characters: Generally, the skull closely resembles that of *M. libycus* in its large, robust size and closed posterior portion of the suprameatal triangle. Two distinguishing differences are the squamosal root of the zygomatic arch having no contact with the anterior portion of the auditory bullae, and the complete ossification of the upper part of the tympanic bullae blocking the view of meatus (see table 2 for cranial measurements).

Genus *Tatera* Lataste, 1882
20- Tatera indica (Hardwicke, 1807) Indian Gerbil
Type locality: between Benares and Hardwar, Unitegd Province, north of India (Wilson and Reeder 1993; 2005).
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 Seri Lanka (Wilson and Reeder 2005).
Expedition localities: This species has been recorded from Mojn Abad on the Southern of Torbat Jam (Heptner 1940). In this study, we also captured it from Torbat Jam (35 °15´ N, 60° 37´ E; Fig 4).
External characters: Upper parts are light brown with black shading; two thirds bases of hairs are gray and one third tips yellowish with black ends, under parts off-white; tail is fully haired and maybe conspicuously tufted in some forms, sometimes slightly shorter than head and body length; hind foot sole is naked (Corbet 1978; Corbet and Hill 1991; Mirshamsi et al. in press; see table 1 for external measurements).
Cranial characters: Occipital region is ridged and upstanding; the posterior part of braincase is not broadened; supra-orbital ridges are present; rostrum is pointed and narrow; Incisors typically one grooved; upper molars less hypsodont than in *Meriones*, involve a series of straight plates in adult specimens which vary depending to age. (Corbet 1978; Corbet and Hill 1991; Mirshamsi et al. in press; see table 2 for cranial measurements).

Genus *Rhombomys* Wagner, 1841
21-Rhombomys opimus (Lichtenstein, 1823) Great Gerbil

Type locality: Karakumy desert, Kzyl-Ordinskaya, Kazakhstan (Wilson and Reeder 1993; 2005).
Distribution: From Southern Mongolia and Northern China to Kazakhstan, Iran, Afghanistan, and Southwest Pakistan (Wilson and Reeder 2005).
Expedition localities: This species has been recorded from Bojnord, Tabas, Dargaz (Etemad 1978), Sarakhs (Peter and Mostashfi 1957), Dasht, Maraveh (Goodwin 1939). In this study, it was captured from Dargaz (37° 25´ N, 59 °11´ E) and Sarakhs (36 °14´ N, 60°39´ E; Fig 4).
External characters: It is one of the largest gerbils; upper parts are buff or yellowish-brown to pale gray; half bases of hairs are light gray, half tips ochre or buff; under parts are lighter than black; tail is yellowish, monochrome in both sides, with longer black or dark brown hairs at the end (see table 1 for external measurements).
Cranial characters: This species differs from the different species of *Meriones* in the rootless molars, the complicated structure of the last molar, the presence of two longitudinal grooves on the anterior surface of the upper incisors, and the form and size of the tympanic bullae (Vinogradov and Argyropulo 1941; see table 2 for cranial measurements).

Family Gliridae
Subfamily Leithiinae
Genus *Dryomys* Thomas, 1906
22- Dryomys nitedula (Pallas, 1778) Forest Dormouse
Type locality: lower Volga River, Russia (Wilson and Reeder 1993; 2005).
Distribution: Wide spread in deciduous woodlands of Europe, Middle East and Central Asia from the Balkans and Carpathian through European Russia, far as North Moscow and Switzerland, South to the Caucasus, Asia Minor and Northern and central Iran, Afghanistan, Turkmenistan and Tien Shan in Xinjiang, China (Wilson and Reeder 2005).
Expedition localities: This species has been recorded from Moghan village (Etemad 1978) and in this study we captured it from Zoshk (36° 21´ N, 59° 18´ E) and Moghan (36° 07´ N, 59° 22´ E) both in vicinity of Mashhad, Shirvan (37° 36´ N, 57° 55´ E), and Chenaran (36° 29´ N, 59° 09´ E; Fig 5).
External characters: Upper parts are light grayish-brown; face paler than back and has a blackish strip extended from the base of whiskers to the ears; under parts are whitish to light gray; tail approximately of same length as head and body or slightly shorter, with whitish hairs at edges (see table 1 for external measurements).
Cranial characters: Interorbital space is flat; tympanic bullae is oblong and large, almost twice as long as the upper tooth row; molars are concave and have large crests; outer margin of crowns of first and second upper molars with two large tubercles corresponding to the edge of the crests(Vinogradov and Argyropulo 1941; see table 2 for cranial measurements).

Family Dipodidae
Subfamily Allactaginae
Genus *Allactaga* Cuvier, 1837
23- Allactaga elater (Lichtenstein, 1828) Small five-toad Jerboa
Type locality: Kazakhstan (Wilson and Reeder 1993; 2005).
Distribution: From lower Volga and East Asia Minor through the desert and semidesert areas of Turkmenistan, Iran, Afghanistan to Xinjiang of China and Southwestern Pakistan (Wilson and Reeder 2005).
Expedition localities: This species has been recorded from Qaen (Etemad 1978), Sabzewar, Sarakhs and Maine (Lay 1967; Etemad 1978). During this stydy, we captured it from Kashmar (35° 11´ N, 58° 20´ E) and Gonabad (34° 21´ N, 58° 45´ E; Fig 6).
External characters: The smallest Jerboa of Dipodidae in Iran; ears are long and rabbit–like; the body fur is long, soft and silky; its color is yellowish-gray or sand color with some mixture of blank-

tipped hairs; the lower cheeks, belly and inside of the limbs are pure white; the tail is long, slender and well covered with short hairs; the tip terminates in a conspicuous black and white flag of longer hairs; the extreme distal portion is white preceded by black hairs; the longitudinal groove on the dorsal surface of the penis almost reaches the apex and branches only into two short lateral grooves; basal one third or one fourth of the penis without spines(Vinogradov and Argyropulo 1941; (see table 1 for external measurements).

Cranial characters: Upper incisors are markedly proodont, with smooth outer surface without any longitudinal groove; they are coated with white enamel; a tiny premolar is also present in front of three molars; the palatal foramen is long and auditory bullae are uninflated (Roberts 1997; see table 2 for cranial measurements).

***24- Allactaga hotsoni* Thomas**, 1920 Hotson's Jerboa.

Type locality: 32 km southwest Kant, Southeast Kerman province, Iran (Wilson and Reeder, 1993; 2005).

Distribution: North, Centre, and Southeast of Iran, Southwest Pakistan and South Afghanistan (Wilson and Reeder, 2005; Darvish et al. 2006).

Expedition localities: This species had not been reported from the province and for the first time Darvish et al. (2006) captured it from Qasem Abad (34° 29´ N, 54° 39´ E), in the Northwest of Bejestan as a sympatric species with *Allactaga elater*.

External characters: Size is rather medium; upper parts are brown ochre mixed with coal in medium parts; under parts are pure white; tail is brown ochre, both dorsally and ventrally, distally its hairs lengthen to form a terminal tuft which forms of three distinct parts, an anterior white, a medium black and distal white; soles are naked Darvish et al. (2006).

Cranial characters: Rostrum is narrow, nasal is short with a distinct cavity posteriorly, lachrymals are short, narrow and rounded distally; tympanic bullae are large; molar tooth rows are relatively short Darvish et al. (2006).

Subfamily Dipodinae

Genus *Jaculus* Erxleben 1777

25- Jaculus blanfordi (Murray, 1884) Blanford's Jerboa

Type locality: Bushire, Iran (Wilson and Reeder 1993; 2005).

Distribution: Southeastern coast of Caspian Sea through Turkmenistan to Central Uzbekistan, eastern and southern Iran, South and West Afghanistan, and southwestern Pakistan (Wilson and Reeder 2005).

Expedition localities: this species has been recorded from Maine (Peter and Mostashfi, 1957) and in this study, we captured it from Kashmar (35° 15´ N, 57° 57´ E), and Gonabad (34° 21´ N, 58° 41´ E; Fig 6).

External characters: This species is the biggest one of this genus and it is considerably larger than *Allactaga elater*, but superficially they look like relatively similar, having elongated hind legs, vestigial forelimbs, and a very long tail terminating in a conspicuous black and white flag; upper parts are pale brown with dark shading; bases of hairs are gray and tips yellowish–ochraceous with black ends; under parts are purely white (see table 1 for external measurements).

Cranial characters: The skull shows greatly inflated tympanic bullae and relatively shorter palatal foramen in contrast to the skull of *Allactaga* species; squamosal with no ridge formed by re-entrant lateral process of parietal; mastoids are much less inflated; cheek teeth appear rather more flat and less angular; upper incisors are normal and grooved (Ellerman, 1966); no premolar exists; upper surface of penis with two large spines; the median crest of the penis situated on the basal palate (Vinogradov and Argyropulo 1941; see table 2 for cranial measurements).

26- Jaculus thaleri (Darvish and Hosseinie, 2005) three-toad Jerboa
Type locality: Jafarabad, Kavir-e-Namak, Kashmar, Iran (Darvish and Hosseinie 2005).
Distribution: known only fom type locality and also one specimen from Bandan in the north of Kavir-e-lout, Iran (Darvish and Hosseinie 2005)
Expedition localities: This taxon was found for the first time from Jafarabad of Kashmar (type locality) and Bandan of Sistan during the field expeditions of the project and described as a new species (Darvish and Hosseinie, 2005; Fig 6).
External characters: The sizes, especially of the ear, hind foot and tail, is smaller than *J. blanfordi*; The dorsal surface of the tail is dark brownish gray and the ventral is black and white; the proximal part of the tail is covered by short hairs and the distal one has a black tail flag with some white hair internally; the baculum is almost similar to *J. blanfordi*, but is longer with a median slender constricted column; it's dorsal surface has a proximal extremity which is wide with a more convex base comparing with *J. balnfordi* (Darvish and Hosseinie 2005; see table 1 for external measurements).
Cranial characters: Bullae are relatively large and greatly inflated, space between them at occipital (above foramen magnum) is about 48-52% of interorbital width; mastoids appearing prominently in superior aspect of the skull (Darvish and Hosseinie 2005; see table 2 for cranial measurements).

CONCLUSION

The northeastern Iran composed of two parallel mountain chains –Kopet Dag and Binaloud– in the north, and parts of Iranian Central desert in the south and west. Eastwards it borders to the eastern part of the Iranian plateau (Afghanistan). Species distributions of rodents in this area are far from that may be seemed in the first view.
The northeast of Iran is of many interests regarding the penetration of species, since it is the point of direct contact between two cradles of endemism –Northeastern Iran and Turkmenistan (Misonne, 1959). Kopet Dag Mountains in the northern part of the studied area make an important ecologic barrier between these two zones. However, some species were able to circle the mountains eastward and enter to the Iranian plateau through Kushk crossing (Misonne, 1959). Another factor, which has been played a very important role in the distribution of rodents in the northeast Iran, is the climatic conditions. Some genus like *Nesokia* and *Apodemus* are very dependent to the humidity which has strictly limited their distributions. Some others as *Rhombomys*, *Gerbillus* and most of *Meriones*, as well as all the dipodids are restricted to the arid and semiarid areas. Variation of climatic conditions which have been mainly occurred due to the droughts has strongly affected the distribution of rodent species in the area. *Grbillus nanus* and *Tatera indica* are two species which were not found previously in such northern latitudes; it seems that the droughts of the recent years have force these species to expand their distribution northward, where there is relatively more humid. The last, but not the least, factor is the geographic and topographic situations. In the studied area, like in other parts of the Iranian plateau, *M. libycus* and *M. crassus* both live in lower altitudes while *M. persicus* exists in higher ones. *Chionomys* is not normally found in lower than 2500m, while the genus *Microtus* rarely exceeds this elevation. These all ecologic, climatic and geographic conditions have provided many local and specific areas and have made the northeast of Iran as a zone of speciation for rodents.

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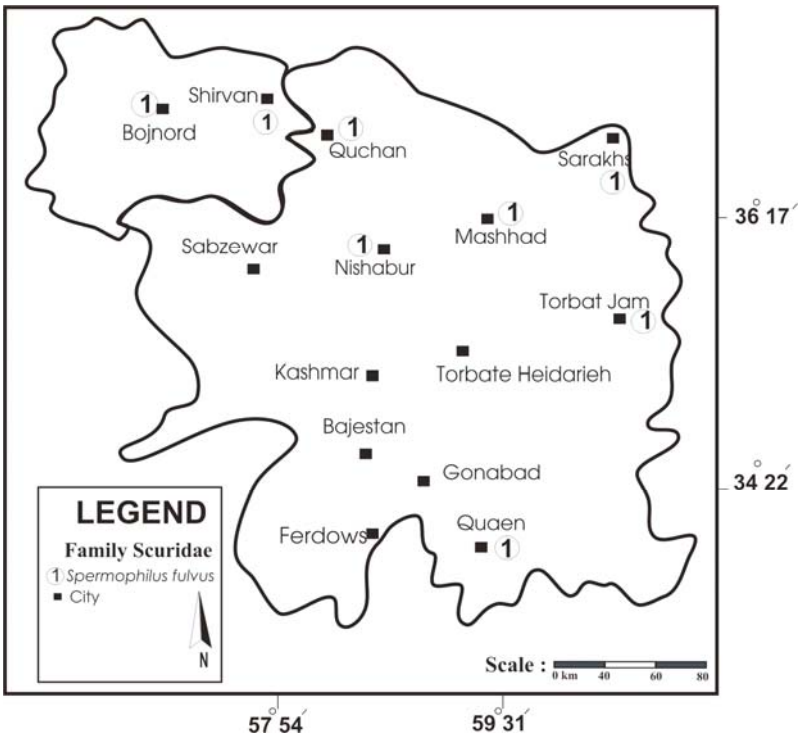

FIG.1.-Map of northeastern Iran with collecting sites for *Spermophilus fulvus*, indicated with number 1.

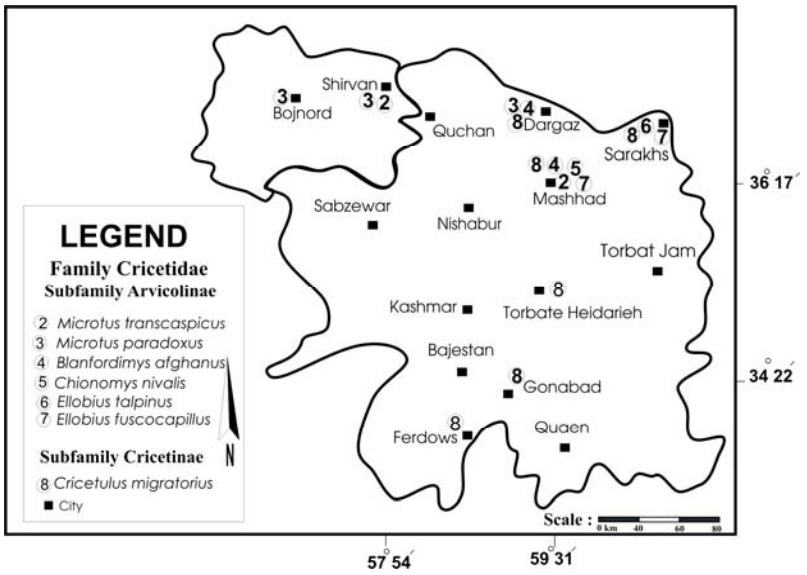

FIG.2.- Map of northeastern Iran with collecting sites for different species of Family Cricetidae, indicated with numbers (the numbers are the same as in text and tables 1-2).

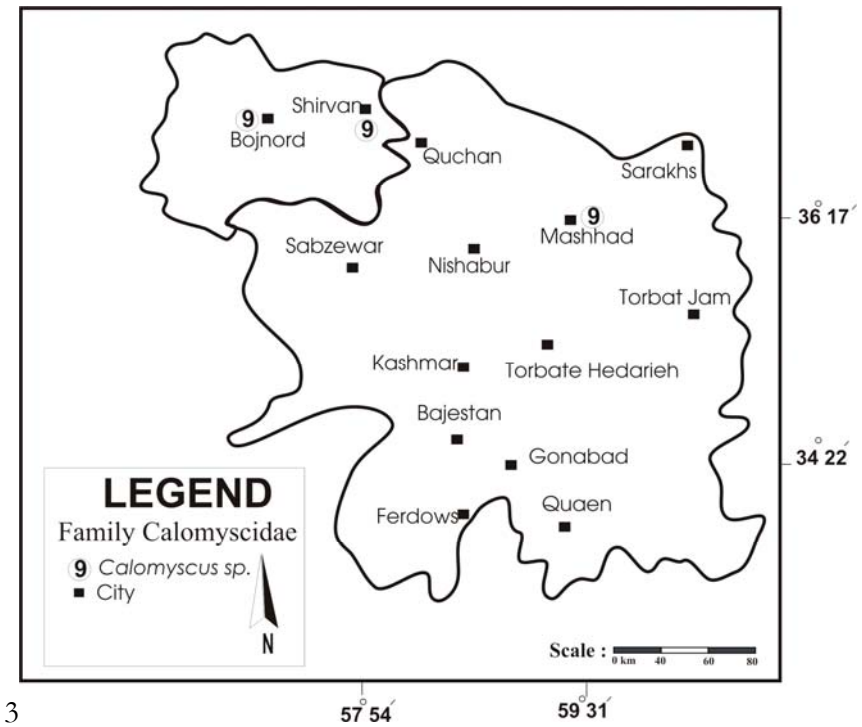

FIG. 3.- Map of northeastern Iran with collecting sites for *Calomyscus sp.*, indicated with number 9.

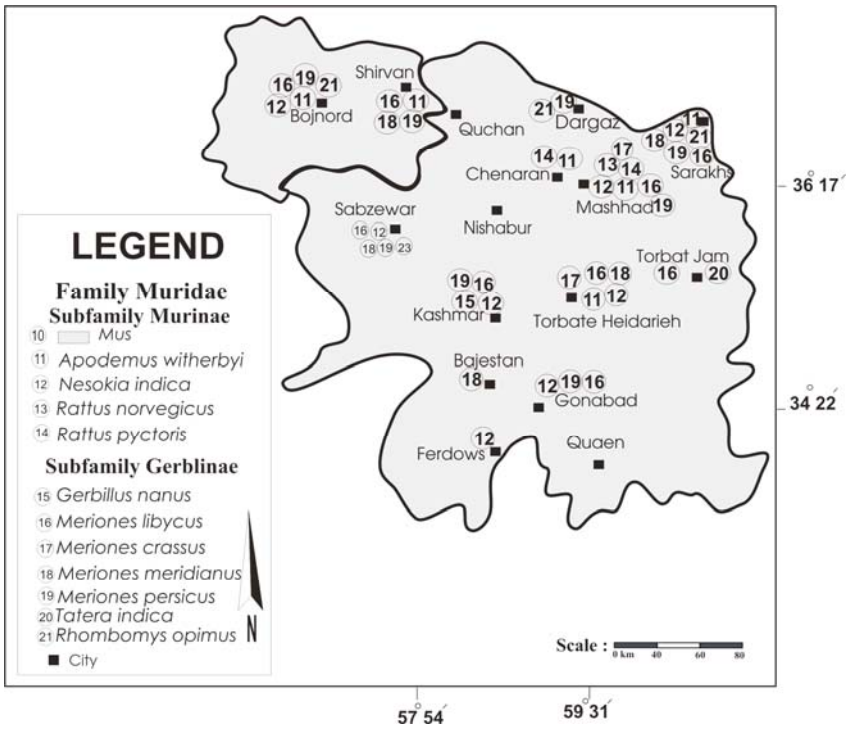

FIG.4.- Map of northeastern Iran with collecting sites for different species of Family Muridae, indicated with numbers (the numbers are the same as in text and tables 1-2).

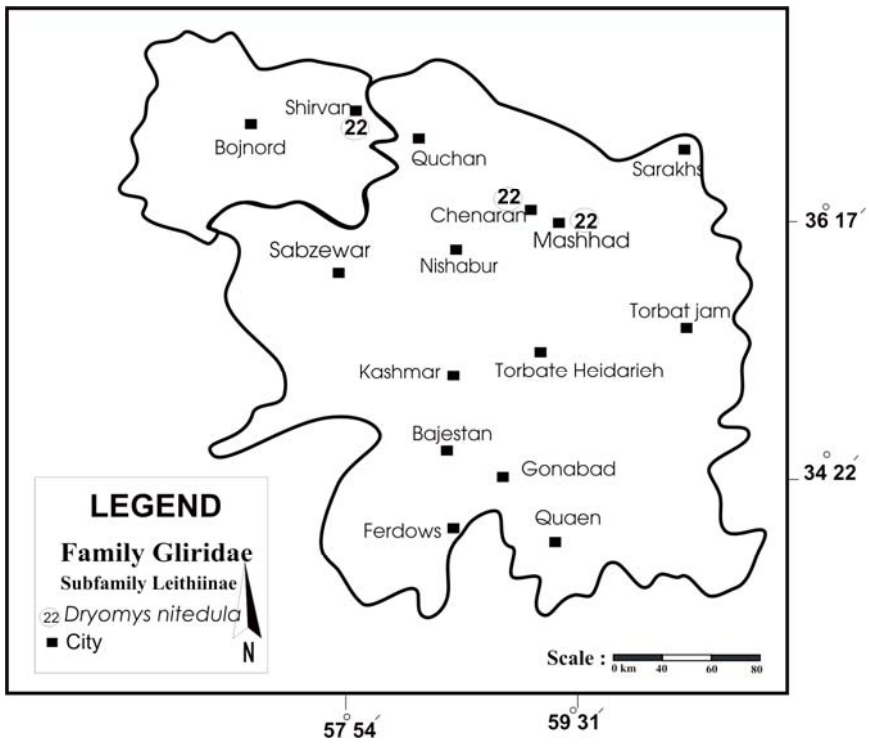

FIG.5.- Map of northeastern Iran with collecting sites for *Dryomys nitedula*, indicated with number 22.

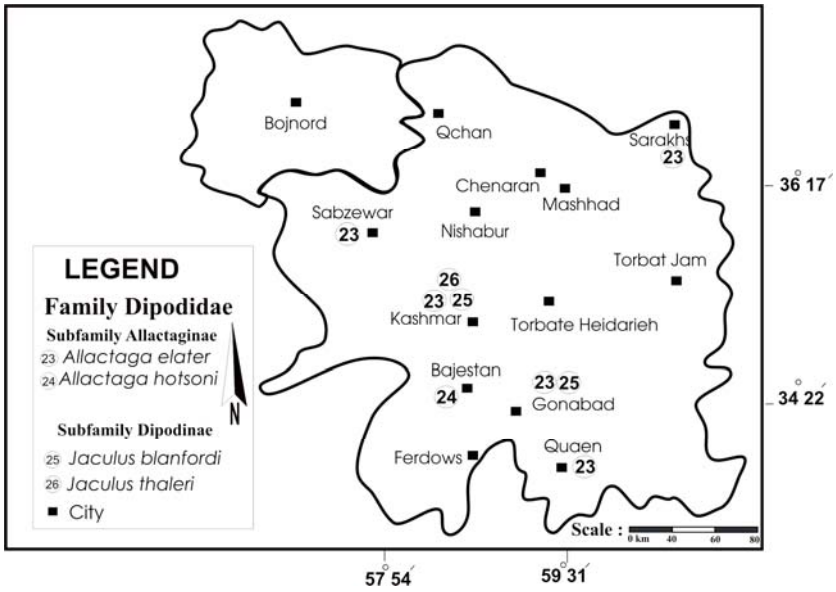

FIG.6.- Map of northeastern Iran with collecting sites for different species of Family Dipodidae, indicated with numbers (the numbers are the same as in text and tables 1-2).

TABLE 1.- Standard external measurements (Mean ± SD, in mm) of different species of rodents in the northeast Iran. Data is not provided for *S. fulvus* and *M. musculus*. The measurements of *B. afghanus*, C. *nivalis*, *A. hotsoni* and *J. thaleri* are cited from Siahsarvie et al. (2005), Darvish et al. (2005), Darvish et al. (2006) and Darvish & Hosseinie (2005), respectively; (see the text for abbreviations).

Taxa	N	EL	FL	TL	HBL	W
Cricetidae						
2- *Microtus transcaspicus*	11	7.82 ± 1.60	20.09 ± 0.7	34.63 ± 5.92	145.9 ± 12.36	38.8 ± 8.7
3- *Microtus paradoxus*		7.86 ± 0.53	17.28 ± 0.61	24.43 ± 1.78	124.64 ± 9.97	25.8 ± 6.6
4- *Blanfordimys afghanus*		10.3 ± 1.60	16.20 ± 1.48	24.17 ± 2.14	97.0 ± 7.62	—
5- *Chionomys nivalis*	2	12.0 , 13.0	18.0 , 19.0	58.0 , 60.0	104.0 , 116.0	—
6- *Ellobius talpinus*	1	—	23.0	9.0	10.50	35.0
7- *Ellobius fuscocapillus*	21	—	22.1 ± 1.66	10.33 ± 1.91	120.71± 12.60	54.2 ± 25.6
8- *Cricetulus migratorius*	36	16.88 ± 2.82	16.11 ± 1.4	25.50 ± 10.15	106.70 ± 14.12	34.6 ± 10.1
Calomyscidae						
9- *Calomyscus sp.*		15.25 ± 0.50	19.66 ± 0.58	89.0 ± 11.31	75.33 ± 6.51	—
Muridae						
11- *Apodemus witherbyi*	25	14.75 ± 2.57	21.30 ± 2.60	88.74 ± 13.21	103.20 ± 35.76	24.5 ± 8.1
12- *Nesokia indica*	47	16.22 ± 2.42	34.72 ± 5.03	102.58 ± 21.99	168.76 ± 33.04	126.3 ± 58.8
13- *Rattus norvegicus*	11	18.66 ± 1.32	42.44 ± 2.35	190.88 ± 9.28	224 ± 18.32	247.6 ± 30.5
14- *Rattus pyctoris*	8	19.87±1.24	35.62±2.50	155.5 ± 28.59	180.25±27.13	19.9 ± 1.2
15- *Gerbillus nanus*	7	11.0 ± 1.41	22.0*	93.0±4.243	67.5±4.95	27.5 ± 3.0
16- *Meriones libycus*	130	16 ± 2.79	36.13±2.02	144.91±14.59	139.39± 16.61	87.5 ± 28.8
17- *Meriones crassus*	1	16	35	122	140	51
18- *Meriones meridianus*	1	13	29	90	84	20
19- *Meriones persicus*	34	20.0 ± 3.30	38.45±1.99	158.35 ± 26.74	139.54±17.13	90.5 ± 29.4
20- *Tatera indica*	47	1.24 ± 2.81	34.49±2.95	136.72 ± 33.29	141.76±31.17	146.6 ± 43.4
21- *Rhombomys opimus*	16	12.62 ± 1.75	38.44±4.23	145.44 ± 23.46	154.22±11.37	12.8 ± 31.0
Gliridae						
22- *Dryomys nitedula*	15	11.60 ± 1.96	21.07 ± 1.53	93.61± 9.99	94.50±10.65	22.5 ± 7.3
Dipodidae						
23- *Allactaga elater*	47	32.6 ± 4.13	49.8±6.10	162.5± 4.40	122.5±52.91	41.3 ± 10.4
24- *Allactaga hotsoni*	1	40	50	180	116	75
25- *Jaculus blanfordi*	12	20.75 ± 1.66	65.27 ± 2.72	200.67 ± 18.97	129.17± 7.12	85.4 ± 8.9
26- *Jaculus thaleri*	1	18	66	175	140	—

*. Only one specimen was available for this character.

TABLE 2.- Dental and cranial measurements (Mean ± SD, in mm) of different species of rodents in the northeast Iran. Data is not provided for *S. fulvus, M. musculus,* and *J. thaleri*. The measurements of *B. afghanus*, C. *nivalis* and *A. hotsoni* are cited from Siahsarvie et al. (2005), Darvish et al. (2005) and Darvish et al. (2006), respectively; (see the text for abbreviations).

Taxa	N	LML	UML	ML	DL	NL	DBC	BB	IC	ZB	GL
Cricetidae											
2-*Microtus transcaspicus*	11	7.00±0.16	7.01±0.26	18.26±0.50	9.10±0.24	8.07±0.52	8.02±0.29	12.55±0.46	3.95±0.16	15.92±0.39	29.36±1.82
3-*Microtus paradoxus*	15	6.13±0.17	0.20±0.21	16.05±0.75	8.22±0.76	7.37±0.31	13.13±0.55	7.96±0.34	4.28±0.28	15.04±0.91	25.53±1.21
4-*Blanfordimys afghanus*		6.11 ± 0.36	6.26 ± 0.13	—	8.98 ± 0.41	7.10 ± 0.24	—	14.15± 0.49	4.12 ± 0.17	16.53 ± 0.17	26.93 ± 0.55
5-*Chionomys nivalis*	2	6.04 , 6.41	6.08 , 6.85	—	—	7.55 , —	—	12.45 , —	4.30 , —	14.90 , —	—
6-*Ellobius talpinus*	1	7.00	6.62	19.12	11.30	7.70	9.72	13.38	5.24	19.94	24.42
7-*Ellobius fuscocapillus*	27	7.87±0.48	7.69±0.47	23.01±2.19	12.55±1.28	8.16±1.12	10.77±0.78	15.25±1.13	5.86±0.31	22.31±2.72	28.19±2.17
8-*Cricetulus migratorius*	22	4.18±0.13	4.10±0.14	17.8±1.41	8.18±0.70	10.32±0.89	10.27±0.52	11.41±0.44	4.26±0.17	14.43±0.88	27.91±1.73
Calomyscidae											
9-*Calomyscus sp.*		3.38±1.27	3.33±0.0	14.95±0.49	6.26±0.12	9.33±0.45	8.79±0.17	11.54±0.26	4.15±0.06	12.27±0.10	24.68±0.87
Muridae											
11- *Apodemus witherbyi*	23	3.85±0.13	3.89±0.12	16.31±0.69	6.77±0.69	9.89±0.50	9.41±0.28	11.78±0.26	4.26±0.14	12.77±0.84	26.22±1.05
12- *Nesokia indica*	45	6.84±0.42	6.44±0.61	29.16±3.60	12.71±1.66	12.01±1.54	15.00±1.39	15.58±0.73	6.02±0.40	23.97±4.31	38.47±3.99
13- *Rattus norvegicus*	14	8.46±4.90	6.99±0.26	—	13.51±1.49	17.40±1.40	14.45±2.83	17.15±0.88	4.033±1.081	21.077±4.74	46.208±1.39

TABLE 2.-Extended.

Taxa	N	LML	UML	ML	DL	NL	DBC	BB	IC	ZB	GL
14- *Rattus pyctoris*	8	6.853±0.53	6.958±0.47	27.48±2.47	11.42±1.23	15.47±1.31	12.09±0.74	16.12±0.68	6.161±0.40	20.20±1.46	41.24±3.20
15- *Gerbillus nanus*	7	3.42±0.20	3.16±0.27	14.23±0.59	6.24±0.23	9.29±0.69	10.39±0.20	12.21±0.39	4.60±0.19	13.10±0.26	25.53±1.02
16-*Meriones libycus*	130	4.69±0.40	4.63±0.35	17.75±0.90	14.40±1.54	19.07±1.91	17.64±1.73	11.57±1.55	6.82±0.48	7.94±1.14	37.74±2.53
17-*Meriones crassus*	5	4.52±0.82	4.30±0.35	16.56±1.38	12.44±1.49	16.70±0.84	16.24±0.77	10.22±0.87	6.32±0.42	6.30±0.49	32.25±2.11
18-*Meriones meridianus*	5	4.04±0.46	3.92±0.41	15.42±1.33	11.12±2.17	15.3±2.28	15.42±1.23	11.02±1.48	5.84±0.35	5.94±0.95	29.93±4.88
19-*Meriones persicus*	34	4.87±0.50	4.99±0.39	17.25±1.15	15.19±2.25	20.16±1.63	17.30±1.94	11.47±1.66	6.43±0.42	8.44±1.29	38.69±2.67
20-*Tatera indica*	47	6.55±0.43	6.63±0.53	24.05±3.46	1.06±1.59	15.91±2.68	15.34±1.76	17.12±0.94	6.62±0.62	20.92±2.60	39.25±5.15
21- *Rhombomys opimus*	10	5.72±0.51	5.89±0.57	25.36±2.08	10.35±1.14	15.27±1.99	15.62±0.76	19.77±1.13	7.26±0.62	23.15±1.86	41.24±4.54
Gliridae											
22- *Dryomys nitedula*	11	4.12±0.29	0.75±0.32	15.78±1.18	6.40±0.54	8.21±0.75	10.96±0.55	12.65±0.33	4.23±0.14	14.9±1.09	26.13±1.81
Dipodidae											
23- *Allactaga elater*	40	4.96±0.24	4.93±0.28	15.72±0.53	8.46±1.70	9.05±0.82	12.25±0.44	15.20±0.33	9.05±0.31	19.74±0.58	27.53±0.78
24- *Allactaga hotsoni*	2	5.33 , 5.73	5.05 , 5.21	—	—	—	—	15.07 , 15.9	9.15 , 9.25	—	26.6 , 27.7
25- *Jaculus balenford*	12	5.28±0.25	4.96±0.12	19.07±0.52	10.45±0.43	11.86±0.85	15.83±1.21	19.84±0.41	12.37±0.55	24.38±0.91	36.73±1.16