

Karyological and some morphological characteristics of the Egyptian mongoose, *Herpestes ichneumon* (Mammalia: Carnivora), along with current distribution range in Turkey

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Abstract: The Egyptian mongoose is the only member of the family Herpestidae in Turkey. The species is distributed mainly in Africa, and Turkey constitutes the northernmost distribution margin of the species. Thus far, a natural specimen's karyotype from an area with a known locality for *H. ichneumon* has not been studied. The karyotype of a male specimen from Hatay was determined to be $2n = 43$, $NF = 71$, $NFa = 66$. The X1 and X2 chromosomes were middle-sized metacentric, and the Y chromosome was middle-sized telocentric. The external and skull measurements of the Adana-Yumurtalık and Hatay specimens are given here in a table. The Egyptian mongoose was distributed in the Mediterranean and Aegean regions before the 1970s. However, during the last 30 years, the distribution of *H. ichneumon* has been recorded only in the Hatay region, mostly because of the lack of detailed distribution studies. We recorded the species from Hatay, Osmaniye, Adana, and Mersin, in the area between Hatay and Silifke. The species seems to be limited in areas below an altitude of 450 m in the Mersin, Adana, and Hatay regions. *H. ichneumon* is distributed mostly in reed, bush, and scrub areas, as well as in agricultural lands with residential areas. Because of the large distributional decrease of the species, it is necessary to develop their populations by rescuing *H. ichneumon* from the risks mentioned below by starting a tracking program immediately.

Key words: Protection, range changing, threats, *Herpestes ichneumon*, Turkey

1. Introduction

The order Carnivora is represented by 15 families, i.e. Felidae, Viverridae, Eupleridae, Nandiniidae, Herpestidae, Hyaenidae, Canidae, Ursidae, Otariidae, Odobenidae, Phosidae, Mustelidae, Mephitidae, Ailuridae, and Procyonidae (Wilson and Reeder, 2005). Many distributional records and new geographical variations on carnivore families in Turkey have been documented (e.g., Danford and Alston, 1877; Satunin, 1906; Blackler, 1916; Thomas, 1920; Kumerloeve, 1967, 1975; Kock and Kinzelback, 1982; Özkurt et al., 1998, 1999; Yiğit et al., 1998; Çolak et al., 1999; Albayrak, 2012).

The Egyptian mongoose, *Herpestes ichneumon*, was originally described from the banks of the Nile River by Linnaeus in 1758. It is distributed naturally in Algeria, Angola, Botswana, Cameroon, Chad, Côte d'Ivoire, Democratic Republic of Congo, Egypt, Ethiopia, Gambia, Ghana, Gibraltar, Guinea, Israel, Jordan, Kenya, Lebanon, Liberia, Libya, Malawi, Morocco, Mozambique, Niger, Portugal, Rwanda, Senegal, Sierra Leone, South Africa, Spain, Sudan, Syria, Tanzania, Togo, Tunisia, Turkey, Uganda, and Zambia (Wilson and Reeder, 2005). Although some researchers have accepted it as an introduced species in Portugal and Spain (Dobson, 1998; Riquelme-Cantal

et al., 2008), the analysis of 2 mitochondrial fragments (cytochrome b and control region) supported a natural process of colonization as a result of Pleistocene sweepstakes dispersal (Gaubert et al., 2011).

H. ichneumon has been recorded from Turkey by Danford and Alston (1877), Betchold (1940), Alkan (1965), Gülen (1953, 1971), Kumerloeve (1955, 1965, 1975, 1978), Corbet (1978), Turan (1984), Bosman and van den Berg (1988), Doğramacı (1989), Özkurt et al. (1998), Gaubert et al. (2011), and Atay and Yeşiloğlu (2012). The Egyptian mongoose is the only member of the family Herpestidae in Turkey (Kryštufek and Vohralik, 2001).

The karyotype of *H. ichneumon* is poorly known; only Fredga (1972) gave the karyotype as $2n = 43$ for males and $2n = 44$ for females from an unknown locality. The sex chromosomes for males were XXY and for females were XXXX.

We present in this study the karyotype of a male specimen, some morphological characteristics, and distributional records from Turkey.

2. Materials and methods

In this study, 1 ♀ specimen found dead in September 1997 at a Halep pine grove, Adana-Yumurtalık (museum

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number 2429) and 1 ♂ specimen thought to have been hit by a car and found in February 2012 at 1 km E of Hasanlı village in Hatay (museum number 19) were evaluated. Aside from these specimens, the visual records procured from 13 locations are presented as distribution records in the study (Figure 1).

From the muscle tissue of the specimen hit by a car on the road in Hatay, a karyotype was produced in the laboratory with a cell culture, according to the method proposed by Barch et al. (1997) and Rooney (2001). The measurements of 1 Adana and 1 Hatay specimen with undamaged skulls are given in the Table. The body measurements of both specimens were taken (Table).

Of the specimens, 5 standard body measurements were taken using calipers. Because the Adana specimen was damaged, it was left in the field after taking the skull. The Hatay specimen was made museum material by embalming it after taking 5 standard measurements and the skull. The specimen has been stored in the Ankara University Science Faculty Department of Biology Museum. The sex of the Hatay specimen was not determined during the morphological observations because of the damage, but the karyotype results showed that it was male. The skulls were photographed after cleaning in the laboratory and measurements were taken.

According to Barch et al. (1997) and Rooney (2001), karyotyping was performed using tissue culture prepared

from sample muscle tissue. The G banding of the chromosomes was performed according to the method proposed by Gosden (1994) and Robinson (2003).

External and cranial measurements were taken as described by Harrison and Bates (1991).

Abbreviations of measurements used in the Table are: L, total length; T, tail length; HF, hind foot; E, ear length; GTL, greatest length of skull; CBL, condylobasal length; ZB, zygomatic breadth; BB, breadth of braincase; IC, interorbital constriction; C-Mⁿ, maxillary tooth row; C-M_n, mandibular tooth row; and M, mandible length.

3. Results

3.1. Karyology

The karyotype of the male specimen from Hatay was determined to be $2n = 43$, $NF = 71$, $NFa = 66$. The X1 and X2 chromosomes were middle-sized metacentric, and the Y chromosome was middle-sized telocentric (Figures 2 and 3). The autosomal set contained 8 pairs of meta/submetacentric, 5 pairs of subtelocentric, and 7 pairs of acrocentric chromosomes (Figure 3).

3.2. Morphology

The skin of the specimen found in Hatay was preserved for morphological examination. The nostril pad of this specimen was naked and brownish, with rough vibrissae located on both sides of the muzzle. The flanks and the rostrum were covered with short brownish hair, and the

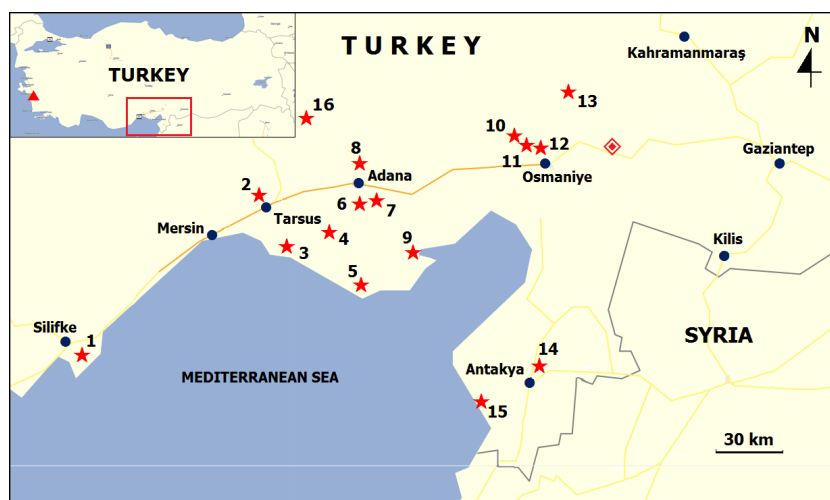


Figure 1. Distribution of *Herpestes ichneumon* in Turkey. ▲: Selçuk (Danford and Alston, 1877); ◆: Bahçe (Gülen, 1971); ★: current distribution recorded during this study. 1) Göksu Delta; 2) Tarsus, near the Mersin–Adana highway; 3) 1 km west of Tabaklar village; 4) 7 km northeast of Kefeli village; 5) 2 km west of Gölyaka village; 6) 3 km south of Adana; 7) 3 km southeast of Adana; 8) 1 km southeast of Menekşe village; 9) 3 km south of Deveciüşağı village (sample no. 2429); 10) near Sakarcalı village; 11) near Yeniköy village; 12) 1 km east of Cevdetiye village; 13) 2 km north of Ahrazlar village; 14) 1 km east of Hasanlı village (sample no. 19); 15) 1 km west of Kapisuyu village; and 16) 1 km south of Emirler village (Karaisalı).



Figure 2. Metaphase plate of a male *H. ichneumon* from Hatay.

hair of the dorsal pelage was short and grizzled brown with white, creamy hairs. The bases of the dorsal hairs were a lighter brown than their anterior tips. The ears were hairy; the tail became thinner towards the posterior, and its tip was blackish. The soles of the fore and hind feet were naked, and the lower sides of the fore and hind legs were uniformly brownish. In contrast, the color of the upper sides of the fore and hind legs was similar to the dorsal color. The chest and abdomen were light brown. The measurements of the Adana-Yumurtalık specimen were as follows: total length: 820 mm; tail: 430 mm; fore foot: 120 mm; hind foot: 100 mm; ear: 12 mm. The measurements of the Hatay specimen were as follows: total length: 750 mm; tail: 365 mm; hind foot: 52 mm; ear: 16 mm; weight: 1095 g. According to these findings, the Adana specimen was

bigger than the Hatay specimen, and the Hatay specimen appeared to be a young individual.

External and skull measurements are given in the Table. Skull morphology is given in Figure 4.

3.3. Distributional and ecological notes

The family Herpestidae is found mostly in reed, bush, and scrub areas, as well as in agricultural lands with residential areas. All of the samples determined in this study were restricted to lowlands, up to 450 m a.s.l., between Hatay and Tarsus (Figure 1).

Despite there being no studies on mongoose population density in Turkey, after meeting with the local residents, it was established that they have been seen in the last 20 years and are breeding very quickly. However, this might likely be because of the increase in human activities around the area and more frequent meetings.

H. ichneumon is mostly found in villages and rural neighborhoods. Because of its proximity to human beings and being often seen on the side of the road, there are some records of individuals being crushed by vehicles. These observations show that *H. ichneumon* has the ability to gain a feeding advantage in residential areas. In these areas, opportunities for finding food are mostly in black and brown rat (*Rattus rattus* and *Rattus norvegicus*) populations, chickens, and food residuals. Their attacks against chickens often lead them into conflict with people. On the other hand, irrigation channels and channels near the agricultural fields of Çukurova, which were next to residential areas, are an environment for voles (*Microtus* spp.), frogs, crabs, and water snakes, and this also permits *H. ichneumon* access to these places. Moreover, the reeds and bushes in these areas create the ability for hiding. Hence, *H. ichneumon* is mostly observed in the areas around these channels (Figure 5).

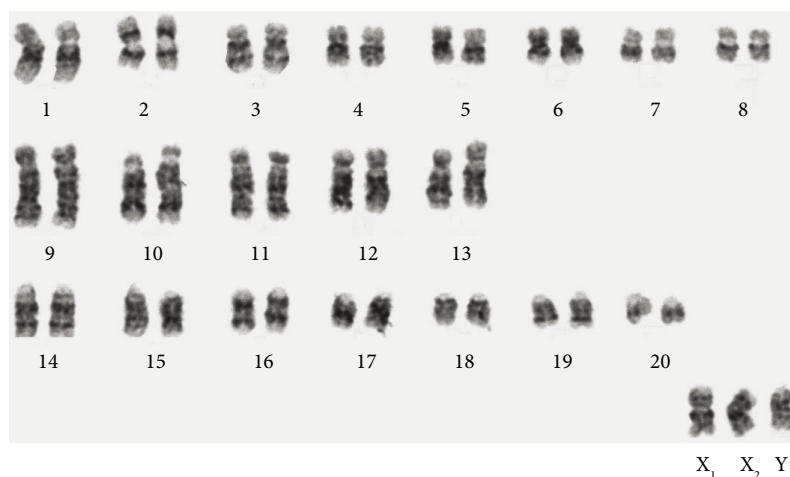
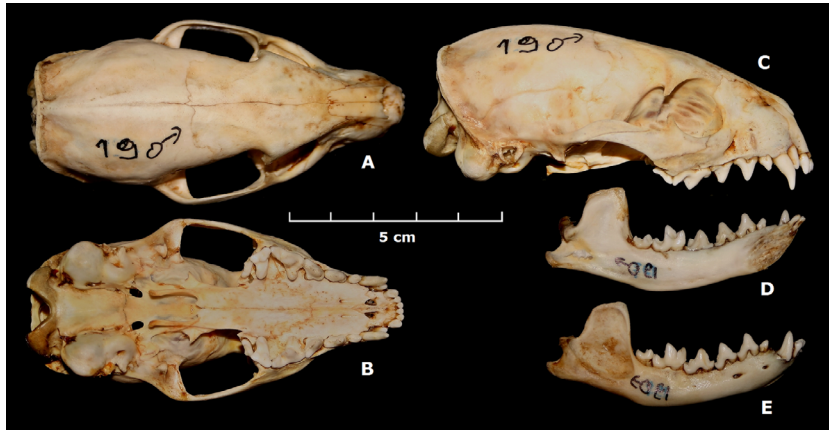


Figure 3. The karyotype of a male *H. ichneumon* from Hatay ($2n = 43$, $NF = 71$, $NFa = 66$).

Table. External and cranial measurements of *H. ichneumon*.

Locality	Harrison and Bates (1991)		Gülen (1953)	Present study	
	Israel and Jordan		Adana	Hatay	Adana
	n	Mean		19♂	2429♀
L	17	927.0	910	750	820
T	17	405.2	400	365	430
HF	21	95.6	60	89	100
E	20	25.5	30	10	12
W ♂♂	12	2953	-	1095	-
W ♀♀	5	2640	-	-	-
GTL	8	96.4	88	85.9	93.3
CBL	8	95.9	-	84.3	92.7
ZB	7	49.1	-	41.6	44.9
BB	8	33.6	35	30.4	33.8
IC	7	17.2	19	15	16.4
C-M ²	7	35.6	29	30.5	33.4
C-M ₂	6	39.8	32	31.8	34.9
M	7	64	-	56.6	61

**Figure 4.** Skull morphology of *H. ichneumon* from Hatay: A) dorsal, B) ventral, C) lateral view of the skull; D) mandible (lingual), E) mandible (labial) view.

4. Discussion

Thus far, there have been no studies on a natural specimen's karyotype from an area with a known locality for *H. ichneumon*. Fredga (1972), who gave the karyotype of the species, stated that there are no original specimens of the 3 *Herpestes ichneumon* he karyotyped. The specimens used in his study were bought from Ravensden Zoological Company Ltd. (Bedford, UK) by Fredga (1972). According to him, the autosomal set consisted of 6 metacentric, 4 submetacentric, 2 subtelocentric, and 8 telocentric pairs. The X₁ chromosome was a metacentric, the X₂ was a

subtelocentric, and the Y was a telocentric or subtelocentric chromosome. The largest chromosome of the complement was subtelocentric (1) and the smallest was telocentric (8). Briefly, the karyotype was 2n = 43 for male and 2n = 44 for female; NF = 72 (69 for male), NFa = 64. The 2n value in our study was similar; however, the NF and NFa values were lower, since the Turkish specimen had 7 pairs of acrocentrics rather than 8. Hence, the number of banded pairs in the Turkish specimen was 13 rather than 12. These results show that the karyotype of *H. ichneumon* has shown at least 2 different variations.



Figure 5. *H. ichneumon* observed in Karataş-Adana on September 2002 (Photo: Şakir Önder Özkurt).

The external characteristics found in this study were mostly consistent with the descriptions of those given by Gülen (1971) and Harrison and Bates (1991).

The first record from Turkey was given by Danford and Alston (1877), which was taken by a stream flowing down to the Kystros (Küçük Menderes) River, close to Ephesus. Gülen (1971) also gave all of the features (skull, external measurements, and some ecological information) after examining an Egyptian mongoose caught around Pirsultan in the Adana/Bahçe area by his student, Ali Müftüoğlu, in March 1952.

Among the public, there are different names for the Egyptian mongoose in Adana, Seyhan, Mersin, Hatay, Gaziantep, and Kahramanmaraş, such as ground beaver, beaver on the ground, and dry ground beaver (Gülen, 1971). Gülen also stated that he had seen them a couple of times on the move, and that they breed and live in winter and summer in the forests and shrubbery areas at altitudes of up to 200–400 m in the Mersin (the İçel), Seyhan, Hatay, Gaziantep, and Kahramanmaraş parts of the Taurus Mountains and Anti-Taurus Mountains. Gülen (1971) also stated that Ord Prof Dr C Koswig saw an Egyptian mongoose on the Bodrum–Marmaris road. Kumerloeve (1975) reported that *H. ichneumon* had expanded its range to the west coastal area of Turkey.

H. ichneumon had spread out over the entire Mediterranean region and the southern part of the Aegean,

which has scrub mostly, in Turkey. In the last 50 years, because of a steep rise in the human population and as a result of agricultural activities in its habitats, it has only been seen in the eastern Mediterranean region, especially in the Adana and Hatay regions. Just as many other small carnivores have, the Egyptian mongoose has developed a method of survival in these areas and can widely be seen in residential and agricultural areas; hence, some individuals are crushed and killed by vehicles.

As we understand from the records above, the habitats of *H. ichneumon* comprise mostly the coastal parts of scrublands, characterized by the warm Mediterranean habitats of the Marmara, Aegean, and Mediterranean regions. In the last 30 years, the presence of *H. ichneumon* has only been recorded by Bosman and van den Berg (1988), Özkurt (1998), and Atay and Yeşiloğlu (2012) in the Hatay region. Its natural habitats are typical Mediterranean scrub areas and the edges of the wetlands around it. Recent data show that the current presence of the species is restricted to the area between Tarsus and Hatay in Turkey, and the species has lost its distribution range between the west coast of the Aegean and Tarsus.

Their presence in residential and agricultural areas due to food opportunities brings about new dangers. In such areas, food sources are not stable, which makes the population unstable. This causes conflict with local people, who see them as a threat to their own resources. This also causes smaller populations by dragging the original population from its close natural habitat into fragmented residential areas. As a result, there is a decrease in the natural population. Hence, it is necessary to start a tracking program immediately, so as to develop the population by rescuing *H. ichneumon* from the above-mentioned risks.

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