

## Records of the golden jackal (*Canis aureus* Linnaeus, 1758) in Hungary from 1800<sup>th</sup> until 2007, based on a literature survey

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**Abstract.** We give a comprehensive overview of the observation of the golden jackal or reed wolf (*Canis aureus*), from the beginning of the 1800s until 1995 in Hungary, based on the available literature. We discuss 57 observations from the period surveyed, seven reports that mentioned canids but certainly not a jackal, 26 questionable cases, and 16 records that certainly refer to jackals. These included records from historical Hungary as well: two from present Serbia, one from present Ukraine, one from present Croatia, and six from present Romania. Until the 1920s, the jackal was observed in Hungary only along major rivers and between the Danube and Tisza, and records are almost missing in the 1920-1945 period, whereas in the last 50 years surveyed, the number of observations increased. Since 1980 the Hungarian jackal population is constantly increasing, its being estimated at above 1500 individuals in 2007. We discuss the distribution pattern observed in the light of the geographical and historical changes that took part in the country in the last few decades.

**Keywords:** *Canidae*, *Canis lupus*, distribution, Slovakia, Serbia, Croatia, Romania

### Introduction

The golden jackal (*Canis aureus*) is one of the native predators of Hungary. It was numerous until the turn of the 19<sup>th</sup>-20<sup>th</sup> century, later its populations decreased, the last voucher specimen being shot in the beginning of the 1940's. In the 40 years that followed, the species was not documented again. Vagrant individuals were recorded from the beginning of the 1980's and soon

reproductive pairs resettled again in their original distribution area.

Determination of the species caused problems, thus the old literature usually contains notes about "reed wolf", but is often difficult to decide what kind of canid this name denoted.

Several papers were published for decades about the species named reed wolf (Anonymous 1937, Blaskovich 1937, Brehm 1929, Dunántúli 1934, Éhik 1932, 1937a,

1937b, 1937c, 1937-38, 1940, 1941, 1942a, 1942b, Gé 1932, Gyöngyös-halászi Takách 1932, Hörömpöly 1966, Lázár & Kriesch 1874-1876, Lovassy 1927, Méhely 1898, Nagy 1914, 1932, 1942b, 1942c, 1947, 1951, 1956, 1959, Nozdroviczky 1932a, 1932b, Paszlavszky 1918, Potoczky 1932, Rainer 1933, Szomjas 1932, Szunyoghy 1959a, 1959b, 1961, Torontáli 1942a, 1942b). This animal could be wolf, stray dog or jackal since the aforementioned species are canids, not specifically living in mountain or forest biotopes; only human persecution and changes of lowlands (conquest of agriculture) pressed it back to less disturbed habitats. In order to solve this question, museologists appealed to hunters to inform the Hungarian National Museum (and later the Hungarian Natural History Museum) about the observation or kill of a reed wolf or an ordinary fox, and to write about their sightings. Such public summons were published by Anonymous (1898, 1942), Éhik (1937a), Gé (1932), Méhely (1898), Nagy (1942b, 1942c, 1953), A Szerkesztőség (1883). Nagy (1942c) also reported about a regulation issued by the Hunting Department of the Ministry of Agriculture (during WW II), mailed to all hunting controllers in the northeastern mountainous regions of Hungary and in Transylvania, to promote the render of ordinary foxes and wolves (meaning jackals).

Certain *C. aureus* records are known from Debró (1882), Bélye (1891), Tyukod (1937) and Derecske (1942) only (Anonymous 1891, Éhik 1931, 1937a, 1937b, 1937c, 1937-38, 1941, Méhely 1898, Muszer 1937, Nagy 1942a, 1942b, 1953, Paszlavszky 1918, Szunyoghy 1959a), then a chronological lack follows until 1981. We have certain data of the recent expansions of the golden jackal, that derive from studies of the species by

the Hungarian Game Management Database since 1995. Spreading and reproduction of this formerly indigenous predator assumed such considerable proportions that in 2007 the population was estimated to be above 1500 individuals (Csányi et al. 2007). Studies were discussed exhaustively, Hungarian observations and kills recently (Szabó et al. 2004, Heltai et al. 2000, 2004) with statistical analyses of the Hungarian Game Management Database (Csányi 1999, 2000, 2001, 2002, 2003, 2004, and Csányi et al. 2005, 2006, 2007).

The aim of this paper is to evaluate in detail all the available Hungarian literature, and to give an overview of the distribution of this canid in the present and historical Hungary based on these literature data.

#### Materials and methods

In order to obtain as substantial a review as possible, we surveyed the hunting and zoological literature from the beginning of the 1800s that summed an amount of over 100,000 printed pages. The journals and issues surveyed were: *Acta Theriologica* (1955, 1958-1973, 1975-1989, 1992-2006), *Carl Hagenbecks Illustrierte Tier- und Menschenwelt* (1927-1928), *Carpații* (1937, 1943), *Das Tier und Wir* (1931-1940), *Erdélyi Nimród* (1999-2007), *Hornbill* (1980-2006), *Jagd und Wild* (1908-1910, 1912), *Kárpáti Vadász* (1928-1934), *Képes Vadászújság* (1879-1880), *Lutreola* (1993), *Lynx* (1962-1977, 1979, 1982, 1984, 1987-1989, 1992), *Magyar Vadász* (1948-1968), *Magyar Vadászújság* (1929-1937, 1941), *Mammal Review* (1970-1988), *Mammalia* (1948-1951, 1953, 1959-2005), *Nimród* (1914-1918, 1920-1924, 1926-1944, 1946-1948, 1969-2006), *Nimrod (Slovakian hunting journal)* (1927-1931), *Säugetierkundliche Mitteilungen* (1954-1974, 1977-1983, 1986, 1992-1999), *Székelyföldi Nimród* (1998-1999), *Vadász-Lap* (1880-1883, 1885-1920), *Vadászújság* (1929-1930), *Vadvilág válogatás* (1993), *Vertebrata Hungarica* (1959-1976, 1978-1982, 1984), *Waidmanns Heil* (1884-1911, 1924-1931), *Zeitschrift für Säugetierkunde - Mammalian Biology* (1926-1942, 1952-1962, 1965-1966, 1968-2006).

We listed all reports available prior to 1995. The observations and kills are in chronological order. We summarised the available data for each case separately and provide our interpretation in *Italics*. A judgment is provided in boldface as follows: certainly jackal, probably jackal, certainly not jackal and questionable record. Jackal records were considered certain where the voucher is in a public collection, a photograph suitable for correct identification was published, or when the identification was made by a suitably trained individual. We used taxonomic keys listed below to distinguish the jackals from other canids, and grouped the remaining reports into the other three categories. All but those data that refer to “surely not jackal” are depicted on maps (Figs 1-3). Separate maps were

prepared for the reports between 1800-1920 (Fig.1), 1920-1945 (Fig.2) and 1945-1995 (Fig.3). Golden jackal and reed wolf observations are illustrated on maps periodically in the light of the historical borders of Hungary. We did not discuss the reports from the Croatian Kingdom, but mentioned only the records north of the Drava River.

#### Taxonomic key and classification criteria

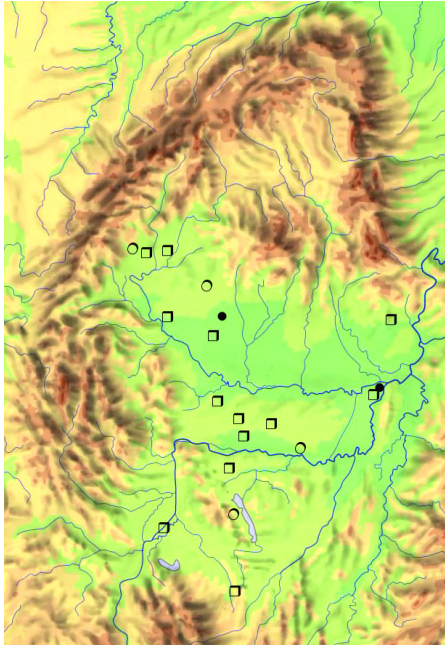
To analyze the observations we used certain taxonomic keys, based on the studies by Heltai & Szűcs (2002) and Heltai *et al.* (2003a, 2003b, 2004), to compare the different characters found in the literature. Additionally, in Table 1 we provide metric data for body proportions base on dissected specimens shot in Hungary (Heltai unpublished data).

**Table 1.** Main body proportions measured on dissected specimens shot in Hungary (Heltai *et al.* unpublished). Legend:  $\bar{x}$ =mean, SD=standard deviation, N=number of individuals.

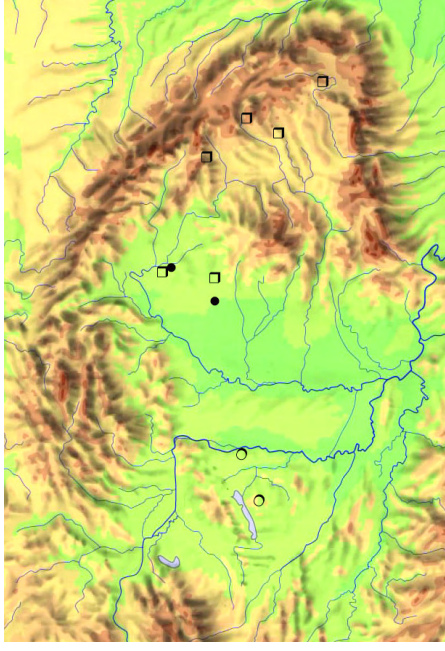
Body proportions	Female			Male		
	$\bar{x}$	SD	N	$\bar{x}$	SD	N
Body length	80,1	2,8	12	82,6	5,5	17
Head length	103,9	3,6	12	106,9	6,1	20
Tail length	23,8	2,5	12	24,3	1,8	17
Length of the back legs	41,3	2,6	15	42,3	2,3	23

- Body length: 65-105 cm.
- Wither's height: 45-50 cm.
- Body weight: ca. 7-15 kg, rarely 15-17 kg.
- Dental formula: : 3142 / 3143 = 42
- A zygomorphic black band runs on the back until the tip of the tail (at the red fox only till the stump of the tail).
- Fur is reddish and yellow-brown coloured in winter, the back is greyish, grey-brown or black. Summer fur is similar but thinner and with less black shading. The colours of the fur do not differentiate from each other, unlike in the fox. The fur is thick and rough to the feel (Simon 1996), being longer on the body.
- On mature specimens there is a white, curved line or a pale band starts behind the shoulders and runs along the body. On the middle of the back there is a darker plume (usually it is only a pale bunch) indicating the position of the individual in the pack. A similar white band can be present on the chest.
- Transversal slurred bands are on the clavicles.

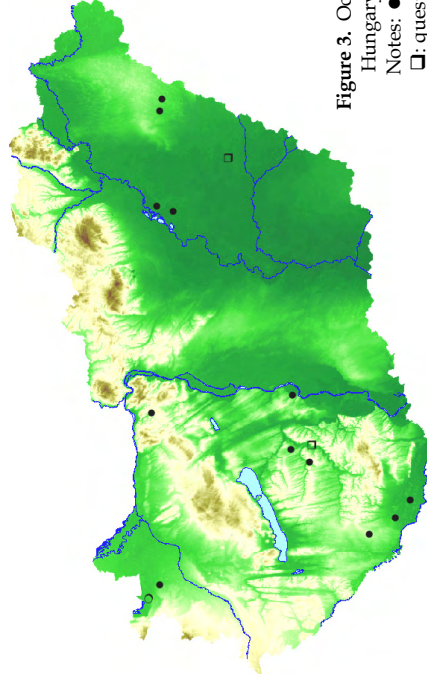
- Sides of the body, thighs and legs are red (at the red fox the legs are black).
- Abdomen, inguinal region and inside surface of the legs are pale, usually greyish-white.
- Thin head, the nasal region is pinched and pointed, but flatter than the red fox's.
- Slit-eyed, similar to the fox (Faragó 1994).
- Face is brown, its ventral side and the throat are dirty white. A light patch runs from the throat to the chest, and the side of the brown, thick-haired neck.
- There is a typical white area around the upper mouth.
- Prick-eared, symmetrically short, their external side being covered by dense, reddish-yellow hair (this is always black in the fox). Smaller ears than a fox's.
- Averagely shaggy 20-30 cm long tail (a fox's 35-40 cm) in the jackal. The tip of it is black-chestnut coloured (hoary or white in the fox).
- Partial symphysis of the digital pads in all paws, typically observable on the fore-feet. This cha-



**Figure 1.** Records of golden jackal in the historical Hungary between 1800 and 1920. Notes: ●: certainly jackal, ○: probably jackal, □: questionable record.



**Figure 2.** Occurrence of golden jackal in the historical Hungary between 1920 and 1945. Notes: ●: certainly jackal, ○: probably jackal, □: questionable record.



**Figure 3.** Occurrence of golden jackal in Hungary between 1945 and 1995. Notes: ●: certainly jackal, ○: probably jackal, □: questionable record.

racter is missing in the adult fox and rare at the wolf or dog. The claws and the two middle fingers are very close to each other.

Considering that the observations detailed below lack anatomical descriptions, we do not list these characters.

## Results

### Case-histories

Schuster (1895) discussed the hunting bags of the demesne of Hédervár (Győr-Moson-Sopron County) between 1820 and 1831, and found reports on the shooting of seven reed wolves in 1822, 1823, 1825, 1826, 1827, 1831, 1831. These specimens passed from Lébényszentmiklós (now Mosonszentmiklós, situated 15 km from Hédervár in the same County) to Hédervár game-reserve in winter, when the Moson-Danube had frozen. Later, Baron János Szina bought the demesne from the Zichy family, built a sugar-factory and dug a canal for trade, thus as a result of the habitat change and disturbance, the reed wolves disappeared from Hédervár. According to the hunting bag of 1833-1882, the species was missing from the area. Huber (2004) considered the reed wolves observed until 1920 around the Lake-Fertő (and the Delta of River Danube) were probably jackals. *The species can not be identified based on the report.* **Questionable record.**

Geréby (1937) reported reed wolves observed between 1830 and 1840 (i.e. before the water regulations-drainage) in the Kiskunság area) at Adacspusztá (now Kunadacs, Bács-Kiskun County) on the land that belonged to his family. Three paintings, made by Sárói in 1897, depicted these animals when hunted with greyhounds.

According to Geréby, these reed wolves were neither large nor dangerous, as no casualties were noted during the greyhounds hunting, and the farm register that contained detailed records of all incidents does not mention sheep or pig attacks neither. Interestingly, later (Geréby 1966) the author stated that wolves did not attack horses and cows, but nip away at pigs and sheep. Lázár and Kriesch (1874-1876) share a different view, and stated that in the plain, reed wolves are hunted with greyhounds, but many hounds are scared of them. Éhik (1937c) pointed out that an article in the 1857 issue of the journal *Vadász- és Versenylap* mentions the wolf hunting at Adacs, where greyhounds were assisted by two mastiffs. Éhik (1942) erroneously stated that the paintings, owned by the Öttömösi Geréby family, were made by an eyewitness of the hunting. Éhik (1937c) and Geréby (1966) published two of the paintings, and Éhik (1937c) stated that the original works depicting the hunting organised by Geréby Pál (1790-1854) were made by an anonymous Italian painter who participated at these events. The paintings were damaged, thus Sárói made the duplicates, but only one of them, that depicting the return from the hunting, survived World War II (Geréby 1966). According to Éhik (1937c), the painting depicting the fight of greyhounds with a reed wolf was not suitable for identification, but the other, which showed a horseman with a reed wolf slung on his arm, depicts a jackal, as a wolf would have been too heavy to be carried home this way. Szunyoghy (1959b) did not consider the paintings good enough to identify the species, and pointed to the fact that the article in *Vadász- és Versenylap* (1857) mentions wolf hunting

only, and does not contain remarks about jackals or reed wolves. Geréby (1966) stated wolves were common at Adacs until 1860, but disappeared at around 1890. He also mentioned that the hunting place shown on the painting was about one hour from Adacs farm, so no one could sling and transport a 25-50 kg wolf on his arms. Öttömösi Geréby (1932) completed his description, with another case. A herdsman informed Geréby's grandfather that wolves inhabit its Répási-land of 3-400 acres. They hunted the land with greyhounds and mastiffs, which captured a wolf but could not kill it, thus it was slung and carried home. Later it crossbred with Komondors, but their offspring killed some sheep, and were slaughtered. Gereby has seen the last of the crossbred offspring, named Maros that was at the farm till the 1870's. *Considering that non of the above mentioned authors took part in these hunts, but had known them from stories, as the paintings of Sárói are probably copies that depict the wolves controversially, the data can not be positively judged.* **Questionable record.**

Öttömösi Geréby (1932) wrote about an observation by a farm manager at Adacs-major (now Kunadacs, Bács-Kiskun County) named Táci, who in the 1850's one night went to a rabbit hunt, 400-500 feet (121-152 meter) from the farm house. Firstly two, then finally 24 wolves stepped out from the reeds, copulated and ran away about midnight. Táci was frightened and climbed up a willow. *It is questionable why had the manager chosen this late hour for a hunt, and why hadn't he asked for help if the house was so close. Still the 24 wolves mentioned refer to jackals rather than wolves.* **Questionable record.**

Blaskovich (1932) reported that his grandfather shot a reed wolf with a muzzle-

loader small-bore rifle at the age of 10 (i.e. the 1850's-1860's) at Tápiószentmárton (Pest County). *The species can not be identified based on the report.* **Questionable record.**

Nagy (1942c) referred to Havas (1863), who mentioned a wolf strike dead near Karcag (Jász-Nagykun-Szolnok County) in the 1860's. Its body was ca. 150 cm long. According Nagy, this canid was larger than a jackal, but not big enough for a wolf. *The single character provided does not allow a correct identification. According to the determination keys above, the maximal length (tail included) of a jackal is ca. 135 cm, thus this specimen is longer by 10%.* **Questionable record.**

Szomjas (1932) in the 1860's observed struggling jackals (sometimes 4-6 individuals) at the end of January-beginning of February, at the Lökös-meadow, near Tiszalök (Szabolcs-Szatmár-Bereg County). Geréby (1966) considered it an erroneous record. *The species can not be identified based on the report.* **Questionable record.**

Szomjas (1932) reported that in the 1860's four reed wolves drove away and killed 64 sheep on the confines of Tiszalök (Szabolcs-Szatmár-Bereg County), near the Tavern "Rázom", while the shepherds were drinking. Geréby (1966) considered the report erroneous. *The species can not be identified based on the report.* **Questionable record.**

Blaskovics (1932) mentioned that in the 1860's-1870's his father found and brought up reed wolf pups at Tarnaerk (now Erk, Heves County). He donated them to the Zoological and Botanical Garden in Budapest, where soon all died because of bad conditions. The specimens were grey and similar to a larger shepherd dog in size. *Neither the colour, nor the size match a jackal.* **Certainly not jackal.**

Szomjas (1932) mentioned that in 1864 his father found four reed wolf pups in the rye at Tiszalök (Szabolcs-Szatmár-Bereg County), a few hundred meters from the "Alsószék" farm. Two were raised by a Komondor, and were later donated to Zoological and Botanical Garden in Budapest. Geréby (1966) listed the record as erroneous. *The species can not be identified based on the report.* **Questionable record.**

Méhely (1898) and Paszlavszky (1918) refer to a report by Jeitleles, who observed in 1866 one reed wolf collected at Szentgotthárd (Vas County) in the Zoo Schönbrunn (Vienna, Austria). Brehm (1929) reproduced the description by Jeitleles: there were black lines on its fore legs, its tail was curly and the tip of it was black, the ears tended backwards. Unfortunately he did not report its colour, nor provided measurements. *The black legs indicate a fox, the curly tail a dog or a wolf, and the black tail tip of a jackal or a dog.* **Questionable record.**

Szomjas (1932) reported that in the 1870's the hunting bags of Gút (Szabolcs County) often mention reed wolves, and from time to time mountain wolves. Geréby (1966) considered these records erroneous. *The species can not be identified based on the report.* **Questionable record.**

Reed wolves killed foals (even in stables) at Tiszadada (Szabolcs-Szatmár-Bereg County) in the 1870's (Szomjas 1932). The record was considered erroneous by Geréby (1966). *Even if this story would be true, a jackal is unable to kill a foal, and we doubt that this timid animal would burst into a stable.*

**Certainly not jackal.**

Gyöngyös-Halászi Takách (1932) mentioned, that his father shot a reed wolf somewhere in Transdanubia during the 1880's and prepared the fur (with a head) as carpet. The fur was smaller than a fox's, it

was about 85-90 cm long from nose to the tail-base. The specimen was a palm taller than a fox, its head and strong teeth resembled that of a coyote. The fur was completely grey, the cover hairs were rugged and longer than a fox's, alternately black and white, its woollen hair was silver-grey. The legs were blackish, its belly was white. Its size was significantly smaller than that of a Carpathian wolf. The author identified it as reed wolf, and not jackal. *According to the descriptions this canid was probably a jackal.* **Probably jackal.**

Gyöngyös-Halászi Takách (1932) reported, that he saw a reed wolf skin at Fecsketanya near to Adacs (now Kunadacs, Bács-Kiskun County), at Gyula Öttömösi Geréby. Here in the 1880's-1890's hunting with greyhounds was common, and the dogs sometimes were killed by wolves. Geréby instructed a shepherd to catch reed wolf pups, that he later brought up and crossbred them with greyhounds. He wanted to hunt with them, but they attacked the sheep, thus Geréby killed all five individuals. Gyöngyös-Halászi Takách first heard this story from his son-in-law, Endre Beretvás the younger, later Gyula Peszeki Muzsik, a landowner of Mikebuda (Pest County), who always took part in the hunts, confirmed the story. The author concluded that these reed wolves were not jackals. *The report resembles the one above, with the difference in the land owner. Jackals would surely not kill greyhounds, and the report does not contain other data which might enable identification.* **Questionable record.**

Count Gyula Károlyi shot a jackal at Parád (Heves County) in 1882. Its skin was donated to the Mammal Collection of the Hungarian Natural History Museum, where it was determined as reed wolf (*Lupus aureus*), which was the former name of the

jackal (Éhik 1940). This was the first verified *C. aureus* in the Museum (Szabó & Heltai 2005). Méhely (1898), Paszlavszky (1918), Éhik (1931), Nagy (1942a) and Szunyoghy (1959a) stated that this individual was shot in Debrő, 20 km from Parád. Marián (1974) referred to *Magyar Birodalom Állatvilága* [*Fauna of the Hungarian Empire*] (1918) and stated that this specimen could be the last found in Heves County. *The specimen is still preserved in the Museum, as collected at "woodland of Debrő, Egerbakta".* **Certainly jackal.**

In 1883 Nozdroviczky (1932) shot a reed wolf in a marshy forest of Sosdia (Șoșdia, Caraș-Severin County, Romania). It was a large, shaggy tailed, dog-like animal with greyish-yellow fur. *The large size and the shaggy tail does not fit a jackal, and additionally the author, who previously observed jackals at the Adriatic coast, did not mention the specimen as jackal.* **Certainly not jackal.**

Blaskovich (1937) referred the book of Jenő Bölcsházai Belházy (1892), who mentioned that in 1884 the Count Frigyes Wenckheim (1842-1912) shot a reed wolf in Békés County (exact locality not mentioned), which was transferred to Hungarian Natural History Museum in Budapest. The specimen resembled a wolf but had shorter legs. Blaskovich considered the reed wolf a separate species, from the jackal and wolf, and assigned the specimen to the first taxon. *The short legs point a jackal, but the specimen is lost, thus it can not be identified.* **Questionable record.**

Felsőőri Nagy (1932) mentioned that prior to 1885 his grandfather hunted reed wolves with greyhounds. Once he shot a specimen, and at another occasion the greyhounds stopped another individual, and the accompanying shepherd dogs killed it. According to the author, this canid was

not too strong as it could be stopped by the greyhounds, but weak either, as only the shepherd dogs could kill it. The work does not contain an exact locality, the author mentions only Fehér County, 28 km far from Danube. We presume that the locality is Zichyújfalu in Fejér County, where Felsőőri Nagy lived. *The species can not be identified based on the report.* **Questionable record.**

Felsőőri Nagy (1932) mentioned a poisoned specimen found in 1885 at Zichyújfalu (Fejér County), which was mounted and exhibited in the hall of the local castle. It was described as resembling a wolf, but much brighter coloured. *It is difficult to identify the species from this single characteristic, but if the only difference was in the colour, it was not a jackal.* **Certainly not jackal.**

A jackal died from poisoned bait in the winter of 1886 in the Munkács (now Munkacsseve, Ukraine) manor (Anonymous 1897). The author discussed the hunting statistics of the Domenium Munkács-Szent-Miklós, (now Csinagyijevo, Ukraine) and mentioned the specimen as a jackal. *The area is located 25-30 km from the Szernye marsh, a potential habitat of the species. The author explicitly names the species jackal.* **Probably jackal.**

Éhik (1937c) reported, based on a letter by Károly Borovszky, three wolves observed in the 1890's during winter hunting near Lajosmizse (Bács-Kiskun County). The hunters shot two of them, and Borovszky determined these sway-backed specimens as jackals. *The species can not be identified based on this single character.* **Questionable record.**

There was a mounted reed wolf at the Hungarian Royal Forest Ranger and Gamekeeper School (now Bedő Albert



Forest Ranger School) at Királyhalom (Csongrád County). The collection data are missing (we know only that it has been shot between 1890 and 1900), but the specimen was exhibited at the International Hunting Exhibition in Vienna in 1910. Presumably it was shot in Hungary (Rohoska 1932). Nagy (1959) published a photograph of this time-worn and badly mounted animal, at that time in the City Museum in Szeged (Csongrád County). The specimen weighed 22 kg, the length of its head and body was 100 cm, the tail was 32 cm and the height at the shoulder 50 cm. The last three data do not differ significantly from the measurements of a jackal, but the specimen was much heavier. **Certainly not jackal.**

Méhely (1898) reports, that Mojsisovics (1897) studied the skin of a wolf shot in 1890 at Bélye (now Belje, Osijek-Baranja County, Croatia), which he had determined as a reed wolf. Méhely considered it a jackal, with black colour, arranged in lines and spots, caused by atavism. According to Mojsisovics the skin, prepared as a carpet, was yellowish, main colour was reddish-brown with black lines extended from the middle of the back to the sides. External sides of the legs were black also, but the internal part of them are blackish-grey. The tail was all white; ears were reddish-brown with black lines and patches. Between the ears the head was rusty and black with long-shaped spots. Under its eyes there were yellowish-white spots, its face was greyish-black, the shaggy tail-base was reddish-brown, which changed to yellowish-grey with black colour. In the middle of the tail, there was a black spot and the tip of it was black. The side of the belly was greyish-white (Méhely 1898, Éhik 1931). Brehm (1929), Nagy (1942c), és Szunyoghy (1959a) mentioned that the skin

was 118 cm long until the tail-base, and the tail was 44 cm, but the skin was stretched during preparation. Nagy (1942b) in 1942 tried to find this skin at Bélye, which should have been exhibited in the Rét Museum established by Josef Pfennigberger in the former castle of the Count Jenő Savoyai. Pfennigberger knew this area very well, and noted that around 1882 the wolf disappeared from there suddenly. After the occupation by the Serbians, the collection of the Museum was moved to Főherceglak (Kneževo, Republika Srpska, Bosnia and Herzegovina) and Belgrad (Serbia). According to Éhik (1931) this skin was moved to the Museum in Zagreb, but there is no evidence of it. Méhely (1898) and Éhik (1931) determined this specimen as jackal based on the description by Mojsisovics, who named the species *Canis lupus minor*. *The species can not be identified based on the report. Although the skin was stretched during preparation, the tail length exceeds by 50% that of a jackal. The colour fits a jackal and a fox, but also shows some degree of melanism.*

#### **Questionable record.**

One specimen was shot in 1891 at Bélye (now Belje, Osijek-Baranja County, Croatia) property of Archduke Albrecht, which was moved by the taxidermist Eduard Hodek in the Natural History Museum in Vienna and later placed in the Museum in Zagreb. In the same year another specimen was shot near Ruma (Vojvodina, Serbia) (Anonymous 1891, Méhely 1898, Nagy 1942a, 1942b). *The taxonomic knowledge of the scientific staff in the two museums implies a correct identification of the species.* **Certainly jackal.**

Ormóshegyi (1942) mentioned one of his childhood memories from a place called Ormóshegy next to Székelyhíd (now Säcueni, Bihor County, Romania). Around

1892 in a very cold winter an animal was howling at nights in the reeds. Its voice was similar to that of a wolf, but of a higher tone, and frightened all dogs in the area. A postmaster from Koly (now Câmpani, Bihor County, Romania) shot the reed wolf in a field at Csokaly (now Ciociaia, Bihor County, Romania) 4 km from Székelyhíd. Its skull and skin were probably lost. Shepherd dogs were not raised in the area in those days. Ormóshegyi provided the following description: longer than a dog and the size of its skull and molar bone were different from a dog's, and it had reddish-dark brown fur and short tail. Nagy (1942c) remarked that Ormóshegyi heard the jackal at Kiskágya (now Briheni, Bihor County, Romania), without further details. The new locality is confusing, as Briheni lies at about 100 km from Săcueni. *The colour and short tail point to a jackal, but its measurements can not be estimated as the description does not contain remarks on the type of dog the author compared the specimen with, except that it was not a shepherd dog. The high tone howling refers to a jackal. Probably jackal.*

Öttömösi Geréby (1932) mentioned that in 1894 a farmer from Bócsa (Bács-Kiskun County) brought him a reed wolf in a hope of reward. The animal was blackish-grey and not taller than an adult fox. *The data indicate a jackal, but it cannot be positively judged. Questionable record.*

Around 1902, when beating for game in the "Dense Forest" at Csengersima (Szabolcs-Szatmár-Bereg County), a jackal was observed but not shot (Szuhányi 1937). The forest lies 18 km from the Ecsed marshland. Szuhányi (1937) published photographs of light yellow coloured reed wolves which were different from the specimens shot by the fathers of two locals (a 63 and a 70 years old man). *The biotope*

*mentioned was one of the known habitat of jackals, but the description is not. It is not clear if these residents ever saw the animals shot by their fathers. Questionable record.*

Éhik (1937c) referred to a letter of Károly Borovszky, who in 1906 shot a wolf at Rezétpuszta (Bajaszentistván-once separate locality now part of Baja, Bács-Kiskun County) during the belling time. The specimen was found only a few days later. Borovszky determined it as jackal, because of its sway back and weight of 12-15 kg. Gy.T.Gy. (1932) mentioned the same case, but dated it to 1900. Borovszky mentioned that he shot the specimen when he hunted with Baron Vécsey and Count Hardenberg at a big dried lake Northeast of Rezét. The specimen was higher with a handbreadth than a fox, but much smaller than a wolf, and was completely grey. *The size indicates a jackal, the colour is not typical, but based on these few data the report can not be positively judged. Probably jackal.*

In 1907 Holéczy (1942) observed a jackal in Aszófő forest (Veszprém County) Tihany Benedictine Abbey, at sunrise. The jackal suddenly appeared about up 8 feet from Holéczy, but he could not shot it. The animal was higher than a fox, its feet were longer, its colour was greyer and darker. Its head, ears, and posture differed from a fox's. *Holéczy was an experienced old hunter, who could identify the canids, as he even raised a wolf. The size, colour and posture and the longer legs indicate a jackal. Probably jackal.*

A landowner, János Kunhegyesi, shot a jackal in 1912 at a gravel-pit at Temeskutas (now Gudurica, Vršac County, Serbia). The jackal was placed in the Museum at Temesvár (now Timișoara, Romania) (Anonymous 1912). Nagy (1914) could not identify the species, but Dunántúli (1934)

considered it one of the last jackals that inhabited the area south of the Danube. Paszlavszky (1918) considered it an erroneous record; based on the personal communication of the high school teacher, Dr. Tótkés L. Éhik (1931) noted that the staff of the Museum at Temesvár did not know about this specimen. *The species can not be identified based on the report.* **Questionable record.**

Count Gyula Teleki shot a wolf in 1923 somewhere in the willowy reeds of the Danube in Fejér County, which was exhibited in his Castle at Révtér (unknown location). Felsőőri Nagy (1932) saw this animal which did not look like a wolf: it was as tall as a smaller Vizsla, 60-65 cm tall, with standing ears and short tail. Its fur was short and its colour was dusty-yellow with brown lines. It looked like a tame animal. *Its similarity to a Vizsla, its colour and its tail refer to jackal, but the measurements are not well defined.* **Probably jackal.**

Nagy (1942c) reports, based on a letter by József Teleki, a small red wolf poisoned in 1924 at Nyárádszentbenedek (now Murgeshi, Mureş County, Romania). The specimen had short ears, legs and tail, and weighed ca. 27 kg. According to Nagy, it was a jackal-bastard. Teleki additionally mentioned the observation of another small, red wolf, without further data. *The weight of the specimen exceeds that of a jackal.* **Certainly not jackal.**

Eidenpenz (1944) mentioned that ca. 10 years previously a canid was shot around Karád (Somogy County). The skin and skull were lost. In 1944 the author saw jackals in Budapest Zoological and Botanical Garden and he recognised the canid as jackals, but of different colour. *At that time the Zoo kept a female black-backed jackal (Canis mesomelas),*

*thus the difference in the colour is understandable.* **Probably jackal.**

Lajos Muszer shot a jackal in 1937 in the Ecsed marshland close to Tyukod (Szabolcs-Szatmár-Bereg County). The face, mouth, ears, legs and belly resembled a fox, but the fur of its back a shepherd dog. Its tail was short and black pointed, its penis and odour were similar to a fox. Its paws were longish; the fur of its face was dense and it weighed ca. 13 kg (Muszer 1937, Éhik 1937a, 1937c). This 105 cm long animal (body + head) with a 25 cm tail was moved to Hungarian Natural History Museum (Éhik 1937b). The date it was shot (i.e. 1936) (Nagy 1942) is probably erroneous. According to the measurements of its skull which was bigger than the specimens found in Asia Minor, Greece or Dalmatia, Éhik (1937c, 1937-38) determined that this specimen was *C. aureus hungaricus*. Today *hungaricus* is a synonym of *aureus*. *The jackal is still in the Hungarian Natural History Museum in Budapest.* **Certainly jackal.**

Szuhányi (1937) in 1937 observed a small canid near Porcsalma (Szabolcs-Szatmár-Bereg County), which was not a fox, nor a dog. He was unable to shoot it. *The species can not be identified based on the reports.* **Questionable record.**

Nagy (1942a) received the fur and the skull of a jackal shot in 1942 by the gamekeeper Sándor Szőke at Derecse (Hajdu-Bihar County). The gamekeeper observed another individual as well. Its total length was 95 cm, the tail 32 cm, withers 43 cm and the height of its backbone at the hips 45 cm. Nagy (1953) mentioned that the specimen was placed in a Museum, but mistyped the shooting date as 1941 (Szunyoghy 1959a). Torontáli (1942a, 1942b) adopted the case. *The jackal is*

still in the Hungarian Natural History Museum in Budapest. **Certainly jackal.**

Between Beszterce (now Bistrita, Bistrița-Năsăud County, Romania) and Nagydemeter (now Dumitra, Bistrița-Năsăud County, Romania) there is a 682 m high mountain called Burg (unknown location). Okolicsányi (1942) in 1942 observed here two canids (one ran ca. 40 m in front of the bus the author travelled in), which he later determined based on a paper by Nagy as small reddish reed wolves. The specimens were reddish (similar to roe deer, but a bit darker), with thick, long legs and long reddish tail, with black end. The tail was thinner than the fox's or wolf's. The ears were black, the belly light red. Its head was red; the shape of it was similar to that of a shepherd dog. *The thick legs, the long tail and the black ears are not characteristics of a jackal, but the shape of the head, the end of the tail, and the colour might fit to this species.*

**Questionable record.**

Torontáli (1942b) observed two dog-like animals at Székelyhida (now Székelyhid/Săcueni, Bihor County, Romania) in 1942. One of them was shot but got lost. The author could not decide if these were jackals or "reed wolves". Nagy (1942c) considered them jackals, as two weeks before Torontáli's observation, they shot one specimen and observed one at Derecske (Hajdú-Bihar County) (ca. 40-45 km from Székelyhida). *The species can not be identified based on the reports.* **Questionable record.**

Nagy in 1942 received the fur of a male jackal-wolf hybrid shot by Baron Ferenc Daniel at Etéd (now Atid, Harghita County, Romania). The author provided the following characteristics, based on the stretched fur: total length (head and body) 120 cm, tail (wolf like) 45 cm, withers 55-58 cm, height of backbone at the back foot 55-

60 cm, triangle shaped rusty ears of 7.5 cm, with rounded inner side. Its colour characters were: fallow-grey on the back, rusty on the legs and belly, pale and dark lines on the head, similar to one specimen from Derecske and one from Dalmatia. The forehead of the specimen was hoary, whereas those of the other two mentioned above were reddish-fallow hoary, but the colour of the mouth agreed. The author compared the three skins and noticed that the black lines and stripes were similar, but that for the specimen from Etéd fallow-grey colour was dominant, while in those from Derecske and Dalmatia, reddish was prevalent on the back. *The colour fits a jackal's, but the measurements exceed the maximum observed (e.g. tail 50% longer), but the fur was stretched.* **Questionable record.**

Dabolczi Fekete (1942) took part in a deer hunt in September 1942 at Nagybacon (now Bățanii Mari, Covasna County, Romania) and Bükszád (now Sepsibükszád/Bixad, Covasna County, Romania). At about 1000 m a.s.l. in a forest named Nagyromlás, he began to lure a hazelgrouse with a pipe. A wolf-like, but smaller animal arrived to within about 25 feet, but ran away before a shot was fired. The author noted a detailed description of this animal. *Some characters might refer to a jackal, but most of them to a dog or a fox.* **Questionable record.**

Nagy (1942c) received the skull and the fur of a reddish wolf shot in September 1942 in the Görgény Mountains (now Gurghiu Mountains, Transylvania, Romania). It was 102 cm long, the tail was 36 cm, the ears were red and rounded, its colour was pale and clay-yellow on its side and belly, it was black on the back because of long hairs, its legs and shanks were rusty-red, and had a black line on the front legs. Nagy consi-

dered it a juvenile, due to the incomplete teeth, and determined it a wolf-jackal hybrid. *The measurements were most probably provided based on the fur that was most probably stretched. The rounded ears and the black line on the front legs are not characteristic for a jackal, but the colour is. The fur was possibly lengthened, thus it could be a jackal.*

**Questionable record.**

Demeter (1984) mentioned that a jackal was observed next to Lake-Fertő in 1949 by Schenk. He had referred to a 1950 paper by Schenk, but did not list it among the references. We could not identify this work.

**Probably jackal.**

Nagy (1953) reported the shot of a blackish, short tailed fox at Füzesgyarmat (Békés County) in the 1950s. Demeter (1984) mentioned this jackal, but reported on two kills instead of one. *The characters fit a jackal's but the information does not allow a correct identification.*

**Questionable record.**

Demeter & Palotás (1992) referred to a personal communication by Béla Rakiczky, about the shooting of a jackal at Hőgyész (Tolna County) in 1952. *The information does not allow a correct identification.*

**Questionable record.**

In 1936 a reed wolf of 36 kg was shot at Nagykőrös (Pest County) (Katona 1963). *Its weight highly exceeds that of a jackal.*

**Certainly not jackal.**

The gamekeeper at Dunakömlőd (Paks, Tolna County), Lajos Sáfrány, shot a jackal in 1981. The specimen was placed in the Hungarian Natural History Museum in Budapest (Anonymous 1985, Demeter 1984, 1985, Rakonczay 1990). *This specimen is still preserved in the collection, but its collection locality is noted as Kajdacs (locality in the same County, 25 km from Dunakömlőd).*

**Certainly jackal.**

Sándor Kocsis in 1983 shot a jackal at Gyarmatpuszta, next to Gyermely (Komárom-Esztergom County), which was identified by András Demeter in the Hungarian Natural History Museum in Budapest. Its skull is preserved in the Museum (Homonnay 1983, Demeter 1984, 1985, Rakonczay 1990). Homonnay (1983) mentioned that some skull characters exceeded by 10% those of other jackals in the Museum. He erroneously reported the specimen as the first jackal shot in Hungary after 41 years. Homonnay excluded the possibility of a dog-jackal hybrid, justifying the statement by the absence of jackal both in nature and Hungarian zoos. *This specimen is still preserved in the collection.*

**Certainly jackal.**

Gábor Kovács in 1984 observed an individual on the Kunmadaras-puszta between the localities Nagyiván and Kunmadaras (Jász-Nagykun-Szolnok County) (Demeter & Palotás 1992). *The taxonomic knowledge of the authors implies a correct identification.*

**Certainly jackal.**

András Demeter shot a jackal in 1988 at Csapod (Győr-Moson-Sopron County), and mailed a photograph to Sándor Faragó, who confirmed the identification (Demeter & Palotás 1992). *The taxonomic knowledge of the authors implies a correct identification.*

**Certainly jackal.**

Csaba Aradi observed one *C. aureus* in 1990 in the region of Nagycsere (Hajdú-Bihar County) (Demeter & Palotás 1992). *The taxonomic knowledge of the authors implies a correct identification.*

**Certainly jackal.**

An individual was shot in 1991 at Regöly (Tolna County) (Demeter & Palotás 1992, Szűcs & Heltai 2002). *The specimen is in the collection of the Hungarian Natural History Museum.*

**Certainly jackal.**

One specimen was shot in 1992 at Egyek (Hajdú-Bihar County), which was determined at the Department of Nature Conservation, Zoology and Game Management of the University of Debrecen, Faculty of Agricultural Sciences (Demeter & Palotás 1992, Szűcs & Heltai 2002). *The taxonomic knowledge of the authors implies a correct identification. Certainly jackal.*

Demeter & Palotás (1992) recorded a *C. aureus* pair in 1992 near Debrecen (Hajdú-Bihar County). According Szűcs & Heltai (2002) only one individual was observed. *The taxonomic knowledge of the authors implies a correct identification. Certainly jackal.*

Tibor Gellai shot a jackal in 1992 near Kétújfalu (Baranya County) (Cseri 2001). *The species is resident in the area, thus we deem the identification correct. Certainly jackal.*

An adult specimen was shot in 1992 at Gyulaj (Tolna County) (Fehér 1992). *The publication contained a photograph as well. Certainly jackal.*

Szűcs & Heltai (2002) referred to Kászoni (1998), who mentioned a specimen observed in 1993 around Lábod (Somogy County). *The taxonomic knowledge of the authors implies a correct identification. Certainly jackal.*

One individual was shot in the area of Körcsönyepuszta (Baranya County), part of the Selye Forestry in 1994 (Agyaki 2000). *The jackal is a resident species in that area, thus the hunters can identify the species correctly. Certainly jackal.*

We have to mention that the list of records from the 1990s can to be considered complete, but the increasing number of observations and voucher specimens prove the resettlement of the species in Hungary. This is proved by two main facts: i) since 1995 the jackal was included in the Hungarian Game Management Database

(Csányi 1999), and ii) Heltai et al. (2004) have identified 32 jackals between 1993 and 2003.

## Discussion

We managed to collect 57 observations from the period surveyed, and classified them as follows: seven reports that mentioned canids but certainly not a jackal; 26 questionable cases, where the taxon could not be identified based on the published information; eight observations that probably related a jackal, and 16 records that certainly related jackals.

Some reports come from the historical Hungary as follows: one jackal recorded between 1800 and 1920 in Serbia, one-one report probably denoting a jackal in the same period from Romania and Ukraine, one, each questionable record from the 1800-1920 period from Croatia and Serbia, and five questionable reports between 1920 and 1945 from Romania (Table 2).

Hungarian records were grouped in three main groups according to their geographical origin, records from the area between the Rivers Danube and Tisza, records from the Tiszántúl region and records from the Dunántúl region. Tiszántúl region refers to the flat areas, parts of the Great Hungarian Plain, east of the Tisza River and the eastern borders of Hungary. Dunántúl region or Transdanubia, is a traditional region of Hungary, bordered in the north and east by the Danube, in south by the Sava and the Mura rivers, and extending to the foothills of the Alps, roughly along the Hungarian-Austrian border in the west.

Until the 1920s, the jackal was observed in Hungary only along major rivers and

between the Danube and Tisza. The north-eastern observations came from different habitats, like prairies in Hortobágy, the sub-Carpathian area, the surroundings of the Szernye marshland or the Ecsed marshland. In the 1920-1945 period certain and questionable records are almost missing (Table 2). In the last 50 years surveyed, the species has returned to Hungary (12 certain and 1 probable record are dated from this period). Presumably the species used the major river valleys, as several reports (e. g. Danube, Drava, Sava) came from along rivers. We

presume that the distribution range of the jackal was more extended in Hungary in the last decades, than supposed. Several records remained unpublished as both among hunters and zoologists there were harsh disputes on the classification of the "reed wolf," having placed it either as a plains ecotype or a subspecies of the wolf, a jackal or a stray dog. Due to the lack of knowledge of the presence of the golden jackal in Hungary, presumably most of the shot specimens were considered dog hybrids and left in the field, and later the hunters

**Table 2.** Summary of the reports of jackals between 1800-1995.

	Certainly jackal			Sum
	1800-1920	1920-1945	1945-1995	
Between the Danube and Tisza	1	-	-	1
Tiszántúl	-	2	4	6
Dunántúl	-	-	8	8
Romania	-	-	-	0
Croatia and Serbia	1	-	-	1
Ukraine	-	-	-	0
	Probably jackal			Sum
	1800-1920	1920-1945	1945-1995	
Between the Danube and Tisza	1	-	-	1
Tiszántúl	-	-	-	0
Dunántúl	2	2	1	5
Romania	1	-	-	1
Croatia and Serbia	-	-	-	0
Ukraine	1	-	-	1
	Questionable record			Sum
	1800-1920	1920-1945	1945-1995	
Between the Danube and Tisza	6	-	-	6
Tiszántúl	7	1	1	9
Dunántúl	3	-	1	4
Romania	-	5	-	5
Croatia and Serbia	2	-	-	2
Ukraine	-	-	-	0

did not boast about the shooting of the animal, as they do not vaunt with the killing of a stray dog nowadays either.

Since the 1980s the population of this invasive indigenous carnivore has been constantly increasing (Heltai et al. 2004, Szabó et al. 2009). Each Hungarian hunting association has to estimate the population size of each species that inhabits the area they are using, and these data are summed in the Hungarian Game Management Database. Population size for the golden jackal has been estimated since 2004. According the database in 2004 the whole Hungarian population would have consisted of 658 specimens, and this has more than doubled (i.e. 1510 specimens estimated in 2007) since (Csányi 1999, 2000, 2001, 2002, 2003, 2004; Csányi et al. 2005, 2006, 2007) (Table 3).

**Table 3.** Hunting bag and estimated population size of *C. aureus* in Hungary between 1995 and 2006. (na=not available)

Year	Hunting bag	Estimated population size
1995	6	na
1996	10	na
1997	11	na
1998	22	na
1999	38	na
2000	59	na
2001	70	na
2002	80	na
2003	85	na
2004	95	658
2005	140	926
2006	163	1164
2007	Na	1510

We presume that this peculiar distribution pattern is correlated with the

geographical and historical changes that took part in the country in the last few decades. The floodplain of the Danube, the Tisza and other smaller rivers running across the Great Hungarian Plain (Alföld) provided excellent habitats for this carnivore.

Presumably the period of the Turkish occupancy in the 16<sup>th</sup>-17<sup>th</sup> century was beneficial for the jackal, when huge areas in the country became unsettled, and fields were not used for agricultural purposes. During the occupancy, hardly any settlements remained, for example, after the Tatar's incursion in 1597 only three inhabited settlements remained in Pest county: Cegléd, Kecskemét, and Nagykörös (Gergely et al. 1988). The number of inhabitants did not increase in the country, but significantly decreased due to the continuous fights and connected diseases (e.g. Typhus in the 1500s known as *Morbus Hungaricus*). Wellmann (1988) reported that in the 1710s, the population of Hungary did not reach 4 million, which was less than 200 years before. After the end of wars and intensive settling of the lowlands begun, in 1790 the population reached 10 million (Wellmann, 1988) and in 1840 almost 13 million inhabitants (Katus 1988). It should be mentioned that the 1831-1832 cholera outbreak claimed 237,641 lives in Hungary (Hóman & Szekfű 1936). The regulation of the big Hungarian rivers began in the 1830s with the Lower Danube, followed by the regulation of the Tisza in the 1840s, and accompanied by the drainage of the extended marshlands, the main habitats of the jackal. The Ecsed marshland (ca. 400 km<sup>2</sup>) was drained at the turn of the 19<sup>th</sup>-20<sup>th</sup> century, the draining of the Szernye marshland (100-120 km<sup>2</sup>) begun in the



middle of the 19<sup>th</sup> century and still continuous; the marshlands of the Hanság were drained starting from the second World War. It was presumed that the regulation of the river Tisza connected to it the vanishing of the huge reed-lands has caused the disappearance of the species from Hungary (A Szerkesztőség 1883).

An alternative hypothesis about the distribution of the species is connected to the wars. Becker (1908) stated, based on the fact that the jackal and wolf have similar lifestyles and migratory habits, that the migration of the jackal might be facilitated by the wars, as the specimens follow the legions, and feed on the dead. Examples of this type of range expansion came about in wolves from 1814 in Germany and ca. 200 years previously, when the same species migrated from Russia to Sweden and Norway, where it had not been recorded previously (Becker 1908).

Hungary was the scene of persistent wars between 1526 and 1711, especially because of the Turkish campaigns. Turks left only garrisons in the castles for the winter, and the legions marched against the country each spring. These legions might have been followed by the jackals from the Balkans, and the species, after it has found suitable habitats, could have settled in Hungary.

The present expansion of the jackal's distribution range has been attributed, besides other factors, by several authors (Anonymous 1994, Cseri 2001, Szűcs & Heltai 2002, Heltai & Szűcs 2002, Rácz 2003) to the Balkan wars as well.

Therefore, in Hungary due to the strained political relations, the big landscape changes took part later than in the rest of Europe, which contributed to maintaining suitable conditions for the

jackal. The last remnant suitable habitats disappeared after the Second World War with the establishment of the large-scale farming system, and correlated to this decrease, the jackal disappeared for a while from the Hungarian fauna.

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