

# **The domestic livestock resources of Turkey: national horse history, breed descriptions and conservation status**

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## **Abstract**

The horse was first domesticated in Central Asia by Turcic peoples. Horses have been important to the Turks and Turkey for more than 5000 years. First used as food they were then used in war as cavalry and draught animals, then in agriculture and for transport and now largely for leisure and sport. The national horse population was about 1.3 million having built up to this number from an earlier population that had been reduced by wars in the nineteenth and early part of the twentieth centuries. By 2009 there were about 180 000 horses in the country. Concomitant to the reduction in numbers was a narrowing of the gene pool and even the total loss of some breeds or distinct populations. Native breeds had evolved to meet various conditions including not only environmental but also social and economic ones and concurrent changes in these facets of production were in large part responsible for the changes in horse numbers and genetic resources. Since the founding of the Turkish Republic (following the fall of the Ottoman Empire) in 1923 there has been much modification of the natural gene pool driven largely by public institutions in response to new challenges. At least nine breeds of various production functions have been imported and crossed with indigenous resources. In 2012 it has been possible to identify 24 functional breeds in Turkey whose description is the main thrust of this paper. In response to the threat of extinction and to the impoverishment or loss of this important aspect of biodiversity Government has established programmes for conservation and preservation of five native breeds. Government, research institutions and producers should work together to ensure that the local gene pool is preserved and can thus continue to contribute to biodiversity and sustainable livestock production.

*Keywords: domestication, indigenous animals, characterization, crossbreeding, risk status*

## **Introduction**

Domestication of the horse is as important in human history as the domestication of fire or the invention of the wheel. The Central Asian steppes, the original home of those who are now the Turkish people, are a probable centre of origin of the domestic horse about 5000 years ago (Turkmen, 1996; Wilson, 1999). There are, of course, conflicting views on the place, time and manner of domestication (Koppers, 1941; Clutton-Brock, 1992; Bennett & Hoffman, 1999; Levine, 2005).

Some 400 horse breeds are known worldwide (Hendricks, 1995). Turkey contributes to this genetic diversity in its own repository of *Equus caballus* (Said, 1940; Yarkin, 1962) although authors do not agree on the number of “breeds” in the country. An authoritative source lists 14 breeds, including varieties of the major types (Mason, 1996). A global data base lists 16 breeds, including those considered extinct and others that are clearly not Turkish, but in all but one or two cases only the name of the breed is provided

(FAO/DADIS, 2011). The current paper does not pretend to be a complete inventory of the functional horse breeds<sup>1</sup> of Turkey but it is nonetheless a comprehensive compendium of them. It provides information on the history of horses in Turkey and on numbers over time before listing the nine known breeds imported to the country since the founding of the Turkish Republic in 1923 and describing 24 indigenous or near-indigenous breeds, types or distinct populations, their status and the conservation measures in place. It is one of a series of papers (Wilson et al., 2011; Yilmaz et al., 2011a; 2011b; 2012a; 2012b; 2012c) that will eventually cover most of the nation's domestic animal species.

## Results

### History of the horse in Turkey

Horse bones were rare in the Neolithic of western Turkey although they have been identified as a very minor constituent of all bones in the central Turkey Neolithic. From these small beginnings horses assumed increasing importance. They were first used as food in the form of meat and then as milk (in the form of soured and slightly fermented 'kimiz', better known internationally as the Mongolian 'koumis' but nonetheless a Turkish invention). Later, horses were used in warfare for transport and cavalry (and for making barbed arrow heads from their bones), for riding and in agricultural operations. The 'kopuz' is a Turkish 3- or 5-stringed instrument akin to the lute whose strings are of horse gut or horse hair. Horsehide is a prized product and has a wide range of uses. The long history of the horse's contribution to agriculture is undisputed and needs no emphasis. The horse has thus for many centuries had a major role in the household and national economies of the country.

Horses were used in warfare in what is modern Turkey at least as early as the Sixth Century BC (that is, two thousand six hundred years ago). Both the Achaemenid king Cyrus the Great (559-530) and Croesus of Lydia used horse cavalry in a battle fought in western Turkey in what is now its Aegean Region in about 547 BC. In winning this battle Cyrus employed what was to become one of the most famous stratagems of Antiquity when he unloaded the burdens of all the baggage camels in his train and set cavalry men upon them. Thus furnished Cyrus ordered his unorthodox cavalry to the van of his armies to attack the horsemen of Croesus. He did this because horses are afraid of camels and can not endure to see or smell them (Herodotus of Halicarnassus, *Histories* 1.80). According to Chinese sources, Turks had horses of eleven different colours during the period of the Gokturk Empire. Horses were traded with the Chinese for silk at this period (Turkmen, 1996).

The horse game 'cirit' (also known as jereed, with various spellings) came to Anatolia with the Turks as they migrated from Central Asia in the eleventh century. It became accepted as a war game by the Ottoman Turks in the sixteenth century and was played to improve the attack and defence skills of the cavalry during peacetime and to enthuse the troops for battle during wartime. Some Ottoman sultans including Bayezid I (1389–1402) and Mehmed I (1413–1421) themselves played the game and considered it important in the training of their armies. A superior class of cavalrymen known as "cündi" was formed from skilled cirit players. It gained its highest popularity in the nineteenth century as a show sport and game in all Ottoman ruled territories. Not so widespread as previously the game is still enjoyed by players (Figure 1) and spectators alike in all weathers (Figure 2) primarily in the east (Artvin, Bayburt, Kars, Erzincan and Erzurum provinces), southeast (Diyabakir and Siirt provinces), west (Balikesir, Bilecik and Usak) and in Konya in southcentral Anatolia. Some 50 clubs in nine provinces continue to organize tournaments (Sansal, 2011).

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<sup>1</sup> "Functional breed" = genetic resource (recognized group) + environment (climate and vegetation) + human influence (management and selective breeding)



*Figure 1. The action in a game of cirit in Erzurum Province (Photo: E. Gulec).*



*Figure 2. Cirit is enjoyed by players and spectators alike in all weathers (Photo: O. Yilmaz).*



The Turkish people became islamized during the eleventh century from which time, as Islam has a positive attitude to horses, the animal became culturally important and was a major element in the Turkish view of world domination. Camels had been dominant in the Arabian Peninsula up to that time with the horse occupying a very minor position (Batu, 1962). The Arab traveller and diplomat Ahmad ibn Fadlan, for example, had reported meeting some Turks who had 10 000 horses and 100 000 sheep (Batu, 1962). In the sixteenth century the Ottoman army had as many as 166 000 cavalry horses (Ozbeyaz et al., 2006).

The apogee of Turkish horse breeding undoubtedly came at the very end of the seventeenth century and the beginning of the eighteenth. These were the glory years of the Ottoman Empire and its horses had qualities of endurance, strength and speed. For these reasons three Turkish (or areas in which the Turks had sovereignty) stallions were foremost in the development of the English Thoroughbred. These were the Byerley Turk from Buda in Hungary which was imported into England in 1688 by Captain Robert Byerley of the Sixth Dragoon Guards after he had captured it from a Turkish Officer, the Darley Arabian bought by Thomas Darley in Aleppo in 1706 – DNA evidence shows that 95 per cent of all modern thoroughbreds carry his blood! (Pickrell, 2005) -- and the Godolphin Arabian imported, it is said, from Tunisia in 1730 by Edward Coke of Longford Hall, Derbyshire but named after his most famous owner Francis Godolphin, 2nd Earl of Godolphin.

Horses were heavily involved in international warfare in the modern Turkish homeland during much of the nineteenth and twentieth centuries. In the nineteenth century these included the Russo-Turkish Crimea Wars (1850-1856) in which the French and English fought on the Turkish side and in which perhaps the most famous of all cavalry actions – the Charge of the Light Brigade – took place and the Russo-Turkish Caucasian War (1877-1878). In the twentieth century horses – notably of the Australia and New Zealand Light Horse Brigade -- were used at Gallipoli where “English” and French forces were overwhelmingly defeated by Turkish forces during World War I (1914-1918) and World War II (1939-1945).

A fundamental change in the status of horses in Turkey occurred in the early years of the twentieth century. Until that time horses had been primarily and indeed almost solely as engines of war and work (Emiroglu & Yuksel, 2009). The Ottoman Jockey Club was set up in 1909 (Yener et al., 2006). An Equestrian and Field Exercise School was established in 1911 which, although still largely military, was also open to civilians. In 1923 the Turkish Equestrian Foundation (TEF) was founded which had a much broader remit. TEF became a member of the Fédération Equestre Internationale (FEI), the first horse races were held in Istanbul in 1933 and in 1936 Turkey participated in the Berlin Olympic Games. In 2011 TEF had 1300 registered riders in 40 federated clubs and hosts such activities as show jumping, dressage, three-day events, pony club and endurance competitions.

### **Changes in numbers of the horse population**

It is not possible to say with any certainty how many horses there were in Turkey before the beginning of the twentieth century. If, however, as has been postulated the Ottoman army could put as many as 166 000 cavalry horses – said to average 152 cm (15 hands) at the withers – in the field in the sixteenth century (Ozbeyaz et al., 2006), numbers must have been considerable. Cavalry horses would need a considerable pyramid of breeding and rearing establishments behind them and in addition there were certainly very many horses involved in civilian transport and agricultural operations. The two major Turkish wars of the mid and late nineteenth century were responsible for huge losses of horses. Following the 1877-1878 war with Russia three studs were set up to breed horses for the cavalry but these failed and were closed in 1908. Further attempts were made in 1909-1913 to produce remounts and 12 farms were set up. Other attempts to increase the numbers (and quality) of horses were made in the early years of the Republic with a state establishment at Karacabey in 1924 and numerous other state and provincial farms operating through into the 1980s (Yener et al., 2006).



Turkey had a population of more than 160 thousand horses (alongside a somewhat larger population of donkeys and about 50 thousand mules) in 2009 which was little more than 10 per cent of the peak population of 1.3 million in the national herd in 1960. This peak was achieved from a total of just under half a million in 1928 which in itself was considerably down on the number of horses at the outbreak of World War I. After 1928 numbers built up in a rather erratic manner to a peak in 1960 followed by a steady decline to 2009 (Figure 3).

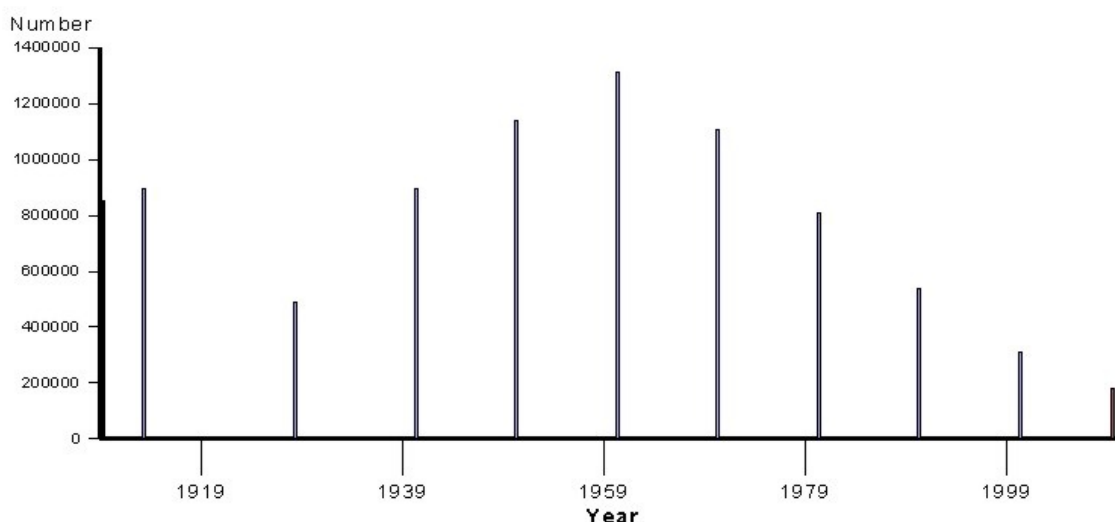


Figure 3. Changes in horse numbers in Turkey, 1909-2009.

One of the principal reasons for the decline in horse numbers is the mechanization, especially during the 1950s and increasingly in the 1960s and 1970s, of agriculture and rural and urban transport (although horse as well as donkeys and mules are still important in these roles in some areas of the country). A further major blow to the horse population was delivered in 1959 with the rapid mechanization of many army units at the expense of the still extensive cavalry.

### Functional breeds

It is no surprise, in view of the history of horses in Turkey, the size of the country and the exchanges that have taken place with its neighbours over a long period that a wide range of equine genetic resources is found. Breeds have not been fully characterized and, with the exception of Arab and Thoroughbred, no societies establish or ensure the purity of the various populations (Bayram et al., 2005; Alarslan, 2009). Registration of Arabs and Thoroughbreds is done by their societies but registrations (if indeed there are any) of other breeds are done by a single unity in the Ministry of Agriculture (Yener et al., 2006). It is perhaps due to this structure that some resources have already become extinct, others are on the road to extinction and in general that there is little definite or adequate data about several others (Yılmaz & Ertugrul, 2011).

Domestic animals are notorious for (apparently) believing that the grass is always greener on the other side of the fence. In a somewhat analogous approach Turkish authorities and breeders have often adopted a similar philosophy and in their pursuit of horses for courses have looked over the fence in order to import in various quantities and at various times a various assemblage of heavy, light, cold blood and warm blood horse types. Concomitant to imports various horse farms and studs have been established (and not a few times disestablished) or existing government properties converted to such use. The Haflinger from South Tyrol (Austria and Italy) and the Nonius from Hungary were imported as light draught horses, the Percheron from France as a heavy draught, the Hanoverian from Germany as a sport horse, the Orlov trotter from

Russia for harness racing, the Anglo-Norman from northwest France as a general purpose animal and Arabs and – in a perhaps ironical twist – Thoroughbreds from England (Yener et al., 2006). Some of these types were used for the original purpose of importation, some hardly at all and several had little more than an ephemeral existence. More recently Mustangs have been imported from the USA by a private individual. A fuller synoptic history of state breeding farms and the multiple attempts at genetic modification of Turkish horses is provided elsewhere (Yener et al., 2006). The remainder of this section provides information on many of the identified populations of horses in Turkey.

*Anatolian Native (Turkish = Anadolu Yerli)*

The Anatolian Native is the most widespread of all Turkish horses and is found over the whole of Anatolia. (Anatolia/Anadolu is the larger part of Turkey on the Asian side of the Bosphorus whereas Thrace/Trakia is the eastern and much smaller part on the European side of the strait.) The Anatolian Native (Figure 4), as many other “breeds”, has developed through millennia of admixtures of blood of various horses. Turkey has always been a bridge between western and eastern civilizations and invaders and incomers have usually travelled with their own domestic stock. A partial family tree of the Anatolian thus includes blood from Akhal-Teke (Turkmenistan), Deliboz (Azerbaijan), Kabarda (Northern Caucasus/Georgia), Karabakh (Southern Caucasus/Azerbaijan), Mongolian, Persian, Turkoman and Arab as well as the truly indigenous ancient Anatolian horse. This type is noted for its ability to survive in extremely harsh climatic conditions and under poor management, its resistance to disease and its tolerance of hunger and thirst (Duzgunes, 1946; Hendricks, 1995; Emiroglu & Yuksel, 2009). Better classified as a pony as it has a withers height of only 123-135 cm (12.0-13.1 hands) this small equine has a small head with a convex or concave profile, small mouth, wide nostrils, narrow chest and sloping croup. The colour is very variable. The Anatolian Native is a riding and pack type (Mason, 1996), strong and fast and noted for its stamina.



Figure 4. A grey-coloured East Anatolian in Ilica County, Erzurum Province (Photo: O. Yilmaz).

### *Araba*

There appears to be only once reference to this type (Mason, 1996) which is said to be a variety of the Anatolian Native that is especially adapted to pulling carriages (araba = carriage).

### *Canik*

Said to be a northeastern variety of the Anatolian Native by one authority (Mason, 1996) another one has it as an ancient stock that was bred pure until about 200 years ago when “the blood of cavalry animals was added” (Equinest, 2011). The home tract of the type is northcentral Anatolia close to the Black Sea mainly in Amasya, Ordu, Samsun and Tokat provinces in the Canik Mountains after which it is named. It is a very sure footed horse well adapted to the hilly and mountainous areas that are its home. Standing 135-145 cm (13.1-14.1 hands) at the withers the animal has a medium sized head set on a short neck, a straight profile and wide set eyes. The croup is rather sloped (Figure 5), the legs and upright pasterns are strong and set on hard and strong hooves and the cannon bone circumference is 17-18 cm (Yarkin 1962). The colour is variable but bays are common. This is a classic riding horse, energetic, speedy and alert although it can be nervous of temperament and possibly difficult to manage (Duzgunes, 1946; Yarkin, 1962; Sonmez, 1975; Hendricks, 1995; Emiroglu & Yuksel, 2009).



*Figure 5. A bay Canik in Ordu Province (Photo: E. Guleck).*

### *Cirit*

Cirit (jeered) is an ancient Turkish game played on horseback (cirit is Turkish for a javelin, the game originally being played with this weapon although now it is played with sticks). There is considerable



discussion whether there is a breed or race of Turkish called Cirit or whether this appellation is a generic term for any horse that is used in the game of cirit (Figure 6). Common types of cirit horse include those that are crosses of the Anatolian Native with Turkish Arab race horses with or without further crosses to the East Anatolian. Karabair horses from Uzbekistan and Tajikistan crossed with Arabs are also considered to be Cirit horses (Hendricks, 1995; Mason, 1996; Gulec, 1998a; Emiroglu & Yuksel, 2009).



*Figure 6. Cirit horse showing Arabian blood introduced for fast start and speed (Photo: O. Yilmaz).*

#### *Coloured (Alaca)*

Recent studies of mainly piebald and skewbald horses were undertaken in northeastern Turkey with a view to establishing whether “coloured” horses (Figure 7) constituted a population distinct from other Turkish horses (Yilmaz & Ertugrul, 2011). The concept is based on the fact that coloured horses in the USA – the American Paint Horse and the Pinto – are admitted as distinct breeds and that the female ascendance of Turkish coloureds is American. The conclusions of the study were that morphologically coloured horses were generally smaller than other Turkish types and behaviourally were more placid. It was recommended that DNA tests should be undertaken in order to identify any differences from the general population.





*Figure 7. Coloured (skewbald) mare in Kars Province by the Armenian border (Photo: O. Yilmaz).*

#### *Cukurova*

Cukurova was one of the first horse breeding stations to be established in Ottoman times in 1894. It is from this location that the Cukurova breed takes its name. A large type Cukurova with a withers height of 150-154 cm (14 hands 3-15 hands) was developed but died out after World War I. The present Cukurova has been developed since 1935 and is a mixture of Turkish Arab, Anatolian Native and Uzunyayla (Mason, 1996). The breed is found mainly in southcentral Turkey in Adana and Osmaniye Provinces in the low-lying Cukurova Plains. With an average withers height of 137 cm (13 hands 2) the Cukurova is slightly larger than the Anatolian Native. The long head has a slight Roman nose, ears that are set high, are long and upright. The long neck emerges from a narrow chest, the abdomen is rounded and the croup long and slightly sloping with the dock set prominently on it (Figure 8). This light, fast and spirited horse is used as both a riding and harness animal (Said, 1940; Yarkin, 1962; Hendricks, 1995; Mason, 1996; Emiroglu & Yuksel, 2009).



*Figure 8. A grey Cukurova at the station that bears its name (Photo: E. Gulec).*

#### *East Anatolian (Dogu Anadolu)*

Also known as the Kurdi (because of its association with the Kurdish people in eastern Turkey, Iraq and Syria) the East Anatolian is limited to the mountainous areas of eastern Turkey. This light horse or pony standing 132-142 cm (13-14 hands) at the withers (Figure 9) may have had infusions of Turkish Arab and Persian blood (Aral, 1974). It is considered in Turkey as a spirited and beautiful animal with good bone, strong and sturdy and with excellent qualities of endurance. It is used as both a riding and pack horse (Hendricks, 1995; Gulec, 2006; Emiroglu & Yuksel, 2009). The animal is rare as there is more interest in its home area in breeding Turkish Arabs (Hendricks, 1995).

#### *Gemlik*

Developed as a competition (jumping) horse at the Gemlik Military Veterinary School and Education Centre (in the Marmara region) the Gemlik horse breed was registered by Turkish Standards Institute in 2002 but has yet to be approved by the Ministry of Food, Agriculture and Livestock. The foundation stock from 1941 were Hungarian Nonius, Karacabey and Turkish Arab with Karacabey and Karacabey Nonius blood being added in 1962. Following careful selection during the 1970s the Gemlik horse was born. The selection and breeding programme continues using horses that have won in competitive events (Emiroglu & Yuksel, 2009).





*Figure 9. A brown East Anatolian type with white hind pasterns (Photo: O. Yilmaz).*

#### *Hinis (Hinin Kolukisasi)*

In the Turkish vernacular *Hinin Kolukisasi* means the horse with short front legs. The origin of this horse is attributed in one source as a variety of the Anatolian Native (Mason, 1996). A more widespread view is that it was developed towards the end of the nineteenth century from crosses of Arabs brought to Turkey by the Muavin Tribe of Iraq on the Anatolian Native (Hendricks, 1995). Named after the town of *Hinis* in Erzurum Province the type is essentially confined to that area of northeastern Anatolia bordering on the Caucasus. The horse stands about 135-138 cm (13 hands 1-13 hands 2) at the withers. The head shows Arab characteristics with a wide forehead, wide-set eyes and small upright ears set on top. The short thick neck leads into a very deep and wide chest which results in part in the apparently short forelegs (Figure 10) from which the horse gets its name. The tail is thick and set high on the rump. The breed has exceptionally good bone and the hooves are hard and black. All usual horse colours are found but bays are most common. It is a very agile and fast horse, highly manoeuvrable and with good qualities of endurance and powers of recovery after short rests and these are the traits sought after by breeders (Gulec, 2002; Emiroglu & Yuksel 2009). This light horse was once used regularly in *cirit* games but has been replaced by horses with higher percentages of Arab blood.

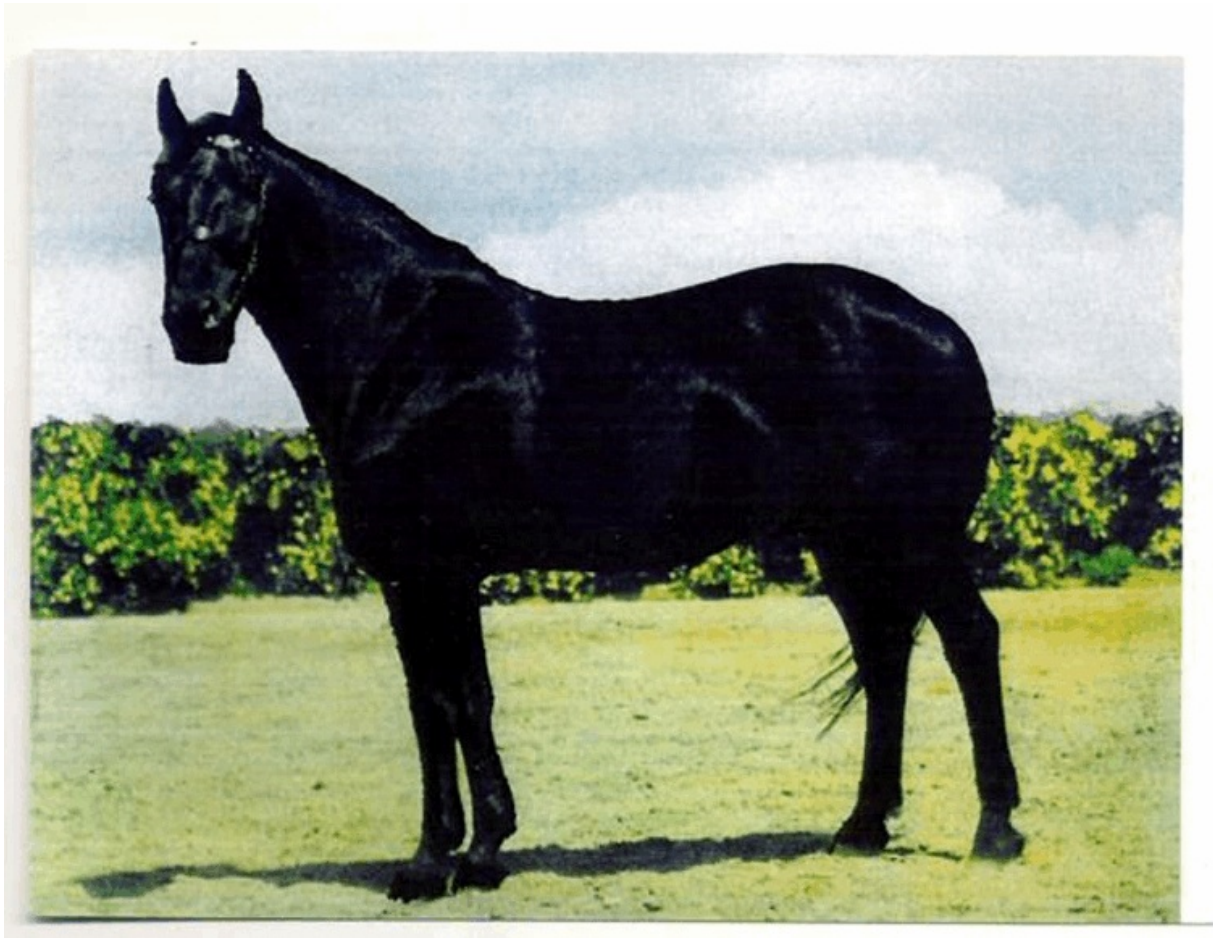




*Figure 10. White Hinis (Hinisin Kolukisasi) horse formerly used in cirit game (Photo: O.Yilmaz).*

#### *Karacabey and Karacabey Nonius*

The Karacabey Stud was opened in 1924 and was the first such establishment of the new Republic of Turkey. It very quickly imported Nonius from Hungary, Haflinger from Austria and Thoroughbreds from Great Britain mainly for crossing on local horses. The first output of the Karacabey Stud, however, was the Karacabey breed which was developed by crossing the Turkish Arab with the Anatolian Native (Hendricks, 1995). This breed has also been known as the Karacabey Half-bred Arab (Mason, 1996). A sizeable horse standing 155-165 cm (15 hands 1-16 hands 1) at the withers and similar to the Arab but with more mass and with good conformation it was bred specifically for racing and jumping. It appeared in a range of colours including chestnut, grey, bay, black and roan. One specimen was presented by the Turkish authorities to Queen Elizabeth II and became a renowned polo pony. As jump sports became more popular in Turkey horses were imported from France and Germany, the Karacabey was neglected for the exotic breeds, and became extinct in 1979 (Hendricks 1995). Another product of Karacabey stud was the Karacabey Nonius (Figure 11) which was developed from the Karacabey after further back crosses to the Anatolian Native and the Nonius (Mason, 1996). This was a slightly larger animal than the Karacabey bred as a jumper – capable of taking fences of 1.5 metres – and harness horse. It had an even shorter life than its predecessor and became extinct in 1970. The Karacabey Stud was closed in 1980 and more than 3000 horses were sold on to the local market eventually to become subsumed into the mass of country horses.



*Figure 11. Karakabey Nonius on its home station in the 1940s (Photo: E. Gulec).*

#### *Karakachan (Karakacan)*

The Karakachan was developed from crosses of Thrace (Trakya) horses with horses brought to Turkey from the vassal countries of the Ottoman Empire including Bosnia, Bulgaria, Hungary and Romania that already had blood of French and Hungarian draught (coldblood) horses (Mason, 1996). At a withers height of 144-155 cm (14 hands 1-15 hands 1) this medium sized horse has a heavy head with a slightly convex profile and large widely spaced expressive eyes. The neck is medium length and well muscled, shoulders sloped, withers well pronounced, back short and strong and croup gently sloped. The legs have good bone with strong joints and hard hooves. Almost all Karakachans are bay. They are very strong and active light draught horses (Figure 12) (Hendricks, 1995). Once numerous in Thrace purebred animals are now rare.

#### *Kula of Camardi (Camardi Kulasi)*

The native name Camardi Kulasi translates as the red roan of Camardi. This almost certainly extinct breed occupied a limited geographical range around Camardi in Nigde Province of southcentral Anatolia in the foothills of the Taurus Mountains. The breed resembled the Akhal-Teke of Turkmenistan but with a withers height of 125-130 cm (12 hands 1-12 hands 3) was shorter and stockier and more heavily boned with short pastern and black hooves. The main colour was light to dark dun (buckskin) (Gulec, 2007a) but in this horse some of the darker points that are usually associated with this colour are absent (Figure 13).





*Figure 12. Karakachan in cart harness in Trakya (Thrace) Region (Photo: E. Gulec).*



*Figure 13. Kula of Camardi in its home county in Higde Province (Photo: E. Gulec).*

*Kurutlu Kaytali of Kirsehir (Kirsehir Kurutlu Kaytalisi)*

This local breed (Figure 14), used as a riding and pack animal, is confined mainly to Kirsehir province in central Anatolia. It has been outbred to the Anatolian Native and may indeed be extinct in the pure form (Gulec, 2005a).



*Figure 14. Kurutlu Kaytali of Kirsehir now believed to be extinct (Photo: E.Gulec).*

*Malakan*

Also known as the Ardahan, the Malakan is the only heavy horse breed in Turkey. Originally bred towards the end of the nineteenth century from horses with Ardennes, Bicuk, Clydesdale, Danish, Orlov, Percheron, and Shire blood brought by Turks to the eastern provinces from the Caucasus (Mason, 1996). These horses were then crossed with local East Anatolian types (with some later additions of further Ardennes blood) to produce the Malakan. The type is found mainly in Ardahan, Artvin and Kars Provinces in northeastern Turkey close to the international border with Georgia and Armenia. Although described as a heavy horse the Malakan is of medium size with a withers height of 135-140 cm (13 hands 1-13 hands 3) but heavily muscled with a shortish neck set into a deep wide chest. The back is of medium length but broad, the haunches are wide and well muscled and often “grooved” (double). The legs are strong and lead to large sturdy black hooves. The original colour was predominantly black but bay and chestnut are now common due to the Ardennes (and possibly some Haflinger) influence. This strong enduring animal with a quiet temperament is mainly a farm and transport animal (Figure 15) (Hendricks, 1995; Kirmizibayrak et al., 2004; Gulec, 2007b; Hamzaoglu, 2007; Emiroglu & Yuksel, 2009). Due to changes in agricultural and transport practices the breed is uncommon.





*Figure 15. A heavily laden pair of Malakans in Gole County, Ardahan Province (Photo: O. Yilmaz).*

#### *Midilli/Mytiline (Ayvacik Midillisi)*

Mytiline is the common English name of the pony known in Turkey as Ayvacik Midillisi (Midilli translates from Turkish as pony) or the pony from Ayvacik which is the county in Canakkale Province bordering on the Aegean Sea which is now the home area of this equine. This type is also known as Ege Midillisi or West Midillisi. Its origin is Mytiline on the island of Lesbos – where it had been selectively bred for many centuries from the smallest of the Anatolian Native type – which was taken by Greece from Turkey at the fall of the Ottoman Empire. The Midilli is the smallest of all Turkish horses with a withers height of 116-120 cm (11 hands 2-11 hands 3). The small head and short neck are connected to the well developed chest via slightly curved shoulders. The legs are short and thick and terminate in hard wide hooves. The most common colour is chestnut but other colours including grey are met with. Originally bred to be small enough to walk under hazel nut and olive trees the breed is now preferred for working on rocky, harsh and rugged areas. With its pacing gait it covers the ground quickly and can carry heavy loads. In many situations the Ayvacik Midillisi is preferred over mules because it walks faster and is more docile and obedient (Yarkin, 1962; Hendricks, 1995; Yilmazer, 2007; Emiroglu & Yuksel, 2009). They make excellent children's ponies because of their size and general docility (Figure 16) but are now very rare.

#### *Rahvan*

This horse has been known in Turkey since the beginning of the Ottoman Empire in Anatolia some 800 years ago and is probably descended from the Canik and the Anatolian Native (Mason, 1996). Rahvan is the word used in Turkey to describe a very fast lateral walking (pacing) gait. The main area of distribution of this breed is Bartin, Kastamonu and Karabük Provinces in the West Black Sea region of northcentral Turkey. This large pony/small horse stands 139 cm (13 hands 2) at the withers. The handsome head is set on a short, thick and muscular neck which is coupled to a wide and deep chest and a short back with the whole set on strong legs terminating in solid hooves (Figure 17). The colour is very variable with every



common horse colour present. Rahvan horses are small and eat less than larger horses but are able to carry the same weight more with more comfort for the rider in part due to the pacing (also known as racking) gait which requires less energy than the normal motion and which is inherent in this breed whereas in many other types it has to be taught. Rahvan horses are also noted for the high head and tail positions when pacing at a fast speed (Hendricks, 1995). Rahvans have been raced in traditional competitions for centuries but in the time of the Republic they have been more organized and formalized. Average speeds in Turkish pace races of 125 winners (in races with a total of 1258 runners) in 1999-2000 were 28.8 km/hr for very small horses ('tozkoparan') and colts, 31.9 km/hr for small horses ('deste'), 33.3 km/hr for small-medium horses ('kucuk orta'), 33.7 km/hr for large-medium horses ('buyuk orta'), 34.3 km/hr for sub-large ('bas alti') and 36.4 km/hr for large horses ('bas'). The individual fastest speed was recorded in Konya in 1999 in the 'bas alti' category as 43.1 km/hr (Caglayan et al., 2010).

*Topugu Killi of Kizilcahamam (Kizilcahamam Topugu Killisi)*

This local breed is from Kizilcahamam county in Ankara Province. The Turkish name Topugu Killi of Kizilcahamam translates as the hairy ankle (or pastern) horse of Kizilcaham and related to the amount of feathering on the lower leg. The breed (Figure 18) is a multipurpose cart, pack and riding animal but is very rare or possibly extinct (Gulec, 2005a).



*Figure 16. A pair of Midilli/Mytiline ponies in a stable (Photo: O. Yilmaz).*



*Figure 17. A bay Rahvan horse in Ardahan Province (Photo: O. Yilmaz)'*



*Figure 18. Dapple grey Topugu Killi of Kizilcahamam, now thought extinct (Photo: E. Gulec).*



*Trakya*

As its name implies the Trakya is a native of Thrace in European Turkey and is sometimes referred to as the Rumelian which is a generic term for small horses in the former European territories of Turkey (Mason, 1996). The breed is an ancient cross of Native Anatolian and indigenous Thracian horses. This small horse is slightly bigger than Native Anatolian and stands 140- 145 cm (13 hands 3-14 hands 1) at the withers. The medium-size head is set on a short neck which links in to a narrow chest, the whole standing on strong legs whose lower parts are covered in coarse feathers. The colour is very varied. Trakya horses are multipurpose as they are used as riding (Figure 19), pack and harness animals. This breed is very enduring and strong and like the Native Anatolian is able to live and work under poor feeding and climatic conditions (Hendricks, 1995). The Trakya is rare.



*Figure 19. Trakya horse with traditional ornamented bridle and modern saddle (Photo: E. Gulec).*



### *Turkish Arab (Turk Arap)*

The Turkish Arab was originally developed from crosses of the Arab on the Anatolian Native. Over the years there have been additional imports of Arabs from a wide range of countries. Turkish Arabian breeding on state farms is now based on horses imported mainly from Iraq and Syria in the 1920s and 1930s plus a very small number of dam lines which date from Ottoman times: there are seven existing direct sire lines and 37 direct dam lines in the State studs (Karacabey, Anadolu and Sultansuyu) and further dam lines in the private sector (Yener et al., 2006). Turkish Arabs tend to be larger than other Arabians and have an average withers height of 152 cm. Withers height and cannon circumferences are about 152 cm (15 hands) and a cannon bone circumference of 19 cm (Figure 20). The Turkish Arab is also usually faster than other Arabs as it is bred specifically for racing. As one of only two breeds to have a Stud Book (established by law in 1926) in Turkey all records are kept, passports issued and foals registered by the Higher Council of Commissioners attached to the Ministry of Food, Agriculture and Livestock. In 2008 there were 10 200 registered purebred Arabian horses in Turkey with about 1 100 foals being registered each year, the issue of 250 stallions and about 1600 mares. Until 2005 blood-typing was used for parent verification in registering horses but since then DNA typing is the standard and since 2006 all foals have been fitted with microchips. Arab horse racing is big business in Turkey as illustrated by the 1646 races run in 2007 with total prize money of US \$40 million and breeders' premiums of US \$5 million (WAHO, 2010).



Figure 20. Turkish Arabian now retired from racing and used as a cirit horse (Photo: O. Yilmaz).

### *Turkish Thoroughbred (Turk Ingiliz)*

There is not much information on the Turkish Thoroughbred (Gulec, 2005b) although in essence it differs little from Thoroughbreds anywhere else in the world (Figure 21). Thoroughbred horses are bred at the lodging facilities at Karacabey, Central Insemination Station at Izmit and at other insemination centres at Izmir-Torbali, Adana-Seyhan and Trakya-Silivri which are all owned by the Turkish Jockey Club. This is the second of only two Turkish horse breeds to have a Stud Book. Thoroughbreds have become more popular for racing in recent years as illustrated by the fact that in 1975 60 per cent of registered race horses were Arab and 40 per cent Thoroughbred which is the reverse of the case in 2005. Races are run on dirt or grass tracks at distance varying from 1200 metres (6 furlongs) to 2400 metres (1 mile 4 furlongs) with 1200 metres (6 furlongs), 1400 metres (7 furlongs), 1600 metres (1 mile) and 1900 metres (1 mile 2½ furlongs) being the most popular distances. Average speeds for the shorter races are in the region of 57 km/hr (35 mph) and for the longer one are 54 km/hr (33 mph) (Ekiz & Kocak, 2007).



*Figure 21. Turkish Thoroughbred in a private stud in Balikesir Province (Photo: O. Yilmaz).*

### *Uzunyayla*

Developed in Turkey from the middle of the nineteenth century the Uzunyayla descends from horses from the north Caucasus, possibly the Kabarda (Mason, 1996). Its secondary name of Cerkez (= Circassian) reflects this descent. Anatolian Native and Nonius blood were added to the breed in about 1930 (Anon 1938). The breed takes its name from the Uzunyayla Plateau between Sivas and Kayseri provinces which is its main area of distribution. The horse varies in height and stands 140-155 cm (13 hands 3-15 hands 1)



with a cannon bone circumference of 18-20 cm. The head is large with a concave profile (“Roman nose”) and adorned with small eyes. The medium length neck merges into well pronounced withers and sloping shoulders placed in front of a long back and a short sloping croup. The legs are strong with good joints the lower parts carrying coarse feathering, the pasterns are sloped and very strong, the feet well shaped and tough. The skin is very thick and covered in coarse hair and the mane and tail are dense, hard, thick and long. The predominant colour is bay but there are also black, grey (Figure 22) and chestnut horses: the last colour is disliked by breeders as are facial and leg markings (Gulec, 1998b; Emiroglu & Yuksel, 2009). The Uzunyayla is a very good long distance animal at a slowish walking speed and they have a good gallop but cannot do the rahvan walk like some other Turkish breeds. They are used for pack, for light draught and as a general riding horse. The breed is rare if indeed not already extinct.



*Figure 22. A grey Uzunyayla and proud owner in Kayseri Province (Photo: E. Gulec).*

### **Conservation measures**

The number of horses in Turkey has fallen steadily since the middle of the twentieth century. Concomitant to the loss in numbers has been a reduction in the genetic resource with the result that some known Turkish native breeds have become extinct and several others are so few in number or of such limited geographic distribution that they are considered to be endangered and at possible risk of extinction in the future. Alarmed, perhaps belatedly, by this situation the Turkish government began to apply conservation policies in an attempt to prevent further decline and to preserve Turkish indigenous horse breeds.

The Genetic Engineering and Biotechnical Institute (GEBI), Marmara Research Centre (MRC) and the Scientific and Technological Research Council of Turkey (STRCT) prepared, in 2005, a project entitled “In Vitro Conservation and Preliminary Molecular Identification of some Turkish Domestic Animal Genetic

Resources (TURKHAYGEN-I)” (Arat 2011). Consequent on several iterations the project was approved by STRCT in March 2007 with a budget of 9.1 million Turkish Lira (about US\$ 5.0 million). The implementation period was 4-5 years with the project expected to be completed by the end of 2011 (Arat, 2011).

As indicated in the project document its expected outcomes were:

- establishment of DNA and viable cell banks (gametes, embryos, somatic cells and tissue samples) of animal genetic resources through cryopreservation at GEBI and at Lalahan Livestock Central Research Institute (LLCRI);
- genetic characterization and registration of valuable species and breeds; and
- enhancement of the competitiveness of national human resources in the area of animal husbandry and the building of a critical mass of researcher capacity.

Collection of genetic material for cattle began in 2006 with other species being included in the programme in 2007. There has been an intensive programme of cryopreservation of genetic material for six breeds of cattle (Yilmaz et al., 2012a), five breeds of goat (Yilmaz et al., 2012b) and 13 breeds of sheep (Yilmaz et al., 2012c). In addition some five conservation flocks of goat and 14 of sheep have been established at various research stations. Horses have had somewhat less attention but limited cryopreservation of genetic material of five breeds has already been undertaken (Table 1) and some horses are being conserved in vivo but ex situ at GEBI/MRC and LLCRI (Anon, 2011). It is expected that this resource will be expanded for preservation, conservation and use of Turkey’s native genetic resources in the future. At least one horse breed has been registered by the Turkish Standards Institute but this has yet to be recognized by the Ministry of Agriculture and Rural Affairs and the official “catalogue” of Turkish livestock (Anon, 2011) does not list any equine breeds.-

*Table 1. Cryopreservation status of genetic material of Turkish horse breeds, May 2011.*

Breed	Location		
	Genetic Engineering and Biotechnical Institute, Kokaeli		Central Livestock Research Institute, Lalahan
	DNA	Cell	DNA
Canik	64 animals	33 animals, 97 vials	64 animals
Cukurova	60 animals	51 animals, 198 vials	60 animals
Hinis	60 animals	42 animals, 214 vials	60 animals
Malakan	64 animals	51 animals, 233 vials	64 animals
Mytiline	49 animals	40 animals, 132 vials	49 animals

Source: Arat 2011

## Discussion nd Conclusions

Horse breeds reflect local human history in the special uses for which they have been bred. During the latter stages of the Ottoman Empire the horse population decreased and, after a period during which they increased, have been reduced even further under the Republic of Turkey. Changing economic and social conditions have been largely responsible for the reduction in numbers. In addition to this, the lack of breed



societies and of registration other than for the Turkish Arab and the Turkish Thoroughbred have contributed to the decline and almost certain narrowing of the gene pool.

Local breeds are a repository of irreplaceable genetic material of unacknowledged merit and value that must not be lost and must be conserved for unknown and unseen future use (Wilson, 2009). Impoverishment of the nation's natural capital is not acceptable under any circumstances but the modest start of conservation measures by government augurs well for the future and for the safeguarding of the country's heritage. Biodiversity will be diminished if the nation's gene pool is not fully characterized and preserved for use by future generations who will face as yet unlooked-for circumstances. Efforts should continue to characterize indigenous horse breeds alongside the use of exotic breeds with possibly and potentially superior performance but lower adaptability. Government, universities and the mass of livestock producers and ancillary industries should work together to conserve and improve the native horse breeds of Turkey.

## References

- Alarslan, E. 2009. Van İli Ercis İlcesi Ulupamir Koyundeki Geleneksel At Yetistirciliginin Yapısal Özellikleri. Yüzüncü Yıl Üniversitesi, Fen Bilimleri Enstitüsü. (The structure of traditional horse breeding in villages in Ercis County of Van Province (Unpublished M.Sc. Thesis). Institute of Science and Technology, Yüzüncü Yıl University.)
- Anon. 1938. Uzunyayla At Yetistirme İşleri Tetkik ve Mesai Raporu. Ziraat Vekaleti Nesriyatı, Ekspres Basımevi, İstanbul. (Preliminary report on Uzunyayla horse breeding and research. Ministry of Agriculture Publications, Express Publications, İstanbul.)
- Anon. 2011. Türkiye Evcil Hayvan Genetik Kaynakları Katalogu. Tarım ve Köy İşleri Bakanlığı, Tarımsal Araştırmalar Genel Müdürlüğü, Ankara. (Domestic Animal Genetic Resources in Turkey. General Directorate of Agricultural Research and Policy, Ministry of Agriculture and Rural Affairs, Ankara.)
- Aral, N. 1974. Türkiye'de Yetistirilen Hayvan Türleri, Yetistircilik Tarihi ve Teknolojisi (1923-1931). Türkiye Jokey Kulübü Yayınları. Ankara. (Species and breeding history of livestock in Turkey (1923-1931). Turkish Jockey Club, Ankara.)
- Arat, S. 2011. In vitro conservation and preliminary molecular identification of some Turkish domestic animal genetic resources (Turkhyaygen-I). Genetic Engineering and Biotechnology Institute, Gebze, Kocaeli, Turkey.
- Batu, S. 1962. Türk Atları ve At Yetistirme Bilgisi. Veteriner Fakültesi Yayınları No: 13. Ankara Üniversitesi, Ankara. (Horses and horse breeding in Turkey. Veterinary Faculty Publication No 13. Ankara University, Ankara.)
- Bayram D, Öztürk, Y. & Kucuk, M. 2005. Van Yöresinde Yetistirilen Atlarda Fenotipik Özellikler. Yüzüncü Yıl Üniversitesi Veteriner Fakültesi Dergisi 16: 85-88. (Phenotypic characteristics of horses in the Van Area. *Journal of the Veterinary Faculty of Yüzüncü Yıl University* 16: 85-88.)
- Bennett, D. & Hoffman, R.S. 1999. *Equus caballus*. *Mammalian Species* 628: 1-14.
- Çağlayan T, İnal S, Garip M, Coşkun B, İnal F, Günül A & Gülec E. 2010. The determination of situation and breed characteristics of Turkish Rahvan horse in Turkey. *Journal of Animal and Veterinary Advances* 9: 674-680. doi: 10.3923/javaa.2010.674.680.

Clutton-Brock, J. 1992. Horse power: A history of the horse and the donkey in human societies. Harvard University Press, Cambridge, MA.

Duzgunes, O. 1946. Atcilik-Uretim, Bakim ve Yemleme Usulleri (Equine production, care and feeding). Ali Riza Incealemdaroglu Basimevi, Zonguldak, Turkey.

Ekiz B & Kocak O. 2007. Estimates of genetic parameters for racing times of thoroughbred horses. *Turkish Journal of Veterinary and Animal Science* 31: 1-5.

Emiroglu, K. & Yuksel, A. 2009. Yoldasimiz At. Yapi Kredi Kultur Yayinlari, No 1744, Istanbul. (Companion horses. Istanbul. Buildings Credit Culture Publications No 1744, Istanbul.)

Equinest. 2011. Canik horse. <http://www.theequinest.com/breeds/canik/>.

Ertugrul, M., Dellal, G., Elmaci, C., Akin, A. O., Pehlivan, E., Soysal, M. I. & Arat, S. 2010. Ciftlik Hayvanlari Genetik Kaynaklarinin Kullanilmasi ve Surdurulebilir Kullanimi. Turk Ziraat Muhendisligi VII. Teknik Kongresi. (Conservation of farm animal genetic resources and sustainable use. Turkish Agricultural Engineering Seventh Technical Congress, 11-15 January 2010, Ankara).

FAO/DADIS. 2010. Databases/breeds database. [http://dad.fao.org/cgi-dad/\\$cgi\\_dad.dll/RSel?Simp.](http://dad.fao.org/cgi-dad/$cgi_dad.dll/RSel?Simp.)

FAOstat. 2011. Faostat.fao.org/site/573/default.aspx#ancor

Gulec, E. 1998a. Türk Cirit Ati. Bilgi Musavirlik ve Muhendislik, Elde basim: Ankara. ISBN 975-96458-1-5. (The Cirit horse. Bilgi Consultancy and Engineering: Ankara.)

Gulec, E. 1998b. Uzunyayla Ati. Anadolu At Irklarini Yasatma ve Gelistirme Dernegi Yayinlari. Elde basim: Ankara. ISBN 975-6846-00-3. (The Uzunyayla horse. Anatolian Horse Racing Survival and Development Association: Ankara.)

Gulec, E. 2002. Cihan Sumul Atimiz Hinis Ati. Anadolu At Irklarini Yasatma ve Gelistirme Dernegi Yayinlari. Elde basim: Ankara. ISBN 975-6577-11-8. (The famous Hinis horse. Anatolian Horse Racing Survival and Development Association: Ankara.)

Gulec, E. 2005a. Turk At Irklari. Anadolu At Irklarini Yasatma ve Gelistirme Dernegi Yayinlari. Elde basim: Ankara. ISBN 975-95931-0-6. (Horse breeds of Turkey. Anatolian Horse Racing Survival and Development Association: Ankara.)

Gulec, E. 2005b. Turk Ingiliz Ati. Anadolu At Irklarini Yasatma ve Gelistirme Dernegi Yayinlari. Elde basim: Ankara. (The Turkish Thoroughbred horse. Anatolian Horse Racing Survival and Development Association: Ankara.)

Gulec, E. 2006. Dogu Anadolu Ati. Anadolu. Bilgi Musavirlik ve Muhendislik. Elde basim: Ankara. ISBN 975-6846-16-X. (The East Anatolian horse. Bilgi Consultancy and Engineering: Ankara.)

Gulec, E. 2007a. Camardi Kulasi Ati. Bilgi Musavirlik ve Muhendislik. Elde basim: Ankara. ISBN 978-975-6846-28-5. (The Camardi Kulasi horse. Bilgi Consultancy and Engineering: Ankara.)



Gulec, E. 2007b. Ardahan Ati (Malakan Ati). Anadolu At Irklarini Yasatma ve Gelistirme Dernegi Yayinlari. Elde basim. Ankara. ISBN 978-975-6577-16-5. (The Ardahan 'Malakan') horse. Anatolian Horse Racing Survival and Development Association: Ankara.)

Hamzaoglu, M. 2007. Malakan Ati (Ardahan Ati). Anadolu At Irklarini Yasatma ve Gelistirme Dernegi Yayinlari. Elde basim: Kars. ISBN 975-6577-02-9. (The Malakan 'Ardahan' horse. Anatolian Horse Racing Survival and Development Association, Kars.)

Hendricks, B. L. 1995. International encyclopedia of horse breeds. University of Oklahoma Press, London, UK.

Kirmizibayrak, T., Aksoy, A. R., Tilki, M. & Saatci, M. 2004. Kars Yoresi Turk Yerli Atlarinin Morfolojik Ozelliklerinin Incelenmesi. Kafkas Universitesi Veteriner Fakultesi Dergisi 17,: 69-72. (Morphological characteristics of Turkish domestic horses in Kars region. *Journal of the Veterinary Faculty of the University of the Caucasus* 17: 69-72.)

Koppers, W. 1941. Cihan Tarihinin Isiginda Ilk Turkluk ve Ilk Indo-Germenlik. Belleten, 20: 471-473. (Proto-Turks and Indo-Germans according to world history. Bulletin 20: 471-473.)

Levine, M. A. 2005. Domestication and early history of the horse. In: The domestic horse: the origins, development, and management of its behaviour, ed. D. S. Mills & S. M. M. McDonnel). Cambridge University Press, UK.

Mason, I.L. 1996. A World Dictionary of Livestock Breeds, Types and Varieties (4th Edition). CAB International, Wallingford, UK.

Pickrell, J. 2005. 95% of thoroughbreds linked to one superstud. New Scientist 6 September 2005.

Said, Z. 1940. Turkiye'de Atciligin Ehemmiyeti ve Arastirma Mevzuu. T. C. Ziraat Vekaleti Yuksek Ziraat Enstitusu Calismalarindan, Sayi: 62. Ankara Yuksek Ziraat Enstitusu Yayini. Ankara. (Studies on the importance of horse breeding and research in Turkey. Studies in the Ministry of Agriculture Institute of Agriculture No 62, Institute of Agriculture, Ankara.)

Sansal, B. 2011. All about Turkey. <http://www.allaboutturkey.com/javelin.htm>.

Sonmez R. 1975. At Yetistirme-Ozel Zootezni. Ziraat Fakultesi Yayinlari No:141. Ege Universitesi, Matbaasi. Izmir. (Horse breeding-animal science. Faculty of Agriculture Publication No 141, Ege University, Matbaasi, Izmir.)

Turkmen, M. 1996. Turklerde Geleneksel Atli Sporlari Yapilisi, Kaynagi ve Bilinmeyen Yeni Boyutlari (Yayimlanmamis Doktora Tezi). Saglik Bilimleri Enstitusu, Marmara Universitesi, Istanbul. (Activities, origins and new directions in traditional horse sports (Unpublished PhD Thesis), Institute of Health Sciences, Marmara University, Istanbul.)

WAHO, 2010. Member report from Turkey: report made at 2009 WAHO Conference. <http://www.waho.org/reports.asp?ID=TASB>

Wilson, R.T. 1999. Horses in the Kyrgyz Republic. *Draught Animal News* 30:2-6.

Wilson, R.T., Yilmaz, O. & Ertugrul, M. 2011. The domestic livestock resources of Turkey: Pigs. *Pig Journal* 66: 26-30.

Yarkin, I. 1962. Atcilik. Ziraat Fakultesi Yayinlari No: 40, Ders Kitabi No:20. Ankara Universitesi, Basimevi, Ankara. (Horse riding. Faculty of Agriculture Publication No 40, Lesson 20, Ankara University, Basimevi, Ankara.)

Yener SM, Gucuyener O & Ozbeyaz C. 2006. Horse breeding in Turkey. 57th Annual meeting of the EAAP, 17-20 September 2006, Antalya, Turkey. [http://www.eaap.org/Previous\\_Annual\\_Meetings/2006Antalya/Papers/H36.1\\_Yener.pdf](http://www.eaap.org/Previous_Annual_Meetings/2006Antalya/Papers/H36.1_Yener.pdf)

Yildirim, I. G. 2007. Atlarda Genel Vucut Yapisinin Morfometrik Yontemlerle Incelenmesi (Yayimlanmamis Yuksek Lisans Tezi, Adnan Menderes Universitesi, Saglik Bilimleri Enstitusu. Aydin. (Morphometric studies on the general body structure of horses (Unpublished MSc Thesis). Institute of Health Sciences, Adnan Menderes University.)

Yilmaz, O. & Ertugrul, M. 2011. Determination of coloured horses raised in Turkey. *Journal of Agricultural Science and Technology, Bulgaria* 3: 203-206.

Yilmaz, O., Ertugrul, M. & Wilson, R.T. 2011a. The domestic livestock resources of Turkey: Water buffalo. *Tropical Animal Health and Production* 44: 707-714. doi: 10.1007/s11250-011-9957-3.

Yilmaz, O., Ertugrul, M. & Wilson, R.T. 2011b. The domestic livestock resources of Turkey: Camel. *Journal of Camel Practice and Research* 18: 21-24.

Yilmaz, O., Akin, O., Yener, S.M., Ertugrul, M. & Wilson, R.T. 2012a. The domestic livestock resources of Turkey: Cattle breeds and types and their conservation status Camel. *Animal Genetic Resources* in press.

Yilmaz, O., Kor, A., F., Ertugrul, M. & Wilson, R.T. 2012b. The domestic livestock resources of Turkey: Goat breeds and types and their conservation status Camel. *Animal Genetic Resources* in press.

Yilmaz, O., Cengiz, F., Ertugrul, M. & Wilson, R.T. 2012c. The domestic livestock resources of Turkey: Sheep breeds and crossbreeds and their conservation status. *Animal Genetic Resources* submitted.

Yilmazer, O. 2007. Ayvacik Midillisi (Unpublished MSc Thesis). Canakkale U. Ziraat Fakultesi Zootekni Bolumu. Canakkale. (The Ayvacik pony (Unpublished MSc Thesis). Department of Animal Science, Faculty of Agriculture, Canakkale University, Canakkale.)