

Review

## The farm animal genetic resources of Turkey: sheep - II - crossbreed and extinct genotypes/breeds

Orhan Yılmaz <sup>a,\*</sup>, Mehmet Ertuğrul <sup>b</sup>, Richard Trevor Wilson <sup>c</sup>, Firat Cengiz <sup>d</sup>

<sup>a</sup> Iğdır University, Faculty of Agriculture, Department of Animal Science, 76000 Iğdır-Turkey

<sup>b</sup> Ankara University, Faculty of Agriculture, Department of Animal Science, 06110 Ankara-Turkey

<sup>c</sup> Bartridge Partners, Umberleigh, Devon EX37 9AS, UK

<sup>d</sup> Yüzüncü Yıl University, Faculty of Agriculture, Department of Animal Science, 65080 Van-Turkey

\* Corresponding author: zileliorhan@gmail.com

### Abstract

Biodiversity richness indicates the economic and genetic wealth of a country. Turkey is like a bridge between Europe and Asia; hence it has been used by traders, travellers or intruders for centuries which resulted with the existence of considerably different kinds of domestic animals. Although some of the genotypes are extinct or are crucially under the risk of extinction, the domestic livestock resources of Turkey have not been adequately appraised. On one hand new breeds are created by human beings, on the other hand much more breeds are getting extinct because of them. The creation of new breeds contributes to human welfare, but the extinction of native breeds exacerbates human life. In this study domestic livestock biodiversity and their conservation in Turkey is intended to be explained by giving brief examples about the sheep breeds of Turkey.

**Keywords:** breed characteristic, conservation, livestock, native breed

### 1. Introduction

The sheep is the second domesticated animal after dog (Yılmaz 1995). Turkey has 21.8 million sheep (Türkiye İstatistik Kurumu 2010) and is the ninth most important sheep producer in the world (Günaydın 2009). Turkish Sheep Breeds are divided into two groups as fat or thin tailed breeds (Table 1).

In Turkish sheep breeding there are four different husbandry systems. The first one is the "small household" system. This is common in the west and the northwest part of Turkey. In this system a family has an average of 3-5 sheep, maximum 10-15 sheep. The second type is the "settled down village flock" system. This system can be seen in any part of Turkey. In a village families can have from 8-10 to 100 sheep. In early morning sheep are released by owners and a village flock is made. This flock is managed by a shepherd and guarded by several shepherd dogs.

**Table 1.** An overview to the crossbreed and extinct sheep breeds of Turkey.

	<b>Fat Tailed</b>	<b>Thin Tailed</b>
<b>Crossbred</b>	Acipayam Kamakuyruk* Malya*	Anatolian Merino, Asaf, Bafra, Central Anatolian Merino, Çukurova, Hasak, Hasmer, Tahirova, Karacabey Merino, Menemen, Polatlı, Ramlıç, Sönmez, Türkgeldi
<b>Extinct</b>	Halkalı Karakaçan, Ödemiş	

\*Long tail with fat at base (Sönmez 1975; Kaymakçı 1979; Ertuğrul et al. 1993; Kaymakçı & Taşkın 2001; Kaymakçı 2008; Sönmez et al. 2009; Ertuğrul et al. 2009; TAGEM 2009).

The third system is the "highland" system. This system is common in the northeast, east and south parts of Turkey. Sheep live in villages during winter season. At the end of spring grass gets dry and it gets hard to find green grass for sheep and lambs. Thus sheep are taken to highlands at the beginning of summer to get more green grass. After 3-5 months, when weather gets cold sheep are brought back to villages to stay in cold season. The last system is the "nomadic" system. This system can be seen in the east and southeast of Turkey. In this region there are some traditional nomadic tribes which have about 100.000-200.000 sheep. Sheep stay and graze during cold season in low levelled plains at the southeast part of Turkey. During the hot season grass gets dry and then the nomadic tribes migrate to the east of Turkey. Migration lasts about 1 month. During the hot season sheep graze in high levelled plains of the east part of Turkey. Members of these tribes always live in goat hair tents when they are with the sheep flock (Ertuğrul et al. 1993)

#### 1. 1. Crossbreds

Naturally, the all crossbred sheep breeds of Turkey are thin tailed including Acipayam (Table 3), Anatolian Merino, Asaf, Bafra, Central Anatolian Merino, Hasak, Hasmer, Karacabey Merino (Turkish Merino), Menemen, Polatlı, Ramlıç, Sönmez, Tahirova, Türkgeldi (Table 4). There are only two breeds which are Kamakuyruk, and Malya that are long tailed and fat at base (Table 3). Apart from these breeds several breeding programs were started to create new sheep breeds (Table 2).

For example a breeding program was carried out jointly by Texel and Kıvrıkcık in Türkgeldi and İnanlı State Farms in 1970s. Because of their weakness against some

**Table 2.** Crossbreeding programs in state farms

Place	Crossbreeding
Türkgeldi State Farm, Kırklareli	Texel x Kivircik
İnanlı State Farm, Tekirdağ	Texel x Kivircik
Gökhöyük State Farm, Amasya	Border Leicester x Karayaka
Alpaslan State Farm, Muş	Lincoln x Morkaraman
Bala State Farm, Ankara	Dorset Down x Akkaraman
Ulaş State Farm, Sivas	Hampshire Down x Akkaraman
Acıpayam State Farm, Denizli	German Mutton x Ramlıç, German Mutton x Acıpayam
Pasture, Grassland and Animal Breeding Research Institute, Ankara	Ile de France x Akkaraman, Ile de France x Anatolian Merino

(Sönmez et al. 2009)

blood parasites the crossbreeding program was stopped. Following this program several crossbreeding programs were initiated but none could be completed.

**1.1.1. Acıpayam** from the provinces of Denizli, Afyon, Isparta, Antalya, and the Ege Region of Turkey is a milk, meat and wool type, crossbred from 50% Awassi, 25% Dağlıç and 25% East Friesian. It has a white body, sometimes brown or black spots on head. Both the male and the female are polled (Mason 1996; Kaymakçı & Taşkın 1998a; Kaymakçı & Taşkın 1998b; TAGEM 2009).

**1.1.2. Anatolian Merino** (Figure 1) is a mid-sized breed, which is heavier and yields more milk than the Akkaraman. Has a fine wool and a meat variety of the Turkish Merino. Both the male and the female are polled. They have a white body, and are originated from the Konya State Farm from the German Mutton Merino (65%) and White Karaman (Pekel et al. 1973; Sönmez 1978; Aşkın 1982; Dellal 2002; Arık et al. 2003; Sönmez et al. 2009; TAGEM 2009).



**Figure 1.** Anatolian Merino Sheep **Figure 2.** Bafra Sheep

**1.1.3. Asaf** is originated from a cooperation of Çukurova University, Faculty of Agriculture, and Hohenheim University of Germany from the East Friesian and Awassi sheep. Once the first offspring of F1 was got, these were inbred and F2 was got which was the Asaf Sheep. At the third stage F2s were crossbred with the Awassi G1s and then the Asaf Sheep was created (Kaymakçı 2008; Sönmez et al. 2009).

**1.1.4. Bafra** (Figure 2) is from northern Anatolia, and has a fine wool, heavier body weight, and a special meat and milk type. The females are 60 kg and the males are 70 kg. These were first bred in 1998 at the Bafra State Farm from the Sakız (75%) and the Karayaka (25%) (Atasoy et al. 2003; BDUTAE 2011).

**1.1.5. Central Anatolian Merino** (Figure 3) has a fine wool and is a meat variety of Turkish Merino bred at Konya State Farm since 1952 from the German Mutton Merino (80%) and the White Karaman (Mason 1996; Sönmez et al. 2009). It has a white body and yields more milk than the Akkaraman. The males are 85-90 kg and the females are 55-60 kg (Pekel & Güney 1974; Akmaz et al. 1992; TAGEM 2009).

**Table 3.** Long tailed with fat at base crossbred sheep breeds of Turkey.

Trait	Breed		
<b>Name of Breed</b>	<b>Acıpayam</b>	<b>Kamakuyruk</b>	<b>Malya</b>
<b>Local Name of Breed</b>	Acıpayam	Kamakuyruk	Malya
<b>Sire and dam lines</b>	East Friesian 25% (♂) x Awassi 50% (♀) x Dağlıç 25% (♀)	Kivircik 50% (♂) x Dağlıç 50% (♀)	German Mutton Merino (♂) x Akkaraman (♀)
<b>Foreign genotype (%)</b>	25	50/50	35
<b>Purpose of raising</b>	Milk, meat, lamb	Meat	Meat
<b>Characteristics</b>	Can mate Dağlıç and give carpet type fleece	Long tail fat at base	Can bred under Akkaraman conditions
<b>Color</b>	White body, black spots on head and neck	White body	White body
<b>Height (♂, ♀ cm)</b>	66 ♂, 62 ♀	-	70 ♀
<b>Body length (♂, ♀ cm)</b>	71 ♂, 63 ♀	-	68 ♀
<b>Birth weight (♂, ♀ kg)</b>	3.5 ♂, 3.2 ♀	-	4.0 ♂, 3.6 ♀
<b>Adult weight (♀, ♂ kg)</b>	55 ♂, 40 ♀	-	80 ♂, 58 ♀
<b>Average daily gain for fattening (g)</b>	220 (♂)	-	240 ♂
<b>Milk (kg)</b>	40-50	-	35
<b>Lactation Length (Days)</b>	100-160	-	90
<b>Wool (Greasy) (kg)</b>	2-3.5	-	2.7
<b>Gestation age (month)</b>	18	-	18
<b>Lamb yield (%)</b>	1.1	-	1.2

(Sönmez 1975 ; Sönmez 1978 ; Ertuğrul et al. 1993).



Figure 3. Central Anatolia Merino Figure 4. Hasak Sheep

**1.1.6. Çukurova** is originated from the Faculty of Agriculture of Çukurova University, bred from the Sakız and the Awassi sheep. After the first offspring of F1, G1 was got. F1 and G1 were inbred and then the Asaf Sheep was got (Kaymakçı 2008; Sönmez et al. 2009).

**1.1.7. Hasak** (Figure 4) is originated from the International Bahri Dağdaş Agricultural Research Institute in Konya, bred from the German Mutton, Hampshire sire line and the Akkaraman dam line. These have a strong, heavy mid-sized body, a pied coat color, a faster growth rate, and a better carcass yield. They are male and female polled and have a long tail fat at base (Kaymakçı 2008; Sönmez 2009; TİGEM 2011).

**1.1.8. Hasmer** (Figure 5) is originated from the International Bahri Dağdaş Agricultural Research Institute in Konya, bred from the German Mutton, Hampshire and Merino. They have a meat and wool type, strong, heavy mid-sized body; white color, faster growth rate, better carcass yield, thin tail and both the male and the female are polled (Kaymakçı 2008; Sönmez et al. 2009; TİGEM 2011).



Figure 5. Hasmer Sheep



Figure 6. Karacabey Merino Sheep

**1.1.9. Kamakuyruk** originated from the Kıvırcık and the Dağlıç F1 crossbreed has a long tail fat at base (wedge tail) (Mason 1996), and are raised in the provinces of Balıkesir, İzmir, Bursa and Çanakkale, at the Northeast of Turkey (Sönmez 1978).

**1.1.10. Karacabey Merino** (Figure 6) which is also known as Turkish Merino of northwest Anatolia has a medium quality wool, meat and milk and is variety of the Turkish Merino originally from Kıvırcık graded up since 1928 with the German Mutton Merino (90-95%) via Karacabey-Kıvırcık (Mason 1996; Sönmez et al. 2009). These originate from the Karacabey State Farm and have a faster growth rate than Kıvırcık, a live weight of 50-55 kg with 3-3.5 kg greasy wool (Öznacar 1973; Özcan et al. 2004; Kaymakçı 2008).

**1.1.11. Malya** (Figure 7) is from central Anatolia and has a fine wool, meat and milk type. The females are 50 kg, the males are 60 kg. These are bred at Malya State Farm since the 1970s from the German Mutton Merino (35%) and Akkaraman (65%) by Prof. Dr. Orhan Düzgüneş (Yılmaz 1984; Ertuğrul et al. 1993; Batmaz & Başpınar 1999; Çolakoğlu & Özbeyaz 1999; Sönmez et al. 2009).



Figure 7. Malya Sheep

Figure 8. Polatlı Sheep

**1.1.12. Menemen** of İzmir is originally from the Ile de France (75%) and Tahirova (25%). These have a faster growth rate than the Ile de France, and better meat quality, milk and lamb yield from the Tahirova. However, more selection and breeding work is needed (Kaymakçı et al. 2006; Sönmez et al. 2009).

**1.1.13. Polatlı** (Figure 8) of central Anatolia has a fine wool and heavier body weight; good meat and milk type, and a white body. The females are 60 kg and the males are 70 kg. These are bred since 1998 at the Bafra State Farm, from the Ile de France males and the Akkaraman females (BDUTAE 2011; TAGEM 2009).

**1.1.14. Ramlic** has good meat, fine wool and heavier body weight. These are bred since 1969 at İstanbul University, from the American Rambouillet (65-70%) and Dağlıç (30-35%). The males are 80-90 kg and the females are 60-65 kg (Sönmez et al. 2009; TAGEM 2009).

**1.1.15. Sönmez** (Figure 9) of West Anatolia has a fine wool, a heavier body weight and a fine meat and milk type. The males are 80-90 kg and the females are 60-65 kg. These originate from the Tahirova (75%) and the Sakız (25%) bred by Prof. Dr. Reşit Sönmez (Ege University) (Ertuğrul et al. 1993; Kaymakçı et al. 2002a; Kaymakçı et al. 2002b).



Figure 9. Sönmez Sheep



Figure 10. Tahirova Sheep

**1.1.16. Tahirova** (Figure 10) of the Ege region has a fine milk, meat and wool, a white body, and is originated from the Tahirova State Farm, bred from the East Friesian (75%) and Kıvırcık (Mason 1996). It has a 160-180% lamb yield and a 250-300 kg milk yield (Sönmez et al. 1975; Sönmez et al. 1991; TAGEM 2009).

**1.1.17. Türkgeldi** of Thrace has a fine milk, meat and wool type. These originated from the Türkgeldi State Farm, bred from the Tahirova (75%) and Kıvırcık (25%). They have a 140-150% lamb yield. The males are 70-80 kg and the females are 40-50 kg. They have a 150-180 kg milk yield (Özder et al. 1996; Özder et al. 2004; Kaymakçı 2008).

## 1. 2. Extinct Breeds

The sheep breeds of Halkalı, Karakaçan and Ödemiş are already extinct.



**Table 4.** Thin tailed crossbred sheep breeds of Turkey.

Trait	Breed															
Name of Breed	Karacabey Merino	Anatolian Merino	Central Anatolian Merino	Tahirova	Ramlıç	Sönmez	Polatlı	Türkgeldi	Bafra	Menemen	Turkgeldi	Hasmer	Hasak	Cukurova	Asaf	
<b>Local Name of Breed</b>	Karacabey Merinosu	Anadolu Merinosu	Orta Anadolu (Konya) Merinosu	Tahirova	Ramlıç	Sönmez	Polatlı	Türkgeldi	Bafra	Menemen	Turkgeldi	Hasmer	Hasak	Cukurova	Asaf	
<b>Sire and dam lines</b>	German Mutton Merino (♂) x Kıvrıkcık (♀)	German Mutton Merino (♂) x Akkaraman (♀)	German Mutton Merino (♂) x Akkaraman (♀)	East Friesian (♂) x Kıvrıkcık (♀)	Rambouillet (♂) x Dağlıç (♀)	Tahirova (♂) x Sakız (♀)	Ile de France (♂) x Akkaraman (♀)	Tahirova (♂) x Kıvrıkcık (♀)	Sakız (♂) x Karayaka (♀)	Ile de France (♂) x Tahirova (♀)	Tahirova (♂) x Kıvrıkcık (♀)	German Mutton x Hampshire x Merino	German Mutton x Hampshire x Akkaraman	Sakız (♂) x Awassi (♀)	East Friesian 25% (♂) x Awassi 75% (♀)	
<b>Foreign genotype (%)</b>	90	65	80	75	65-70	75	-	75	75	75	75	100	100	62.5	25	
<b>Purpose of raising</b>	Meat, wool	Meat, wool	Meat, wool	Milk, meat	Meat, wool	Meat, milk	Meat, milk	Milk, meat, wool	Lamb, milk, meat	Meat, milk	Milk, meat, wool	Milk, meat, wool	Meat, lamb	Milk, lamb	Milk, lamb	
<b>Characteristics</b>	Heavier and faster growth rate	More milk yield than Akkaraman	More milk yield than Akkaraman	160-180% Lamb yield	Fine wool, heavier body weight	Fine wool, heavier body weight	Fine wool, heavier body weight	150-150% Lamb yield	Fine wool, heavier body weight	Faster growth rate from Ile de France, better meat quality, lamb and milk yield	150-150% Lamb yield	Strong and heavy body structure, better wool quality	Faster growth rate, better meat quality, lamb and milk yield from Akkaraman	-	-	
<b>Color</b>	White body	White body	White body	White body	White body	White body	White body	White body	White body, black spots on head	White body, black spots on head	White body	White body, dark spots on head and legs	Generally pied body, from black to brown	-	-	
<b>Height (♂, ♀ cm)</b>	77 ♂, 73 ♀	75 ♂, 66 ♀	76 ♂, 68 ♀	-	74 ♂, 70 ♀	-	-	-	68 ♀	68 ♀	-	-	-	-	-	
<b>Body length (♂, ♀ cm)</b>	73 ♂, 72 ♀	86 ♂, 74 ♀	88 ♂, 75 ♀	-	75 ♂, 72 ♀	-	-	-	71 ♀	71 ♀	-	-	-	-	-	
<b>Birth weight (♂, ♀ kg)</b>	4.5 ♂, 4.3 ♀	4.3 ♂, 4.1 ♀	4.4 ♂, 4.1 ♀	-	4.5 ♂, 4.0 ♀	-	-	-	4.0 ♂, 3.8 ♀	-	-	4.6	4.2	-	-	
<b>Adult weight (♀, ♂ kg)</b>	80-100 ♂, 60-65 ♀	80-90 ♂, 50-55 ♀	85-90 ♂, 55-60 ♀	60-85	80-90 ♂, 60-65 ♀	65-100	-	70-80 ♂, 40-50 ♀	70 ♂, 60 ♀	70 ♂, 60 ♀	70-80 ♂, 40-50 ♀	75-85 ♂, 60-65 ♀	75-90 ♂, 60-65 ♀	-	-	
<b>Average daily gain for fattening (g)</b>	322 ♂	240 ♂	290 ♂, 235 ♀	-	265 ♂	-	-	-	240 (♂)	122-183	-	-	-	-	-	
<b>Milk (kg)</b>	78	70-90	60-70	250-300	50-60	350-400	-	150-180	120	-	150-180	-	-	-	-	
<b>Lactation Length (Days)</b>	140	120	150	-	130-150	-	-	172-186	120	-	172-186	-	-	-	-	
<b>Wool (Greasy) (kg)</b>	3.6	3.0-3.5	3.6-3.8	3-4	2.5-3.0	3-4	-	3-4	2.2	1.8	3-4	3.5	3.1	-	-	
<b>Gestation age (month)</b>	10-14	18	18	-	10-14	-	-	-	12	-	-	16-18	-	-	-	
<b>Lamb yield (%)</b>	1.4	1.4	1.4	-	1.3	-	-	1.4-1.5	1.8	1.3	1.4-1.5	1.2	1.2	-	-	

(Sönmez 1975; Sönmez 1978; Ertuğrul et al. 1993; Kaymakçı 2008)

**1.2.1. Halkali** is extinct and there is not enough information about them (Ertuğrul et al. 2009).

**1.2.2. Karakachan** (Figure 11) is extinct and there is not enough information about them (Kaymakçı 2008; Sönmez et al. 2009; Ertuğrul et al. 2009).

**1.2.3 Ödemiş** (Figure 12) of the Small Menderes Valley of west Turkey is already extinct (Ertuğrul et al. 2009). These had a coarse meat, milk and wool, a white body, black or brown spots around their mouth, eyes, on ears and legs. The males were horned. The females were polled and these had a fat tail (Sönmez & Kızılay 1972; Mason 1996; TAGEM 2009).



**Figure 11.** Karakachan Sheep



**Figure 12.** Odemis Sheep and its huge tail.

## 2. Conclusion

Crossbreeding programmes were started in 1934 for the native sheep breeds, but there were not much was achieved after about 80 years. Currently only 4% of the sheep population is of crossbreed and the farmers are not keen on raising these new sheep breeds or types. Crossbreeding programmes had three different purposes: The first purpose was to increase wool fabric production for the fabric industry. In 1934 the native Kivircik sheep which were raised in the west of Turkey started to be crossbred with the German Wool- Mutton Merino by the Ministry of Agriculture. After 20 years only 20% of the target progeny was got under the crossbreeding programme. Because of some unknown reason the sheep breeders did not want to raise this new crossbreed Merino breed and then the crossbreeding programme was stopped. After this unsuccessful attempt another crossbreeding programme was initiated in the central and eastern parts of Turkey in the 1950's. Because of the same reasons seen during the former crossbreeding programme which was applied in the west of Turkey, the second crossbreeding programme was unsuccessful and was stopped in the 1970's. In the 1950's the university scientists jointed these crossbreeding programmes and then some achievements were made. The first aim was to get carpet wool instead of fabric wool. The university scientists advised to the government officers to crossbreed native Akkaraman sheep, which are mainly raised in the central part of Turkey, with the German Wool-Mutton Merino. In this way the breed of Malya Sheep was created by Prof. Dr. Orhan Düzgüneş (Ertuğrul et al. 1993)

The second aim was to increase the amount of mutton for the food industry. The sheep breeds of Rambouillet, Ile de France, Texel, Border Leicester, Dorset Down, Hampshire Down, Lincoln and German Blackhead Mutton Merino were used to increase the adult body weight and the wool of the native sheep breeds. Texel and Kivircik crossbreeding programme was a disaster because all of the first generation lambs died of an unknown disease. The crossbreeding programme was stopped immediately. The Ile de France was crossbred with several native sheep breeds and the results were hopeful, but the Ministry of Agriculture could not apply enough crossbreeding programmes nationwide. Later those Ile de France rams were removed from the programme. In the 1980's the university scientists insisted on implementing government policies to apply crossbreeding programmes which would increase the mutton type breeds in some local regions. Those crossbreeding programmes are still going on and the first results were hopeful Ertuğrul et al. (1993)

The third aim was to increase milk production for the food industry. In Turkey the milk of sheep is still important for sheep breeders. The "Milk Yield Increasing Breeding Programmes" were applied in two directions. According to the first, some milk type sheep breeds such as Awassi, Sakız and İmroz were bred to combine pure-bred and selection breeding. According to the second, crossbreeding programmes were applied to the breeds of Awassi, Sakız and İmroz together with the Akkaraman, Morkaraman and Dağlıç in order to increase their milk yield (Ertuğrul et al. 1993).

**Table 5.** Extinction and risk situations of Turkish native sheep breeds.

Breed and Type	Not endangered	Endangered	Nearly extinct	Extinct
Akkaraman, Morkaraman, Kangal Akkaraman, Kivircik, İvesi, Karayaka, İmroz	x			
Güney Karaman Herik, Hemşin, Karya, Karakaş, Norduz		x		
Dağlıç, Tushin Sakız, Çine Çaparı			x	
Ödemiş, Halkalı, Karakaşan				x

(Ertuğrul et al. 2009; Ertuğrul et al. 2010)

As a conclusion none of the crossbreeding programmes in Turkey could be successfully completed. One of the most important reasons is that the 90% of the Turkish sheep population have fat tail. The native fat tail always needs human manipulation to mate with the foreign thin tail sheep. Native sheep breed rams can lift the tail to mate female sheep, but the foreign thin tail ram can never lift the tail to mate the females. The Government or university breeding programmes always used some expert staff or technicians to mate the foreign thin tail rams to the native fat tail females. Under rural conditions, village farmers can never implemet that human manipulation for mating; so this kind of programmes cannot be applied at rural conditions. Because of these and other reasons the amount of sheep population decreases year by year and the sheep breeds disappear rapidly (Table 5). Conservation policies should continue and present breeds should survive for future generations.

## References

- Akmaz A, Tekin ME, Kadak R, Deniz, Nazlı M (1992). Akkaraman, İvesi ve Konya Merinosu koyunlarının önemli verim özellikleri yönünden karşılaştırılması. Tarım ve Köyişleri Bakanlığı, Hayvancılık Merkez Araştırma Müdürlüğü, Konya.
- Arık IZ, Dellal G, Cengiz F (2003). Anadolu Merinosu, Akkaraman, Ile de France x Anadolu Merinosu (F1) ve Ile de France x Akkaraman (F1) melezi koyunlarda bazı yapıları fiziksel özellikleri. Turk J Vet Anim Sci 27, 651-656.
- Aşkın Y (1982). Akkaraman ve Anadolu Merinosu koyunlarında eksogen hormon kullanarak kızgınlığın sinkronizasyonu ve döl veriminin denetimi olanakları. Doçentlik Tezi, Ankara Üniversitesi, Ziraat Fakültesi, s 224.
- Atasoy F, Ünal N, Akçapınar H, Mundan D (2003). Karayaka ve Bafra (Sakız x Karayaka G1) koyunlarında bazı verim özellikleri. Turk J Vet Anim Sci 27, 259-264.
- Batmaz ES, Başpınar H (1999). Karacabey Merinosu koyunların yarı-entansif koşullarda kuzulama aralığının kısaltılması üzerine bir çalışma. Turk J Vet Anim Sci 23, 665-672.

- BDUTAE (2011). Hayvan ırkları (http://bdutae.gov.tr/urunler/18/20.html, accessed on 14.05.2011).
- Çolakoğlu N, Özbeyaz C (1999). Akkaraman ve Malya koyunlarının bazı verim özelliklerinin karşılaştırılması. *Türk J Vet Anim Sci* 23, 351-360.
- Dellal G (2002). Akkaraman ve Anadolu Merinoslarında çevre ve kalıtım faktörlerinin kuzu verim özelliklerine etkisi. *Türk Vet Hay Derg* 26, 581-586.
- Ertuğrul M, Akman N, Aşkın Y, Cengiz F, Fıratlı C, Türkoğlu M, Yener SM (1993). Hayvan yetiştirme (Yetiştiricilik). Baran Ofset, Ankara.
- Ertuğrul M, Dellal G, Soysal İM, Elmacı C, Akın O, Arat S, Barıtcı I, Pehlivan E, Yılmaz O (2009). Türkiye yerli koyun ırklarının korunması. *Uludağ Üniv Ziraat Fak Derg* 23, 97-119.
- Ertuğrul M, Dellal G, Elmacı C, Akın AO, Pehlivan E, Soysal İM, Arat S (2010). Çiftlik hayvanları genetik kaynaklarının korunması ve sürdürülebilir kullanımı. *Türk Ziraat Mühendisliği VII. Teknik Kongresi*, 11-15 Ocak 2010, Ankara.
- Günaydın G (2009). Economic and political analysis of Turkish sheep breeding sector. *Sheep Breeding Congress of Turkey*, 12-13 February 2009, İzmir, Turkey.
- Kaymakçı M (1979). Çeşitli genetik yapılarıdaki koyunlarda döl veriminin artırılması ve doğumlarının sinkronizasyonu üzerinde araştırmalar. *Ege Üniversitesi Ziraat Fakültesi*, Yayın No 361, Bornova, İzmir.
- Kaymakçı M, Taşkın T (1998a). Acıpayam koyunlarının tip sabitleştirilmesinde seleksiyon ve akrabalı yetiştirme olanaklarından yararlanma. (I. Acıpayam koyunlarında döl verimi ve gelişme özellikleri). *Ege Üniv Ziraat Fak Derg* 35, 33-39.
- Kaymakçı M, Taşkın T (1998b). Acıpayam koyunlarının tip sabitleştirilmesinde seleksiyon ve akrabalı yetiştirme olanaklarından yararlanma. (II. Acıpayam koyunlarında dış yapı ve süt verim özellikleri). *Ege Üniv Ziraat Fak Derg* 35, 41-48.
- Kaymakçı M, Taşkın T (2001). Batı Anadolu ve Trakya'da melezleme ile elde edilen yeni koyun tipleri. *Hayvansal Üretim Dergisi* 42, 45-52.
- Kaymakçı M, Taşkın T, Koşum N (2002a). Sönmez koyunlarında tip sabitleştirilmesi (I. döl verimi gelişme özellikleri). *Ege Üniv Ziraat Fak Derg* 39, 87-94.
- Kaymakçı M, Taşkın T, Koşum N (2002b). Sönmez Koyunlarında tip sabitleştirilmesi (II. kimi vücut ölçüleri ve süt verim özellikleri). *Ege Üniv Ziraat Fak Derg* 39, 95-101.
- Kaymakçı M, Koşum N, Taşkın T, Akbaş Y, Ataç F (2006). Menemen koyunlarında kimi verim özelliklerinin belirlenmesi üzerinde bir araştırma. *Ege Üniv Ziraat Fak Derg* 43, 63-74.
- Kaymakçı M (2008). Türkiye koyunculığında melezleme çalışmaları. *Hayvansal Üretim* 49, 43-51.
- Mason IL (1996). *A world dictionary of livestock breeds, types and varieties* (4<sup>th</sup> edition). CAB International: Wallingford, UK.
- Özcan M, Ekiz B, Yılmaz A, Ceyhan A (2004). The effects of some environmental factors affecting on the growth and greasy fleece yield at first shearing of Turkish Merino (Karacabey Merino) lambs. *İstanbul Üniv Vet Fak Derg* 30, 159-167.
- Özder M, Kaymakçı M, Soysal İ, Kızılay E, Sönmez R (1996). Türkgeldi sürüsünde tipin sabitleştirilmesi. TUBİTAK, VHAG-537 nolu proje kesin raporu, Tekirdağ.
- Özder M, Kaymakçı M, Taşkın T, Köycü E, Karaağaç F, Sönmez R (2004). Growth and milk yield traits of Türkgeldi sheep type. *Türk J Vet Anim Sci* 28, 195-200.
- Öznacar K (1973). Karacabey Merinoslarında yapağı yönünden seleksiyon imkanları. *Lalahan Zootečni Araştırma Enstitüsü*, Yayın No 32, Ankara.
- Pekel E, Düzgüneş O, Güney O (1973). Gözlu Devlet Üretim Çiftliğinde yetiştirilen Anadolu Merinosları üzerinde tanıtıcı araştırmalar. *Ankara Üniversitesi Ziraat Fakültesi Yıllığı*, 3 (1-2).
- Pekel E, Güney O (1974). Anadolu Merinosu, Akkaraman, İvesi koyunları ile bunların saf dölllerinin Gözlu Devlet Üretim Çiftliği şartlarında önemli bazı verimler yönünden karşılaştırılmaları. *Çukurova Üniversitesi Ziraat Fakültesi Yıllığı* 5, 1-2.
- Sönmez R, Kızılay E (1972). Ziraat Fakültesi Menemen Uygulama Çiftliğinde Yetiştirilen İvesi, Kıvırcık, Sakız ve Ödemiş koyunlarının verimle ilgili özellikleri üzerinde mukayeseli araştırma. *Ege Üniv Ziraat Fak Derg* 9, 1-4.
- Sönmez R (1975). Hayvan yetiştirme. *Ege Üniversitesi Ziraat Fakültesi Yayınları*, s 141, İzmir.
- Sönmez R, Kaymakçı M, Türkmüt L, Kızılay E (1975). Tahirova koyunlarında tipin sabitleştirilmesi ve halk elindeki Kıvırcık koyunlarının bu tiplerle ıslahı olanakları. TUBİTAK BAKKA-9 Kesin Rapor, İzmir.
- Sönmez R (1978). Koyun yetiştiriciliği ve yapağı. *Ege Üniversitesi Ziraat Fakültesi Yayınları*, s 108, İzmir.
- Sönmez R, Türkmüt L, Kaymakçı M (1991). Tahirova koyunlarında tipin sabitleştirilmesi ve halk elinde Kıvırcık koyunlarının bu tiplerle ıslahı olanakları. *Türk J Vet Anim Sci* 15, 72-86.
- Sönmez R, Kaymakçı M, Eliçin A, Tuncel E, Wassmuth R, Taşkın T (2009). Türkiye koyun ıslahı çalışmaları. *Türkiye Koyun Yetiştiriciliği Kongresi*, 12-13 Şubat 2009, İzmir, Türkiye.
- TAGEM (2009). *Türkiye Çiftlik Hayvanları Genetik Kaynakları Kataloğu*. Tarım ve Köyişleri Bakanlığı, Tarımsal Araştırmalar Genel Müdürlüğü, Ankara.
- TİGEM (2011). *Koyun İrkları* (http://www.tigem.gov.tr, accessed on 14.05.2011).
- Türkiye İstatistik Kurumu (2010). *Hayvancılık İstatistikleri* (http://www.turkstat.gov.tr, accessed on 23.12.2010)
- Yılmaz O (1984). Türkiye yerli koyunlarını tanımlayıcı parametreler. Lisans tezi, Ankara Üniversitesi, Ziraat Fakültesi, Zootečni Bölümü. Ankara, Türkiye, s 78.
- Yılmaz O (1995). Some repeatability and heritability characters on Scottish Blackface sheep. Unpublished MSc Thesis, Aberdeen University, Faculty of Agriculture, Department of Animal Science. Aberdeen, UK, 96 pp.