

Review

## The farm animal genetic resources of Turkey: sheep – I – common and rare breeds

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

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

<sup>b</sup> Bartridge Partners, Umberleigh, Devon EX37 9AS, United Kingdom

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

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

\* Corresponding author: zileiorhan@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, travelers or intruders for centuries which cause existence of considerable different kinds of domestic animals. Although some of genotypes extinct or crucially under extinction risk, domestic livestock resources of Turkey have not been adequately appraised. On one hand new breeds are domesticated by human, on the other hand much more breeds are getting extinct by human. Creation new breeds supplies to human welfare, but extinction of native breeds also leads to exacerbate human life. In this study, domestic livestock biodiversity and conservation of Turkey is intended to explain by giving brief examples about 21 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 and is one of the most important sheep producer in the world (Türkiye İstatistik Kurumu 2011). Turkish sheep breeds are divided into 2 groups as fat or thin tailed breeds (Table 1). Fat tailed sheep are in majority in Turkish sheep population. The reason is that sheep breeding is generally seemed as a second job after crop production by Turkish farmers. Sheeps are grazed in open land in spring season. In this season animals complete their body condition up to normal body size. At the end of June, generally grass becomes dry on pasture and in July cereals are harvested. After July, sheeps generally eat either dry grass on pasture or stubble leftover by cereals on fields until winter season, so then sheeps put on fat either under skin or around intestine and kidneys, but especially in tail.

**Table 1.** An overview to the common and rare sheep breeds of Turkey

	Fat Tailed	Thin Tailed
<b>Common</b>	İvesi, Dağlıç, Morkaraman, Akkaraman	Karayaka, Kıvırcık,
<b>Rare</b>	Çandır, Çine Çaparı, Hemşin, Herik, Kangal, Karaman, Karacadağ, Karagül, Karakaş, Norduz, Güney Karaman, Tuj	İmroz (Gökçeada), Karya, Pırlak, Sakız,

(Sönmez 1975; Ertuğrul et al. 1993; Kaymakçı 2008; Ertuğrul et al. 2009; Sönmez 2009; TAGEM 2009)

Tail grows up to maximum size before winter season. During winter season sheep are fed by lots of wheat straw and some wheat bran. Sheep can only survive by

consuming fat in tail by the end of the winter season. Due to inadequate feeding in winter sheep lose some part of body tissues besides fat. After winter season sheep can first complete these body tissues and then after July they put on fat again. This circle repeats every year; hence fat tail is very crucial for sheeps (Sönmez 1978).

#### 1.1. Common Breeds

The common sheep breeds of Turkey are İvesi, Dağlıç, Karayaka, Kıvırcık, Morkaraman, and Akkaraman (Table 2). The breeds of Karayaka and Kıvırcık have thin tail and rest have fat tail.

**1.1.1. İvesi** (Figure 1) also known as Awassi which mainly lives in southeast Turkey (Mason 1996) and endangered (Ertuğrul et al. 2009). İvesi sheeps are featured with mid-sized white body, having black or brown spots on head, neck and legs. Both male and female are polled (TAGEM 2009).



**Figure 1.** İvesi Sheep

**Figure 2.** Dağlıç Sheep

**1.1.2. Dağlıç** (Figure 2) lives in western Anatolia. It is a coarse wool, meat and milk type breed with black spots on head and legs. Male is usually horned female is usually polled (Mason 1996). Dağlıç is nearly extinct and 200 sheep have been under protection by three farmers in Bolvadin (Ertuğrul et al. 2009).

**Table 2.** Fat and thin tailed common native sheep breeds of Turkey

Trait	Fat Tailed Breeds				Thin Tailed Breeds	
	Akkaraman	Morkaraman	Dağlıç	İvesi	Kıvırcık	Karayaka
Name of Breed	Akkaraman	Morkaraman	Dağlıç	İvesi	Kıvırcık	Karayaka
Local Name of Breed	Akkaraman	Morkaraman	Dağlıç	İvesi	Kıvırcık	Karayaka
Breed at risk	Not endangered	Not endangered	Nearly extinct	Not endangered	Not endangered	Not endangered
Purpose of raising	Meat, milk	Meat	Meat, milk	Milk, meat	Meat	Meat, wool, milk
Main region or country	Central Anatolia	East Anatolia	Central-West Anatolia	Southeast Anatolia	Thrace, Marmara and North Aegean	From Sinop to Trabzon
Color	White body, black spots on muzzle, ears and feet	Light to dark brown body	White body, black or brown spots on muzzle, ears and feet	White body, black or brown spots on head, neck and legs	White body, sometimes black or pied	White body, black spots on head and neck
Polled or not	Female not horn, male has horn	Female not horn, male has horn	Female not horn, male has long, spiral horn	Female polled, male horned	Female not horn, male has spiral horn	Female not horn, male has horn
Height (♂, ♀ cm)	-	75 ♂, 68 ♀	67 ♂, 61 ♀	66 ♂, 65 ♀	69 ♂, 64 ♀	66 ♂, 62 ♀
Body length (♂, ♀ cm)	-	72 ♂, 67 ♀	65 ♂, 63 ♀	62 ♂, 59 ♀	80 ♂, 66 ♀	71 ♂, 63 ♀
Birth weight (♂, ♀ kg)	4-4.9	3.9 ♂, 3.5 ♀	3.5 ♂, 3.5 ♀	4.6 ♂, 4.4 ♀	4.0 ♂, 3.7 ♀	3.5 ♂, 3.2 ♀
Adult weight (♂, ♀ kg)	50-60 ♂, 35-40 ♀	50-90 ♂, 40-60 ♀	53 ♂, 46 ♀	74 ♂, 50 ♀	60-70 ♂, 45-55 ♀	55 ♂, 40 ♀
Average daily gain for fattening (g)	-	192 (♂)	241 (♂)	264 (♂)	263 (♂)	220 (♂)
Milk (kg)	38-60	60	57	172	83	40-50
Lactation Length (days)	125	126	75-105	185	180	100-160
Wool (Greasy) (kg)	1.5-2.0	1.5-2.0	2.3	2.5	1.5	2-3.5
Gestation age (month)	-	18	18	18	16-18	18
Lamb yield (%)	1.05	1.0	1.0	1.1	1.2	1.1

(Sönmez 1975; Sönmez 1978; Ertuğrul et al 1993; TAGEM 2009)

**1.1.3. Karayaka** (Figure 3) lives in north Anatolia. It has coarse wool, long thin tail and small body size. Males are 55 kg and females are 40 kg. Body coat colour is white with black eyes or black head and legs but occasionally black or brown. Males are usually thick, and spirally horned, females are usually polled (Mason 1996; Arat 2011).



**Figure 3.** Karayaka Sheep



**Figure 4.** Kıvırcık Sheep

**1.1.4. Kıvırcık** (Figure 4) lives northwest Turkey. Kıvırcık is meat and, milk type breed and has medium/coarse wool similar to Karnobat of Bulgaria and to Tsigai; part of Ruda (Balkans). They have white with white or spotted face but black and brown varieties. Kıvırcık male is horned and female is usually polled. (Mason 1996). A total of 286 sheep (15 ram and 271 sheep) is kept under protection by government at Marmara Agricultural Research Institute (MARI) and 200 sheep are under protection by one farmer in Kırklareli (Ertuğrul et al. 2009). Because of different genetic structure Kıvırcık is possibly originated from European sheep Breeds (Koban 2004).

**1.1.5. Morkaraman** (Figure 5) is a dominant sheep breed of East Anatolia. It is a meat type and has light to dark brown body. Male is horned, and female is usually polled. Males are 50-90 kg, and females are 40-60 kg (TAGEM 2009).

**1.1.6. Akkaraman** (Figure 6) lives in central Anatolia. It is a meat, and milk type breed. They have coarse wool. Coat colour is black on nose and face and occasionally around eyes. Male is usually polled, and female is polled (Mason 1996).



**Figure 5.** Morkaraman Sheep



**Figure 6.** Akkaraman sheep

## 1.2. Rare Breeds

There are rare sheep breeds of Çandır, Çine Çaparı, Hemşin, Herik, İmroz (Gökçeada), Kangal Karaman, Karacadağ, Karagül, Karakaş, Karya, Norduz, Pırlak, Sakız, Güney Karaman, and Tuj in Turkey (Table 3). The breeds of İmroz (Gökçeada), Karya, Pırlak, and Sakız are thin tailed and rest is fat tailed.

**1.2.1. Çandır** (crossbred) is a crossbred of Dağlıç x Akkaraman and lives in western Anatolia (Mason 1996). A synonym name is Kesber (Sönmez 1978).

**1.2.2. Çine Çaparı** (Figure 7) sheep are found in Aydın province. They are supposedly disease resistant. Females are 35 kg in adult weight. Coat colour is white, sometimes with light brown to black spots on feet and stomach (MARA/FAO 2000) They are also endangered breed and nearly extinct. 120 sheep are under protection by two farmers in Aydın (Ertuğrul et al. 2009).



**Figure 7.** Çine Çaparı Sheep



**Figure 8.** Hemşin Sheep

**Table 3.** Fat and thin tailed rare native sheep breeds of Turkey.

Trait	Fat Tailed Breeds								Thin Tailed Sheep Breeds			
	Çine Çaparı	Karagül	Norduz	Tuj	Güney Karaman	Hemşin	Herik	Kangal Karaman	Pırlak	Karya	Sakız	İmroz
<b>Name of Breed</b>	Çine Çaparı	Karagül	Norduz	Tuj	Güney Karaman	Hemşin	Herik	Kangal Karaman	Pırlak	Karya	Sakız	İmroz
<b>Local Name of Breed</b>	Çine Çaparı	Karagül	Norduz	Tuj	Güney Karaman	Hemşin	Herik	Akkaraman	Pırlak	Karya	Sakız	Gökçeada
<b>Breed at risk</b>	Nearly extinct	Nearly extinct	Endangered	Nearly extinct	Endangered	Endangered	Endangered	Not endangered	Endangered	Endangered	Nearly extinct	Not endangered
<b>Purpose of raising</b>	Meat, milk	Meat, milk, skin	Meat, milk	Meat, wool, milk	Meat, milk	Meat, wool	Meat, milk, wool	Meat, milk	Meat, milk	Milk, lamb	Milk, lamb	Milk, meat
<b>Main region or country</b>	Çine and Bozdoğan counties in Aydın Province	Province of Tokat and around	Norduz Region in Gürpınar County of Van Province	Çıldır County of Kars, Ardahan, Iğdır	Provinces of Antalya, Mersin, Hatay and Gaziantep	Artvin and Rize Provinces	Province of Amasya	Sivas and adjacent provinces in Central Anatolia	Kütahya, Afyon, Uşak, Manisa, Isparta, and Burdur Provinces	Provinces of Aydın, İzmir, Mani,sa, Uşak and Denizli	Çeşme, Urla and Seferihisar in İzmir Province	Island of Gökçeada, Canakkale Province
<b>Color</b>	Beige or light grey body; dark spots head, ears, legs and abdomen	Commonly black, rarely brown, grey or white body	Commonly white, rarely grey, brown, or white body	Shiny white body; dark spots on head, and, legs	White, grey, brown, red, black and pied body	From brown to black, sometimes light gray	White body, sometimes black or brown, dark spots on head, legs	White body, black spots around mouth and eyes	White body with black spots around mouth, eyes, on ears	White body with black spots around mouth, eyes, on ears	White body with black spots around mouth, eyes, on ears and legs	White body with black spots around mouth, eyes, on ears and legs
<b>Polled or not</b>	Female mostly not horn, male has big spiral horn	13% of female horn, male has horn	About 50% of female horn, male has horn	Female mostly polled, male has spiral horn	Female rarely has horn, male has horn	Female sometimes horn, male has big spiral horn	Female polled, male horned	Female not horn, 10% of male has horn	Female not horn, male has spiral horn	Female not horn, male has spiral horn	Female not horn, male has horn	Female polled, male has spiral horn
<b>Height (♂, ♀ cm)</b>	70 ♂, 65 ♀	65 ♂, 58 ♀	71 ♀	61 ♀	68 ♂, 63 ♀	79 ♂, 73 ♀	65 ♂, 61 ♀	-	63 ♀	67 ♀	75 ♂, 73 ♀	61 ♀
<b>Body length (♂, ♀ cm)</b>	64 ♂, 62 ♀	66 ♂, 58 ♀	68 ♀	71 ♀	63 ♂, 58 ♀	72 ♂, 68 ♀	67 ♂, 62 ♀	-	60 ♀	64 ♀	75 ♂, 72 ♀	63 ♀
<b>Birth weight (♂, ♀ kg)</b>	4.0 ♂, 3.5 ♀	3.3 ♂, 3.1 ♀	4.3 ♂, 4.0 ♀	3.8 ♂, 3.7 ♀	4.2 ♂, 3.6 ♀	3.4 ♂, 3.1 ♀	3.5 ♂, 3.3 ♀	-	4.0 ♂, 3.5 ♀	4.5 ♂, 3.5 ♀	3.2 ♂, 3.0 ♀	3.8 ♂, 3.7 ♀
<b>Adult weight (♂, ♀ kg)</b>	55-60 ♂, 35-40 ♀	58 ♂, 38 ♀	60 ♀	50-55 ♂, 45-50 ♀	52 ♂, 37 ♀	55-70 ♂, 55-60 ♀	60 ♂, 47 ♀	-	45-50 ♀	55 ♂, 45 ♀	70 ♂, 50 ♀	55 ♂, 48 ♀
<b>Average daily gain for fattening (g)</b>	210 ♂	-	279 ♂	190 ♂	275 ♂	215 ♂, 180 ♀	-	-	150 ♂	182 ♂	242 ♂	191 ♂
<b>Milk (kg)</b>	50	-	137	45	25-30	110	-	-	75-80	100	180-200	121
<b>Lactation Length (days)</b>	145-150	-	182	124	-	135-170	-	-	120	170	190	204
<b>Wool (Greasy) (kg)</b>	1.2	1.8-3.0	-	-	2.7	1.7	1.8-3.5	-	2-2.5	1.0	2	2.2
<b>Gestation age (month)</b>	-	11-18	-	-	18	18	18	-	18	10-14	8-9	16
<b>Lamb yield (%)</b>	1.1	1.0	1.1	1.2	1.0	1.1	1.1	-	1.2-1.5	1.6	2.0	1.2

(Sönmez 1975; Sönmez 1978; Ertuğrul et al 1993; TAGEM 2009)

**1.2.3. Hemşin** (Figure 8) is a variety of Morkaraman of northeast Turkey. It is a coarse wool, and meat type breed. Coat colour is brown, black or white. Male is horned, and female is usually polled. Tail is long with fat at base (Mason 1996). Hemşin is endangered and 200 sheep are under protection by one farmer in Ardanuç, Artvin (Ertuğrul et al. 2009).

**1.2.4. Herik** (Figure 9) of north Anatolia coarse wool, meat and milk type. Similar to Dağlıç usually white with dark spots on head; male horned, female usually polled; short fat tail (Mason 1996), endangered and 200 sheep are

under protection by three farmers in Amasya (Ertuğrul et al. 2009).



**Figure 9.** Herik Sheep



**Figure 10.** Imroz Sheep

**1.2.5. İmroz** (Figure 10) is milk, meat and coarse wool type breed. Male is horned, and female is polled or scars. A synonym name is Gökçeada (Mason 1996). A total of 94 sheep (18 ram and 76 sheep) is under protection by government and 200 sheep are under protection by two farmers in Gökçeada, Çanakkale (Ertuğrul et al. 2009).

**1.2.6. Kangal Karaman** lives in Sivas and Malatya provinces and is a local variety of Akkaraman (Mason 1996). It has white body, black spots on head. 5% of males have horn, and female is polled (TAGEM 2009).



**1.2.7. Karacadağ** of Diyarbakır is a local variety of Morkaraman near province of Diyarbakır (Mason 1996).

**1.2.8. Karagül** (Figure 11) is endangered, and 200 sheep are under protection by two farmers in Tokat (Ertuğrul et al. 2009). It is a meat, and milk type breed. Coat colour of Karagül is commonly black, rarely brown, grey or white. 13% of female and male has horn (TAGEM 2009). 200 sheep are under protection by two farmers in Tokat (Ertuğrul et al. 2009)

**1.2.9. Karakaş** is endangered sheep breed (Ertuğrul et al. 2009) and lives in Southeast Anatolia. It is a variety of Akkaraman. It has white body, and black spots on head (Sönmez 1978).

**1.2.10. Karya** lives in provinces of Aydın, İzmir, Manisa, Uşak and Denizli. It has coarse wool, small body size and is meat and milk type. Karya has usually white body with black spots around mouth, eyes, on ears. Male is usually thick, strong and spirally horned, female is usually polled. It has long thin tail (TAGEM 2009), and is endangered (Ertuğrul et al. 2009).

**1.2.11. Norduz** is a local breed of Norduz Region in Gürpınar County of Van Province of east Turkey. Coat colour is commonly white, rarely gray, grey, brown, or white. Norduz is a meat and milk type breed. Male is horned, and female is 50% polled. It is a fat tail breed. Norduz is endangered and 200 sheep are under protection by eleven farmers in province of Van (TAGEM 2009; Ertuğrul et al. 2009).

**1.2.12. Pırlak** lives in Afyon, Burdur, Isparta, Kütahya, Manisa, and Uşak. It has coarse wool, and mid-sized body. Coat colour is usually white with black spots around mouth, eyes, on ears. Male is usually strong and spirally horned, female is usually polled. Tail is long with fat at base (TAGEM 2009), and endangered (Ertuğrul et al. 2009).

**1.2.13. Sakız** (Figure 12) lives in İzmir. Coat colour is white with black spots around mouth and eyes and on ears and legs. Male is horned, and female is usually polled. Tail is long with fat at base (Mason 1996). It is nearly extinct, and a total of 130 sheep (35 ram and 95 sheep) is under protection by government and 113 sheep are under protection by four farmers in Çeşme, İzmir (Ertuğrul et al. 2009).



Figure 11. Karagül Sheep

Figure 12. Sakız Sheep

**1.2.14. Güney Karaman** (Figure 13) is black variety of Ak Karaman from Antalya, Mersin, Hatay and Gaziantep Provinces of South Anatolia (Mason 1996). It is a meat and milk type breed. Coat colour is white, grey, brown, red, black and pied. Female rarely has horn, male has horn. Male is about 52 kg, and female is 37 kg (TAGEM 2009). It is endangered, and a total of 46 sheep (24 ram

and 22 sheep) is under protection by government at Bahri Dağdaş International Agricultural Research Institute (Ertuğrul et al. 2009).

**1.2.15. Tuj** (Tushin) (Figure 14) lives in Kars, Ardahan and Iğdır Provinces. It is a meat, coarse wool and milk type breed. Coat colour is sometimes dark marks around eyes and on feet. Male is about 50-55 kg, and female is 45-50 kg. Male is horned, and female is polled. Tuj has short fat tail or fat rump. This breed is originally from Georgia (Mason 1996; TAGEM 2009) and nearly extinct (Ertuğrul et al. 2009).



Figure 13. Güney Karaman

Figure 14. Tuj Sheep

## 2. Conclusion

Sheep husbandry has lots of advantages unlike other farm animals. Sheep can be raised in different environmental conditions. They have many product and by product such as meat, milk, wool, skin, intestine and dung. They can consume roughage efficiently. Their sheepfold can be built lesser money than cattle. Because of many advantages sheep population decreased to half in 30 years.

Some breeds have been extinct and some of them nearly extinct and endangered. Therefore in 1995 The Preservation of Farm Animal Genetic Resources (FAnGR) Project started to preserve cattle breeds which were endangered. In 1996 breeds of sheep were included into the project. Hence, 14 sheep breeds were covered by this project (Table 4).

Table 4. Places and breeds/lines under preservation

Breed/line	Place
Karayaka, Herik, Çine Çaparı, Karagül, İvesi, Dağlıç, Cine,	Lalahan Livestock Research Institute (LLRI), Ankara
Sakız, Kıvrıkcık, İmroz (Chios)	Marmara Livestock Research Institute (MLRI), Balıkesir
Akkaraman	Bahri Dağdaş International Agricultural Research Institute (BDIARI), Konya
Morkaraman, Hemşin, Norduz	Bahri Dağdaş International Agricultural Research Institute (BDIARI), Konya

(TAGEM 2009)

After five years, DNA, cell and embryos were gathered for 13 sheep breeds and they are placed into two research institute (Table 5). However none of the breeding programmes have been succeeded completely. One of the most important reasons was that 90% of Turkish sheep populations have a fat tail. The fat tail always needs human manipulation to mate native sheep to foreign thin tail sheep. Native sheep breed rams can lift the tail to mate female sheep, but foreign thin tail ram never can lift the tail to mate females.

**Table 5.** Current DNA and Cell Bank Contents of sheep in May 2011

Breed	GEBI, Gebze, Kocaeli		LLCRI, Lalahan, Ankara			
	DNA	Cell	Embryo	Sperm	DNA	Cell
Karayaka	49 indiv.	64 indiv., 292 vial	136	25 indiv., 663 straws	49 indiv.	-
Herik	49 indiv.	48 indiv., 480 vial	50	18 indiv., 603 straws	49 indiv.	47 indiv., 470 vial
Gökçeada	50 indiv.	49 indiv., 490 vial	102	23 indiv., 730 straws	50 indiv.	49 indiv., 490 vial
Karagül	50 indiv.	48 indiv., 283 vial	60	13 indiv., 465 straws	50 indiv.	-
Morkaraman	50 indiv.	44 indiv., 184 vial	173	13 indiv., 556 straws	50 indiv.	-
Akkaraman	50 indiv.	49 indiv., 490 vial	65	23 indiv., 704 straws	50 indiv.	44 indiv., 440 vial
Sakız	49 indiv.	47 indiv., 470 vial	22	7 indiv., 298 straws	49 indiv.	47 indiv., 470 vial
Kıvırcık	45 indiv.	43 indiv., 195 vial	185	21 indiv., 656 straws	45 indiv.	-
İvesi	51 indiv.	51 indiv., 183 vial	50	23 indiv., 681 straws	51 indiv.	-
Dağlıç	50 indiv.	50 indiv., 192 vial	8	19 indiv., 635 straws	50 indiv.	-
Çine Çaparı	39 indiv.	39 indiv., 390 vial	38	16 indiv., 530 straws	39 indiv.	34 indiv., 340 vial
Hemşin	48 indiv.	48 indiv., 284 vial	64	18 indiv., 550 straws	48 indiv.	-
Norduz	54 indiv.	49 indiv., 490 vial	36	23 indiv., 807 straws	54 indiv.	49 indiv., 490 vial

(TÜRKHAYGEN-I 2011), GEBI: Genetic Engineering and Biotechnical Institute, LLRI: Lalahan Livestock Research Institute.

Always government or university breeding programmes are carried out using some expert staff or technicians to mate foreign thin tail rams to native fat tail females. Under rural conditions villager farmers never achieve human manipulation mating; hence this kind of programme cannot be applied at rural conditions. At the east and southeast of Anatolia huge amount of grasslands cannot be used by sheep flocks because of terror problem. Rural site people migrate from villages to metropolis cities due to insufficient life conditions so that they give up sheep breeding.

**Table 6.** Extinction and risk situations of Turkish native sheep breeds.

Breed and Type	Not endangered	Endangered	Nearly extinct	Extinct
Ak, Mor and Kangal Karaman, Kıvırcık, İvesi, Karayaka, İmroz	x			
Güney Karaman, Herik, Hemşin, Karya, Karakaş, Norduz		x		
Dağlıç, Tuj, Sakız, Cine, Capari			x	
Odemis, Halkali, Karakachan				x

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

Crop fields become smaller year by year because of heritage for every generation and sheep breeders cannot produce enough roughage and food for sheep. Because of such reasons, amount of sheep population decreases year by year and sheep breeds disappears rapidly (Table 6). Preservation policies should go on and present breeds should be survived for future generations.

## References

Arat S (2011). *In vitro* conservation and preliminary molecular identification of some Turkish domestic animal genetic resources (TÜRKHAYGEN-I). Genetic Engineering and Biotechnology Institute, Gebze, Kocaeli, Turkey.

Ertuğrul M, Akman N, Aşkın Y, Cengiz F, Fıratlı C, Turkoğlu M, Yener SM (1993). Hayvan yetiştirme (Yetiştiricilik). Baran Ofset, Ankara, 288 p.

Ertuğrul M, Dellal G, Soysal IM, Elmacı C, Akin O, Arat S, Barıtcı I, Pehlivan E, Yılmaz, O (2009). Türkiye yerli koyun ırklarının korunması. Uludağ Univ Ziraat Fak Derg 23, 97-119.

Ertuğrul M, Dellal G, Elmacı C, Akin AO, Pehlivan E, Soysal MI, Arat (2010). Çiftlik hayvanları genetik kaynaklarının kullanılması ve sürdürülebilir kullanımı. Türk Ziraat Mühendisliği VII. Teknik Kongresi, 11-15 Ocak 2010, 179-198 pp.

MARA/FAO (2001). Agriculture in Turkey, Güzelış Ltd. Ankara, 231 p. (ISBN 975-8153-00-5).

Kaymakçı M (2008). Türkiye koyunculığında melezleme çalışmaları. Hayvansal Üretim 49, 43-51.

Koban E (2004). Genetic diversity of native and crossbreed sheep breeds in Anatolia. The Graduate School of Natural and Applied Sciences, PhD Thesis, Middle East Technical University.

Mason IL (1996). A world dictionary of livestock breeds, types and varieties (4th Edition). CAB International: Wallingford, UK, 496 pp.

Sönmez R (1975). Özel zootečni. Ege Üniversitesi Ziraat Fakültesi Yayınları: 141, İzmir, 228 pp.

Sönmez R (1978). Koyunculuk ve yapağı. Ege Üniversitesi Ziraat Fakültesi Yayınları: 108, İzmir, 388 pp.

Sönmez R (2009). Türkiye koyun ıslahı çalışmaları. Uludağ Üniv Ziraat Fak Derg 23, 43-65.

TAGEM (2009). Türkiye çiftlik hayvanları genetik kaynakları kataloğu. Tarım ve Köyişleri Bakanlığı, Tarımsal Araştırmalar Genel Müdürlüğü, Ankara, 96 p.

TÜRKHAYGEN-I (2011). TÜRKHAYGEN-I Projesi ([www.turkhaygen.gov.tr](http://www.turkhaygen.gov.tr), accessed on 07.10.2011).

Türkiye İstatistik Kurumu (2011). Hayvancılık istatistikleri (<http://www.turkstat.gov.tr>, accessed on 23.12.2010).

Yılmaz O (1995). Some repeatability and heritability characters on Scottish Blackface sheep. Faculty of Agriculture, MSc Thesis, Aberdeen University, UK.