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Key information

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ГЕОТЕХНИКО ЕПИМЕЛЕТНРИО ЕЛЛАДАΣ

ДОЛНЕНИ

Abstract

According to the Ministry of Rural Development and Food there are 26 recognized autochthonous sheep breeds in Greece. Many of these breeds nowadays are threatened with extinction and are categorised as "critically endangered", while others are categorised as "endangered" or "vulnerable". Some other autochthonous sheep breeds are either extinct or their phenotypical and morphological characteristics do not correspond to their original (pure) form. The factors that have contributed to the shrinkage of the population of many of these breeds in Greece and which, inevitably lead some of them to their extinction or close to extinction, are complex and can be identified at many levels. Generally, it is broadly recognized that the following three aspects played a key role towards to the critical reduction of these populations, thus a) the uncontrolled and not planned or not selected mattings between animals of different breeds within flocks. This practice is taking place over the last seventy years or so and it is common to the majority of the sheep flocks in Greece, b) the lack of farmers' knowledge and inability (or carelessness in many cases) on implementing or participating in genetic improvement programs, and c) the neglection the scientific community showed over the last decades on the critical issue of preserving Greece's indigenous genetic resources. The Florina (known also as Florina-Pelagonia or Pelagonia) sheep breed it is now considered as a vulnerable to extinction. According to records held at the Centre of Animal Genetic Resources of Thessaloniki, the current population of the Florina sheep breed is estimated at about 1800 animals that are reared in about ten farms. The Pelagonia (Florina) sheep breed was traditionally reared for centuries in the area of Western Macedonia, particularly in the broaden area of the Florina prefecture but also in the broaden areas of Kozani and Kastoria. The breed is characterized as a hardy, thrifty and resistant to diseases. It can effectively utilise mountainous vegetation and can cope in adverse environmental conditions; based on its productive characteristics the breed is described as "dual purpose" as it has good capacities both for milk and meat production, with the latter being as one of the most important, due to the very good carcass conformation of the lambs and the tenderness of the meat. Over the last decade, there is a growing interest amongst sheep farmers on the Florina sheep breed; many farmers are keen to increase their flocks while other are keen to introduce Florina sheep in their farms. This interest inevitably increases the need for available genetic resources and reproducing animals of the Florina breed.

This report provides up to date information on the existing population and breeding status of the Florina sheep breed. It reviews the available literature on the autochthonous Greek sheep breeds with particular focus on the Florina breed and provides insights on the current issues of the Florina sheep production. The report presents the evolution of the breed both in terms of population and historical evolution

and maps the morphological and phenotypical characteristics of the Florina breed. The report finally discusses the production competitiveness of the breed, the pros and the cons, and provides a basis for a framework under which the breed could play a key role in sheep farming sector in Greece, particularly in the less favoured – mountainous areas.

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1. Historical background of sheep farming in Greece

Sheep farming comprises an important part of the ancient Greek economy according to Hesiod and it is strongly associated with the ordinary life of ancient Greeks, as illustrated by Greek Mythology and Aesop's tales. The first written description of sheep farming in Greece is found in Homer's Odyssey (12th century BCE), where Homer describes how shepherd Polyphemus takes his sheep out to graze and gives a clear and full description of a cheese-making and cheese-storing process of that time. However, the first documented evidence of milk consumption in Greece is tracked back to Neolithic era (5.400BC), as it was evidenced by chemical analysis of Prehistoric jars found in Makriyalos and Stavroupoli of Central Macedonia, containing milk remains (Evershed et al., 2008). This is the oldest recorded use of milk that has been found on the European territory and although it cannot be directly related to sheep production, according to findings from the same archaeological excavations, the domesticated animals that were bred in the area were about 54% sheep and goats, 29% cattle and 17% pigs (Giannouli, 2004). Analysis of the faunal assemblage of the Neolithic lakeside settlement of Dispilio, Western Macedonia, Greece, indicates that amongst domesticated animals, sheep is the most common species (Samartzidou, 2012) a finding that has significant similarities with other Neolithic faunal assemblages found in Greece (Samartzidou, 2014).

During the years of the so-called Byzantium (Eastern Roman Empire), sheep farming was a prominent feature of the livestock production during the Byzantine period (330–1453) for the expanse of the Byzantine Empire (Eustathiou, 1996). Dairy sheep products were staple foods for Romioi (Ρωμιοί; Ρωμιός, Romios; the name by which the Greeks were known in the Byzantine periods) and there are references about many types of cheeses and dairy products of that time, such as *asvestotyri* (a cheap low quality cheese), *tyrepsitos zomos* (a delicacy), *pyriati* (a kind of buttermilk), *oxygala* etc., many of which, are recognised as contemporary dairy products, as well. It should also be noted that during medieval times the contribution of monasteries (as self-sufficient communities) was very

important in the developing of new cheese varieties and cheese-making techniques. The tradition of sheep farming in the Greek territory continues during Ottoman Empire up to the 20th century with the establishment of national borders and continues up to current times.

It is broadly accepted that the preservation and the continuation of the sheep farming in Greece from Byzantine times through the Ottoman Empire till today, is attributed to the Sarakatsani and the Vlachs, nomadic shepherd people, who preserved for eons their pastoral way of life, social organisation and tradition. The Sarakatsani, as traditionally transhumant shepherds were moving their flocks seasonally from mountainous areas to lower plains (i.e. the migration would start on the eve of Saint George's day in April and the return migration would begin on Saint Demetrius' day, on 26 October), exploiting the vegetation of the mountainous areas during the summer and the vegetation of the lower plains during winter; a practise that also allowed to deal effectively with summer droughts in the lowlands and winter cold and snow in the mountainous areas. Before the Second World War some flocks were often migrating to neighbouring countries, as at that time border crossings were unobstructed. Upon border closing in 1947 some Sarakatsani families were trapped in Albania, Bulgaria and countries of the former Yugoslavia and were not able to return to Greece.

The seasonal movement of sheep between summer and winter pastures was the dominant type of pastoralism and sheep farming in Greece. Nowadays, the extensive and semi-extensive farming systems have become the main sheep farming systems in Greece while the transhumant system represents about 7% of all sheep flocks in Greece (Laga, 2017).

1.2. Fluctuation of Sheep Population in Greece

In general, the population of sheep in Greece has always been large considering the size of the country and the human population. The first documented record on sheep

population in Greece comes as early as from 1852, indicating around 2 million sheep at that time (Hatziminaoglou, 2001); nevertheless, the population of sheep in the Greek territory in the late of the 19th century is estimated to be much higher. Over the last 100 years the population of sheep increased and reached almost 10 million heads during 1999-2009 (Figure 1).

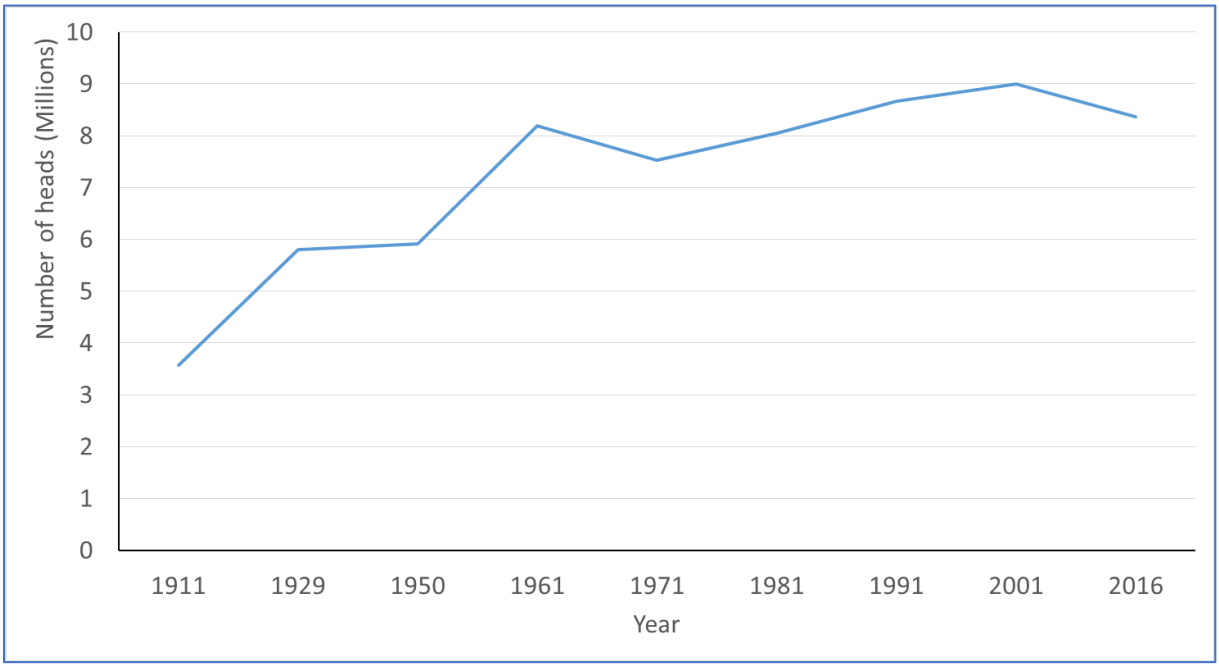

Figure 1. Fluctuation of Sheep Population in Greece (FAOSTAT, 2019)

This increase has been continuous with the exemption of two periods a) 1940-1950, a period related to extraordinary events imposed by the Second World War and b) during 1960 – 1970 where a significant number of Greeks migrated to Europe, Americas and Australia due to the economic uncertainty and the big demand for human labour in these continents. The increase of the sheep population during late 1990s to late 2000, is largely attributed to the EU polices on sheep farm subsidization as this was implemented on a flock size basis. Indeed, farmers during this period chose to increase flock size over productivity in order to maintain or increase their income (Hadjigeorgiou, 1998). Flock

size increasement was also influenced by the easiness to hire inexpensive workers due to the influx of thousands of immigrants (illegal or not) from neighbouring countries during this decade. Sheep population in Greece over the last five years remains relatively stable at about 8 million heads (FAOSTAT, 2019). The distribution of sheep population over the regions of Greece is shown in Figure 2.

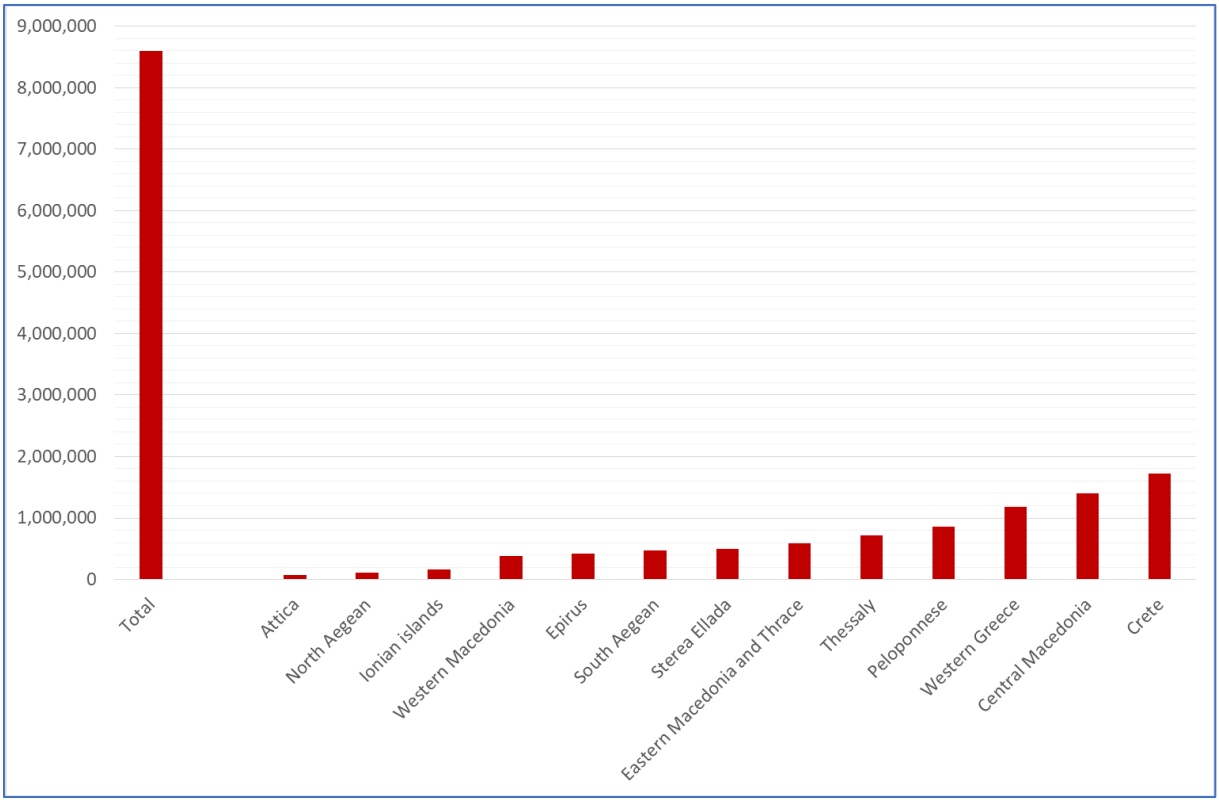

Figure 2. Distribution of sheep population over the regions of Greece (FAOSTAT, 2019)

1.3. Indigenous sheep breeds in Greece

The indigenous breeds of sheep have resulted from ancient types in the distant past primarily through natural selection (Hatziminaoglou, 2001; Rogdakis, 2006). It is also likely that shepherds themselves could have also played a role in the formation of some of the characteristics of the indigenous breeds through selection for desired characteristics. For example it is known that The Sarakatsani were in favor of the sheep

with back fleece and normally they were selecting for this morphological trait (G Zaralis, personal communication).

It is generally accepted that indigenous breeds of sheep belong either to the Zackel or Ruda types in view of the type of the wool and the thickness of the tail. According to these characteristics indigenous breeds can be classified as shown in Table 1. In the Zackel type belong breeds that normally have coarse-wooled type of fleece and thin tails. These breeds are used both for meat and milk production while the color of the wool although mostly white can also be brown, black or pied. Males have normally long spiral horns but females may be polled. The Zackel type of breeds is found both in the mainland and in the islands of the country while almost all the highland and some of the lowland breeds belong to this category.

Table 1. Classification of indigenous Greek Sheep Breeds based on tail thickness and wool type.

	Coarse-wooled	**Uniform-wooled**
Thin tail	Karagouniko Kalaritiki Boutsiko Sarakatsaniki Sfakion Lemnos Karystos Zakynthos Kefalonia	Serrai Thrace Kimi Skopelou **Florina (Pelagonia)** Frisarta
Semi-thick tail	Lesvou	Chios

Breeds of the Ruda type have a finer-fleeced type of wool (uniform-wooled) that is normally white, while the thickness of the tail can be either thin or medium thick. Ruda

sheep are regarded to derive from the Tsigai type that originates from Asia Minor and became widely spread in the peninsula of Haemus via Hungary. Ruda breeds are bred for milk and wool but are regarded to have excellent meat characteristics as well. Breeds belong to this type can be found in the northern regions of Greece (Macedonia, Thrace) as well as in some Aegean islands.

These breeds, based on the geographical area they originate from, are classified as *Mountain*, *Lowland* and *Island* breeds. In addition they represent about 20% of the total sheep population in Greece while the majority (about 80%) of sheep population belongs to the so-called crossbreeds or uncategorized genotypes.

Mountain breeds: This category includes breeds classified in the Zackel type and are bred mainly in the semi-mountainous and mountainous areas of Mainland Greece and some islands and are typical of the extensive or semi-extensive pastoral systems (i.e. transhumant). Such breeds are the Vlach breed, the Sarakatsaniki (also Karakachan, Karatsaniko) –named after Sarakatsani shepherds - the Boutsiko breed, the Sitia the Psiloris and Sfakia breeds from Crete. The exact population of these breeds is not accurately known but certainly are regarded as endangered or vulnerable for extinction (Hatziminaoglou 2001, Laga, 2017). Typically animals from these breeds are small, with strong constitution, tolerant to adverse climatic conditions, resistant to diseases and show great ability in long distance walking due to their short but strong legs (Hatziminaoglou 2001, Laga, 2017).

Lowland breeds: These breeds belong either to the lowland Zackel type or the Ruda type. These breeds are normally raised in semi-intensive flocks mainly in Thessaly and Central Macedonia but are also found in semi-mountainous areas of Greece. Examples of these breeds are Karagouniki from the Zackel type and Serrai and Chios (although originated from island of Chios) from the Ruda type. The total population of all these breeds together is estimated at about 220,000 heads; however a large (but not determined)

number of sheep raised in the lowlands are regarded to have at different extends genetic background from these breeds (Karagouniki) Hatziminaoglou 2001, Laga, 2017).

Island breeds: Breeds of Chios, Skopelos, Kymi, Zakynthos and Lesvos belong to this category. All these breeds are regarded as high production breeds with Chios having a greater intrinsic capacity for milk production, while the breed of Lesvos is considered to have moderate milk yields. Nevertheless, apart from the Chios breed all the other breeds are categorized as critically endangered, endangered or vulnerable, in terms of degree of danger for extinction.

Uncategorized genotypes of sheep: The population of many of the aforementioned breeds has been declining dramatically over the last fifty years or so, and as already mentioned many of these breeds are facing the danger of extinction to a greater or lower extent, if not already extinct. The population of the sheep in Greece today is estimated at about 8 000 000 heads and only 20% of this population i.e. about 1 600 000 sheep can be categorized in pure breeds. This includes animals that belong to the indigenous Greek breeds as well as animals that belong to imported breeds. Generally speaking, in Greece the number of pure breed animals is quite low due to extensive and unorganised crossbreeding. Therefore the protection of the remaining rare breeds is imperative in order to preserve, not only the genetic material, but also the cultural and ethnological heritage of sheep farming.

1.4. Factors affecting the population of the indigenous breeds.

Population levels of the indigenous sheep breeds have been in a gradual reduction over the last 50 years -or so in Greece. This have lead some of the indigenous breeds to their total extinction, while some others are facing the danger of extinction to a different extent. In 1995, the Ministry of Rural Development and Food in Greece classified the recognized indigenous Greek sheep breeds into categories, based on their population levels, indicating the degree of danger for extinction every single one was facing at that

time (Table 2). Nowadays, many of the breeds that were classified as "critically endangered" in 1995, such as the breed of Argos or the breed of Roumloukion, are considered extinct; while the indigenous breed of Chalkidiki was extinct (not-listed) before 1995.

Table 2. Classification of the recognized indigenous Greek Sheep Breeds according to the degree of danger for extinction (source, P.D. 434/1995; Ministry of Rural Development and Food, Greece)

Critically Endangered[1]	**Endangered[2]**	**Vulnerable[3]**	**Normal[4]**
Katafigion	Zakynthos	Skopelow	*Karagouniko*
Roumloukion	**Florina (Pelagonia)**	Kimi	Lesvou
Evdilos Ikaria	Sarakatsaniki (Karatsaniko or Karakachan)	Chios	Sfakion
Lefkimmi	Katsika	Agrinio	Frisarta
Argos		Drama	Serrai
		Thrace	Kefalonia
		Kalaritiki	Boutsiko (*Epirus*)
		Piliou	*Skyros*
			Karystos

[1], *Critically Endangered: Facing an extremely high risk of extinction in the wild.*
[2], *Endangered: Very likely to become extinct in the near future.*
[3], *Vulnerable: likely to become endangered unless the circumstances that are threatening its survival and reproduction improve.*
[4], *Normal: evaluated as not being a focus of species conservation.*

Most scientists agree that the main factors responsible for the constant reduction of the population of the indigenous breeds of sheep are: a) the frequent and often unjustified, replacement of the purebred indigenous animals with imported ones, also known as "improved breeds", and b) the unselective and/or accidental mattings that occur

between different breeds (or genotypes) of sheep within a flock (Hatziminaoglou 2001, Christodoulou, et al., 2007). Indeed, in attempt to increase profit, many farmers instead of improving and developing further their farming system exploiting existing genetic resources, chose to replace indigenous purebred animals with imported breeds solely based on the capacity of these breeds for high production. In addition, for many years farmers never applied selected reproductive schemes to improve production traits of their flocks and any attempt towards this direction was through uncontrolled and unplanned mattings. Under this practice, the resulted population of sheep is of various morphological and productive characteristics and therefore cannot be classified in certain breeds.

Towards this direction has contributed considerably the absence of national integrated breeding programs with the aim to improve indigenous breeds for the benefit of the farmers. It should be stressed that both the scientific community and the national authorities for many years have failed in preserving indigenous genetic resources and have not trained and educated farmers in developing and applying appropriate reproductive schemes for their flocks. Most farmers merely rely on the anticipated productivity of the imported breeds or the crossbreeds and often fail to account for their suitability to particular environmental conditions, feed availability, and farming type in general. On the other hand, the advantages of the indigenous breeds such as the effective utilization of mountainous vegetation, ability for disease resistance, ability to cope with adverse climatic conditions are not appropriately communicated to farmers by experts in sheep production. In addition, given the admittedly superior quality of milk, meat, and wool characteristics that indigenous breeds can produce, investing in product quality has not been seen as means for enhancing farmers' profit.

2. The Florina (Pelagonia) sheep breed

2.1. General aspects

Florina (Pelagonia) sheep were traditionally bred in areas of Western Macedonia. Florina sheep typically are bred in extensive or semi-extensive systems and it is regarded as a semi-mountainous breed. They are capable of long distance walking a characteristic that enables them to graze in large (broaden) area far from the farm and thus, can effectively utilize the vegetation of mountain and semi-mountain pastures. They are normally robust animals that can cope with the adverse climatic conditions of mountainous and semi-mountainous areas (Triantafillidis et al., 1998). The breed, based on its productive characteristics, can be characterised as "dual purpose" given the exceptional potential of growth and fattening ability of lambs and the quality of their carcass (Christodoulou et al., 2007; Papas 1996), but also in view of the milk quality and the ability to increase milk production under certain conditions (Alexandridis et al., 1987). It is a notable breed that could certainly play a key role for milk and meat production in mountainous or semi-mountainous areas of mainland Greece. However over the last fifty years or more, its population gradually declined and in year 1995 the breed was categorised as *endangered*, meaning that the likelihood to become extinct in the near future is high if not appropriate measures are set in place.

2.2. Origin and population of the Florina breed

The Florina sheep breed is originated from the broaden area of the Florina prefecture (hence the name of the Breed; but also known as Pelagonia) and since time immemorial the breed was traditionally bred in the wider area of Western Macedonia. The ancestors of the breed is difficult, if not impossible, to be tracked down, but it is regarded to be originated from ancient indigenous Greek populations (Triantafillidis et al., 1997). The breed has common characteristics with the Kymi and Skopelos breeds while there are anecdotal evidence that Florina breed is originated from the breed of

Halkidiki (now extinct). It is possible that these breeds come from the Zigaia type of sheep, which were introduced to Greece from the regions of Eastern Romulia (Polymerou-Kamilaki, A., 2016). According to Brooke and Ryder (1978) the breed is regarded as a cross between the Mountain and Lowland types of sheep.

It is not possible to estimate the exact number for the Florina sheep in the area before year 1995 as registrations of animal populations was not referring to specific breeds of animals. Data on the Florina population became available after the breed was characterized as "endangered". According to the available data, by the end of 1970, the population of the Florina breeds in Western Macedonia is estimated at 1,500 - 2,000 animals. The breed in terms of animal population for that period was characterized as "sensitive". About 100 to 150 Florina sheep have been kept constantly at the Farm of the University of Western Macedonia (former Agricultural School) for teaching and research purposes while by mid-1990s about 500 adult sheep were brought and kept in the research unit of ETHIAGE (Giannitsa Animal Husbandry Institute) for research purposes. Today the population of the Florina sheep breed is estimated at about 1800 heads that are bred in ten farms, two of which are experimental farms (i.e. University of Western Macedonia; Giannitsa Research Livestock Institute)

2.3. Morphological characteristics of Florina sheep

The morphological characteristics of Florina sheep have been described in Triantafillidis et al., (1997) and Triantafillidis et al., (1998). Most recently, body measurements and other morphological traits were collected by Roustemis and Zaralis (unpublished data) from a number of Florina sheep (preliminary data are shown in Table 3)

Colours of Florina sheep: The colour of the Florina sheep is typically white, but in the vast majority of the animals the surrounding area (hair/skin) around the eyes is coloured black, often is referred as “back ring of the eyes”. This ring varies in size and in some

cases (rarely) the ring is incomplete. A small percentage of the animals may have a completely white head. Normally the colour towards the endings of both ears is black but in some cases both ears may be black. Black spots may also appear on the nose and rarely black spots may appear below the knee in the area of the cannon and pastern.

Table 3. Typical body size of Florina Sheep (Roustemis and Zaralis, unpublished data)

Body measurement	Size (cm)
Wither Height	68,19
Height at the middle of the back	65,96
Body length	79,01
Chest Width	23,38
Chest Depth	30,62
Chest Girth	92,94
Rump Length	22,44
Rump Width	19,83
Ear length	13,81
Head length	24,41
Head width	9,14
Cannon circumference	9,11

Head: The head is large, triangular shaped with a convex profile (more pronounced in males) and ears are slightly hanging downwards.

Horns: Horns are normally of helical shape in the rams but there might be also polled rams. The colour of the horns is light and with a black line along the length. Ewes are usually polled but a small percentage may have horns, while rudimentary horns are rare.

Body: The body is of medium length and width with a straight back line. Body weight for an adult ewe and ram ranges from 55 to 65 kg and 75 to 82 kg, respectively. Height ranges from 63 to 70 cm and 75 to 82 cm for ewes and rams, respectively. The tail

is long, thin and covered with wool. The breast is well developed, often spherical, usually with vertical nipples, properly positioned.

Wool: The breed is classified as Ruda type, and the fleece is always white coloured covers the entire body, except the head, lower neck, abdomen, and limbs.

2.4. Productive and reproductive characteristics

Florina sheep reach puberty quite early (i.e. at about 7 to 8 months of age) and first matting will occur at about 10 months of age as most of the ewe lambs will reach 2/3 of their adult body weight by that time. Breeding season normally starts in late June to July and can last up until the end of October. First lambings will occur in December but most ewes will give birth in January till late February (depending on reproductive management). Conception rate is about 85% (i.e. number of ewes lambed over number of ewes exposed to the ram) with ewe prolificacy at 1.4.

In terms of milk production the breed is characterised as medium producing breed. The average sellable quantity of milk per ewe is estimated at about 120 to 140 kg per milking period (i.e. 80 – 110 days) while, under experimental conditions some individuals produced on average 242 kg of milk over 180 days, indicating the potential of the breed for better milk yields (Triantafillidis et al., 1997). The average milk fat content is about 6.7%.

The Florina breed is considered as one of the best meat producing sheep breeds in Greece compared to other indigenous breeds, based on meat quality characteristics and carcass conformation (Christodoulou et al., 2007). According to data from a series of fattening experiments with weaned lambs, growth capacity is high (i.e. average of 280 g per day for males; 220 g per day for females) with very good feed conversion ratio (i.e. 4.6 or male and 5.6 for female lambs) (Papas, 1996; Christodoulou et al., 2007).

3. Conclusions – potential of the Florina sheep breed

Indigenous breeds of sheep have been adapted in a remarkable way to a wide range of climatic conditions and ecosystems and have accompanied our ancestors for thousands of year, serving as a valuable source for food as well as covering a range of other essential daily needs for human survival. However, sheep farming Greece during the 20th century has undergone through many changes and has been influenced by many factors. The use of unselective genotypes for reproduction and random breeding, the uncontrolled replacement of indigenous breeds with imported ones, the failure use artificial insemination within breeding programmes to improve existing indigenous populations based on selection traits are some of the factors that contributed to the gradual reduction of the population of the indigenous breeds and altered their morphological characteristics.

The preservation of the autochthonous breeds it is critical to the enhancement of the genetic biodiversity but also important to our cultural heritage. Moreover, it can enable us to select suitable genetic resources to develop new genotypes that co-respond to ever-changing climatic conditions and to the needs and expectations of the market and the society (e.g. in terms of sustainable food production and food security).

Florina or Pelagonia sheep breed is one of the most endangered sheep breeds of Greece that faces a risk of extinction. Florina sheep are robust and well adapted to the environmental conditions of the region of Western Macedonia which is a mountainous area with generally cold winters and mild-warm summers. Florina sheep have an exceptional ability to effectively utilise the vegetation of mountainous and semi-mountainous areas of the region and can withstand long distance walking for reaching remote pastures. The breed is resistant to diseases and can cope adverse environments and harsh conditions while it is known for its enhanced maternal instincts and ease of lambing. The opportunities this breed can bring into the sheep production of the region are very important and in addition to the conservation of the biodiversity it can help to

increase the income of the sheep producers and act as a driving force in generating multiplier effects for other businesses in the region, thereby helping the overall process of encouraging local entrepreneurship.

It is therefore critical to take precautions to mitigate the further decrease of the population of the Florina sheep, as well as to highlight the important role this breed can play for a sustainable sheep production, especially in harsh environments and marginal areas. It is also important to provide farmers with a handy tool that they can refer to for practical guidance in order to achieve high standards of animal productivity, ensuring optimal animal health and welfare.

More information about the project

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