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Analysis of the imports of Ile de France animals in Bulgaria, 2005-2023

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Abstract

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The meat sheep breed Ile-de-France was introduced from France to Bulgaria more than 50 years ago. However, the most imports took place in the recent 20 years and especially after the establishment in 2005 of a breeding association for this breed in Bulgaria. In this study, an attempt to analyse and review the imports from France in the last 18 years was made. It was based on the data about the imported animals provided by the Association for breeding of Ile-de-France sheep in Bulgaria. These animals were selected for import not only on the quality of their parents, but also on their genetic predisposal to classical Scrapie. As a result, most of the animals with known prion protein gene genotypes were of the preferred, low risk one. Within the parents, for which data was available, 34% of the sires were ranked as improvers of growth qualities, and 45% of the dams as mothers of sires. The animals were raised in similar climatic conditions in both countries. The animal with most progeny in the herdbook was also imported one, having 163 records as a sire. The continuous import of low risk genotype animals should have positive impact on the resistance of the local population against Scrapie. As there are also Ile-de-France animals raised in Bulgaria, it might be beneficial to monitor the genetic diversity of prion protein gene in the local population.

Keywords*:* transboundary breed; breeding; Scrapie

Introduction

The first introduction of the French meat sheep breed Ile-de-France in Bulgaria was done in 1968, when 94 females and 21 males were imported, in order to evaluate the adaptive features of the breed and to study its meat qualities. There were three stages of development of the breed in Bulgaria – Testing and acclimatization (19681973); Introduction and reproduction, followed by closed selection (1973-2003) and from 2003 up to now, almost yearly import of males and females for breeding in purebred flocks or for industrial crossings (Achkakanova, 2023). In 2006, the Association for breeding of Ile-de-France sheep in Bulgaria was established and a breeding programme approved. The association has started with 885 purebred animals in 2005 and until 2023 the numbers have increased almost tenfold, reaching 8296 animals in 58 farms. The breeding programme relies not only on animals bred in Bulgaria, but also on frequent import of animals from France (Dimitrov et al., 2016). One of the reasons for using such animals is to increase the resistance of the local population against the classical Scrapie disease, a lethal infectious disease with long incubation period. It affects both sheep and goats, most often animals 2 and 5 years of age, and it takes 1 to 6 months from first clinical symptoms to the lethal outcome. (Collinge & Clarke, 2007). Scrapie is caused by prion protein (Prusiner, 1995), and the first cases are described already in XVIII century (McGowan, 1922). There are three polymorphic codons in the PRNP gene in sheep - 136 A (Alanine) / V (Valine), 154 R

(Arginine) / H (Histidine), and 171 Q (Glutamine) / R (Arginine) / H (Histidine) associated with resistance (Laplanche et al., 1993; Hunter & Goldmann, 1994; Hunter et al., 1997). The most resistance to the classic Scrapie is associated with Alanine, Arginine and Arginine at codons 136, 154 and 171, whereas the VRQ or ARQ are more susceptible (Hunter, 1997). Thus, ARR/ARR genotype animals are almost resistant and VRQ/VRQ are most vulnerable.

France has started already in 2001 a national programme for Scrapie resistance, and in 2008, resistant rams were diffused in sheep meat breeds (Sidani et al., 2008). In six French breeds, including Ile-de-France 60-80% of the females in their nucleus flocks are of ARR/ARR genotype (Moreno et al. (2006).

The aim of this study is to review the import of Ile-de-France animals in Bulgaria and to evaluate their qualities, including also the predisposal to Scrapie.

Material and Methods

The data for the import was provided by the Association for breeding of Ile-de-France sheep in Bulgaria (AILFB). It contained information about the identification of the imported animals, pedigree data, information about the qualifications of the sire and dam, the genotypes of the imported animals and their parents, the sending farms in France and the receiving farms in Bulgaria. The data, which was provided in various formats, both electronic and on paper, was unified in a spreadsheet file and analysed.

The pedigree of the Ile-de-France population in Bulgaria, compiled from the herdbook data of AILFB, was also studied, in order to find the most represented imported male animal in terms of number of offspring.

To compare the climate in the origin and destination regions of the imported animals in terms of annual temperature, the Copernicus Climate Change Service (C3S) (2023) was used. The ERA5 “2 metre temperature” data (Hersbach et al., 2018) at 00:00, 06:00, 12:00 and 18:00 each day for the years 2008-2022 at one location in each region were used to calculate daily the nearsurface air temperature.

Results and Discussion

At the time of the study, more than 4000 live animals were imported between 2005 and 2023,

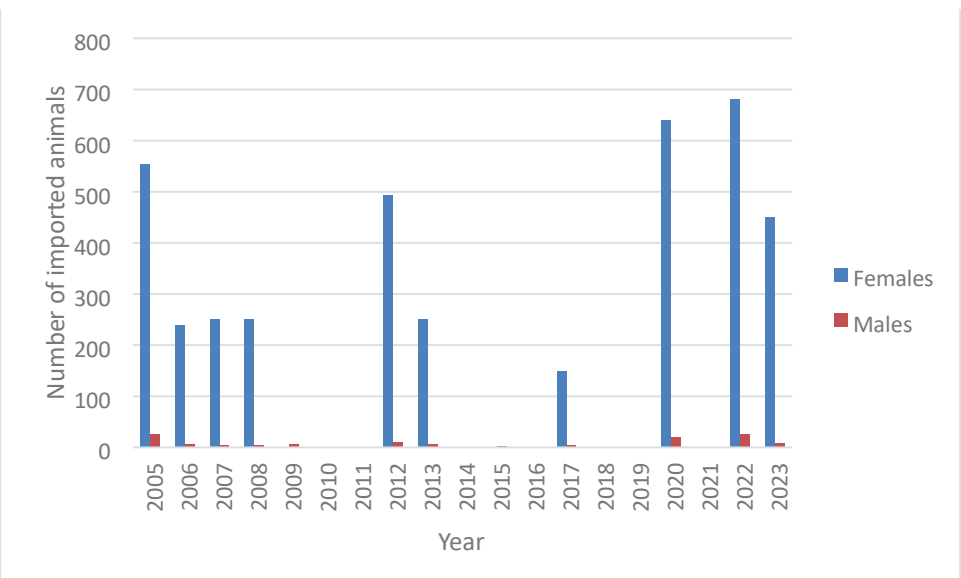

Figure 1. Ile-de-France animals imported from France in 2005-2023

of them 3959 females and 123 males (Fig 1.).

One of the largest imports in absolute numbers, and relative to the available population in

Bulgaria, took place in 2005. At that time, the imported animals were about 66% of the purebred population in the country. In some of the years, only a few rams were imported, as it was done in 2009 and 2015. In addition, in 2018 and 2023, reproductive material (frozen semen straws) from more than 20 rams was also imported. The straws were purchased from the male breeding station in Verdilly, France. The donors are included in the catalogue of the best male breeding animals of the French organization OSON -lle de France, they are judged by their own productivity, by progeny and have a FEDA test as a complex assessment, on the basis of which each one is qualified.

Birth rank data was available for 1680 animals. Of these, 62% were born twins, followed by 22% singles and 17% triplets and more. Achkakanova & Penchev (2023) conclude that the birth rank does not have significant impact on slaughter performance, however, the "manifestation of compensatory growth in lambs born as twins enables the realization of high growth at an early age and is an important indicator of the economic results of breeding the breed".

Many animals came from the Departments of Oise, Aisne, Côte-d'Or, Auvergne, and the Rhein region, where the climatic conditions are similar to Bulgaria. In the period 2008-2022, the near surface temperature ranged from -14°C in the winter to +31°C in summer in these regions. The climate was milder in winter in Oise and Aisne, not getting lower than -5°C in winter, and below 30°C in summer (even less than 25°C in Auvergne), in the recent 8 years.

In Bulgaria, the animals were imported in multiple farms in various regions of the country – Danubian Plane, in and around the Stara Planina and Sredna Gora Mountains and in Dobrich region (Fig 2.). The temperature extremes were more prominent in these regions, from -17°C to +32°C. On average, the summer temperatures in the West part were moderate, with temperatures slightly below +25°C, whereas in the Dobrich region, they reached almost yearly +30°C and beyond. In winter, the temperatures in the West were getting as low as -10°C and beyond, but the regions of Dobrich and Sliven were experiencing a warmer weather.

A difference between the breeding in these two countries is that the animals are kept more on pasture in France, whereas this is not a practice in Bulgaria.

Most of the animals with known PRnP genotypes, predicted, based on genotypes of their parents, or genotyped themselves, are of the favorable ARR/ARR genotype (Fig 3.). Only one male animal is of a different genotype - ARR/ARQ, which is also associated with low

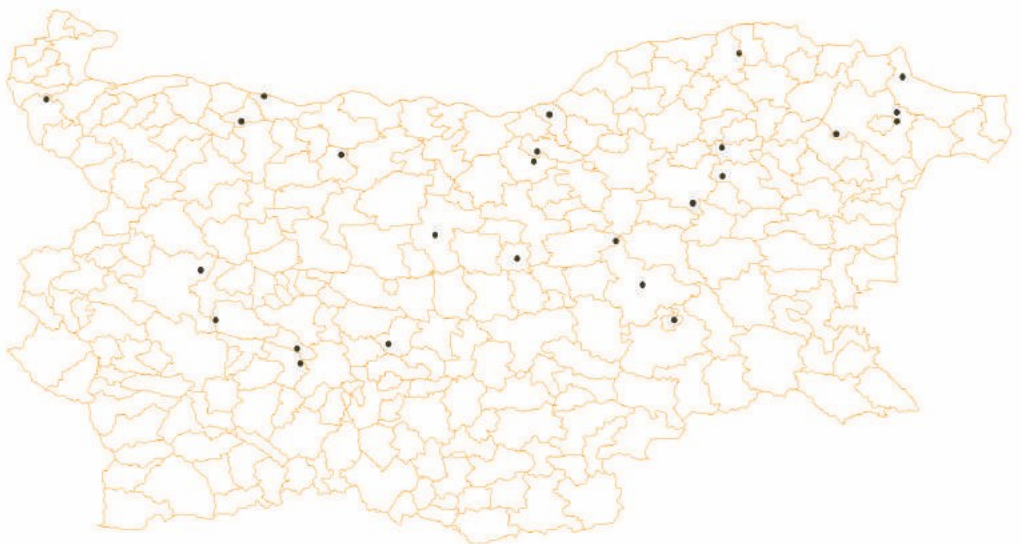

Figure 2. Locations in Bulgaria, where Ile-de-France animals have been imported

risk (Dawson et al., 2008). No imported animals with VRQ/ VRQ genotype were identified in the data. This is a result of the selection policy of the breeding association. Every animal with VRQ allele was rejected for import already at the stage of selecting potential candidates by their data. It should be noted that genotype data was not available for all animals. Taking also into account that only few animals have been genotyped in Bulgaria, it might prove beneficial to monitor the local population for the presence of undesired genotypes.

Regarding the parents of the imported animals, in most cases, where data about their genotypes were available, both sire and dam were ARR/ARR genotype, and if not, at least one of the parents was of this genotype. Other genotypes of the parents were ARR/ARQ, ARQ/ARQ, ARQ/

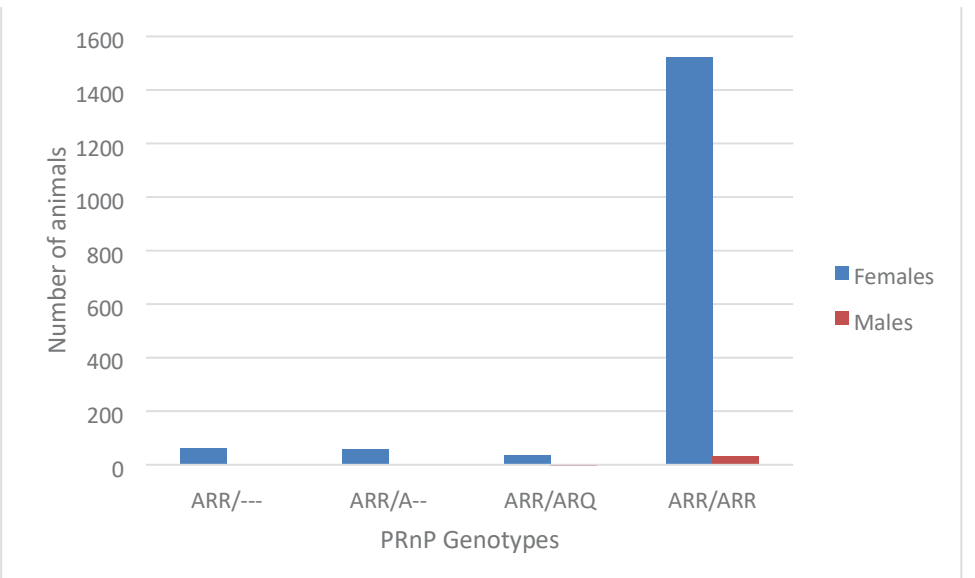

Figure 3. Distribution of animals by PRnP Genotypes

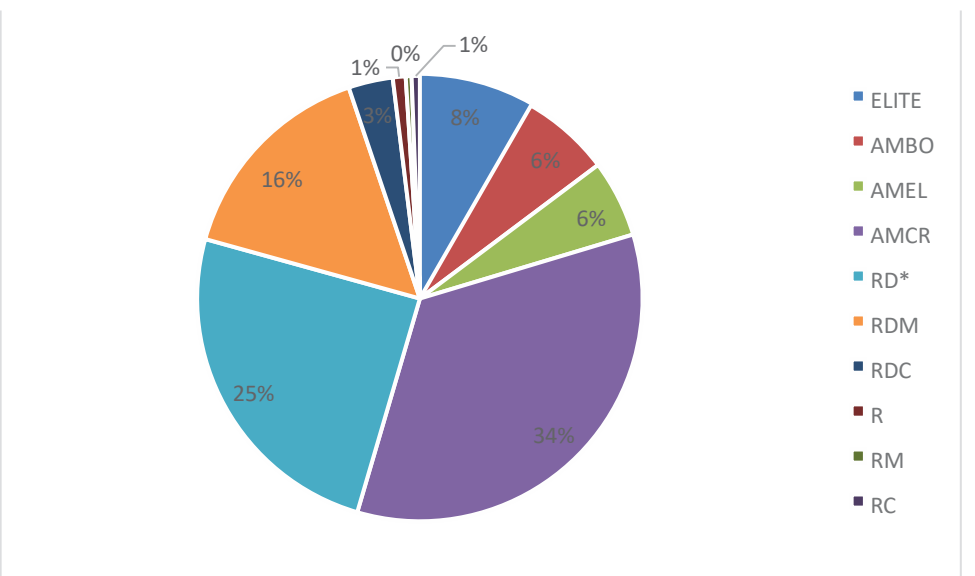

Figure 4. Distribution of the sires by known qualification

VRQ, ARR/VRQ, and for some only one allele was known – ARR/--- and even VRQ/---. In ten of the cases, where VRQ allele was involved, the offspring itself was genotyped as ARR/ARR, and in three others as ARR/ARQ.

The qualification data was available for 1179 sires (Fig 4.). Most of these were of class AMCR - rams qualified, after testing on progeny, as improvers of growth qualities. The second group of sires are young rams currently being tested. The elite category is represented with 8% and AMEL - rams are qualified, after progeny testing, as improvers of breeding qualities and AMBO - improvers of meat qualities, each with 6%.

Of the 1797 dams with data, 45% are the MB - mothers of sires and 35% MA - mothers of dams (Fig 5.). The MB class of the breed is comprised of 15-20% of the best ewes of the breed in prolificacy and the MA – of 40-50% of the best

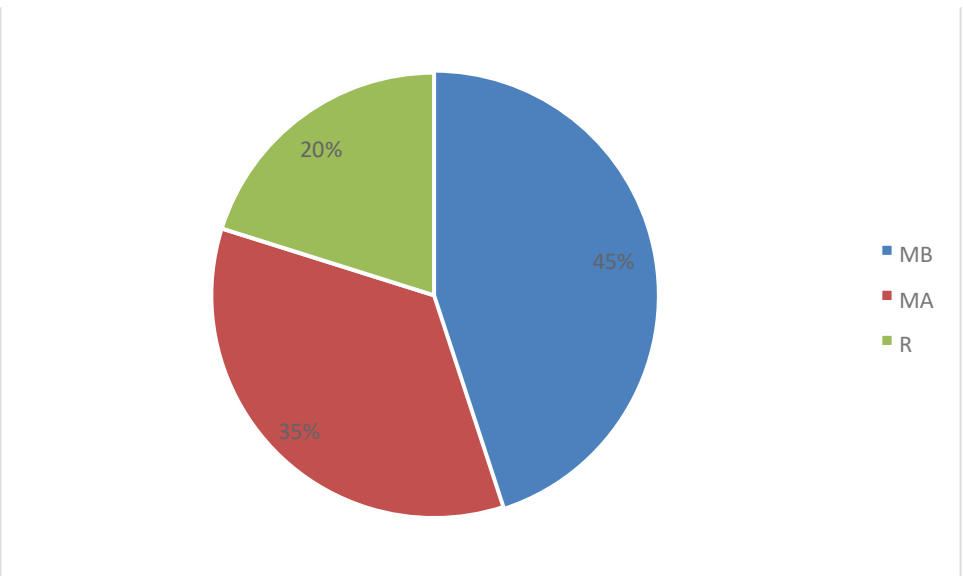

Figure 5. Distribution of the dams by known qualification

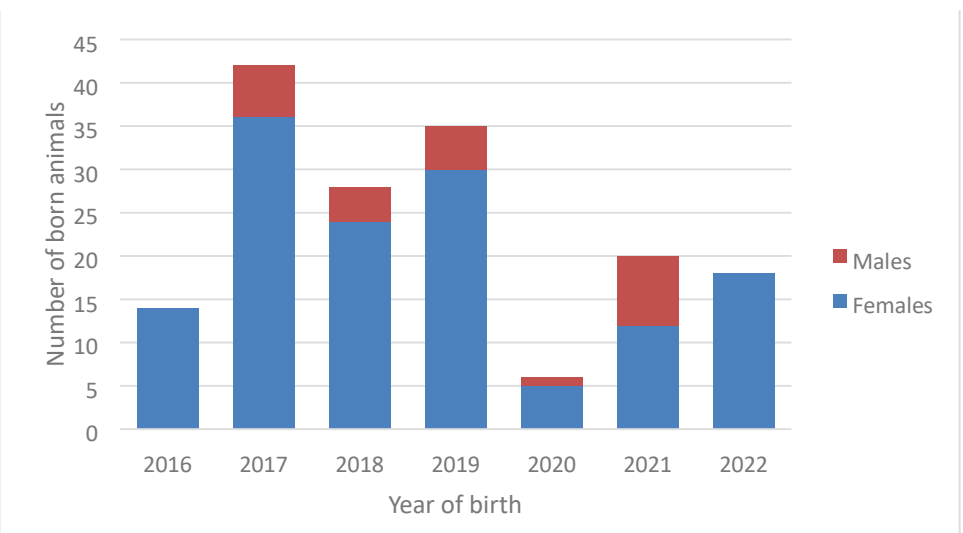

Figure 6. Offspring of the most represented sire - FR21552550117

ewes by the same criteria. The high percentage of females from these two classes in the dams of the imported animals speaks about the quality of their offspring.

Analysis of the available pedigree data of the Ile-de-France sheep population in Bulgaria identified the most represented male is an imported one - FR21552550117, born in year 2014. It has 163 records as sire in the pedigree in 7 years, of which 24 sons and 139 daughters (Figure 6.).

Conclusions

The imported in Bulgaria Ile-de-France breeding animals are offspring of parents with good qualification. They were also selected by their genotype, mostly ARR/ARR, and therefore, should have improved and continue to improve the resistance of the local population against Scrapie. A study of the genetic variation of ovine prion protein in the population Ile-deFrance breed in Bulgaria might prove beneficial to the activities of AILFB regarding Scrapie resistance.

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