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RESEARCH REGARDING THE EVALUATION OF THE CURRENT STATUS OF A NEW SHEEP POPULATION CREATED IN ROMANIA

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Abstract

The research aimed to make a more complex assessment of the current breed status of a new sheep population with very good milk production skills. The population concerned represented the result of research activity to form a new breed with superior skills in milk production. The biological material was represented by a significant number of 1200 females and 58 breeding rams. This herd is part of the living stock and is registered in the Genealogical Register. The data processing was done by methods accepted by the experimental technique. From the data processing, it results that the actual size of the new type population is placed at the level that allows the application of a sustained selection program. For this indicator, the average values show that the new population is evolving very well in other areas, where the pedoclimatic conditions are slightly different from those in the training area. The average value of the actual size varies depending on the holding and the area, from the minimum of 105.88 for the populations outside the training area to 115.16 for the analyzed herd in the training area.

***Key words**: Awassi sheep, breeding isolation, crossbreeding, improvement, Rovasi, Ţigaie.*

INTRODUCTION

In Romania, Awassi sheep were imported especially for making crossbreeds with local breeds. The first import of Awassi parents was made from Israel in May 1973. The imported flock was brought to the Research and Development Institute for Sheep and Goat Breeding Palas-Constanța and was represented by 10 rams and 70 females, aged for 7 months. Subsequently, this herd was transferred to the Rușețu Sheep and Goat Breeding Research and Development Station - where it was kept purebred for several generations.

Simultaneous with the herd imported from Israel, it was used at various crosses with local Romanian breeds, a process that ended with obtaining new breeds of sheep. Thus, at the research-development unit from Palas-Constanța, by crossing with Merinos de Palas and Friza, the Palas Milk Breed was formed, which was approved in 2010, and at the Research and Development Station for Raising Szekler Sheep and Goats - Bacău by crossing with the rusty variety of Țigaia breed, a new type of sheep was obtained, called Rovasi, which is in the process of homologation.

Rovasi is a population of a new type of sheep that provide large milk production, being selected and raised in purebred for several generations. The new type of sheep was formed, evolved, and developed in the northeastern part of Romania, in an area populated with traditional Romanian sheep breeds, represented especially by Țurcană and Țigaie, with all varieties of color, but also by their crossbreeds.

The new genotype created is well adapted to the harsh environmental conditions in the breeding area and provides superior milk production, located very close to the level reached by specialized breeds. It also shows a well-established organic resistance and is suitable for growth based on the application of different technologies.

This population has different characteristics from the old and traditional breeds in the formation area (Ţigaie and Țurcană) but is similar to most breeds in which Macedonian Awassi, Egyptian Baladi, Ausi, Nuami, Gezirieh, and others (Aziz et al., 1988; Dzabirski et al, 2016; Fareed et al., 1981; Enas El-Hady, 2020; Goot, 1986; Gürsoy et al., 1993; Galala et al., 2008; Hamdon, 1980; Juma et al., 2006; Kassem et al., 1980).

MATERIALS AND METHODS

The biological material was represented by females and males in the living stock of the new sheep population existing in different breeding ponds. The entire research staff is registered in the Genealogical Register.

The actual size of the new breed was analyzed on a numerically significant population, consisting of 1200 females (adult and young breeding sheep) and 58 breeding rams, using the calculation below:

$$\text{Ne} = \frac{4NmxNf}{Nm + Nf},$$

where:

Nm = number of males,

Nf = number of females.

Based on the value determined for the actual size of the population, it was possible to highlight the homozygous growth rate for each new generation of animals (ΔF) and the genetic effect due to inbreeding, knowing that ΔF = 1/2 Ne.

To determine the current breeding isolation status of the herd belonging to the new population, data from the genealogical register were used.

Based on them, the value of the reproductive isolation coefficient was calculated, and the formula used was the one described by Wright, 1921, quoted by Drăgănescu, 1972; Drăgănescu, 1979:

$$\text{CIR} = \frac{AA - (AI + II)}{AA + AI + II},$$

where:

CIR = reproductive isolation coefficient;

AA = the number of individuals admitted to the range, studied from the core nucleus and having both native parents;

AI = the number of individuals admitted to the range, studied from the core nucleus and having one native parent and another immigrant;

II = the number of individuals admitted to rang, studied from the core nucleus and having both immigrant parents.

To estimate the genetic distance between the individuals of the new sheep population, the standard method described by Nei (1972) was based on the construction of dendrograms containing data organized in subcategories until the desired level of detail was reached. Dendrogram was constructed using the neighbor-joining (NJ) method (Saitou and Nei 1987). Nei's standard distances (Ds; Nei, 1972), observed heterozygosity (Ho) and expected heterozygosity (He), neighbor-joining trees, and bootstrap values were computed using the DISPAN computer package (Ota, 1993).

To evaluate the existing inbreeding degree, the parent-descendant chain was analyzed because the degree of kinship is given by the position in the pedigree of the common ancestor of two or more individuals.

RESULTS AND DISCUSSIONS

In full agreement with the main objective, the methodology used in the formation of new breeds was based on the application of a systematic cross-breeding program which aimed at summing on a new type genotype the gene pool responsible for milk production capacity (from Awassi) and keeping the breed local genes responsible for organic resistance, adaptation to different technological conditions, resistance to climatic factors and different pathogens etc.

To fix the production characters, but also to increase the degree of genetic similarity, the half breeds obtained in the R_2 generation were subjected to a sustained selection process, being retained only individuals who had a correct external appearance and a body conformation that include the basic requirements for the type of sheep with high milk production.

According to the work scheme used to create the new population (Rovasi), an absorption cross was constantly applied until the R_2 generation was obtained, when the gene pool in the new half breed was 78.70% owned by the Awassi breed and only 12.30% of the Ţigaie breed.

From that moment on, the R_2 and R_3 individuals were reproduced for 4 generations (back cross), applying a rigorous selection, and a controlled reproduction where, the goal was represented by increasing the degree of phenotypic similarity, fixing, and consolidating the specific characters of the new type of sheep.

Currently, the nucleus is closed from a reproductive point of view for over seven generations, and on this background, the degree of similarity between them has increased; also, the characteristics of production, reproduction, and those that give a high resistance to pedo-climatic factors specific to the training area have been consolidated.

The actual size was determined to objectively highlight the current status of the new population, knowing that the strength of the genetic drift effect is governed by the size of the actual population.

When the actual population size is small, the genetic drift will be stronger.

Performing mathematical calculations allows highlighting the fact that the values of the actual size of the population vary depending on the farm and area, from a minimum of 105.88 to populations outside the training area to 115.16 to the number analyzed in the training area.

As these differences are very small, it can be stated that there is a good extension of the new type of sheep outside the training area.

Based on the value determined for the effective size (Ne) of the population, it was possible to highlight the growth rate of homozygosity on each new generation, applying in the calculation of the inbreeding coefficient the mathematical calculation principles presented by Lush (quoted Vintilă, 1988).

Determining the inbreeding coefficient is very important in the analysis because it helps to identify the status of a population, highlighting the proportion of decreasing homozygous locus compared to the base population, due to the use of related breeding.

Determining the degree of inbreeding involves the use of computational procedures that measure the proportion of homozygous genes of an individual from related parents. The calculation procedure starts from the premise that the degree of kinship between two individuals is given by the pedigree position of the common ancestor or ancestors.

Thus, for the calculation of the degree of inbreeding, it is necessary to know the number of generations that link the parents of the analyzed individual to the common ancestor. There are several methods for determining the degree of inbreeding: the free generation method, the removal method, the inbreeding coefficient, the Hardiman method, and the matrix method of table evaluation (Lush, 1967; Sas et al., 2004).

Applying the mathematical calculation relations to determine the inbreeding coefficient on the analyzed population, it results that regarding the Rovasi breed, on the entire analyzed herd, a value of 6.38 was obtained, tensing in the moderate type of inbreeding.

The practical importance of determining the inbreeding coefficient is because the fact that it serves to estimate the degree of kinship that can also be estimated on an analysis based on pedigree.

Table 1. Actual size, sex ratio, and inbreeding rate

Specification	Males (Nm)	Females (Nf)	Sex ratio Nm/Nf	Actual size (Ne)	Inbreeding coefficient (ΔF)	Breeding isolation index
Inside the creation area	30	715	23.83	115.16	5.31	0.77
Outside the creation area	28	485	17.32	105.88	6.48	0.81
Total population	58	1200	16.21	221.30	6.38	0.79

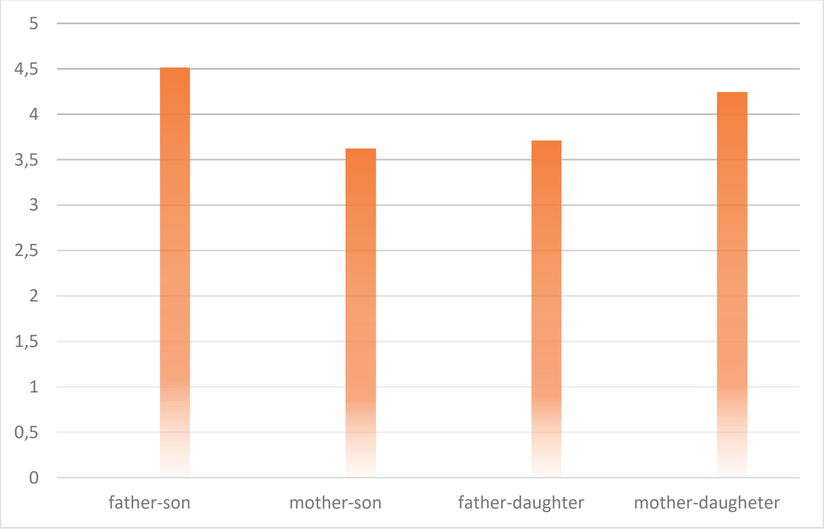

Figure 1. The interval between generations at Rovasi breed

This genetic indicator is extremely important because the calculation of the proportion of homozygous genes of an individual from genetically similar (related) parents can be done with the help of the inbreeding coefficient (Fx) made by Wright. The inbreeding coefficient measures the increase in the proportion of homozygous loci in inbred individuals compared to the base population.

Determining the degree of reproductive isolation is a basic objective of research because the mechanisms of reproductive isolation are dependent on evolutionary processes, behavioral processes, and many physiological processes critical to species.

Reproductive isolation prevents members of different species from producing offspring by crossing them or ensures that the resulting offspring are viable and sterile (Beker, 1959; Barton et al., 1986; Strickberger, 1978; Futuyma, 1998).

At the species level, through the mechanisms through which it acts, reproductive isolation creates certain barriers that maintain the integrity of the fundamental characters that define a given population by reducing the flow of genes from other related populations.

From the determination of this indicator a slight difference of the average values from the two growth basins can be observed. The fact that in the training area the reproductive isolation index is 0.77 shows that the claims and restrictions regarding the penetration inside the population of some breeders of wide breeds are stricter.

The analysis of the intergenerational interval is an extremely important indicator of selection, representing an essential factor of improvement, directly influencing the effect of selection on each new generation.

This character is important in the improvement work because it conditions the speed or the rhythm of obtaining the effect due to the selection. (Pipernea, 1979; Popa, 2006).

Based on the analyzed data, it is found that for the newly created breed the interval between generations has a variable average duration, being 4.2 on the mother-daughter chain and decreases to 3.6 on the mother-son chain.

In the case of the analysis performed on the father's chain, a contradictory evolution is registered because the interval between generations is longer, respectively 4.51 for the father-son relationship and is reduced to 3.7 for the father-daughter relationship.

Comparing these values with those determined by other authors it can be seen that the interval between generations is located at the same coordinates with the mention that the one for father and son and father and daughter has lower average values because it is found that farmers show a desire to introduce more early sheep in the reproductive and productive circuit.

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CONCLUSIONS

The research aimed at analyzing the current status of a sheep population in the final phase of approval as a new breed of sheep.

The analyzed population was formed in the pedo-climatic conditions specific to the northeastern area of Romania through systematic crosses of the Awassi breed and local Țigaie sheep from the rust variety.

The determination of the effective size of the population has an average value of 221.30, a level that supports the application of an efficiency improvement program based on rigorous selection activities to improve performance and performance.

The determination of the inbreeding coefficient on the analyzed population indicates that the average value of 6.38 allows the inclusion in the moderate type of inbreeding.

The value of the reproductive isolation index registers close values, being 0.77 in the training area and 0.81 outside this area, which indicates some difference between these areas in terms of the requirement for the penetration of some breeders from the population of late rase.

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