A NEW BIOLOGICAL CREATION OF SCIENTIFIC RESEARCH DEVELOPED IN ROMANIAN ANIMAL HUSBANDRY

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Abstract

The scientific research carried out in the research-development units was intensified after 1990. Under these conditions, some new populations appeared, with distinct characters associated with some of the specific productions of sheep. During this period, Palas milk breed, Palas meat breed, Black head sheep from Teleorman, Brown variety of Karakul of Botoşani breed and the Grey line from the same breed were approved as breeds. Regarding the new sheep population formed at the Research and Development Station for Sheep and Goat Breeding, Secuieni-Bacău, the works were started in 1982 when were introduced for breeding at Luncani farm rams of Awassi breed which were used for natural and artificial breeding on a number of 114 local Rusty Ţigaie sheep.

In 1983, according to the Technical Report prepared by Eng. V. Caprosu et al. cited by Pascal (2018) crosses were made with 1500 Ţigaie sheep from two units in Bacău County, namely SCPCO BACAU, currently SCDCOC Secuieni-Bacău, (500 sheep) and CAP Mărgineni (1000 adult sheep) and rams of Awassi breed brought from SCPCO Ruşeţu. During the crossing process the males obtained in F1 and R1 were sacrificed and the females with desired traits were selected in order to continue the formation process. From the R2 generation, along with the females, the males with valuable qualities (growth intensity, vigour, vivacity) with correct exterior and a robust constitution were also selected. From that moment on, the individuals R2 and R3 reproduced themselves for 4 generations (back cross), applying a rigorous selection and a directed crossing in which, in order to increase the degree of phenotypic similarity, a moderate inbreeding was used.

Currently, the nucleus has been closed reproductive for over seven generations, and against this background the degree of similarity between them has increased, the production and reproduction characteristics have been very well consolidated, as well as those that confer a resistance to pedoclimatic factors specific to the training area. The new population is distinguished from other breeds with which it cohabits in the formation area, having a distinct phenodeme and genodema. Also, highlighting the differences between it and the local sheep, which dominate in the breed structure located in the training area.

Key words: Awassi, Tigaie, imporovement, sheep milk

The new biological creation represents the result of the research work carried out for over four decades by several research teams that have worked within the Secuieni Sheep and Goat Breeding Station - Bacău.

The new sheep population was formed, evolved and developed in an area populated with other traditional Romanian breeds - Ţurcană and Ţigaie with their varieties (white, black, rusty, belle and smoky face and their crossbreeds), being present in the area and other populations such as stubble or spanking sheep. The newly created population has totally different characteristics from those of the old and traditional races, being, however, similar to most races in the formation of which the Awassi race participated (Macedonian Awassi, Egyptian Baladi, Deiri, Syrian, Ausi, Nuami, Gezirieh).

The new genotype created is well adapted to the harsh environmental conditions in the

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breeding area and provides superior milk production, located very close to the level reached by specialized breeds.

1. The training objectives were represented by the interests of sheep breeders located in the Central Plateau of Moldova who wanted a type of sheep with higher milk production, well adapted to soil and climate conditions and climate change.

2. The formation of the new biological creation. 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 between the native breed represented by Ţigaie rusty and parents of the Awassi breed, imported from Israel after 1970. This cross-breeding program on a new type genotype of the gene pool responsible for lactogene capacity (from Awassi) and the preservation from the local breed of genes responsible for organic resistance, adaptation to different technological conditions, resistance to climatic factors and different pathogens, etc.

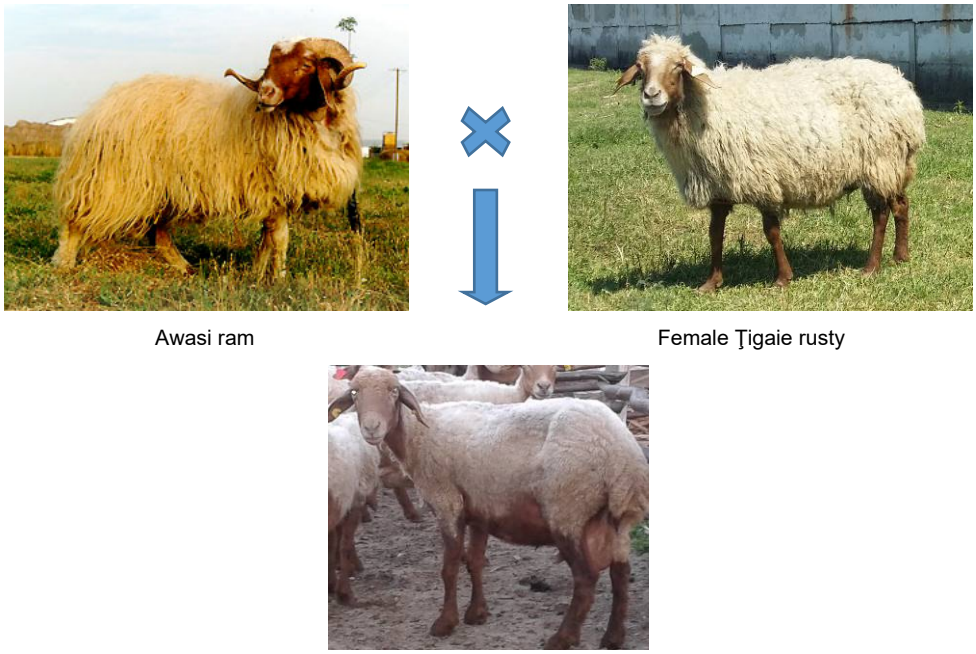

Fig. 1. The parent races and the current type of the newly created population

In order to fix the production characters, but also to increase the degree of genetic similarity, the crossbreeds obtained from R_2 were subjected to a sustained selection process, being retained only the parents who had an external appearance and conformity according to the requirements established for milk type.

According to the working scheme, used to create the new breed, an absorption cross was constantly applied until the R_2 generation was obtained, at which point the gene pool in mixed individuals belonged in proportion of 78.70% to the Awassi breed and 12.30% of the local Ţigaie breed.

During the cross-breeding process, the males obtained in F1 and R1 were sacrificed and the females with the desired characteristics were selected in order to continue the process of genetic formation and consolidation. From the R_2 generation, along with females, males with valuable qualities (growth intensity, vivacity, vigour) with a correct exterior and a robust constitution were also selected. From that moment on, the individuals R_2 and R_3 reproduced themselves for 4 generations (back cross), applying a rigorous selection and a directed crossing in which, in order to increase the degree of

phenotypic similarity, a moderate inbreeding was used.

Currently, the nucleus has been evolving closed reproductive for over seven generations, and against this background the degree of similarity between them has increased, the production and reproduction characteristics have been consolidated very well, as well as those that confer a resistance to pedo-climatic factors specific to the training area.

The new population is distinguished from other breeds with which it cohabits in the formation area, having a distinct phenodeme and genodeme. Also, the highlighting of the differences between it and the local sheep that dominate in the breed structure located in the training area, is easy to highlight from the data presented in table 1.

Table 1 Comparative situation of bodily and major development reproduction indices in sheep populations in the training area

Specification	Females				Rams
	Body mass (kg)	Wool (kg)	Milked milk (l)	Prolificacy (%)	Live weight (kg)
Ţigaie white	48.70	2.6	46.70	115	69.24
Ţigaie rusty	49.20	3.7	49.65	115	66.18
Ţigaie smoky face	54.31	3.2	53.35	115	70.56
Ţurcană	42.70	2.9	65.90	108	75.35
New sheep type	57.66	3.2	77.65	110	85.71

From the presented data it can be seen that in the newly created sheep population the live weight and prolificacy has average values higher than the other populations in the area of growth and formation. Compared to Ţigaie rusty, the live weight is 14.67% higher in females and over 20% in males. However, in the new type created, the milk production has values higher by 36.05% compared to the quantity of milk obtained from the rusty variety of the Ţigaie breed.

2. Reproductive isolation of animal populations is also a very important factor that can be used to improve the characteristics of reproduction and production. Depending on the degree of reproductive isolation, the following categories of populations can be distinguished:

- open - represented by reproductive communities that are constantly subjected to a supply of foreign genes;
- closed - represented by reproductive communities with a high degree of reproductive isolation, they are not subject to the contribution of foreign genes, as is the case of pure breeds that have closed genealogical registers.

At this moment, the reproduction of the new population is evolving closed reproductively in order to outline and finalize the final type of the breed.

In order to determine the degree of reproductive isolation studies and analyzes were performed of the registers in which the zoo-technical records from several active populations kept within the new formed breed are kept.

In general, the reproductive isolation of breeds can be done through geographical or political barriers or by man through direct and total intervention in the process of multiplication. Demographic, genetic and economic causes requiring reproductive closure may occur in accordance with the directions of improvement during the exploitation of a breed or population of animals.

In order to determine the current reproductive isolation status of the herd inside the new population, based on the data in the zoo-technical records, the value of the reproductive isolation coefficient was calculated, the formula used being the one described by Wright, 1921, quoted by Drăgănescu in 1972 and 1979, namely:

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

where: CIR=reproductive isolation coefficient;

AA = the number of individuals admitted on the studied interval from the queen nucleus and who have both native parents;

AI = number of individuals admitted on the studied interval from the mother nucleus and who have a native parent and another immigrant;

AII = number of individuals admitted on the studied interval from the mother nucleus and who have both immigrant parents.

In the case of the new population, reproductive isolation is supported by the existence, presence and functioning of the Genealogical Register (improperly called Awassi). In 2007, from the herd of the active population, from the new population, the category represented by the breeding males has a proportion of only 7.01%, of which 4.78% is represented by the nursery rams and 2.32% by the juveniles retained for breeding.

The category represented by females has a proportion of 92.79%, of which 77.75% is represented by adult sheep and 15.15% by breeding sheep.

The role and importance of this new biological creation is very well highlighted by the fact that many flocks have been acquired by farmers and breeders domiciled in other counties where, traditionally, they are also bred for meat and fine wool, in the South and South-Eastern part of Romania (Constanţa, Ialomiţa, Giurgiu). From the total number in the Genealogical Register, a total of 4218 individuals were delivered and are in operation in these areas, which represents a total proportion of 48.37%.

The presence in other areas, where the Ţigaie breed is found in small numbers, where the pedo-climatic conditions are totally different, proves, argues and claims that the new type of sheep trained at SCDCOC Secuieni-Bacău is a population with extremely well-defined biological values, an aspect that allowed an immediate adaptation to the pedo-climatic conditions specific to the arid and drier areas in the south of the country. The high capacity for accommodation in these areas is inherited from the Awassi breed that formed in the arid areas specific to the Middle East.

Analyzing the general structure of the new sheep population, we can say that, at this moment, it has a large enough herd to support the rigorous application of the breeding program in order to improve performance but also to increase the consistency of characters and a uniformity of the degree of genetic and phenotypic similarity.

The dynamics of the herd that formed the living stock of the new population during the period between 2007 and 2019 is shown in table 2. Analyzing these data we can see that in 2007 the living stock was represented by a total of 128 heads, from which 1.56% rams, then 5.45% lambs, and 47.65 adults and the difference of 45.34 was represented by the young female used for the first time in breeding.

Table 2 Population dynamics that formed the living stock in the period 2007-2019

No.	Year	Age category (individuals)			
		Rams	Male youth	Adult sheep	Female youth
1	2007	2	7	61	58
2	2008	42	7	667	165
3	2009	67	49	1124	378
4	2010	67	26	1570	199
5	2011	59	19	1825	240
6	2012	90	38	2059	405
7	2013	56	60	2450	416
8	2014	71	93	2060	609
9	2015	103	99	3955	600
10	2016	150	108	4679	816
11	2017	167	153	5102	785
12	2018	381	234	6749	1556
13	2019	419	152	8024	1682

In the over 13 years, the population has evolved in a progressive dynamic and in 2019 the live stock reached 10,277, consisting of 4.07% rams, 1.47% male youth, 16.36% female youth and 78.10% adult females.

In order to estimate the degree of reproductive isolation, analyzes of zoo-technical records were performed from several active populations within the newly created population, located in different growth areas.

The actual size was studied on a numerically significant population represented by 1200 females and daughters of 58 nursery rams, using the calculation relation below:

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

which: Nm = number of males;
Nf = number of females.

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 said that the existence of a good extension outside the training area can already be discussed at this time.

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 of animals applying in the calculation of the inbreeding coefficient the mathematical calculation principles presented by Lush, quoted by Vintilă, 1988.

Table 3 Actual size, sex ratio and inbreeding rate

Specification	Rams (Nm)	Females (Nf)	Sex ratio Nm/Nf	Actual size (Ne)	Inbreeding coefficient (ΔF)	Reproductive isolation index
In training areas	30	715	23.83	115.16	5.31	-
In neighbouring areas	28	485	17.32	105.88	6.48	-
Total population	58	1200	16.21	221.30	6.38	0.75

The practical importance of determining the inbreeding coefficient is very important in the analysis performed to identify the status of a population because it highlights the proportion of decreasing homozygous loci compared to the base population due to the use of related mating.

3. Inbreeding coefficient. In order to evaluate the degree of inbreeding existing in the analyzed population, the parent-descendant chain was analyzed because the degree of kinship is given by the pedigree position of the common ancestor of two or more individuals.

In determining the inbreeding coefficient, a mathematical relationship was applied that included the number of generations (arrows) that link the individual's father and mother to the common ancestor.

Depending on the average increase in inbreeding per generation, there are several types of inbreeding:

- incestuous (Δ F = 12 - 25%);
- close (Δ F = 6 - 12%);
- moderate (Δ F = 1 - 6%);
- removed (Δ F <1%).

Applying the mathematical relations of calculation in order to determine the inbreeding coefficient on the analyzed population, it results that at present at the new type of sheep, on the entire analyzed herd; a value of 5.38 was obtained, tensing in the moderate type of inbreeding.

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

4. Analysis of the interval between generations. This indicator is extremely important because it is also an essential factor of improvement, directly influencing the effect of selection on each new generation.

The analysis of the evidence documents of the mounts and calving (fig. 2) highlights that at the new biological creation the interval between generations has an average duration of 4.28 years on the interval 1990-2016.

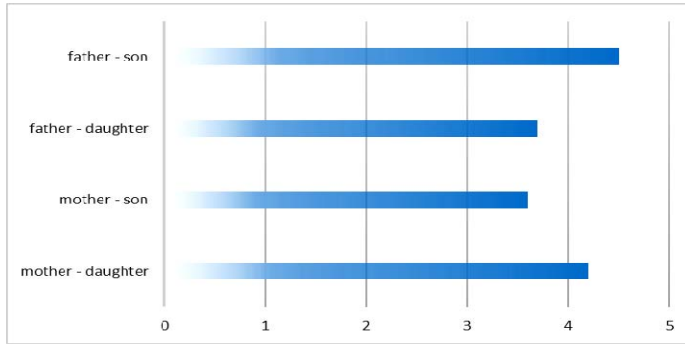

Fig. 2. The interval between generations in the new population

Comparing these values with those determined by other authors, but for other sheep breeds, 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 values due to the desire of breeders to use earlier at reproduction youth represented by lambs and lambs.

CONCLUSIONS

At present, the newly formed sheep population has an optimal structure that allows the application of breeding programs to increase production and reproduction performance.

From training until now, the population has evolved in a progressive dynamic and in 2019 the live stock reached 10,277 individuals of which: 4.07% rams, 1.47% male youth, 16.36% were female youth and 78.10% females adult.

In the new biological creation, the live weight and the prolificacy have average values superior to the other populations in the area of growth and formation; compared to Ţigaie rusty, the live weight is 14.67% higher in females and over 20% in males.

Milk production has values 36.05% higher than the amount of milk obtained from the rusty variety of the Ţigaie breed.

According to all the data presented in this document, it is very easy to see that the long process of crossing between parents Awassi and Ţigaie resulted in a population with new productive and reproductive valences and by the fact that they have a different phenodeme and genodeme than to the initial populations we consider justified the request for recognition as a new breed under the name Rovasi.

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