THE CONSERVATION STRATEGY OF ROMANIAN PINZGAU CATTLE GENETIC RESOURCES

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RESEARCH ARTICLE

Abstract
The Romanian Pinzgau cattle breed represents a unique and valuable genetic resource, possessing a rich history deeply intertwined with the agricultural heritage of Romania and is known for dual-purpose characteristics, which have faced significant challenges in the past, including declining population numbers and genetic erosion. In our country, the Food and Agriculture Organization of the United Nations (FAO) maintained the status of ' endangered-maintained 'cattle breed in 2000 considered to be threatened with extinction. Through advanced molecular and phenotypic methods, the genetic diversity and uniqueness of the Romanian Pinzgau cattle population are assessed. This knowledge helps in identifying individuals that are most important for maintaining genetic diversity. The conservation strategy for Romanian Pinzgau cattle genetic resources is a multifaceted approach that combines science, culture, and collaboration. It aims to protect the breed's genetic diversity, preserve its cultural significance, and secure its future in a changing agricultural landscape. The success of this strategy will not only safeguard a unique genetic resource but also contribute to the sustainability of Romania's agricultural heritage. Encouraging the use of Romanian Pinzgau cattle in sustainable and local agriculture can stimulate demand for the breed, making it economically viable for farmers and further ensuring its survival. This paper provides an overview of the conservation strategy employed to safeguard the genetic resources of Romanian Pinzgau cattle.

Keywords: biodiversity, cattle, conservation, genetic diversity, Pinzgau
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INTRODUCTION

Pinzgau cattle is the result of absorption crosses of the autochthonous Mountain or Mocănita breed, and to a lesser extent of the Grey Steppe, with the Austrian Pinzgau. The first imports took place starting in 1860, in Transylvania (Sibiu, Brasov, Hunedoara), Caras-Severin and Bucovina. A significant role in the formation of the breed was played by the various trade unions, especially some farms established for this purpose, such as the one in Beclean (1884) and later those in Medias and Cisnadie (Popa et al., 2012).

Until the beginning of the First World War, the breed experienced a fairly rapid spread, but between the two wars it gradually gave way in favor of the Romanian Spotted and Romanian Brown breeds, as a result of the lower productive characteristics compared to this one. In Romania, the Pinzgau breed is meets in three areas: the north-west of Moldova, the south-west of Transylvania and the west of Transylvania-Apuseni. Transylvanian Pinzgau breed has a strong constitution, lively temperament, docile disposition, average precocity, high endurance, good adaptation ability, resistance to disease and environment. At the same time, there are herds belonging to the Pinzgau breed from Transylvania and in the Hateg depression towards the Caranesbes Mountains, a mountainous area of Moldavia and the Rodna Mountains. The breed has a share of 1.6% of the total cattle raised in the country (Georgescu, 1998).

The biodiversity of cattle has drastically decreased in the previous few decades. The primary cause of the genetic deterioration seen was the specialization of livestock production in favor of high-quality, cosmopolitan breeds. As a result, managing livestock breeding programs has made controlling the genetic variety of cattle a top priority (Kukučková et al., 2017; Kadlecik et al., 2004).

The FAO reports that the Pinzgau breed is endangered and will soon fall under the category of endangered cattle. According to Scherf (2000), FAO studies frequently highlight

the numerical decline of various species, the categorization of various breeds based on the number of individuals in each breed, the female to male ratio, and the inclusion of these breeds in active conservation or maintenance programs or research institutions. These breeds are classified as extinct, critical, endangered, critical-maintained, endangered-maintained, or not at risk (Maciuc, 2006; Davidescu et al., 2021).

The Pinzgau breed deserves to be included in the nation's genetic resources due to its rustic nature, tolerance to a specific hilly and mountainous climate, amazing lifespan and survival, and the manifestation of its unique genetic features (Davidescu et al., 2022).

Using high-performance molecular data, the primary goal of this work was to offer a comprehensive understanding of the genomic characterization of the Pinzgau cow breed, particularly the Romanian Pinzgau breed.

MATERIAL AND METHOD

Fourteen bibliographic sources in the specialized literature were consulted in order to accomplish the goals of this investigation. A review of the Pinzgau breed's morphology and productivity, particularly in our nation, is covered in detail, along with details on the genetic diversity of this critically endangered species.

In this study, the research methods of genetic analysis, numerical evolution, and morpho-productive properties of the Pinzgau cattle breed were analyzed and visualized graphically from specialized literature.

RESULTS AND DISCUSSIONS

The morphological and productive characteristics of the Pinzgau cattle breed

According to numerous studies in the specialized literature, (Gîlcă et al., 2012; Davidescu et al., 2021; Maciuc, 2006, Acatincăi, 2004) the Pinzgau cattle from the Apuseni Mountains and the Hateg-Petrosani depressions were formed over 100 years ago, through unsystematic crossings between Grey Steppe and mountain bulls with the Pinzgau breed. In the area of the valleys, Simmental bulls were also used, thus there were many white-headed animals called white-headed Pinzgau.

- *The average body weight* of the cows was 382.3 kg, those from the valley area having 392 kg, and those from the mountainous and pre-mountainous area 371 kg. The body weight of the bulls was 662.2 kg.
- *The average milk production* in the third lactation and above by growing area is between 1682.9 l (Bucova-Sarmisegetusa area) and 2328.3 l (Brad-Baia de Cris-Halmagiu area). The average milk fat content in the different investigated areas was between 3.62% and 3.76%. The maximum individual milk production on normal lactation was 4152 l with 3.72% fat.
- *The average slaughter yield* for cows was between 46.7% (Beius-Huedin area) and 47.3% (Deva-Hateg area), with some cows reaching up to 54.7%. For bulls, the average yield was 48.7% with a maximum limit of 55.1%.

The population of Pinzgau taurines in the area of the Apuseni Mountains and the Hateg-Petrosani depressions is characterized by a great variability of characteristics due to the conditions of formation and the lack of a systematic selection. They have good reproductive longevity, with more than 9% of the herd having more than 8 calvings, and 2.5% having more than 10 calvings during their lifetime. The majority of the herd studied over time corresponds to the milk production type, except for the animals from the Haţeg Depression, which tend towards the meat-milk type.

The share of the population of individuals from the Pinzgau breed, compared to share of the other breeds populations (Romanian Spotted, Romanian Brown, Romanian Black Spotted, etc), in 2014, can be consulted in figure 1.

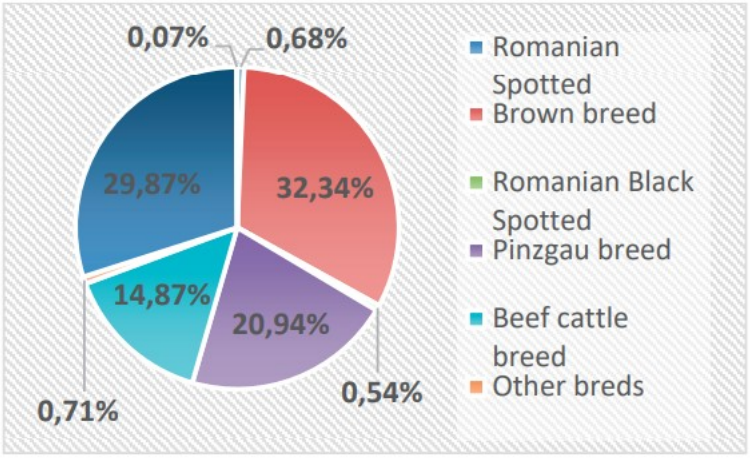

Figure 1 **The population of individuals from the Pinzgau breed, in 2014**

Figure 1 shows that in 2014, the Pinzgau breed accounted for 20.94% of all cattle in our nation's territory that belonged to the bovine species, which is 0.66% more than the year before (Gîlcă et al., 2012).

In terms of appearance, conformation and constitution, in general, bulls of this breed have a pleasant, attractive and harmonious appearance, having a conformation characteristic of breeds with intermediate production abilities. Phenotypically, the breed shows the color typical of the improved breed, dark chestnut red, with a white stripe, which starts from the withers region towards the rear extremities of the trunk, descends on the inguinal region and advances on the lower face of the trunk to the head of the chest, forming on the calves and arms as many a ring of the same color. The craniological type is brachycephalic; the breed is well adapted to the current growing areas. The general body development is relatively variable depending on the distribution area, respectively the local geoclimatic conditions within them. According to the research carried out by numerous researchers between 1923 and 2006, the main morphological characteristics are marked on average in cows with a waist of less than 130 cm and a body mass of just over 470 kg, respectively, in bulls of 134 cm and 663 kg, with the remark made previously of a pronounced variation (Acatincai S., 2004).

The morphological characteristics of the Pinzgau breed can be consulted in table 1.

Table 1

The main morphological characteristics of the Pinzgau breed
(data processed from specialized literature)

Characteristic	***U.M***	***N-W Moldova (cattle)***	***Apuseni Mountains (cattle)***	***The Haţeg depression***	***Cattle***	***Bulls***	***Dorna cattle variety***
Waist	cm	126,3	129,4	127,5	128,6	134,0	125,0
The oblique length of the trunk	cm	151,2	155,0	148,0	153,1	163,1	151,0
Chest depth	cm	67,4	67,9	66,0	67,5	74,3	64
Perimeter chest	cm	178,8	179,3	179.5	179.1	199.7	176.0
Lean body mass	kg	469.2	482.8	451.2	471.1	662.9	444

Zooeconomic characteristics of the Pinzgau breed

The breed is resistant to environmental conditions, but with lower production characteristics compared to the other improved domestic breeds. With medium precocity, it achieves the age of first calving at 30-35 months and an economic life of 5-6 lactations which in many cases extends up to 9-10 lactations. The birth rate is 85%. Phenotypic performances in the direction of milk production are different with limits between 1900-3500 kg and 3.62-4% fat. Regarding the herds under official production control, they show a very tortuous evolution, the number of completed lactations varying in the last 50 years between 179-2175. The quantitative production of normal lactation was between 2300-2960 kg between 1960-2000, evolving to over 4000 kg of milk, but with a fat content below 3.9% and only 3.25% protein. Regarding the evolution of milk production according to the rank of lactation, it has a linear character, the differences between lactations being very small and insignificant (Maciuc, 2006).

The breed's milk production prowess is illustrated by the performance of nominated bull, champion cows, and the top 25 cows in the official milk yield ranking for finished lactation production. Performances of 8277 kg of milk with 3.98% fat were achieved (Gîlcă et al., 2012).

In terms of meat production, the young have a body mass of 32-38 kg at birth and then achieve average daily growth increments of between 0.7-0.9 kg. The cutting yield varies for adult stock between 47-50% and for youth and fattened steers between 50-54%.

Within the breed there is a variety known as Cattle of Dorna or Black Pinzgau. It is a special type of the breed spread in the area with the same name, especially around the towns of Vatra Dornei, Campulung Moldovenesc and Gura Humorului. According to Felius, Gîlcă, and Caroli, this variety was formed on the basis of the local dark gray and black mountain bulls. To a very small extent, the Black bulls that were imported between the 2 wars also contributed.

The size of livestock in the Campulung Moldovenesc and Vatra Dornei basins is primarily influenced by the possibility of providing fodder.

The Dorna and Câmpulung Moldovenesc areas are of the greatest importance for the breeding of the Pinzgau breed in Suceava county. The Pinzgau breed is represented by 58% of the total female cattle in the Dornelor basin and by 48% in the Campulung Moldovenesc basin, these two areas having the highest number of cows of this breed, compared to the other areas where the percentage is much lower (Davidescu et al., 2021).

In the structure of the agricultural land related to the Vatra Dornei and Campulung Moldovenesc basins, most of it is occupied by pastures and hayfields, the arable land representing only 4% of the agricultural area. The area of pastures is much larger in the Dorna area (28,983 ha and 53%), compared to the Campulung Moldovenesc area (13,901 ha and 32%). The average number of cattle and agricultural land on a farm in the Campulung Moldovenesc area is 4 ha of agricultural land and 1.6 head of cattle, and in Dorna 4.7 ha and 1.8 head (Acatincai S., 2004).

Genetic markers studied in the Pinzgau cattle breed

The study focused on the analysis of genetic markers correlated with the production characteristics. In the case of endangered cattle breeds, like Pinzgau breed, this was helpful in understanding the significance of the survival of genetic capital relevant to animal origin, the level of breed uniformity, and the location of the animals' development and domestication, which was supported by a number of other significant molecular markers.

Erhardt (1996) used alkaline polyacrylamide gel electrophoresis and isoelectric focusing in polyacrylamide gels to study Pinzgauer populations in Austria, Bavaria, and Germany. Through these methods, he found a new K-casein variant (K-CN G) with a frequency of 0.003. The endangered Limpurger breed's milk samples did not contain K-CN G.

In Austria and Slovakia, genetic variation in the Pinzgau breed was studied by Ivan Pavlík et al. (2014). A total of 12,442 individuals were used in the sample reflecting the reference population and have been studied four sub populations. Five generations were considered, and the mean inbreeding coefficients for Austrian dairy products (AD), Austrian beef (AB), Slovak dairy products (SD), and Slovak beef (SB) were 0.0186, 0.0242, 0.0151, and 0.0126, respectively. The population's effective size ranged from 122.5 (AD) to 809.4 (SB).

The Romanian Pinzgau is one of the active breeds that have been locally bred and adapted to local conditions. Genetic evaluation

is a valuable tool in breeding and cattle selection.

Trends and guidelines in the breeding and exploitation of the Pinzgau breed

The guidelines in breeding the breed are strictly related to the trends in its breeding and exploitation, the type of animal desired and, last but not least, the socio-economic requirements of animal breeders. We consider the following exploitation directions necessary for the normal development of the improvement activity and highlighting the genetic potential:

- The desired type is the mixed one, with an equal share of meat and milk productions or even 55% milk, 45% meat;
- Ensuring fodder at the production level expected from genetic progress or at least at a semi-intensive exploitation level;
- Scheduling the herds in the April-May period for inseminating the cows before they leave for summer camps and making the most of the productive potential by calving in the months of February-March;
- Improving housing and care conditions by building shelters that meet the minimum requirements for thermal comfort, ventilation, light, running water and mechanical milking
- The application of modern reproduction biotechniques to ensure the perpetuation of the breed and its elimination from the category of risk of abandonment (Davidescu et al., 2022).

CONCLUSIONS

The conservation of local breeds is important for ensuring the food security of the Romanian population. Recent climate changes may bring new challenges in the future, the taurine species, the most exposed to these changes, through local breeds that are not appreciated today from an economic point of view, can be an effective alternative to improved breeds.

Pinzgau cattle breed represents a valuable genetic reserve for livestock of Romania.

The Romanian Pinzgau must be regarded as a part of national genetic wealth, owing to its rusticity, tolerance to the unique hilly and mountainous climate, with a remarkable endurance, an indication of its genetic distinction from other breeds.

REFERENCES

Popa, R., 2012. Animal biodiversity conservation, a key of sustainable agriculture. case study: The Romanian Pinzgau breed in Transilvania region. Scientific Papers, Animal Science, Series D, vol. LV.

Georgescu, G. 1998. Cattle Breeding Treaty. Publishing House-Ceres, Bucharest, Romania.

Kukučková, V. 2017. Genomic characterization of Pinzgau cattle: genetic Conservation and breeding perspectives. Conservation Genetics, 18, 893–910.

Kadlecik, O., Swalve, H., Lederer, R., & Grosu, H. 2004. Development of dual-purpose Pinzgau cattle. Publsihing House-SPU, Nitra, Slovak Republic, 128.

Scherf, B.D. 2000. World Watch List for domestic animal diversity, 3rd edition, FAO, Rome, available at: http://www.fao.org/docrep/009/x8750e/ x8750e00.htm (Accessed on 24.03.2023).

Maciuc, V. 2006. The management of cattle breeding. Publishing House-Alfa, Iași, Romania.

Davidescu, M., Madescu, B., Ciorpac, M., Dascalu, L., Bugeac, T., Matei, A., Porosnicu, I., Creanga, St. 2021. Genetic diversity of Pinzgau cattle breed: a systematic review. Scientific Papers. Series D. Animal Science. Vol. LXIV (2), 40-44.

Davidescu, M.-A., Simeanu, D., Gorgan, D.-L., Ciorpac, M., Creanga, S., 2022. Analysis of Phylogeny and Genetic Diversity of Endangered Romanian Grey Steppe Cattle Breed, a Reservoir of Valuable Genes to Preserve Biodiversity. Agriculture, 12, 2059. doi.org/10.3390/agriculture12122059.

Acatincăi, S. 2004. Cattle production, second edition, Publishing House-Eurobit, Timișoara, Romania.

Felius, M., Beerling, M.L., Buchanan, D.S., Theunissen, B., Koolmees, P.A., & Lenstra, J.A. 2014. On the history of cattle genetic resources. Diversity, 6, 705–750.

Gîlcă, I. & Gîlcă, V. 2012. Researches regarding the performance of milk production registered in dairy breeds Pinzgau and Transilvania's Pinzgau, exploited in the North-East of Romania. Scientific papers - U.S.A.M.V. Iasi, Zootechnics, 58 (17), 265.

Caroli, A., Rizzi, R., Lühken, G., & Erhardt, G. 2010. Short communication: Milk protein genetic variation and casein haplotype structure in the Original Pinzgauer cattle. Journal Dairy Science, 93, 1260–1265.

Erhardt, G. 1996. Detection of a new K-casein variant in milk of Pinzgauer cattle. Animal Genetics, 27, 105- 107.

Pavlík, I., Sölkner, J., Kadlečík, O., Kasarda, R., Mészáros, G., Fuerst, C., & Fuerst-Waltl, B. 2014. Joint genealogical analysis as a tool for diversity evaluation in Pinzgau cattle populations. Archiv. Tierzucht, 57 (14), 1