DOI: https://doi.org/10.59913/dagr.2026.25234

New aspects of the history and current status of the Milking Tsigai sheep breed in Hungary

VÁSÁRHELYI, Anna Mária[1]* – LÉVAI, András[2] – BECSKEI, Zsolt[3] – GÁSPÁRDY, András[4]

[1]University of Veterinary Medicine Budapest, Doctoral School, István utca 2., 1078 Budapest, Hungary
[2]Hungarian Sheep and Goat Breeders' Association, Lőportár utca 16., 1134 Budapest, Hungary
[3]University of Belgrade, Faculty of Veterinary Medicine, Department of Animal Breeding and Genetics, Bulevar Oslobodjenja 18, Belgrade, Serbia
[4]University of Veterinary Medicine Budapest, Institute for Animal Breeding, Nutrition and Laboratory Animal Science, Department of Animal Breeding and Genetics, István utca 2., 1078 Budapest, Hungary
*corresponding author: vmarianna2@gmail.com

Abstract

The dairy-type Tsigai represents a breed variant of the Tsigai sheep indigenous to Hungary and Serbia. The origins of the Milking Tsigai can be traced back to the 19th century, when selection for milk yield was emphasized in certain flocks of the historical Vojvodina region. In Hungary, the contemporary Milking Tsigai population emerged during the final decades of the 20th century through modern breeding programs and the importation of Serbian animals. With a breeding population of fewer than 300 ewes, the Milking Tsigai is regarded as critically endangered in Hungary. Current conservation strategies emphasize genetic surveillance and planned mating schemes. Prospective applications also involve exploiting the breed's favourable milk quality for niche dairy products and its suitability for sustainable, low-input agricultural systems.
Earlier assessments of genetic diversity were based on analyses of blood groups and protein polymorphisms, which indicated moderate variability within the population. Subsequent molecular investigations have incorporated the analysis of STR polymorphisms. At present, research efforts are focused on characterizing the maternal lineage through the analysis of mtDNA.

Keywords: breed preservation, milking variant, genetic diversity

DOI: https://doi.org/10.59913/dagr.2026.25234

Introduction

The conservation of indigenous livestock breeds has become increasingly important as specialized breeds have progressively replaced locally adapted populations in modern animal production. Indigenous breeds represent more than historical agricultural practices: they retain genetic variation accumulated through long-term natural and artificial selection under specific environmental and management conditions. Their conservation is therefore relevant both to cultural heritage and to the preservation of genetic resources.

The Tsigai sheep is a traditional long-tailed sheep breed associated with the Balkans, Central and Eastern Europe and Asia Minor (BECSKEI el al., 2024). In Hungary, Tsigai sheep became established as a multipurpose population, historically valued for milk, meat and wool. Its wool was valued for its relatively fine characteristics compared to the more widespread Hungarian Sheep (Racka), contributing to its persistence in Hungarian sheep farming despite never becoming one of the country's dominant breeds (GÁSPÁRDY and SÁFÁR, 2014; KUSZA et al., 2011). During the twentieth century, however, changes in production systems and breeding priorities substantially reduced the importance and population size, as multipurpose flocks were increasingly displaced by more productive, single-purpose breeds.

Within the Hungarian Tsigai population, two clearly distinguishable breeds are currently recognized: the Native Tsigai, maintained primarily as a genetic resource without selection for a specific production direction, and the Milking Tsigai, which has undergone directional selection for milk production. The latter is now treated as a distinct breed because of its different phenotypic and production characteristics (MJKSZ, 2024).

The present article summarizes the history, breed characteristics, reproductive performance and population status of the Milking Tsigai in Hungary and discusses its potential role in future conservation-oriented and low-input production systems.

Breed history

The Tsigai sheep is traditionally reported to have reached the territory of Hungary from the Balkans at the end of the eighteenth century. RODICZKY (1904) subsequently reported 1792 as the earliest documented date associated with its arrival, when the demand of Hungarian woollen mills and the developing wool trade encouraged farmers in Transylvania and neighbouring regions to replace coarser-woolled sheep with Tsigai animals producing finer wool (GÁSPÁRDY et al., 2006). The breed subsequently became established particularly in Transylvania and later spread to other parts of historical Hungary.

The breed was initially valued primarily for its wool, but its multipurpose character was recognized relatively early. By the beginning of the twentieth century, Tsigai

DOI: https://doi.org/10.59913/dagr.2026.25234

sheep were considered better milk producers than Hungarian Sheep and were particularly useful in smallholder farms on the Great Hungarian Plain (KOVÁCSY, 1926). At the same time, in the Balkans the breed was also valued as a meat-producing sheep (NASTIC et al., 2020; SAVIĆ et al., 2000). The breed never became dominant in Hungary, mainly because the Merino was introduced during approximately the same time, with more specialized production, and the Hungarian Sheep also remained more influential (GÁSPÁRDY et al., 2022).

The emergence of the Milking Tsigai represents a later stage: by the turn of the twentieth century, different Tsigai populations had acquired distinctive characteristics associated with local breeding objectives and conditions. Among these were larger-bodied populations in the Great Hungarian Plain, flocks selected for wool production, and populations with particularly good milk yield (KOVÁCSY, 1926).

The historical development of the Milking Tsigai is closely associated with Tsigai populations of the Zombor region and with Pivnica (Pivnička) sheep in present-day Vojvodina, Serbia (BECSKEI el al., 2024), with some speculating other, possibly including Bergamasca or Karakul influence (GÁSPÁRDY and SÁFÁR, 2014). Importantly, the Kisszállás flock, established from animals originating from the Zombor region, already showed characteristics associated with milk-oriented production in the early twentieth century, including relatively large body size, black head and legs, polledness, good milk yield and the ability to utilize relatively poor sandy pastures (KOVÁCSY, 1926). However, the animals did not yet display all of the morphological characteristics subsequently associated with the Milking Tsigai.

The political and economic changes surrounding and following the Second World War contributed to a substantial decline in population size. The animals survived in the region between the Duna and Tisza rivers, on small family farms, with the aim of increasingly prioritizing milk production (KOVÁCSY, 1926; GÁSPÁRDY et al., 2022).

Following the reorganization of Hungarian sheep breeding organizations in the early 1990s, the Tsigai and Milking Tsigai were maintained as separate breeds by the Hungarian Sheep and Goat Breeders' Association (MJKSZ), while official recognition of the Milking Tsigai took place on 18 April 2000 (GÁSPÁRDY et al., 2022).

Breed characteristics and production

Morphological characteristics

The Tsigai is traditionally considered a finer-bodied breed compared to other indigenous sheep. The Milking Tsigai is a comparatively large-framed sheep with a characteristic long head, convex nasal profile and long, pendulous ears. The forehead is free of wool, and the frontal wool tuft characteristic of the indigenous type is

DOI: https://doi.org/10.59913/dagr.2026.25234

absent (GÁSPÁRDY et al., 2022). The official breed description characterizes the Milking Tsigai as a medium-to-large, hardy and robust sheep (MJKSZ, 2024). Ewes are hornless, whereas rams may be either horned or polled, with horned rams being more common. The head and legs are black or brown, the skin is pigmented, and the fleece is predominantly white and curly, although black fibres may occur within it (DUNKA, 1997; VERESS, 1997). Milking Tsigai have comparatively coarser, greasier wool, with longer fibres (GÁSPÁRDY et al., 2006).
Compared to the Native Tsigai, they differ markedly in body size and conformation. Comparative measurements demonstrate statistically significant differences in several traits (Table 1).

Table 1: Comparison of body measurements of adult Native and Milking Tsigai ewes, after GÁSPÁRDY et al. (2001)

Parameter	Native Tsigai	Milking Tsigai
Live weight, kg	53.4	76.0
Height at wither, cm	67.5	73.8
Body length, cm	75.0	79.6
Chest depth, cm	35.1	34.8
Chest width, cm	24.3	25.0
Heart girth, cm	91.4	104.6
Rump width, cm	24.4	28.7
Cannon girth, cm	8.5	10.1
Head length, cm	22.1	25.6
Ear length, cm	13.9	20.4

Another qualitative distinction is the colour of newborn lambs: Milking Tsigai lambs are born black, whereas Native Tsigai lambs show different darker or brownish shades that subsequently become white (MJKSZ, 2024).

Milk production

Milk yield is the principal distinguishing production trait of the breed. Historical Hungarian flocks already demonstrated substantial milk potential. In the Kisszállás flock, ewes produced approximately 3 dl of milk per day after a two-month suckling period, with recorded milking yields of 107 litres over 230 milking days or 51 litres over 150 days, depending on the production system (PÓCZOS, 1934). Later descriptions of the Milking Tsigai report approximately 1.1–1.25 litres of milk per day, around 130 litres per lactation and a milking period of approximately 100 days (KUKOVICS et al., 2006; CSANÁDI et al., 2007). Other documented flocks reached substantially higher values, and the breed has been described as capable of

DOI: https://doi.org/10.59913/dagr.2026.25234

approaching 200 litres when milk consumed by the lamb is also considered (KESZTHELYI et al., 1998). The composition of the milk is also of practical interest. Reported values for Milking Tsigai milk include approximately 6.0–7.0% fat, 5.8–6.4% protein and 4.27–5.15% sugar (CSANÁDI, 2005; BAJÚSZ, 2008). Such composition is particularly relevant for cheese and fermented dairy products because high concentrations of milk solids increase processing yield. Historically, Tsigai milk was used for a range of products, demonstrating the breed's economic and culinary significance (KUKOVICS and NAGY, 2000; BAJÚSZ, 2009).

Reproductive traits

Reproductive performance is central to the conservation of a small sheep population because demographic recovery depends directly on the ability of breeding females to produce and successfully rear replacement animals. Historical observations indicate a multifaceted reproductive profile characterized by relatively late maturation, good maternal performance, prolificacy and substantial milk yield (SCHANDL and BEREK G-né, 1961).

Nineteenth-century reports from Hétfalu described the regular occurrence of twins, while a 1896 report from Somogyszentimre stated that the number of offspring, including twins, normally exceeded the number of ewes (SZENTKIRÁLYI, 1923).

Later quantitative observations provide more precise evidence. PÓCZOS (1934) reported that approximately 15% of ewes produced twins, while a more recent survey by NAGY et al. (2008) estimated lambing performance in Milking Tsigai at approximately 150%. These data indicate useful reproductive capacity, although prolificacy estimates should be interpreted in relation to management conditions, season, parity and flock structure.

Maternal ability is another relevant characteristic. GYIMÓTHY (2011) reported a markedly higher proportion of lambs weaned relative to the number of ewes in Tsigai than in prolific Merino ewes, 81.2% compared with 52.5%. This observation illustrates an important distinction between prolificacy and reproductive efficiency. Producing multiple lambs has limited value if maternal ability is inadequate. A breed capable of combining acceptable prolificacy with effective lamb rearing may therefore have greater practical value under extensive conditions (SCHANDL and BEREK G-né, 1961). The combination of milk production and maternal ability is particularly valuable in low-input systems because reproductive output cannot be evaluated independently from the ability of the ewe to rear multiple offspring.

An interesting relationship has also been reported between temperament, physiological stress and milk production in Native Tsigai sheep. PAJOR et al. (2010) found that calmer Tsigai ewes produced more milk during a 106-day milking period than animals classified as nervous, with mean yields of 52.4 and 46.1 litres, respectively. The calmer animals also showed lower blood cortisol and lactate concentrations, and their lambs subsequently achieved better weaning and fattening performance. These findings suggest that behavioural and physiological

DOI: https://doi.org/10.59913/dagr.2026.25234

characteristics may interact with productive performance and could therefore be relevant to future breeding and management strategies, warranting further investigation of these relationships in the breed.

Male reproductive performance is another relevant component. OLÁH (2010) compared quantitative and qualitative semen characteristics of rams from seven sheep breeds used in Hungary, including semen concentration, motility, freezing capacity and post-thaw motility. Tsigai rams ranked among the three best-performing breeds for several semen-quality traits. Nevertheless, seasonal variation was evident, consistent with the reproductive seasonality characteristic of sheep.

Current population status

The major conservation problem facing Milking Tsigai in Hungary is its small and fluctuating population size. The latest available evidence indicates that the Hungarian population remains small, making conservation a central issue. Data presented from the Hungarian breeding records (Figure 1) show substantial variation in the number of registered ewes over the past three decades. In 1993, 121 ewes were registered in one farm. The number increased to 840 ewes in seven farms in 1998 reaching the highest number recorded in the presented series in 1999 at 1020 animals, before declining to 437 in 2005 and 325 in 2009. A temporary increase to 731 ewes occurred in 2015, followed by further declines to 255 in 2016 and 245 in 2019. The population increased to 369 ewes in 2020 but declined again to 229 in 2023. In 2024, 243 registered ewes were distributed among four farms.

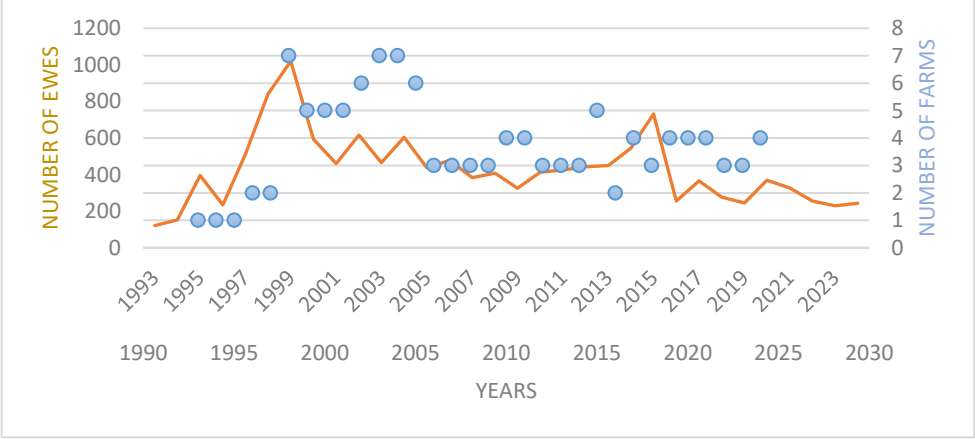


Figure 1: Number of registered Milking Tsigai breeding ewes and breeding farms in Hungary from 1993 to 2024. Data source: Hungarian Sheep and Goat Breeders' Association (MJKSZ, 2024) and GÁSPÁRDY and SÁFÁR (2014).

DOI: https://doi.org/10.59913/dagr.2026.25234

These numbers demonstrate that the breed remains vulnerable to demographic fluctuations and that population size alone is not a sufficient measure of conservation success: a temporary increase can be followed by rapid contraction, particularly when the number of breeding farms is small. A population of only a few hundred registered ewes is inherently vulnerable to demographic stochasticity, loss of breeding families and excessive reproductive contribution of individual rams.

Although the Tsigai as a transboundary breed is represented by much larger populations internationally (ĆINKULOV et al., 2007), the Hungarian population is sufficiently small to require active conservation measures. The small population size is particularly important because conservation involves more than simply maintaining a numerical population threshold. Effective conservation requires maintaining genetic variation, controlling relatedness and ensuring that breeding decisions do not excessively favour a limited number of breeding animals (SZALAY and KOPPÁNY, 2017). For this reason, herd-book recording, planned mating and the exchange of breeding rams between flocks are important components of the conservation programme.

The economic context presents an additional challenge. The Hungarian sheep sector has experienced a general decline, while the number of specialized dairy sheep remains limited, resulting in domestic sheep milk and dairy products occupying a relatively small market niche (KUKOVICS and NAGY, 2000; NAGY et al., 2008; NASTIC et al., 2020). Even when sheep dairy products are available, their market presentation and promotion have often been insufficient (GÁSPÁRDY, 2003).

For Milking Tsigai, this creates a paradox. Its strongest distinguishing feature - milk production - could support conservation if linked to economically viable products, but low market demand reduces the financial incentive to maintain specialized dairy flocks. Conservation subsidies are therefore important, but long-term survival is more likely when conservation is combined with productive utilization.

Genetic diversity

Genetic characterization has been used to distinguish Hungarian Tsigai populations and to monitor their genetic status. Earlier studies relied on blood-group and biochemical protein polymorphisms (Fésüs, 1974). These investigations were initiated in Hungarian Native sheep during the second half of the twentieth century and were subsequently used to characterize the Native and Milking Tsigai populations. The Milking Tsigai was first specifically characterized using these approaches in 1990 (Fésüs and Al Dabbagh, 1991). These studies identified differences in systems such as haemoglobin and transferrin and demonstrated that the Milking Tsigai population differed from several Native populations.

The subsequent application of DNA-based markers considerably increased the resolution of these investigations. During the 1990s, protein polymorphisms in Milking Tsigai were characterized and genotyped (ANTON et al., 1999). GÁSPÁRDY et al. (2013) used microsatellite polymorphisms to compare Hungarian

DOI: https://doi.org/10.59913/dagr.2026.25234

Tsigai flocks, while KUSZA et al. (2010) examined ten Hungarian populations using 16 microsatellite loci. The latter study detected 262 alleles and 15 population-specific alleles, demonstrating substantial allelic variation. Genetic distances and clustering revealed relationships among populations associated with geographical and breeding history, and did not indicate an immediate threat from inbreeding under the conditions examined (KUSZA et al., 2024).

More recently, GÁSPÁRDY et al. (2022) investigated the maternal genetic background of Native Tsigai using mitochondrial cytochrome *b* and control-region sequences. Further studies examining DNA-based markers amongst the Milking Tsigai population could provide useful insights into the genetic background and evaluation of the maternal families and paternal lines could provide valuable information for future breeding-program decisions.

Future perspectives

The future of Milking Tsigai depends on resolving the apparent conflict between conservation and economic viability. A population cannot be sustainably maintained indefinitely if keeping the animals has no economic rationale. Conversely, intensive selection for maximum production could undermine the very characteristics that justify conservation.

The first priority should therefore be demographic stabilization. The number of breeding ewes should increase, but population growth must be accompanied by an effective mating strategy. Pedigree analysis should be combined with molecular information to identify underrepresented lines and minimize unnecessary loss of genetic variation.

Second, production should emphasize the strengths of the breed (BODÓ, 1991). The Milking Tsigai has historically been selected under relatively extensive conditions and retains characteristics compatible with low-input farming. These characteristics suggest potential suitability for organic and other environmentally oriented production systems in which resilience, maternal ability and efficient use of pasture are important alongside milk yield.

Third, milk should be regarded as a means of conservation rather than simply as a production trait (KUKOVICS and NAGY, 2000). The breed's relatively high milk fat and protein concentrations make it suitable for value-added dairy products (ANTON et al., 1998; CSANÁDI, 2005; NAGY et al., 2008; BAJÚSZ, 2009). Small-scale cheese and fermented dairy products may offer opportunities for higher-value utilization than commodity milk (CSANÁDI et al., 2007). The objective should not be to compete directly with highly specialized dairy sheep breeds in maximum milk yield, but to conserve the breed’s character alongside sensible production use.

Fourth, the genetic identity of the Milking Tsigai requires continued monitoring. In particular, genome-wide analyses could further clarify relationships among Hungarian Milking Tsigai, Native Tsigai, Serbian and other Balkan Tsigai

DOI: https://doi.org/10.59913/dagr.2026.25234

populations, as well as the possible contribution of historically proposed source populations (ĆINKULOV et al., 2008), and potential historical contributor breeds. Such work would help distinguish genuine historical introgression from convergent phenotypic similarity.

Finally, the potential role of Milking Tsigai in pasture and landscape management deserves further investigation. Extensive sheep production can contribute to the maintenance of grassland habitats (PENKSZA et al., 2024), while the preservation of locally adapted breeds can support production systems requiring relatively low external inputs, although the specific ecological contribution of Milking Tsigai remains to be evaluated. The breed therefore has potential value at the intersection of genetic conservation, sustainable agriculture and rural heritage.

The central principle should be that conservation and utilization are complementary. The historical development of Milking Tsigai demonstrates that productive selection can create a valuable population without eliminating its local character. Future breeding should retain this balance rather than pursuing either genetic isolation or unrestricted improvement.

Conclusion and recommendation

The Milking Tsigai represents a distinctive component of Hungary's sheep genetic resources. Its history extends from the introduction of Tsigai sheep into Hungary at the end of the eighteenth century through the development of regionally differentiated populations and, ultimately, the emergence of a strongly milk-oriented type. The modern Milking Tsigai is phenotypically distinct from the Native Tsigai, particularly in body size, head and ear characteristics, fleece properties and production orientation.

One of its principal distinguishing values is its milk yield, supported by reproductive performance and good maternal ability. At the same time, the Hungarian population remains very small and fluctuates considerably between years, placing the breed in a vulnerable position. Genetic studies imply that flocks retain considerable genetic variation, but further studies are needed to evaluate the current state of the genetic resource, especially considering the maternal families and paternal lines.

The long-term conservation of Milking Tsigai should therefore combine demographic expansion with controlled breeding, pedigree management and genetic monitoring. Economically viable low-input and organic production, especially through high-value dairy products, could provide an important foundation for maintaining the breed in active agricultural use. Conservation should ultimately aim not merely to preserve the name “Milking Tsigai”, but to retain the population's distinctive genetic, phenotypic and productive characteristics as a functional Hungarian genetic resource.

DOI: https://doi.org/10.59913/dagr.2026.25234

Acknowledgements

This research forms part of a PhD research project conducted at the University of Veterinary Medicine Budapest. It was realized in part with the subsidization (MGEF/81-2/2025) of the Ministry of Agriculture. The authors gratefully acknowledge the Hungarian Sheep and Goat Breeders' Association for its support and assistance with breeding-population data.

References

ANTON, I. – ZSOLNAI, A. – FÉSÜS, L. – KUKOVICS, S. – MOLNÁR, A. (1998): Genetic polymorphisms of milk proteins in Hungarian dairy sheep breeds and crosses, Sheep and Goat Production in Central and Eastern European Countries, Hungary, REU Technical Series, 50: 224–226.

ANTON, I. – ZSOLNAI, A. – FÉSÜS, L. – KUKOVICS, S. – MOLNÁR, A. (1999): Survey of β-Lactoglobulin and αs1-Casein polymorphisms in Hungarian dairy sheep breeds and crosses on DNA level. Archiv für Tierzucht, 42:387–392.

BAJÚSZ, I. (2008): Három cigája fajtaváltozat tejének beltartalmi vizsgálata és a juhtej kazein frakcióinak elválasztása RP-HPLC módszerrel. Agrártudományi Közlemények – Acta Agraria Debreceniensis, 31:13–22.

BAJÚSZ, I. (2009): A nyers juhtej egyes összetevőinek vizsgálata, és a fehérjefrakciók hatása a sajtgyártásra. Doktori értekezés. Debreceni Egyetem, Debrecen

BECSKEI, Z. – TARIĆ, E. – ČALOVIĆ, S. – GÁSPÁRDY, A. – PASKAŠ, S. – BJEDOV, S. – CEKIĆ, B. – RAŠETA, M. – SAVIĆ, M. (2024): Past, present and future of the Tsigai sheep. Win or lose? Winter School Animal biotechnology, Nitra, February 1st, 2024, 38–38.

BODÓ, I. (1991): A géntartalékok megőrzése az állattenyésztésben. Akadémiai doktori disszertáció. Budapest, pp 124–126.

ĆINKULOV, M. – TAPIO, M. – OZEROV, M. – KISELYOVA, T. – MARZANOV, N. – PIHLER, I. – OLSAKER, I. – VEGARA, M. – KANTANEN, J. (2008): Genetic differentiation between the Old and New types of Serbian Tsigai sheep. Genet Sel Evol, 40:321–331. https://doi.org/10.1051/gse:2008006

CSANÁDI, J. (2005): A juhtej termelése, minősége és feldolgozása közötti összefüggések. Doktori értekezés. Debreceni Egyetem, Debrecen

CSANÁDI, J. – FENYVESSY, J. – BALÁZSA-BAJUSZ, I. (2007): The breeding of Tsigai sheep as a possibility towards the profitability I. Milking performance, production indexes. Review of Faculty of Engineering: Analecta Technica Szegedinensia 2007(1):23–30.

DUNKA, B. (1997): A cigája és a cikta. Kistermelők Lapja XXV:7., p 7.

FÉSÜS, L. (1974): A juh vércsoportjai 1. : Az első hazai vizsgálatok eredménye. Állattenyésztés, 23(5):83–88.

DOI: https://doi.org/10.59913/dagr.2026.25234

FÉSÜS, L. – AL DABBAGH, A. (1991): A génrezerv cigája és cikta állományok vércsoport és biokémiai polimorfizmus vizsgálatának eredményei. Állattenyésztés és Takarmányozás, 40:411–416.

GÁSPÁRDY, A. (2003): A cigája. In: Kútvölgyi M (ed) Megőrzött ízek: Juhételek, III. Timp Kiadó, Budapest

GÁSPÁRDY, A. – ESZES, F. – BODÓ, I. – KOPPÁNY, G. – KESZTHELYI, T. (2001): A cigája (berke) juhfajta hazai változatainak alkattani összehasonlító vizsgálata. Állattenyésztés és Takarmányozás, 50:33–42.

GÁSPÁRDY, A. – KUKOVICS, S. – ANTON, I. – ZSOLNAI, A. – KOMLÓSI, I. (2013): Hazai cigája juhnyájak összehasonlítása mikroszatellita-polimorfizmusok alapján. Magyar Állatorvosok Lapja 135. évf.:660–665.

GÁSPÁRDY, A. – MEGYERNÉ NAGY, J, – KESZTHELYI, T. – ESZES, F. – ZÁHONYI, J. (2006): Hazai cigája (berke) változatok gyapjútulajdonságainak összehasonlító vizsgálata. Állattenyésztés és Takarmányozás 55. évf.:35–55.

GÁSPÁRDY, A. – SÁFÁR, L. (2014): Őshonos juhfajtáink: Cigája és tejelő cigája. MJKSZ, HVG Press Kft., pp 43.

GÁSPÁRDY, A. – ZENKE, P. – KOVÁCS, E. – ANNUS, K. – POSTA, J. – SÁFÁR, L. – MARÓTI-AGÓTS, Á. (2022): Evaluation of Maternal Genetic Background of Two Hungarian Autochthonous Sheep Breeds Coming from Different Geographical Directions. Animals, 12:218. https://doi.org/10.3390/ani12030218

GYIMÓTHY, G. (2011): Reproductive Seasonality in Various Genotypes of Female Sheep. PhD thesis. University of Debrecen

KESZTHELYI, T. – BODÓ, I. – GÁSPÁRDY, A. – ESZES, F. (1998): A cigája juh fajtafenntartásának egy évtizedes tapasztalatai Jákotpusztán. In: Akadémiai Beszámolók. Budapest, p 13.

KOVÁCSY, B. (1926): Juhtenyésztés (IV. kötet). In: Magyarország állattenyésztése, Szerk.: Konkoly Thege S., Pátria irodalmi Vállalat és Nyomdai részvénytársaság nyomása, Budapest

KUKOVICS, S. – MOLNÁR, A. – ÁBRAHÁM, M. – NÉMETH, T. – KOMLÓSI, I. (2006): Effects of udder traits on the milk yield of sheep. Archives Animal Breeding 49:165–175. https://doi.org/10.5194/aab-49-165-2006

KUKOVICS, S. – NAGY, Z. (2000): A juhtej, nem mint melléktermék. Állattenyésztés és Takarmányozás, 49:51–61.

KUSZA, S. – KUKOVICS, S. – JÁVOR, A. (2006): A cigája változatok közötti genetikai távolság becslése. In: Mihók S (ed) Génmegőrzés. Hagyományos háziállatfajták genetikai és gazdasági értékének tudományos feltárása. Debreceni Egyetem, Debrecen, pp 64–69.

KUSZA, S. – NAGY, I. – NÉMETH, T. – MOLNÁR, A. – JÁVOR, A. – KUKOVICS, S. (2010): The genetic variability of Hungarian Tsigai sheep. Archives Animal Breeding, 53:309–317. https://doi.org/10.5194/aab-53-309-2010

DOI: https://doi.org/10.59913/dagr.2026.25234

KUSZA, SZ. – IVANKOVIĆ, A. – RAMLJAK, J. – NAGY, I. – JÁVOR, A. – KUKOVICS, S. (2011): Genetic structure of Tsigai, Ruda, Pramenka and other local sheep in Southern and Eastern Europe. Small Ruminant Research 99:130–134. https://doi.org/10.1016/j.smallrumres.2011.03.059

MJKSZ (2024): A Magyar Juh- és Kecsketenyésztő Szövetség juhfajtákra vonatkozó tenyésztési programja. juh-tenyesztesi-program-2024.pdf mjksz.hu

NAGY, ZS. – TOLDI, GY. – SÁFÁR, L. – KUKOVICS, S. (2008): A tejelő cigája versenyképessége hazai tejtermelési és vágóbárány-előállítási feltételek között. Állattenyésztés és takarmányozás, 57:339–355.

NASTIĆ, L. – IVANOVIC, S. – MARKOVIC, T. (2020): Economic efficiency of breeding Tsigai sheep in the Central and South-East Europe. Economics of Agriculture, 67:175–188.

OLÁH, J. (2010): A juh ondó minőségét befolyásoló tényezők. Doktori értekezés. Debreceni Egyetem, Debrecen

PAJOR, F. – MURÁNYI, A. – SZENTLÉLEKI, A. – TŐZSÉR, J. – PÓTI, P. (2010): Effect of temperament of ewes on their maternal ability and their lambs' postweaning traits in Tsigai breed. Archives Animal Breeding, 53:465–474. https://doi.org/10.5194/aab-53-465-2010

PENKSZA, K. – SALÁTA, D. – FŰRÉSZ, A. – PENKSZA, P. – FUCHS, M. – PAJOR, F. – SIPOS, L. – SALÁTA-FALUSI, E. – WAGENHOFFER, Z. – SZENTES, S. (2024): Are Hungarian Grey Cattle or Hungarian Racka Sheep the Best Choice for the Conservation of Wood-Pasture Habitats in the Pannonian Region? Agronomy, 14:846. https://doi.org/10.3390/agronomy14040846

PÓCZOS, L. (1934): A cigája fejős-juhászat jövedelmezősége. Állattenyésztők Lapja, 11(6):75–76.

RODICZKY, J. (1904): A juhtenyésztés mult és jelen irányairól. Pátria Irodalmi Vállalat és Nyomdaipari Rt., Budapest

SAVIĆ, M. – JOVANOVIĆ, S. – TRAILOVIĆ, R. (2000): Some genetic variation of blood proteins in Tsigai sheep in Yugoslavia. Acta Veterinaria-Beograd, 50:113–117.

SCHANDL, J. – BEREK, G-né (1961): A cigája nemesítése Ile de France fajtával. Állattenyésztés, 10(1):41–45.

SZALAY, I. – KOPPÁNY, G. (2017): Haszonállataink in vivo fajtavédelmi rendszere, a génbanki állományok kialakításának és fenntartásának hagyományos tenyésztési módszerei. In: Szalay I (ed) Génbanki kutatások régi haszonállataink védelmében: Műhelytanulmányok a tudományos génmegőrzés tárgyköréből. Gödöllő: Haszonállat-génmegőrzési Központ, Mezőgazda Lap- és Könyvkiadó, Budapest, pp 13–28.

SZENTKIRÁLYI, Á. (1923): Erdély juhai, Erdély juhtenyésztése, A mult – a jelen – a jövő. Providencia Könyvnyomdai Műintézet, Cluj-Kolozsvár

VERESS, L. (1997): Hol a helye a cigájának? Kistermelők Lapja, XXV:11., 16.p.