

Status and development trends of the controlled population of the autochthonous breed Bulgarian Gray Cattle

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Abstract

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Based on the analysis of the breeding documentation and monitoring, the status and development of the autochthonous breed Bulgarian Gray Cattle during the last 20 years have been studied. It has been established that after the resumption of the breeding activity in 2001, there is a steady development trend – from 10 farms with 88 animals in 2003, in 2021, 4769 animals are under selection control, incl. 4687 cows and 82 bulls, in 99 farms. By the middle of the period, the number of farms has stabilized and the number of animals is growing at a slow pace. Bulgarian gray cattle are bred mainly in pastures in the mountainous and semi-mountainous regions of the country. It was found that the controlled population has a good potential for in situ preservation, but the number of bulls for natural service is small, and the National Gene Bank has stored semen of only 6 bulls. It is proposed that the work on the conservation of the breed be focused on the expanded production of bulls for natural service and preservation of genetic material from bulls from all breeding areas. In order to increase the income and create lasting interest of the farmers in breeding the breed, it is proposed to develop and produce unique, geographically and breed protected products with high biological value, for which, bio-compliant animal breeding and the main habitats of the breed are extremely suitable.

Keywords: Bulgarian gray cattle; autochthonous breeds; in situ preservation

Introduction

The Bulgarian gray cattle is an autochthonous, primitive breed, and until the 50s of the last century it was the main breed in the country (Savov & Totev, 1954). The animals are medium-sized. The height at the withers is 119.4 ± 2.2 cm for cows and 128.5 ± 1.5 cm for bulls, and the live weight, respectively 380 ± 25.0 for cows and 560 ± 35.0 for bulls (Gorinov & Lidji, 2021). The cattle of the breed have a rough-dense constitution, a strong bone system, tight muscles and strong tendons. They are extremely adapted to the conditions of the mountainous and semi-mountainous regions of the country. They assimilate pastures well, are not demanding to the growing conditions, are resistant to adverse climatic influences, and are grazed almost all year round, often without special super-

vision by the farmers. The breed is late maturing, but has high fertility, resistance to disease, longevity.

In the process of domestication, the Gray population of cattle is formed as a breed of combined type – for work, meat and milk (Gorinov, 2011). With the development of mechanization and the elimination of the need for animal traction, animals are used for meat production in conditions of environmentally friendly breeding (Gorinov & Lidji, 2021), but the fattening qualities are relatively low. The milk yield of cows is also low.

Until the 70-80s of the last century, the breed was studied by a number of authors, searching for opportunities for its development (Platikanov, 1930; Vladimirov, 1944-1945; Gerov, 1951; Vladimirov & Kumanov, 1953; Konstantinov, 1964; Evtimov et al., 1968; Ivanov, 1977; Zahariev et al., 1982; Zahariev et

al., 1985). But since the middle of the century, with the import and distribution of highly productive breeds, as well as with the creation of new breeds in our country, the range of gray cattle is constantly narrowing, according to Hinkovski et al. (1984) it was only 4.7% of the cattle in the country as of 1977.

Work with the breed resumed in 2001 with the launch of the Rare Local Breeds project, funded by the Swiss Agency for Development and Cooperation (Nikolov, 2012). The main goal of the project is to search for and describe animals of 4 autochthonous Bulgarian breeds, including the Bulgarian Gray Cattle. The work with the breed is undertaken by Assoc. Prof. Dr. Yanko Gorinov, in collaboration with Assoc. Prof. Dr. Krasimira Lidji from the Institute of Animal Sciences in Kostinbrod, who have worked with the breed so far and also continue research subsequently (Gorinov, 1991; Gorinov & Yotov, 2006, 2009; Gorinov & Lidji, 2007, 2011, 2013a, b; Lidji & Gorinov, 2013).

In 2003 the Association for Rare Local Breeds in Bulgaria was established, with a section of Bulgarian Gray Cattle (BGC). The following year a breeding program was developed and protected (Gorinov, 2004). In 2005 the association received a breeding permit. In pursuance of the amendments to the Animal Husbandry Act of 2010, regulating breeding organizations to work with animals of one species, the sections of the Bulgarian Gray Cattle and the Rhodope Shorthorn Cattle of the Association for Rare Local Breeds in Bulgaria are merged into a new breeding organization, the Association for Breeding of Indigenous Cattle Breeds, established in the same year. A new breeding program has been developed (Gorinov, 2011) and in 2011 the organization received a permit to work with BGC for a period of 10 years. In 2021, the breeding program was updated (Gorinov & Lidji, 2021), and the permit for breeding activity was extended for another 10 years.

The purpose of this study is to analyze the dynamics of development of the breed in its recent history, from the beginning of the search in 2001 to the present day.

Material and Methods

The study included herds controlled by the Association for Rare Local Breeds in Bulgaria and the Association for Breeding of Indigenous Cattle Breeds. Archival data on the breed from the breeding documentation of the two organizations, reports, documents from the control activities of the Executive Agency for Selection and Reproduction in Animal Breeding, as well as own observations and studies were used. Herd monitoring is carried out mainly twice a year – in spring and autumn. The origin of the animals on the farms is established on the basis of own observations, survey data, documentation of farms and breeding organizations.

Results and Discussion

Summarizing the data from the first official study (started in 1948) of the breed distribution of animals in our country, Savov & Totev (1954) indicate that “Gray local Iskar cattle” occupies 82.12% of cattle in the country. The 1957 census (Hinkovski et al., 1984) is considered to be more accurate, when it was found that the relative share of gray cattle is 48.15% of the number of cattle – local gray – 41.07% (429 975) and Iskar – 7.08% – (74 152). The latest data from the previous history of the breed is from 1982 and only for animals in the public sector – 4180 – Local gray and 967 – Iskar (Hinkovski et al., 1984).

After the start of work on the project Rare local breeds, until 2003 through search activities, within the project, 10 herds with 88 female animals of reproductive age were registered (Table 1). For the most part, the livestock is bred in mixed-breed farms with impaired breeding discipline (Gorinov, 2004). The distribution of cows in the herds is from 1 to 30 pieces. There is uncontrolled inbreeding. During the inspections of the herds annually, about 10% of the offspring are determined as purebred (Gorinov & Lidji, 2021).

By its origin, the gray population in Bulgaria is an intermediate form obtained by spontaneous crossing of *Bos taurus primigenius* and *Bos taurus brachyceros*. Academician Platičkanov (1954) writes “The research done so far on bone materials from domestic cattle found during excavations of Neolithic deposits, as well as research on the origin of our local beef breeds leads to the conclusion that the first domestic cattle inhabiting our country were of the short-horned cattle type. The long-horned cattle of the primigenic type were brought to Bulgaria for the first time, probably by the Thracians during their resettlement on the Balkan Peninsula. A crossbreeding has taken place between the short-horned cattle found in our country and the long-horned primigenic cattle brought by the Thracians, which has lasted for centuries. However, this crossbreeding did not happen with equal intensity in all regions of the country. Therefore, some differences have been found between local cattle from different parts of the country.” A similar view was expressed by (Hlebarov et al., 1984), pointing to differences in the exterior of gray cattle from different areas. Thus, between the gray local cattle, the authors say, in the plains, semi-mountainous and mountainous parts of the country there is such a difference that as much as the regions are lower and flatter, i.e., the forage conditions are better, so is the influence of the primigenic type of cattle – the animals are larger, stronger and more productive (for example, the Gray cattle along the Iskar, Vit, Osam and Rositsa rivers). In more recent research, Gorinov (2011) has also found that depending on the economic and geographical regions of the country, his-

Table 1. Dynamics of the Bulgarian gray cattle population in the recent history of the breed

Year	Herds		Animals*		Average farm size
	N	Increase, %	N	Increase, %	number
until 2003	10		88		8,80
2004–2005	19	90.00	293	232.95	15.42
2006–2007	28	47.37	457	55.97	16.32
2008–2009	38	35.71	1369	199.56	36.03
2010–2011	49	28.95	1651	20.60	33.69
2012	55	12.24	1630	-1.27	29.64
2013	71	29.09	1908	17.06	26.87
2014	82	15.49	1967	3.09	23.99
2015	96	17.07	2299	16.88	23.95
2016	97	1.04	2596	12.92	26.76
2017	102	5.15	3361	29.47	32.95
2018	105	2.94	3508	4.37	33.41
2019	101	-3.81	3812	8.67	37.74
2020	100	-0.99	4217	10.62	42.17
2021	99	-1.00	4094	-2.91	41.35

* Note: Female animals – fertile age

torically there are several types of gray cattle, which differ in live weight, build and productivity.

During the search activity, since the beginning of the century, all the areas in which, according to the latest historical data, the Bulgarian gray cattle have been bred, have been studied. In the first years, for maximum preservation of genetic diversity, all animals were registered, which according to the Instruction for breeding work in the conservation of local (autochthonous) breeds in Bulgaria (2003) of the the Executive Agency for Selection and Reproduction in Animal Breeding, belong to the gray population – Iskar cattle, Stara Planina cattle, other local mountain cattle, as well as local gray cattle from other parts of the country (Gorinov, 2011). At the beginning of the actual breeding activity, the animals of the registered population are evaluated within the region of distribution. Cattle are assessed by origin, morphological features and typicality, basic external parameters are taken – height at the withers and sacrum, hair length, depth, width and girth of the chest, range of shin–bone. On this basis, decisions are made on the use of breeding animals.

The limited productive possibilities of the breed are decisive for the negative economic results of its breeding, as they are especially unfavorable during the period of restoration of the breeding structures (Gorinov & Lidji, 2007; 2013). A critical period for the recovery of the breed is the breeding of young breeding animals. Due to the late maturity of the animals, in each newly registered herd the breeding of young animals continues until the fourth year, and only on the sixth, from the initial registration, the groups of young breeding animals are formed.

Gradually, in compliance with the breeding discipline in the controlled population, the organizational structure is slowly built (Gorinov & Lidji, 2011). As a result of purposeful research and breeding activities, the number of Bulgarian gray cattle is increasing (Table 1), and the rates over the years are variable. In the initial period, the number of herds practically doubled, but then the growth rate slowed down. Nevertheless, by the middle of the study period – 2011-2012, the number of herds increased 5 times, and the number of cows under selective control – nearly 19 times. Along with the increase in the number of animals, there has been a significant consolidation of farms.

Until this period, the growth rate is significantly higher than that of the other autochthonous breed with which the breeding organization works – the Rhodope shorthorn cattle. Thus, according to Nikolov (2009), at the establishment, the association began working with 97 Rhodope shorthorn cows of small owners from the village of Kushla and two farms – in the village of Stomanovo and Madzharovo, and at the end of 2008, under control are 17 herds with 246 cows. By 2012, the number of shorthorn cows under breeding control increased to 695 (Malinova & Nikolov, 2013). In general, for these two periods (2008, 2012) the number of short-horned cows increased 2.5 and 7.2 times, respectively, while the gray increase was 15.6 and 18.5 times. The main reason for the observed positive trend, along with the organization of breeding activities, are the implemented measures to support farmers.

The first specific support is under the Special Accession Programme for Agricultural and Rural Development in the Republic of Bulgaria (SAPARD). The program finances the

breeds with which the project “Rare local breeds” works (Nikolov, 2015). The support of SAPARD farmers is in making agri-environmental commitments for a 5-year period, with 343 euros per cattle paid for the first year and 314 euros for the remaining 4 years. The maximum amount of compensatory payments for one agri-environmental project is 10 000 euros for year. The Ordinance on Support was promulgated in 2006, and the first funds were received in 2008. Nikolov (2015) found that the conditions for applying for and acquiring SAPARD funds are difficult for farmers – a 5-year commitment, special education, development of agri-environmental plans. When applying for support, the applicant submits 17 documents, and after approval, when submitting payment documents, another 12 to 16 are required.

The second specific support for autochthonous breeds is under measure “Agri-environmental payments” (measure 214) of the Rural Development Program for the period 2007-2013. The support is 200 euros per cattle (including suckler cows) over two years of age; 120 euros per cattle from 6 months to 2 years.

Gorinov & Lidji (2013), analyzing the effectiveness of support for the Bulgarian Gray Cattle, point out that with the support under the SAPARD program the number of animals under selective control increases by 2 times higher than with the support under the Rural Development Program. The reason, according to the authors, is that the SAPARD scheme provides funds for breeding all female offspring in the herds, which gives maximum opportunities for expanded reproduction.

Despite the continuation of the support, in the last 5 years the dynamics of the population of Bulgarian gray cattle is relatively weak. The last significant increase was in the period 2012-2017, when the number of farms and animals under selective control practically doubled. Since this period, the number of farms has stabilized at about 100, and the increase in the number of animals is at the expense of the controlled population's own reproduction. The reasons are probably not of a financial nature, as the Rhodope shorthorn cattle, which has significantly less productive capacity, is growing. In 2017, the number of controlled short-horned cows was practically equal to that of the gray ones, and in 2021 it was higher by 37.9%.

One of the reasons for the observed may be the specificity of the habitats of both breeds. Rhodope shorthorn cattle are bred mainly in the Eastern Rhodopes, which due to their limited natural resources are not suitable for breeding other breeds of cattle. The area of the controlled population of the Bulgarian gray cattle is mainly in the semi-mountainous and mountainous regions of Strandzha, Sakar, Central Balkans, Central Sredna Gora, Pirin, where the pastures are significantly richer. Small herds of the breed are bred in Shumen and Varna regions.

Initially, 5 breeding areas were formed in the breed, but in the process of building the breeding structure of the breed, great interest is shown by farmers from Southwestern Bulgaria, which is why in recent years a new breeding zone has been established – “Western” (Gorinov & Lidji, 2021). It covers the territory of Blagoevgrad, Kyustendil, Pernik and Sofia districts. Both state herds are included as structural breeding units – Kabiyuk State-owned Enterprise and Sredets National Research Center.

During the last five years the breeding structure of the breed has not changed significantly. In 2016, the largest number of farms and animals were in Haskovo, Burgas, Plovdiv and Blagoevgrad regions (Table 2), with 3-5 farms each in Varna, Kardzhali, Sofia, Shumen and Lovech regions, and in Veliko Tarnovo, Smolyan, Pernik, Pazardzhik, Kyustendil, Yambol and Stara Zagora districts there is one farm each. In 2021 (Table 3) there is an increase in the number of farms in Burgas region – +5, Botevgrad and Varna – +2, Plovdiv, Sofia and Veliko Tarnovo with 1 farm each. The number of farms in Haskovo, Shumen and Kardzhali districts has decreased by one farm each. Two new farms have been established in Plevnen region, and the herds in Lovech, Kyustendil and Yambol regions have dropped out. In all districts, except Shumen and Pernik, the number of animals has increased, with the most significant increase in Blagoevgrad (249.4%), Veliko Tarnovo (196.9%) and Varna (180.2%) districts.

We believe that, depending on the conditions of the breeding region, farms can be grouped into 7 breeding areas (Fig. 1): 1. Strandzha Region (Burgas District), 2. Northeastern Bulgaria Region (Varna and Shumen Districts), 3. North-Central region (Pleven and Veliko Tarnovo districts), 4. Rhodope region (Haskovo, Kardzhali and Smolyan districts), 5. South-Central region (Plovdiv, Stara Zagora and Pazardzhik districts), 6. Sofia regions (Sofia and Pernik region) and 7. Blagoevgrad region.

The individual breeding areas are specific in terms of climatic and fodder conditions. In Strandzha, Sakar and the Eastern Rhodopes there is a prolonged summer drought – a result of the pronounced Mediterranean climate influence. The area is also burdened with piroplasmiasis. The animals are kept on pasture all year round and only on snow-covered days they are fed in mangers. Pasture areas are natural low-yielding forest terrains with relatively weak grass vegetation. For their feeding, the animals make long transitions, which during the dry period reach over 25 km per day (Gorinov & Lidji, 2021). In the Central Balkans, Central Sredna Gora and Pirin the grass is kept for a long time, but the grazing period is shorter, the terrains are heavily rugged, with high altitude. In Northern Bulgaria the conditions for grazing are better, but the winters are harsher and the animals, during this period, are usually kept in a stable.

Table 2. Territorial distribution of the controlled population in 2016

№	District	Farms, number	Cattle, number				
			Total	Cows	Bulls	Heifers	Male calves
12	Haskovo	23	759	731	14	14	0
1	Blagoevgrad	20	356	319	12	23	2
2	Burgas	15	622	524	19	76	3
9	Plovdiv	14	497	427	12	58	0
10	Sofia	5	174	172	2	0	0
4	Varna	4	111	94	2	15	0
13	Shumen	3	99	85	3	11	0
15	Lovech	3	24	21	2	1	0
5	Kardzhali	3	100	94	1	4	1
3	Veliko Tarnovo	1	32	32	0	0	0
6	Pazardzhik	1	8	7	1	0	0
7	Pernik	1	10	9	1	0	0
8	Smolyan	1	35	30	1	4	0
11	Stara Zagora	1	35	34	1	0	0
14	Kyustendil	1	8	7	1	0	0
16	Yambol	1	11	10	1	0	0
Total		97	2881	2596	73	206	6

Table 3. Territorial distribution of the controlled population in 2021

№	District	Farms, number	Cattle, number					
			Total	Cows	Bulls	Heifers	Female calves	Male calves
1	Haskovo	22	1138	1050	17	67	4	
2	Blagoevgrad	22	888	742	9	119	10	8
3	Burgas	20	977	814	16	143	2	2
4	Plovdiv	13	732	667	11	53		1
5	Sofia	4	275	252	5	18		
6	Varna	6	200	182		14		4
7	Shumen	2	81	68	2	4	7	
8	Kardzhali	2	137	113	1	23		
9	Veliko Tarnovo	2	63	56			6	1
10	Pazardzhik	1	46	34	1	11		
11	Pernik	1	9	9				
12	Smolyan	1	58	51	1	6		
13	Stara Zagora	1	59	58	1			
14	Pleven	2	106	80	1	24		1
Total		99	4769	4176	65	482	29	17

From the number of controlled animals it is not possible to draw a conclusion about the potential of the breed in terms of breeding. The specified in Table 3 number of heifers is 11.5% of the number of cows, which is sufficient for normal reproduction, considering the duration of use of cows. The gender ratio of 71.7: 1 is too high. Some farms use artificial insemination, but only semen of 6 bulls is stored in the National Gene Bank – Botsko (1220 doses), Kaloyan (2095), Sitalk (2152), Pepal (2703), Pravets (2223) and Chasovnik (2176). The number of doses is more than enough, but the widespread use of artificial insemination in the presence of semen only from

these bulls would lead to a significant narrowing of genetic diversity. It is necessary to take action to increase the number of bulls from which semen material is produced, according to the scheme proposed by Nikolov (2013) – genetic material for cryopreservation to be taken in sufficient quantity for the reproduction of one population, periodically but not more rarely than once every two generations. According to the scheme proposed by the author, by 2022 the semen of 14 bulls should be produced for Bulgarian gray cattle.

To preserve the genetic diversity, in the Breeding program of the breed, a scheme for rotation of bulls is described both

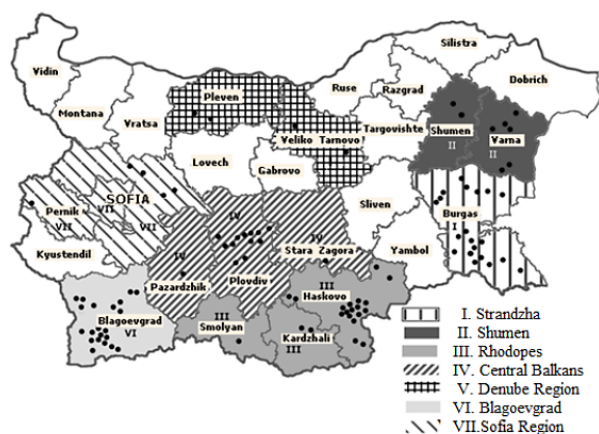


Fig. 1. Areas of Bulgarian gray cattle by breeding areas

within the breeding area and between the regions (Gorinov & Lidji, 2021). The rotational scheme of movement of the brood animals is on a tour basis, observing the sex ratio of 25:1. The rotation takes place over a period of three years, with each breeding center maintaining the required number of breeders in its kinship group, depending on the needs of each herd of the active part of the population by breeding areas. The rotation of bulls between breeding areas is from 6 to 21 years. In order to maintain the scheme, it is necessary to focus efforts on storing semen from bulls of all intrabreed populations when storing semen. This will allow, with the available small number of bulls (Table 3), to maximize the preservation of genetic diversity and appropriate use of brood animals for its maintenance.

The number of those listed in Table 3 female and male calves is significantly smaller than the real one. The reason is that the young animals are kept in separate registers and are not entered in the studbook. Cows usually enter it after the first calving, and bulls – during the first season.

In general, the potential for in situ conservation of Bulgarian gray cattle is great, but the growth rate of the number of animals is low, and in the last three years there has been a tendency to reduce the number of farms and keep the number of animals at the same level. Whether the reasons for this are of an objective nature – exhaustion of the possibilities of the areas, competition from the rapidly growing population of specialized meat breeds or of a subjective nature – keeping the number of animals to the “limit of threat” will be shown in the coming years. However, it is imperative to take measures to increase the interest of farmers in breeding the breed. Against the background of the exclusion of the progressive team on economic grounds, this can be achieved by creating and producing unique, geographically and breed-protected products, with bio-compliant animal husbandry, which is applied in

practice in almost all controlled farms. For this purpose it is necessary to study the quality of meat of animals of the breed in different geographical areas of the country.

A number of studies have shown that grazing, which is the main method of breeding Bulgarian gray cattle, improves the biological integrity of meat (French et al., 2000; Steen et al., 2003; Ponnampalam et al., 2006; Daley et al., 2010; Stanton et al., 2020; Butler et al., 2021). In particular, Butler et al. (2021) found that in all-pasture farming, intramuscular fats contain twice as much omega-3 fatty acids, the concentration of long-chain omega-3 fatty acids is 1.9 times higher, and the ratio omega-6: omega-3 fatty acids almost twice (1.5 ± 0.78 versus 2.8 ± 0.39) more favorably than meat produced in a non-organic way.

Increasing the economic efficiency of breeding the breed is the only way to increase farmers’ interest in it and its sustainable conservation and development.

Conclusion

In the autochthonous breed Bulgarian Gray Cattle, after the restoration of the breeding activity in 2001, there is a steady tendency to increase the number of animals under selection control. Of the 10 farms with 88 animals in 2003, in 2021 the breeding activity covers 4769 animals, incl. 4687 cows and 82 bulls in 99 farms. Since the middle of the analyzed period, the number of farms has stabilized and the number of animals is growing slowly. Bulgarian gray cattle are bred on pasture, mainly in the mountainous and semi-mountainous parts of Strandzha, Sakar, Sredna Gora, Central Balkans, Pirin, Eastern Rhodopes, and there are separate herds in the plains, mainly in Varna, Shumen and Plevan regions.

The controlled population of Bulgarian gray cattle has good potential for in situ preservation, but the number of bulls for natural service is small, and the National Gene Bank has stored semen of only 6 bulls. In order to preserve genetic diversity and reduce the risk of inbreeding, the conservation work of the breed should focus on the expanded production of bulls for natural semen and the preservation of genetic material from bulls from all breeding areas.

In order to increase the income and create a lasting interest of farmers in breeding the breed, it is necessary to develop and produce unique, geographically and breed protected products with high biological value, for which bio-compliant animal breeding and the main habitats of the breed are extremely suitable.

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