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Moravka Pig

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Abstract

Indigenous breeds of pigs are adapted to the specific areas in which they were created. In terms of scientific substantiation, their production potential and the products obtained from them are, as in the case of Moravka pig, practically untapped. The main objective of the present chapter is to present history and current status of this breed, breeding area, its performance, production systems and main products from this local breed of pigs. Reproductive traits were estimated by means of sow age at first farrowing, litter size, weaning weight, duration of lactation and length of the farrowing interval. Growth performance was estimated by means of average daily gain and average daily feed intake in the early, middle, late and overall fattening stage. Carcass performance was evaluated by means of slaughter weight, hot carcass weight, carcass yield, lean meat content, loin eye area, the back fat thickness at the level of the last rib and withers and the back fat and muscle thickness above the *gluteus medius* muscle. Meat quality traits of the *longissimus* muscle were evaluated by means of pH at 45 min and 24 h after slaughter, objective colour (CIE L*, a* b*), intramuscular fat content and fatty acid content of intramuscular fat.

Keywords: traditional European breed, TREASURE, productive traits, phenotype, Serbia

1. History and current status of the breed (census)

Šiška, a primitive breed of pigs created by domestication of wild pigs [1], was of great importance in the eighteenth century for the development of pig farming in the territory of Serbia, Croatia, Slovenia, Hungary, Romania, and Bulgaria. In the nineteenth century, in better conditions of rearing, from Šiška the Šumadinka breed of pig was created. Unfortunately, both breeds had disappeared permanently today. However, Moravka a breed of combined production traits was created as a result of unsystematic crossings of Šumadinka and Berkshire [2]. In order to create herds of pigs for pure breeding, and partly to improve the production characteristics of domestic breed Šumadinka, at the end of nineteenth and beginning of twentieth century, the breeds Berkshire and Yorkshire have been imported [2]. This is why Moravka is also known by the name “Moravka Black English”. In 1909 there was a proposal that Black English pigs called “Moravka” should be bred in a pure breed with better care, nutrition and selection, but also crossing with Yorkshire was proposed, with the selection control of cross pigs. However, there is no relevant information whether this crossing was done. In addition to Moravka, at the same time, Resavka breed (“Colourful Moravka”) was created in a similar way but in smaller numbers. The only difference is the colour, since Resavka has unequal fields

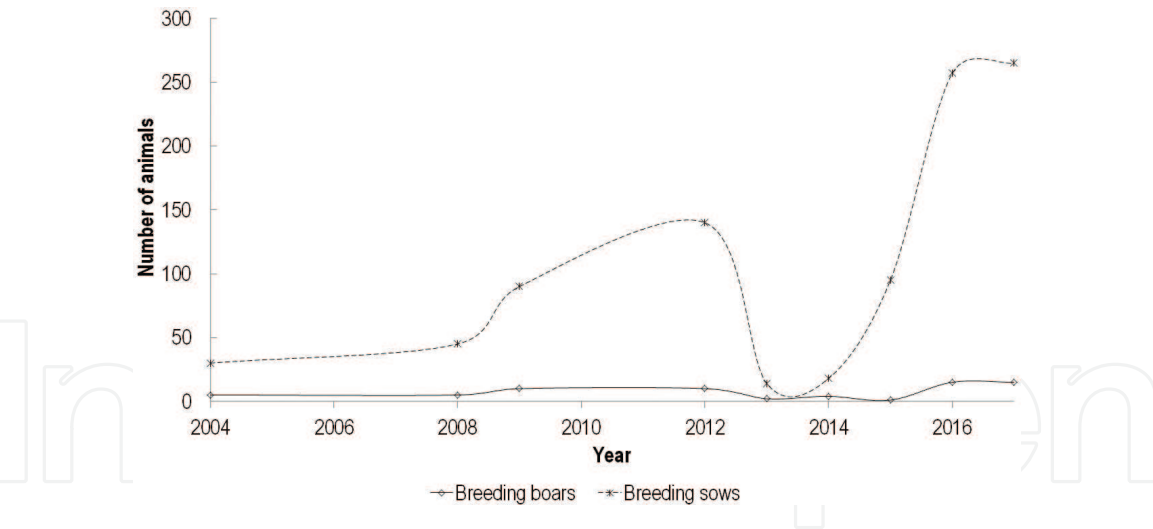


Figure 1.
Chronological distribution of Moravka pig breed, presenting number of sows and boars per year, starting with the year of herdbook establishment.

of black and white-yellowish colour of the hair and skin. Chronological distribution of Moravka pig breed is presented in **Figure 1**. Presently, in Serbia there are only 25 registered farms with 265 breeding sows and 15 boars of Moravka pig breed in the latest available status (February 2018; [3]).

2. Exterior characteristics

Information about the morphological characteristics of Moravka pig is summarized in **Table 1**. The Moravka pig has relatively thin, pigmented black skin and thick but rare (“naked Moravka”) black hair, which is smooth and straight [4]. The longer hairs are located on the ridge, neck, and upper parts and thinner on the lower parts of the body. When removing hair from the skin with hot water, the pigmented epidermis is removed, after which the skin that is completely white remains [2]. The neck is of medium length and is often narrow. The body is quite long and often narrow, and the back line is slightly convex or straight. The extremities are medium long, thin, gentle, and poorly covered with muscle tissue (**Figures 2 and 3**). When the animals are reared in the intensive conditions, they have well-defined exterior widths. The mammary complex consists of four to six pairs of teats.

Measurement (average)	Adult male	Adult female
Body weight (kg)	98.0	93.7
Body length ¹ (cm)	84.6	82.6
Head length (cm)	–	27.1
Ear length	–	21.7
Chest girth (cm)	112.2	107.2
Height at withers (cm)	63.4	62.4
Number of teats	–	8–12

¹Measured from the tip of the nose to the starting point of the tail.

Table 1.
Summary of morphological characteristics of Moravka pig breed.



Figure 2.
Moravka sows with piglets.



Figure 3.
Moravka boar.

3. Geographical location and production system

Moravka pig breed was first developed in extensive management conditions in the Morava Valley of central Serbia. In the present times, Moravka pigs are reared in municipalities of Despotovac, Ub, Ljig, Mionica, Mladenovac, Topola, Prokuplje, and Kuršumlija. These pigs are usually reared in free-range conditions and outdoor extensive or semi-intensive systems. Rearing of pigs implies a free holding in the limited areas in pastures, woods, or orchards. In extensive system, pigs are kept around the house, which depends on the number of animals and size of the owner's household, and in the winter period, animals are housed in cheap, wooden pig stables [4]. Feeding is primarily based on pasture and forest products (oaks, wild fruits). Additional daily meal represents an extremely small amount of grains per head, primarily corn. In extensive system sows very frequently farrow in the forest, which significantly complicates the control of productivity and record keeping. In semi-intensive conditions, sows farrow in objects, which enable better control. In the growing and fattening phase, pigs are mostly in the open section. They are rarely intensely fattened; however if so they achieve a satisfactory growth rate.

4. Organization for breeding, monitoring and conservation

Information on population status in the last 20 years is collected by the organizations listed in **Table 2**. The law of incentives in agriculture and rural

Name of organization	Address	Web address
University of Belgrade Faculty of Agriculture	Nemanjina 6, Beograd 11,080, Serbia	http://www.agrif.bg.ac.rs/
Institute for Animal Husbandry	Autoput 16, 11,080 Zemun-Belgrade, Serbia	http://istocar.bg.ac.rs/en/
Ministry of Agriculture, Forestry, and Water Management	Nemanjina 22–26, 11,000 Belgrade, Serbia	http://www.minpolj.gov.rs/?lang=lat

Table 2.
Contact details of breeding organization for Moravka pig breed.

development [5] defines the maximum amounts of incentives per head for breeding gilts, boars, and sows of Mangalitsa, Moravka, and Resavka [6]. However, the data on size of population are unreliable, and the greatest number of animals of Moravka wasn't included in the conservation program [4]; thus a sufficient number of representative animals should be selected in order to form herd in the breeding region. Based on the observations in the last 60 years of the existence of this breed, Savić et al. [7] concluded that the lower phenotypic value of some traits in the present is probably due to the decline of population, which indicates the need to increase the population, to continuously control productivity, to improve the system of raring, and to implement the systematic selection. The Moravka breed have the status "critically endangered"; when this reference was published, ex situ protection of endangered species did not exist in Serbia. But in 2017, ex situ preservation of animal genetic resources started accordingly with the rulebook on incentives for the conservation of animal genetic resources in the gene bank [5].

5. Productive performance

5.1 Reproductive traits

Basic data obtained on reproductive traits in this review are presented in **Table 3**. The age of sows at first parturition is approximately 11.6 months [3, 4, 9]. Sows of Moravka pig breed have 1.5 litters per year [3]. Average piglet birth weight is 1.3 kg [2–4, 8, 9]. Stillborn percentage of piglets and mortality rate until weaning are not reported within considered studies. Duration of lactation is prolonged in comparison to modern intensive systems to 60 days [2, 4, 8, 9], which leads to a longer farrowing interval (243 days; [3]) and higher weaning weight (10 kg, [2, 4, 8]).

5.2 Growth performance

Basic data on growth performance obtained in this review are presented in **Tables 4** and **5**. Due to big differences between studies with regard to the live weight range covered, we defined the stages for growth performance as growing stage (from weaning to approximately 30 kg live body weight) and early, middle, and late fattening stages estimated between approximately 30 and 60 kg, 60 and 100 kg, and above 100 kg live body weight, respectively. Sometimes the source provided only the overall growth rate for the whole fattening stage (defined as overall) or even from birth to slaughter (defined as birth–slaughter, which is often calculated from the data given on live weight and age of pigs). It should also be noted that a big part of the collected studies simulated practical conditions of the production systems used and that only

Reference	Sow age at first parturition (mth)	Litters per sow per year	Piglet live weight (kg)	Piglet weaning weight (kg)	Duration of lactation (d)	Farrowing interval (d)
[2]	–	–	1.2	10.0	60	–
[3]	12.4	1.5	1.3	–	–	243
[4]	–	–	–	–	–	–
	11.0	–	–	–	60	–
	–	–	1.2	10.0	60	–
[8]	–	–	1.3	10.4	60	–
[9]	11.5	–	1.2	–	–	–

No. number, mth month, d days.

Table 3.
Summary of collected literature data on reproduction traits of Moravka pig breed.

Reference	Feeding	No. of animals	ADG growing ¹	ADG fattening ²				ADG birth–slaughter
				Early	Middle	Late	Overall	
[1]	Rest	12	–	–	–	–	369	–
[2]	–	25	–	–	–	–	660	–
	–	25	–	–	490	–	490	–
	–	50	192	–	–	–	–	–
[4]	Rest	–	–	–	–	–	385	266
[9]	–	10	–	477	552	478	510	–
[10]	–	20	–	–	–	–	600	–
	–	24	–	–	–	–	660	–
[11]	–	15	–	–	–	–	388	303

No., number; ADG, average daily gain in g; Rest, restrictive feeding regime.
¹ADG in growing period estimated from weaning to approximately 30 kg live body weight.
²ADG in a period of fattening is reported for early, middle, and late fattening stages estimated between approximately 30 and 60 kg, 60 and 100 kg, and above 100 kg live body weight, respectively. Sometimes the source provided only the overall growth rate for the whole studied period (in that case defined as overall).

Table 4.
Summary of collected literature data on growth performance of Moravka pig breed.

a smaller part of the studies actually aimed at evaluating the breed growth potential. In the considered studies, an average daily gain in growing stage was extremely low (192 g/day; [2]) and increased to 477, 521, and 478 g/day in early, middle, and late fattening stages [2, 9]. The average daily gain in the overall fattening stage was 508 g/day [1, 2, 4, 9–11] and only 285 g/day in the period from birth to slaughter [4, 11]. In the context of the evaluation of growth performance, it is also of interest to observe the extreme values, because it can be assumed that the maximum figures exhibit the growth potentials of Moravka pigs in *ad libitum* conditions of feeding (≈660 g/day in overall fattening stage). The maximal growth rate with completed feed mixture observed for Moravka was 607 g in the period corresponding to average body weight of 79 and 89 kg (data not shown, [12]).

In considered studies, the information on feed intake and feed nutritional value were scarce, which limits the evaluation of growth potential. Average daily feed

Reference	Feeding	CP content of feed (%)	No. of animals	ADFI fattening ¹			
				Early	Middle	Late	Overall
[2]	–	–	25	–	2.99	2.99	–
	–	–	25	–	2.45	–	–
[4]	Rest	–	–	–	–	–	1.44
[9]	–	15	10	1.83	–	–	–
	–	13	10	–	3.12	2.76	2.65
[10]	–	–	20	–	3.16	3.16	–
	–	–	24	–	3.16	3.16	–

No., number; ADFI, average daily feed intake in kg/day; Rest, restrictive feeding regime; CP, crude protein.
¹ADFI in a period of fattening is reported for early, middle and late fattening stages estimated between approximately 30 and 60 kg, 60 and 100 kg, and above 100 kg live body weight, respectively. Sometimes the source provided only the overall daily feed intake for the whole studied period (in that case defined as overall).

Table 5.
Summary of collected literature data on average daily feed intake (in kg/day) in Moravka pig breed.

intake increased from 1.8 kg/day [9] in the early fattening stage to 3.0 kg/day in the late fattening stage [2, 10], whereas pigs consumed 1.4–2.6 kg/day considering overall fattening period [4, 9].

5.3 Body composition and carcass traits

Basic data obtained in this review with some of the most commonly encountered carcass traits that could be compared are presented in **Table 6**. In considered studies, pigs of the Moravka breed were slaughtered at an approximately 133 kg live weight [1, 2, 9, 10, 13–15]. Dressing yield was between 76 and 83% [2, 9, 10, 14] and lean meat content between 32 and 39% ([1, 13, 14]; SEUROP classification or dissection). The backfat thickness values measured at the level of the last rib ranged from 35 to 84 mm [1, 2, 9, 10, 13, 14], at the position of withers from 59 to 94 mm, and at the level of the *gluteus medius* muscle from 42 to 83 mm [1, 2, 9, 10, 13, 14]. Muscularity measured as loin eye area averaged 27 cm² [1, 13] and as muscle thickness above the *gluteus medius* 63 mm [1, 9].

5.4 Meat quality

Basic data obtained in this review with some of the most commonly encountered meat and fat quality traits measured in the *longissimus* muscle that could be found are presented in **Table 7**. In the studies reporting meat quality of Moravka pigs, the traits considered were pH measured in the *longissimus* muscle at 45 min and 24 h *post-mortem* that were 6.0–6.5 and 5.7–5.9 [1, 9], respectively. The intramuscular fat content was 6.7% [11, 14], and colour measured in CIE L*, a*, b* colour space was around 52, 10.2, and 5.3 for L*, a*, and b* [1, 9]. In available studies SFA, MUFA, and PUFA content of intramuscular fat in the *longissimus* muscle were approximately 42, 54, and 4% [11, 15], respectively. The research of Savić et al. [15] showed that castrated males exhibited higher content of saturated fatty acids C14:0 and C18:0 than females. Increase of slaughter weight was accompanied with decrease of linoleic acid, decrease of total content of polyunsaturated acids, increase of palmitoleic acid, increase in total content of monounsaturated fatty acids, increase of C17:0, and decreased of P/S ratio.

Reference	No. of animals	Final age (d)	Final BW (kg)	Hot CW (kg)	Dressing yield (%)	Lean meat content (%)	Backfat thickness (mm)			M ¹ (mm)	Loin eye area (cm ²)
							S ²	At withers	At last rib		
[1]	12	–	135	–	–	35.2	48	67	44	61	29
[2]	6	–	145	110	75.5	–	75	90	84	–	–
	50	–	150	117	78.2	–	83	94	82	–	–
[9]	10	–	131	–	80.7	–	63	84	61	64	–
[10]	19	–	132	101	76.9	–	69	91	77	–	–
[13]	16	–	125	–	–	39.0	42	59	35	–	25
[14]	10	–	101	84	83.1	32.1	51	63	43	–	–
[15]	21	339	113	–	–	–	–	–	–	–	–

No., number; BW, body weight; CW, carcass weight.

¹M muscle thickness measured according to ZP method [at the cranial edge of the gluteus medius muscle (mm)].

²S backfat thickness measured according to ZP method [above the gluteus medius muscle (mm)].

Table 6.

Summary of collected literature data on body composition and carcass traits in Moravka pig breed.

Reference	No. of animals	pH 45	pH 24	CIE ¹			IMF content (%)	Fatty acid composition ² (%)		
				L*	a*	b*		SFA	MUFA	PUFA
[1]	12	6.53	5.65	49	12.0	5.9	–	–	–	–
[9]	10	5.95	5.87	55	8.3	4.6	–	–	–	–
[11]	15	–	–	–	–	–	6.7	41.6	53.8	4.1
[14]	10	–	–	–	–	–	6.7	–	–	–
[15]	21	–	–	–	–	–	–	41.8	54.0	4.1

No., number; pH 45, pH measured approximately 45 min post-mortem; pH 24, pH measured approximately 24 h post-mortem; IMF, intramuscular fat; SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids.

¹CIE, objective colour defined by the Commission Internationale de l'Eclairage; L* greater value indicates a lighter colour; a* greater value indicates a redder colour; b* greater value indicates a more yellow colour.

²For fatty acid composition, only pigs on control diet were considered. Control diets differed among studies, to see diet composition address to the corresponding source.

Table 7.
Summary of collected literature data on meat quality of Moravka pig breed.

6. The use of breed and main products

The potential of the Moravka breed is untapped. The territory of Serbia has high potential of rearing autochthonous breeds, given the natural resources it possesses. The autochthonous Moravka breed is well adapted to this area, so it is one of the breeds that are suitable for outdoor rearing, in an ecological or organic, low-input production system. The study of Radović et al. [1] showed not significant better growth rate between Moravka and Moravka x Duroc (average daily gain, 368.9 vs. 503.0 g) but higher content of meat in carcass sides (35.2 vs. 43.6%). The animals not included in the nucleus herd could be crossed with Duroc, which would contribute to more economical production of meat. From this crossbreed, with combined production capabilities, we could obtain quality raw materials for the production of various products (ham, dried bacon, sausages). Today, on individual farms, these products are made according to traditional recipes and have added value, and the price of such products is significantly higher than those of conventional products. According to the results of Parunović et al. [16], it is possible to produce some meat products (kulen and sremska dry fermented sausages), with the appropriate combination of meat and fat from local pig breeds, with a respectable chemical content, with a favourable and reasonably healthful fatty acid composition, and with sensory qualities acceptable for consumers. This result should contribute to encouraging the sustainable breeding of the Moravka pigs which can significantly contribute to regional rural development.

Acknowledgements

The research was conducted within the project TREASURE, which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 634476. The content of this paper reflects only the author's view, and the European Union Agency is not responsible for any use that may be made of the information it contains. Partial financing of the Ministry of Education and Science of the Republic of Serbia (project TR 31081 for RS, ČR, MP, MG, and DR) is acknowledged.

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References

- [1] Radović Č, Petrović M, Parunović N, Radojković D, Savić R, Stanišić N, et al. Carcass and pork quality traits of indigenous pure breeds (Mangalitsa, Moravka) and their crossbreeds. *Indian Journal of Animal Research*. 2017;**51**:371-376
- [2] Živković R, Kostić J. Prilog poznavanju crne i šarene svinje (moravke i resavke). *Arhiv za Poljoprivredne Nauke*. 1952;**5**:23-46
- [3] FAO. The Domestic Animal Diversity Information System [Internet]. Available from: <http://dad.fao.org/> [Accessed: May 15, 2018]
- [4] Petrović M, Mijatović M, Radojković D, Radović Č, Marinkov G, Stojanović L. Genetic resources in pig breeding: Moravka. *Biotechnology in Animal Husbandry*. 2007;**23**:1-11
- [5] Republic of Serbia. Rulebook on incentives for the conservation of animal genetic resources in the gene bank. Official Gazette of the Republic of Serbia; 2017. No. 110/2017
- [6] Radović Č, Petrović M, Katanić N, Radojković D, Savić R, Gogić M, et al. Fertility traits of autochthonous breeds of mangalitsa, moravka and resavka. *Biotechnology in Animal Husbandry*. 2017;**33**:389-396
- [7] Savić R, Petrović M, Gogić M, Radović Č, Radojković D, Stanišić N, et al. Productive traits of moravka breed- has anything changed in last sixty years? In: *Proceedings of the 11th International Symposium Modern Trends in Livestock Production*; 11-13 November 2017; Belgrade, Serbia: Institute for Animal Husbandry; 2017. pp. 517-526
- [8] Lalević D. Uticaj načina i vremena pripusta na plodnost krmača. *Zbornik radova Poljoprivrednog Fakulteta*. 1954;**2**:1-7
- [9] Savić R. Personal communication, data collected within TREASURE survey 2.1. Belgrade, Serbia: University of Belgrade, Faculty of Agriculture; 2016
- [10] Mitrović D, Kostić J. Ispitivanje utroška hrane u zimskom tovu svinja. *Arhiv za Poljoprivredne Nauke*. 1954;**VII**(16):46-58
- [11] Petrović M, Wähner M, Radović Č, Radojković D, Parunović N, Savić R, et al. Fatty acid profile of *m. longissimus* dorsi of Mangalitsa and Moravka pig breeds. *Archives Animal Breeding*. 2014;**57**:1-12
- [12] Radović Č, Petrović M, Savić R, Gogić M, Lukić M, Stanišić N, et al. Growth potential of Serbian local pig breeds Mangalitsa and Moravka. *Agriculturae Conspectus Scientificus*. 2017;**83**:217-220
- [13] Petrović M, Mijatović M, Radović Č, Radojković D, Josipović S. Genetic resources in pig breeding: Carcass quality traits of breeds Moravka and Mangalitsa. *Biotechnology in Animal Husbandry*. 2007;**23**:421-428
- [14] Petrović M, Radović Č, Parunović N, Mijatović M, Radojković D, Aleksić S, et al. Quality traits of carcass sides and meat of Moravka and Mangalitsa pig breeds. *Biotechnology in Animal Husbandry*. 2010;**26**:21-27
- [15] Savić R, Petrović M, Radović Č, Parunović N, Radojković D, Stanišić N, et al. Fatty acids content of *M. longissimus* dorsi of moravka pigs. In: *Book of Abstracts of the 4th Fatty Pig Science and Utilization International Conference*; 23-25 November 2017; Badajoz, Spain; 2017. pp. 143-144. DOI: 10.5281/zenodo.1135218
- [16] Parunović N, Radović Č, Savić R. Sensory properties and fatty acids profiles of fermented dry sausages

made of pork meat from various breeds. In: van Ginkel L, Hennekinne JA, Velebit B, editors. Proceedings of the 59th International Meat Industry Conference MEATCON2017, IOP Conference Series: Earth and Environmental Science; 1-4 October 2017; Zlatibor, Serbia; 2017. pp. 1-11. DOI: 10.1088/1755-1315/85/1/012014