



Rustic gene reserves for the future of breed improvement technologies: old swine (*Sus scrofa domestica*) strains and their perspectives

¹Miklos Botha, ^{1,2,3}I. Valentin Petrescu-Mag, ¹Claudiu Gavriloaie

¹ SC Bioflux SRL, Cluj-Napoca, Romania; ² University of Agricultural Sciences and Veterinary Medicine (USAMV), Faculty of Agriculture, Cluj-Napoca, Romania; ³ University of Oradea, Oradea, Romania. Corresponding author: M. Botha, miklosbotha@yahoo.com

Abstract. In the case of natural decline or disaster many livestock breeds (including swines) are irreversible vulnerable and could not be replaced. A concrete and recent example is that of the recent past outbreak of Foot and Mouth disease in Britain. A large number of minority breeds, just as the rare breeds became highly endangered due to the enforcement of policies in case of epidemic diseases. The transfer of genetic material around the world is becoming increasingly more complex, and much of the stock currently held in Research Stations or Natural Reservations is largely irreplaceable. An outbreak of disease would devastate not only the entire breeding studs dating back several generations, but possibly also the nucleus of many breeds which are available in a limited stock. Many of these breeds have already proved their importance in the past, and they certainly still keep/carry many priceless genetic resources, therefore their loss would be immeasurable. Certain semen quantity is already preserved in AnGR (Animal Genetic Resources) storage facilities, but unfortunately it comprises material from only a few of the common breeds and is by no means a comprehensive or representative collection. In addition, because today the emphasis is on performance-rated sires, the collections of even the most common breed genitors are from a very narrow genetic base. In addition, farming technologies are permanently "evolving", generating a genetic pressure, and there is an inevitable gene loss due to reproductive discrimination (selection – the main improvement tool), therefore, often there is a need to go back to bloodlines that have adapted to specific tasks. A good example of this is when the original breed has been developed into large framed animal through the introduction of foreign semen, and is known as a breed adapted to specific climate condition. These animals, however, may be adapted to feed lot conditions but are not suitable for range conditions. It is of great importance that a variable genetic base of all livestock to be preserved so as to be available for future needs.

Key Words: Mangalitsa, Stocli, Romanian Saddleback, AnGR, cryopreservation, wild, seminatural, *Sus scrofa*.

Introduction. Heritage swine breeds are descending from bloodlines going far back in history, even hundreds of years, when livestock was raised based on extensive agriculture principles, via open-pasture farms. Because of their breeding/raising management and genes inherited, different ancient breeds outstand and became known for a variety of characteristics, including the rich and consistent taste of their meat, distinct marbling, bacon savors and creamy fat. Nowadays, the heritage breeds still carry excellent qualities, but many of them are not suitable for commercial farming practices. Therefore, they and their gene reserves are endangered of being lost forever. As the heritage pig breeds stock are decreasing, their gene pool decreases directly proportional, and some breeds are now becoming critically rare, and endangered by inbreeding and genetic drift. In the conditions of the recent commercial market, heritage breeds cannot compete with commodity pigs (Country Report 2003).

Breeding strategy for locally adapted breeds (native or resulted by an old grading up, without continuous import) is necessary for several species (sheep, buffaloes, goats, asses, cattle) including pigs to pastoral, free-ranging, organic, niche production, subsistence production systems and for conservation of AnGR. Even the scientific

research institutes of Romania and the poultry state company paid attention since 1960 to the conservation of animal genetic resources. There was not a legislative engagement issued on the subject, and as a result, in the period of 1950-1970 several important indigenous breeds belonging to different species (Stocli pigs, Mocanitsa - the Walachian cow, etc) have been lost (Country Report 2003).

In Romania, the importance of the swine sector as the animal husbandry leading branch is incontestable as reveals the data presented in Table 1. Although the data presented in Table 1 seems to be out of date, since 2003 is the only official state report, and no updated data are published since today.

Table 1

The importance of animal products deduced from production quantity (2001)
(Country Report 2003)

Production	Species	Breed type	Quantity	
			x 1000	%
Meat (t)	Pig	Recently introduced	613	41.3
	Poultry	Recently introduced	363	25.0
	Cattle	Recently introduced	295	21.3
	Sheep	Native	114	8.4
Milk (hL)	Cattle (+ Buffaloes)	Continually imported Native	51,000	94.1
	Sheep (+ Goats)	Native	3144	5.9

Figure 1 reveals a density of 70.5 pigs/100 ha arable land, in Romania, highlighting Maramures, Gorj, Valcea, and Ilfov County as leading regions in this aspect.

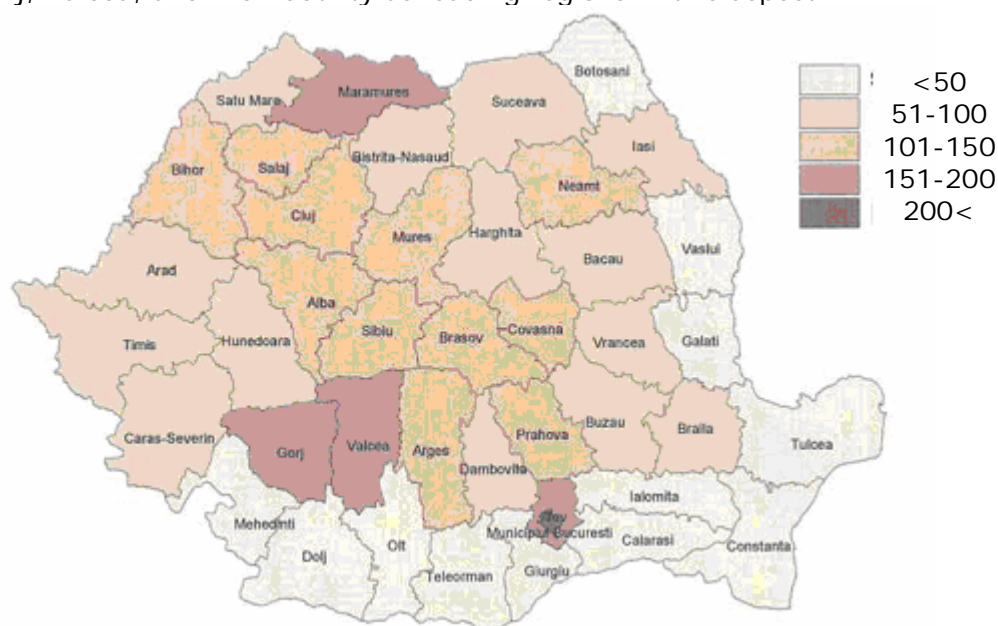


Figure 1. Density of the swine stock/100 ha infield at 30 June 2003 (Country Report 2003).

In the past in Romania, meat was provided in hierarchical importance by the following species: sheep, cattle, poultry, and swine. Once with the development of the cereal production (19th century) and the technological progress, the hierarchy was changed, indicated by the production, as: swine, poultry, cattle, and sheep. Up to the last 50 years, in the rural areas, inhabitants used to consume pork just during the winter (at Christmas time), and seldom they preferred fat breeds (Mangalitsa or later Romanian Saddleback "Bazna"). As agriculture has low mechanization, fat meat was important for its caloric nutrition indispensable for hard labor (Country Report 2003) (Table 2 & 3).

Table 2

Relative importance of livestock products and services within species (%) (Country Report 2003)

<i>Species</i>	<i>Milk</i>	<i>Meat</i>	<i>Egg</i>	<i>Fiber</i>	<i>Skin</i>	<i>Risk management</i>	<i>Fertilizer manure</i>	<i>Draught</i>	<i>Culture</i>	<i>Recreation</i>	<i>Fuel</i>	<i>Feather</i>	<i>Environmental management</i>	<i>Total</i>
Cattle	58	39			1		2							100
Buffalo	48	19			1		2	30						100
Sheep	54	38		4	2		2							100
Goat	70	25		1	2		2							100
Horse							2	90		8				100
Donkey							2	98						100
Pig		98					2							100
Chicken		53	45				1			1				100
Turkey		95	4				1							100
Geese		90	4				1					5		100
Duck		30	66				1					3		100

Table 3

Relative importance of species within livestock products and services (%) (Country Report 2003)

<i>Species</i>	<i>Milk</i>	<i>Meat</i>	<i>Egg</i>	<i>Fiber</i>	<i>Skin</i>	<i>Risk management</i>	<i>Fertilizer manure</i>	<i>Draught</i>	<i>Culture</i>	<i>Recreation</i>	<i>Fuel</i>	<i>Feather</i>	<i>Environmental management</i>
Cattle	75	18			45		60	2					
Buffalo	8	3			5		5	5					
Sheep	15	10		100	40		15						
Goat	2	1			5								
Horse							10	90		80			
Donkey							1	3					
Pig		50			5		4						
Chicken		15	95				3			15		20	
Turkey		1	1				1			1			
Geese		1	1				1			2		60	
Duck		1	3							2		20	
Total	100	100	100	100	100		100	100		100		100	

According to the Country Report (2003), at that time, from the local breeds, only the Romanian Saddleback was used by some peasants. In the last few years another ancient rustic breed, namely the Mangalitza lives its renaissance (Botha et al 2014). After the year 2000, once the Mangalitza gained the attention of scientists and breeders, due to its meat and fat outstanding quality, which is in accordance with the new "slow food" trend, several studies have been performed (Botha et al 2014; Oroian & Petrescu-Mag 2014; Parunovic et al 2015; Varo-Ghiuru et al 2011; Zăhan et al 2010; Zsolnai et al 2006), regarding the breed real qualities and capacities.

Material and Method. The national and international literature was surveyed. We also used material provided by researchers and research stations which has as main goal AngR (Animal Genetic Resource) preservation and improvement in situ or ex situ.

Results and Discussion

The domestication of the wild boar resulted in primitive pig breeds (Mangalitza, Stocli, Bazna), which today are considered endangered, and from these through controlled breeding schemes with infusion of imported breeds resulted new breeds like Black of Strei (Negru de Strei) and White of Banat (Alb de Banat). Among the oldest primitive pigs from Asia where the Chinese pig with mask (with an age of about 5,000 years), along with the Siamese pig, and in Europe the Celtic pig, the Palatin pig and even the Stocli (<http://ferme-porci.ro/originea-si-inceputul-cresterii-porcilor/>).

The Stocli pig. The Stocli pig is the oldest swine breed reared in Romania. Morphologically the breed is characterized by short and erect ears, with convex upper bodyline, weak developed and beveled croup, thin thighs with very weak musculature, long legs but not robust, small and resistant hoofs, grey thick skin, harsh and abundant hair, with mane. The color is brown, like the wild boar, with different shades. There are two varieties, the mountain type and the wallow (Figure 2). Overall this breed is very alike the European wild boar. At the age of two years the sows go up to 145 kg. The prolificacy is characterized by 6.25 piglets/parturition, the sows exhibiting outstanding maternal instinct.

The Stocli has an important role in developing new breeds like White of Rusetu (Alb de Rusetu) and Black of Strei (Negru de Strei) (<http://www.gazetadeagricultura.info/animale/porcine/>).

The Stocli breed, preserved in pure breed in the west of the Apuseni Mountains, Vrancea and Măcinului region, and in the swamps of Brăila (Romania), seem to be formed through different geographic conditions, therefore there in the mountain area Stocli, and in swamp conditions as Wallow (Gligor 1969).

The Stocli is the base of the Romanian indigenous pig breeds. It is very suitable for free-range systems, specific to the Middle Ages, when it was a very popular breed, and was reared in high stocks (as it confirm some documents). The breed can be easily maintained at pasture, in mountain areas with acorn, beech nut, and other wood fruits. Herds of pigs were sent from Moldavia to forests of Bistrița, as it is mentioned by the bishop (Efre) of Rădăuți from the beginning of the XVII century. Due to its rusticity, the Stocli can survive in the wilderness, without any kind of shelter by feeding themselves even for long periods, even months. That is why crossbreeding with the wild boar (*Sus scrofa ferus*), native species to Eurasia and North Africa (Petrescu-Mag et al 2014), is quite easily explainable. Besides arheo-zoological analyses already mentioned this kind of phenomenon in the Middle Age Moldavia (Bejenaru & Bacumenco-Pîrnău 2011).



Figure 2. The Stocli pig (Source: <http://stiri24.md/>).

The Romanian Saddleback "Bazna". The Romanian Saddleback (Bazna) swine (Figure 3) was founded back in 1872 in Bazna, Sibiu County, Romania, through crossbreeding Mangalitsa sows with Berk hogs imported from UK. After that, in 1959, the resulted population was infused with Sattelschwein hogs, and in the period of 1969-1970 with Wessex hogs. After the year 1970, there was no other infusions performed, the population was breed in a closed system. In order to avoid inbreeding, blood lines were established, and the breeding program used the cross between those blood lines (<http://www.madr.ro/>).

An important step was performed in 1950, when at Turda (Romania) was organized a nucleus of Romanian saddleback in order to elaborate a breeding program for improvement and conservation, the breed being in endangered situation (Drăgănescu et al 2008).

Tables 4 & 5 present the actual state regarding some morphological traits, and reproductive performances of the breeding stock from the Experimental Station Turda (Romania).

Table 4

Some morphological traits of the Romanian Saddleback (Bazna) breeding stock from the SCDA Turda, Cluj County, Romania (Nagy 2014)

Specification	Hogs			Sows		
	$x \pm s_x$	s	v%	$x \pm s_x$	s	v%
Oblique-length of the body (cm)	120.00±6.43	14.14	12	93.17±2.73	8.64	9.28
Height at withers (cm)	109.36±2.23	9.37	8.57	86.75±2.014	6.37	7.35
Height at rump (cm)	104.36±2.23	8.04	7.71	84.38±1.96	6.20	7.35
Thoracic perimeter (cm)	102.41±7.89	17.65	17.24	88.86±2.06	6.53	7.35
Tibia perimeter (cm)	18.57±0.83	3.46	18.64	16.75±0.98	3.12	18.64
Weight (kg)	136.78±3.87	8.65	6.33	130.36±3.66	11.58	8.89

Table 5

Reproductive performance dynamics for the Romanian Saddleback (Bazna) breeding stock sows from the SCDA Turda, Cluj County, Romania (Nagy 2014)

Specification	Parturition									
	1		2		3		4		5	
	$X \pm SX$	V%	$X \pm SX$	V%	$X \pm SX$	V%	$X \pm SX$	V%	$X \pm SX$	V%
No of piglets/ parturition (individuals)	7.43±2.06	7.42	8.43±2.06	8.42	8.23±2.06	8.22	8.28±1.66	8.24	7.39±2.24	7.39
No of alive piglets/ parturition (individuals)	6.03±1.79	6.04	7.25±1.64	7.70	6.57±1.54	6.54	6.57±1.54	6.54	5.71±1.54	5.70
Average weight of the piglets at birth (kg)	1.12±0.04	11.28	1.14±0.07	11.46	1.14±0.05	11.42	1.15±0.05	11.50	1.16±0.04	11.60
No of piglets at the age of 21 days (individuals)	5.67±1.30	5.67	6.71±1.24	6.75	6.25±1.27	6.25	6.15±1.27	6.14	5.53±1.24	5.53
Average weight of the piglets at 21 days (kg)	5.08±0.45	5.07	4.97±0.43	4.96	4.98±0.51	4.96	5.12±0.62	5.10	5.30±0.51	5.28
Lactating capacity of the sows (kg)	28.80±5.12	2.71	33.34±3.50	2.92	31.2±5.15	3.03	31.48±5.68	3.00	29.30±3.88	2.96
No of weaned piglets (individuals)	5.35±0.98	0.53	6.10±0.87	0.60	5.89±1.10	0.57	5.71±1.11	0.57	5.14±0.84	0.50
Average weight of the piglets at weaning (kg)	11.73±1.27	1.14	11.84±1.16	1.17	12.58±3.78	1.25	11.98±1.16	1.17	12.05±0.94	1.17



Figure 3. The Romanian Saddleback (other names: Bazna, Basner, Porcul de Banat) (Source: <http://agrointel.ro/40838/>).

Mangalitsa. For a comprehensive description we display a material realized by Radnóczy (2002):

"The typical fat type breed (the original Hungarian name is Mangalica) was developed in the 19th century in the Carpathian basin. As the breed does not require special care and has good fattening ability and excellent fat production from the beginning of the 19th century until 1950 it was the most popular swine breed in Hungary. The fat, bacon and not at least its salami were demanded products in the European market, so it was rightly world famous in its time. The old breeds, such as Bakonyi and Szalontai were taken to the farmyards of the domains and the small owners, fed with maize and crossed with the "Sumadia" breed of Serbian origin. The constitution of the animals has gradually changed and the "fat-type" hogs were developed. Sows of the slow growing type were mated with the "new-type" boars. Thus quickly growing pigs were inclined to put on weight faster than the old breeds. One of the forerunners of these changes was the Kisjenő domain of the Royal Archduke József in Arad county. The National Society of Fat-Type Hog Breeders, established in 1927, organized the purposeful improvement of the breed. The population of registered hogs included only 1-2000 animals in the 20s, however this number increased to 30.000 till 1943. Breeding animals of 66 Blond Mangalica, 7 Swallow Bellied Mangalica, and 5 Szalontai red-haired Mangalica stock breeding farms were advertised for sale in a fair-calendar of 1940. Due to the activity of the National Association of Animal Breeding Organisations another boom of breeding started after the World War II, then by the rapid decrease of the number of Mangalica hogs, the breed gave place to the recent meat-type pig breeds. Based on the most popular technology the fattening schedule started with 12 and 18 months old mangalicas, kept previously on pasture, on original grass, or they were used for picking up and rooting scraps after harvesting of crops. Owing to the plenty of movements, growings 50-70 kg in weight have a strong bone structure capable of bearing this big weight. Barrows and culled sows are also desirable for this purpose, as they can produce a higher end-weight".

Figure 4 presents the three Mangalitsa varieties, recognized by the Mangalitsa Breeders Association in Hungary. Tables 5 & 6 display some morphological traits, and reproduction indices of the Mangalitsa breeding stock from the SCDA Turda (Figure 5), Cluj, Romania.



Figure 4. The three Mangalica pig breeds participating in gene preservation Blonde Mangalitsa (1), Red Mangalitsa (2), Swallow-bellied Mangalitsa (3) (Szabó 2006).

Table 5

Some morphological traits of the Mangalitsa breeding stock from the SCDA Turda, Cluj County, Romania (Nagy 2014)

Specification	Hogs			Sows		
	$X \pm SX$	S	V%	$X \pm SX$	S	V%
Oblique-length of the body (cm)	115.21±2.95	6.60	5.73	109.76±6.42	20.30	18.50
Height at withers (cm)	105.07±5.53	12.37	11.78	101.47±3.25	10.28	10.14
Height at rump (cm)	108.02±4.11	9.94	9.21	103.32±2.39	7.56	7.32
Thoracic perimeter (cm)	117.58±3.07	6.87	5.85	103.25±3.22	10.17	10.07
Tibia perimeter (cm)	17.42±1.35	3.03	17.42	15.51±1.54	2.39	15.41
Weight (kg)	141.03±5.21	11.66	8.33	126.16±3.49	11.05	8.76



Figure 5. Free-range Mangalitsa stock at SCDA Turda, Cluj County, Romania (Nagy 2014).

Table 6

Reproductive performance dynamics for the Mangalitsa breeding stock sows from the SCDA Turda, Cluj County, Romania (Nagy 2014)

Specification	Parturition									
	1		2		3		4		5	
	$X \pm SX$	V%	$X \pm SX$	V%	$X \pm SX$	V%	$X \pm SX$	V%	$X \pm SX$	V%
No of piglets/ parturition (individuals)	8.03±1.50	7.75	8.70±1.63	8.39	8.03±1.82	7.75	9.25±1.97	8.92	8.64±2.08	8.14
No of alive piglets/ parturition (individuals)	7.17±1.46	7.17	8.00±1.21	8.00	7.46±1.57	7.46	8.10±1.55	7.75	7.75±1.55	7.75
Average weight of the piglets at birth (kg)	1.15±0.05	11.85	1.20±0.04	12.03	1.20±0.06	12.03	1.16±0.05	11.67	1.17±0.06	11.71
No of piglets at the age of 21 days (individuals)	6.67±1.30	5.67	7.32±1.24	6.71	6.89±1.26	6.25	7.39±1.26	6.14	7.14±1.03	5.53
Average weight of the piglets at 21 days (kg)	5.76±1.02	5.75	5.67±0.89	5.64	5.98±0.83	5.96	5.59±0.84	5.57	5.90±1.02	5.89
Lactating capacity of the sows (kg)	38.41±4.89	4.17	41.05±4.95	4.32	41.20±5.31	4.32	41.31±4.05	4.51	42.12±4.05	4.51
No of weaned piglets (individuals)	6.67±1.12	0.64	7.32±1.12	0.98	6.89±1.06	0.67	7.39±1.03	0.72	7.14±1.07	0.70
Average weight of the piglets at weaning (kg)	12.38±0.82	1.21	12.66±0.48	1.25	12.80±0.54	1.28	12.37±1.04	1.21	12.34±0.89	1.21

During 2011-2014 through the project “Proiectul Sectorial ADER 1.1.5.” (Nagy 2014), reproduction material of Mangalitsa and Romanian Saddleback was diffused in the neighboring counties (Figure 6, Table 7).



Figure 6. Counties which benefited of Romanian Saddleback (Bazna) and Mangalitsa breeding material through “Proiectul Sectorial ADER 1.1.5.” project (Nagy 2014).

Table 7

The breeding material out-put quantification regarding distribution from Figure 8 (Nagy 2014)

Year	Breed	
	Bazna	Mangalitsa
2011	35	59
2012	41	67
2013	69	55
2014	37	38

Traditional systems like: pendulation (transhumance) (Figure 7); local grazing on pastures around the settlements; free range swine and poultry; traditional, low-intensity (low input, self-sustaining, using more native, locally adapted breeds) farming systems, most of them of crafting agriculture type, played a historical role in supporting the population up to 19th century and in creating a natural vegetation, landscape biotope of high nature conservation value. In Romania there are still some such systems, some with a great importance (39...100%) in animal production sector, most of them extended especially on the last 20 years, but with an uncertain future. They may be considered low-input in terms of energy, food and productivity (non-industrial), but they are usually high-intensity in terms of human labor, due to its non mechanized situation. Here must

be mentioned that for an individual craft often the farm activities are only part-time, and crofters usually need to have others means of financial income (Country Report 2003).

Pendulation (Transterminance in Spanish nomenclature) is the swing of animal herds, between the native village and mountain pasture. This pendulation was set up mainly for the sheep species, but always there was other species beside like cattle, goats, pigs, horses, donkeys, which are dwellers of mountains or foothills villages. The herds/flock was organized at the beginning of summer in big flock 300-500 individuals. The flocks usually are managed by professional herdsman (1 to 100 animals/person) and travels short distances (10-50 km) for summer grazing on the alpine areas, for milk or meat production (Country Report 2003).



Figure 7. A transhumance setup in the hill area, Romania (source: <http://info-receacristur.ro/>).

The livestock (pigs and poultry) kept in households are usually fed by-products of peasants farms. In Romania there is an ancient tradition in processing a pig for Christmas time, therefore about 50-70% of rural population feed a pig for Christmas and 80-90% of them has some poultry. The efficiency of the system is disputable, but in the past and present socio-economical context it survived and there is expected to survive at least on short term. The hobby breeders contribution is very important for the conservation of endangered breeds (Country Report 2003).

There is a free ranging husbandry of bovines and pigs in the Danube Delta, on the Romania premier nature conservation site, which now became a Biosphere Reserve and a World Heritage Site, has established an "Economic Zone" of 3061 km² (52.8%) with 7 villages and 1 town, where domestic animals are permitted. Most of the animals (cattle and pigs) kept in this area are maintained in free-ranging system, exceptions are only for some house cows and domestic poultry, which are kept by peasants around the households. The stocks are giving birth to their descendents, grow and live free in the Delta. For centuries they formed there a unique ecosystem, in which the livestock has been a component of the Delta terrestrial ecosystems. The owners of swineherds, usually composed of a few tens, keep the contact with their animals feed them corn about once every two weeks. It is usual that herds of some hundred are marketed with their owners mark. In autumn for own supply or commercial purposes the "crop" is harvested and the rest of the animals winter free in the Delta (Drăgănescu 2001).

In 1972 the National Breeding Program proposed to conserve Grey Steppe Cattle and Stocli pigs in Delta but it was too late. In the 60's other breeds (Santa Gertrudis, Large White) have been introduced and it was impossible to avoid free mating (crossbreeding). For both, nature conservation (genetic resources, landscape) and social-economical reasons, it is necessary for the national and international institutes (IUCN, Euroconsult, etc) to accept that domestic animals are important components of natural ecosystems and to recommend their conservation in National Parks (Country Report 2003).

Before 1948 the organization form of the agriculture was characterized by medium-scale (input) commercial systems, the so called "system of former landlords or rich peasants' farms". After 1950, until 1990 the most systems were of co-operative and state farms. In that system, there was no capital for investments (low input), even if the farms had commercial dimensions (100-500 to 1,000-10,000 animals/unit). In 2003 still this was the main development objective, but their size was still small. There were like 3,573 agricultural private units and 6,264 associations, working about 2,200,000 ha agricultural land. Some of these units also have medium sized swine farms, taken from the former co-operative or state farms (Country Report 2003) (Table 8).

Table 8
Systems of Romanian animal production (Country Report 2003)

Production system	Farming system*	Weight of animals (%)							
		Cattle	Buffaloes	Sheep	Goats	Pigs	Horses	Ass	Poultry
Low input									
Pendulation (swing village mountain)	Subsistence	1		30		1	1	15	
	Small-scale commercial			15					
Transhumance (swing mountain - plain pasture)	Large scale commercial			4	1		1	15	
	Subsistence Smallholder								
Local grazing	Small-scale commercial	80	100	46	99				
House animals	Subsistence Small scale commercial					50	90	70	35
Free ranging in Danube Delta	Large scale commercial	1				1			
Medium input									
Farms (some 6,264 associations and 3,573 firms working some 2,200,000 ha)	Large and small commercial	10		5		38	5		45
High input									
	Companies	8				10			20

*Subsistence - less than 50% of production marketed; Smallholder, small-scale commercial - more than 50% production marketed; Large-scale commercial - 100% production marketed

In the year 1991 in Romania took place an agrarian reform which ended with a considerable fragmentation of about 80% of vegetable and animal production sector in

subsistence and smallholder farms, turning the specialized enterprises in low-input farming systems (in average 2.28 ha/farm, 1-2 bovine, 1 swine, and some poultry/farm). The owners/farmers had low technical and financial possibilities. These events induced also a sudden change in services and infrastructure approach of animal production. The quantity and the quality of animal production and the livestock experienced a dramatic decrease. Some breeds even have been declared extinct (Table 9). Due to those mentioned above Romania shifted from an important exporter of animal products to an importer one (Country Report 2003).

Table 9

Active, at risk and extinct Romanian large farm mammal breeds (Country Report 2003)

Species	Active			At risk		Extinct	
	Locally adapted	Recently introduced	Continually imported	Native	Recently introduced	Native	Recently imported
Cattle		1	3	1		4	9
Sheep	6	1	1	5	6	1	12
Goat	2						
Buffalo	1						
Horse	6		1		4	3	
Ass	1						
Pig		3		2	1	5	
Total	16	5	5	8	11	13	21

As it can be seen in Table 10 the pure breed swine are equal with those obtained by crossbreeding. Crossbreed individuals have some advantages over purebred ones because of the heterosis genetic phenomenon, also known as hybrid vigor. Because of heterosis, most commercial swine producers use crossbred pigs rather than purebreds, because heterosis usually gives crossbred pig an improvement over the average of its parent purebreds in a certain trait. This is the reason why heritage breeds loose popularity in the advantage of their industrial conspecifics.

Table 10

Number of widely used breeds with breeding strategies (Country Report 2003)

Species	Breeding system			
	Total number of breeds	Purebred selection	Crossbreeding	Both
Cattle	4	4		
Buffalo	1	1		
Sheep	>12*	8*	(2)	
Goat	2	2		
Horse	10*	10*	10**	10
Donkey	1	1		
Pig	9*	5	5***	5
Chicken	7	4(20****)	20****	4(20)
Turkey	3	3	3	3
Geese				
Duck	1	1	1	

* including some endangered; **in production farms; ***industrial crossbreeding**** strain used for industrial crossbreeding.

For the most important farm species there are breeding strategies developed and specific tools being used (Table 11). Economic concerns force breeders/farms/research stations to try to capture all the genetic improvement possible. Improvement from the molecular technology point of view still must come from genetic suppliers.

Table 11

Number of breeds with current breeding strategies and tools being used (Country Report 2003)

Species	Breeding strategies				Tools			
	Breeding goals	Designed	Designed and implemented	Indiv. identif.	Recording	AI	ET	Genetic evaluation
Cattle	4	4	4	4	4	2	(1)**	4
Buffalo	1							
Sheep	6	6	6	6	6			4
Goat								
Horse	10	10	10	10	10			10
Donkey								
Pig	9	9	9	9	9	2	*	9
Chicken	20*	20	20	20	20			20
Turkey	3	3	3	3	3			3

*lines; **just introduced.

In the rural area, peasants contributed to the conservation of the Mangalitsa swine breed up to 1974. There is a hope in the reorganization of the closed state "Gene Bank" (Romanian State Gene Bank) and with the help of hobby breeders there is hope in the conservation of other breeds (Country Report 2003).

Two endangered swine breeds, the Romanian Saddleback (Bazna) and the Red Mangalitsa were included in a conservation program in 1970 and 1974 at an Experimental Station. In the last years the conservation work on the endangered species was supported by scientific research funds and some unsystematic financial support accorded by the Ministry of Agriculture (Country Report 2003).

The actual policies trend are directed and have a major effect in all production systems, targeting the high input system (industrial) including the bovine, swine and poultry sectors (Country Report 2003).

The systems less affected by the nowadays agricultural policies seem to be more favorable to native adapted breeds, but not in all cases. Culturally important pastoral systems (transhumance, pendulation) did not receive much attention (Country Report 2003). From this point of view the future of the Romanian old/heritage breed sector is not so sparkling (Table 12).

Table 12

Effects of existing policies and legal instruments on the utilization (use and development of AnGR) (Country Report 2003)

Species	Urban/Species per-urban systems		Rural production	
	Industrial systems	Small-holder systems	Industrial systems	Small-holder systems
Cattle	4	4	4	4
Buffalo	1	1	1	1
Sheep	2	2	2	2
Goat	1	1	1	1
Horse	4*	1	1	1
Donkey	1	1	1	1
Pig	4**	1	4**	1
Chicken	4**		4**	1
Turkey			1	1
Geese			1	1

1=any effect; 2=small effect; 3=medium effect; 4=good effect; 5=great effect

*more endangered breeds

**medium and high input system

The concern of recent agro-policies is focused on extension and training activities and toward the organization of breeders/farmers. The utilization of continually imported breeds in all species, of recently introduced new bloodlines in swine and other species and of native breeds is also in the attention of policy makers (Table 13) (Country Report 2003).

Table 13

The focus of current policies on activities related to the utilization (use and development) of AnGR (Country Report 2003)

<i>Species</i>	<i>Activities</i>			
	<i>Use of exotic breeds*</i>	<i>Use of locally adapted breeds</i>	<i>Training, research and extension</i>	<i>Organization of breeders/farmers</i>
Cattle	4		4	3
Buffalo	1	4	3	1
Sheep	1		4	3
Goat	1		1	1
Horse	1		4	4
Donkey	1		1	1
Pig	4		4	3
Chicken	1		4	3
Turkey	3		3	2
Geese	1		2	2
Duck	1		2	2

*recently introduced and continually imported breed.

As a result of the main focus in utilizing imported breeds, strains and bloodlines in most of the species, most of local breeds disappeared by the end of 1970. Some breeds have been conserved by natural selection (especially in mountain areas), by peasants in their own households, by hobby breeders, by research institutes (as in the case of the Romanian Saddleback and Mangalitsa breeds), or by some production companies (Country Report 2003).

Breeding strategy for locally adapted breeds (autochthonous or produced by an old grading up, without continually import) is necessary for all species including swine, for pastoral, free-ranging, organic, niche production, subsistence production systems and for conservation of AnGR. It is worth to be considered the followings:

- ◇ the productivity of any species must be correlated with the support capacity of the environment they are designed for, because the introduction of exotic breeds do not lead to increased production yields and productivity in extensive (free-range) conditions;
- ◇ there is a need to create opportunities to involve farmers in animal registration and genetic improvement programs and to guide stakeholders in a sustainable management system of the animal genetic resources;
- ◇ focus on the research on identifying the local breeds and in elaboration of breeding/improvement programs and useful utilization models;
- ◇ genetic improvement can not be supported without an adequate farmers/breeders organization, government agencies and resources, and a reliable infrastructure (Country Report 2003).

The main difficulties in preserving and improving local breeds as components of the national cultural heritage is that the national reservations and parks do not pay attention to the conservation of interesting breeds of domestic animals, generally speaking for all species, including swine breeds also (Stocli and Mangalitsa pigs in Danube Delta etc) (Country Report 2003).

There was a plan for breeding conservation designed to include hobby breeders and farmers and research institutes who should receive subventions for they contribution. The Danube Delta Natural Reservation was planned to be included also in the program of breed conservation including Mangalitsa and Stocli pigs (Country Report 2003).

It was a really optimistic draft plan which unfortunately was never implemented, due to lack of the implementation policies and lack of financial support.

The long term policies which encouraged the import of exotic breeds, and not real interest and involvement in preservation of the local/native breeds had lead to a long list of extinct breeds (Table 14).

Table 14

Romanian breeds (active, endangered, extinct) of large mammals (Country Report 2003)

<i>Group</i>	<i>Species</i>	<i>Origin</i>	<i>International (local) name of the breed</i>	<i>Status</i>
Extinct breeds	Sheep	Rec. introduced	Texel	Extinct
		Rec. introduced	Border Leicester	Extinct
		Rec. introduced	Romanov	Extinct
		Rec. introduced	Finish Landrace	Extinct
		Rec. introduced	Suffolk	Extinct
		Rec. introduced	Perendal	Extinct
		Rec. introduced	Drysdal	Extinct
		Rec. introduced	Awasi	Extinct
	Pig	Native	Stocli (Stocli)	Extinct
		Native	Palatin (Palatin)	Extinct
		Native	Strei (Strei)	Extinct
		Native	Banat White	Extinct
		Native	Black Dobrogea Pig	Extinct
	Horse	Native	Romanian local breeds (Moldavian, Mountain, Ialomitsan etc.)	Extinct

Table 15 emphasizes the livestock farm systems until 2003, which clearly show that the large scale industrial enterprises gain more and more importance in the swine production systems.

Table 15

Type of livestock farm by production system for swine (%) (Country Report 2003)

<i>Type of operation</i>	<i>Production systems</i>		
	<i>Low input</i>	<i>Medium input</i>	<i>High input</i>
Subsistence	100		
Smallholder	60	40	
Small-scale-commercial		100	
Large-scale-commercial		40	60

It is crucial to develop conservation breeding programmes for the threatened farm species in order to maintain populations for future uses. It can be seen from Table 16 that 6 farm species are included in conservation programmes, also includes 2 swine breeds. Fortunately all mentioned species benefit of both, in situ and ex situ conservation programmes.

Table 16

Current number of breeds in managed conservation programmes

<i>Species</i>	<i>Number of locally adapted breeds at risk</i>			
	<i>Total</i>	<i>Managed in situ</i>	<i>Managed ex situ</i>	<i>Both (in situ and ex situ)</i>
Cattle	1	1	1	2
Buffalo				
Sheep	2	2		2
Goat				
Horse	4	4		4
Donkey				
Pig	2	2		2
Chicken	70	70		70
Turkey	3	3		3
Geese				
Duck				
Guinea fowl				
Quail				

A current study (Socol & Şonea 2015) on the swine pure breed livestock at county level accredited for the management of the genealogical registers, showed that there are no record about heritage breeds but industrial ones (Table 17).

Table 17

The swine pure breed livestock at county level available at the 6th control organizations accredited for the management of the genealogical registers (Socol & Şonea 2015)

<i>County</i>	<i>Pure breed</i>	<i>Total pure breed livestock (no. of individuals)</i>
Argeş	Large White	195
	Landrace	171
	Duroc	35
Calarasi	Large White	211
	Pietrain	10
Ialomita	Large White	75
Neamt	Large White	206
	Landrace	80
	Pietrain	78
Sibiu	Landrace	105
	Pietrain	67
	Large White	102
Timiş	Landrace	521
	Large White	725
Total		1856

The ham obtained from indigenous breeds (see Iberian ham etc) is on the top of delicatessen of worldwide cuisine. The excellence of these products is given by the free-range technology where the finishing is realized by acorn feeding on pasture. The pasture raised pork is unmistakable by some characteristics as its marbling, succulence and unique taste. These aspects should convince anybody by the local/rustic breeds importance and about their social, cultural and economic importance. The real supporter of the heritage breeds is the Slow Food trend (Petrescu-Mag 2009), where prevails the nutritional value of the products against economic advantages. "The free-range system increases the value of animal products due to the influence of outdoor rearing on the chemical, physical and organoleptic characteristics of the product" (Pugliese & Sirtori 2012).

Here, it is worth to mention the "Sibiu Salami" recipe (Romanian specialty), which is designed to use a meat from such breeds, marbled with intramuscular fat, not added fat, as it is now done for this assortment. It is surprising that in our country there is such less interest about these breeds, although in some countries in the European Community there is a real market demand for such kind of meat. For example, to obtain the famous "Serano ham," it is used meat from pigs with similar production characteristics as that obtained from the Mangalitsa pigs, the final product being extremely well-paid on the market. In Hungary for instance, there is an industry producing such kind of meat for export, the economic results obtained by pig farmers who grow Mangalitsa swines are quite enviable.

In Romania for long time the rustic/native breeds, well adapted to the country pedological and climatic conditions, were of no concern in terms of conservation and breeding programmes, not to mention the lack of financial support at national level. Instead buyers come from Hungary or even from England requesting such high quality animals. At present there are funds from the European Community for programs designed to maintain biodiversity through the revival of these breeds, but they are not used at their full capacity.

Due to the heritage pig breeds characteristics and their final product delivered, there is no doubt that their future will be ensured by the organic pig farming (Ichim 2012), no matter how fancy or pretentious names they fit.

Subcutaneous fat (bacon) and intramuscular fat obtained from traditionally feeded/kept Mangalitsa pig have a content of "bad" cholesterol (LDL cholesterol - low-density lipoprotein) lower than the vegetable margarines (Coroian et al 2015; Răducu et al 2015). An advanced study emphasized that Mangalitsa fat contain 12-16% less saturated fatty acids and 8-10% more unsaturated fatty acids (like n-3 and n-6) than the conventional/modern swine breeds (Nistor et al 2012).

Preservation of genotypes *in situ* is important but is effectively costly (Critser & Russel 2000). Therefore "germplasm preservation can provide a cost-effective alternative to the maintenance of breeding colonies for the preservation of rare genotypes and can also provide the means to prevent the loss of rare genotypes" (Hettig et al 2012). Therefore the value and feasibility of genome resource banking in order to preserve rare genotypes gained its utility for many years (Whittingham et al 1977). There are many studies which underlined that in terms of rare breed maintenance, improvement, and preservations the main tool/source is the gene bank. Without it this kind of programs can be endangered (Hettig et al 2012; Zăhan et al 2014; Socol et al 2015a, b, c).

Conclusions. According to the past and present experiences regarding the future of heritage breed pigs is conditioned by the farmers' possibilities in order to afford to raise them, and by research stations who establish among their purpose the preservation and improvement of local/native rustic breeds. However, the civil community can encourage this work by consuming heritage breed pork. This behavior would be beneficial for the consumer (having high nutritional and valuable food), and the targeted breeds by rewinning the prestige from the past. It would be just that simple, creating a demand for their meat, these valuable breeds may be saved for future generations. Today, exigent butchers, niche markets and respectable restaurants are beginning to look for heritage breed pork. Other good reasons to support heritage breeds are the advantages of whole animal utilization, which has economical and culinary (taste) benefits. There are current events like "Cochon 555" (<http://cochon555.com>), which honor the entire animal, and its history by utilizing each pig in its entirety from snout to tail. This current is an art of butchery exhibiting highly skilled practice, and when an animal is utilized in its entirety, nothing goes to waste.

Ethical concern regarding the use and welfare of farm animals may lead to a favorable impact on the extensive agriculture practices, which only can use heritage breed, because only they would survive, and only they can generate economic value through free-range systems. Although implementing free-range technologies we can fulfill the animal welfare in its entire meaning. Furthermore by keeping animals mainly on fresh air (when the season permits), there can be serious economic savings on antibiotic

usage (which raise the issues related to antibiotic resistance in humans and animals), by immune system enhancement due to solar radiation, fresh air flow, and low temperature amplitude. It is possible that EU policies related to this problem will generate a negative impact on the last industrial (high-input - large ecological footprint) production systems in poultry and pig industry. A concrete example in this regard is the interdiction of use of cages in poultry management, which is a difficult and sensible problem.

Another issue raised is regarding competitiveness of the domestic poultry and pig sectors which are relatively unprotected. They are particularly losing market share in the advantage of cheaper imports which are abundantly supplied. Some optimistic minds emphasized that while the heritage breeds market is a niche one, the main goal should be not in compete the conventional products but fueling the Slow Food trend.

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Received: 28 October 2016. Accepted: 01 December 2016. Published online: 05 December 2016.

Authors:

Miklos Botha, SC Bioflx SRL, Romania, Cluj-Napoca, 400488, 54 Ceahlau Street, e-mail: miklosbotha@yahoo.com

Ioan Valentin Petrescu-Mag, SC Bioflux SRL, Romania, Cluj, Cluj-Napoca 400488, 54 Ceahlău Street; Department of Environment and Plant Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine, Romania, Cluj-Napoca, 400372, 3-5 Calea Mănăştur Street; University of Oradea, Romania, Oradea, 410087, 1 Universitatii Street, e-mail: zoobiomag2004@yahoo.com

Claudiu Gavriiloaie, SC Bioflx SRL, Romania, Cluj-Napoca, 400488, 54 Ceahlau Street, e-mail: claudiugavriiloaie@gmail.com

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How to cite this article:

Botha M., Petrescu-Mag I. V., Gavriiloaie C., 2016 Rustic gene reserves for the future of breed improvement technologies: old swine (*Sus scrofa domesticus*) strains and their perspectives. *Porc Res* 6(2):37-56.