



Dwarf pig, another proof of pig plasticity

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Abstract. We propose through this short article to present some information that suggests new applications of pig breeding and which reflects the qualities of the pig as a model organism, but also the genetic plasticity of this taxon. Beyond its role as a pet, the dwarf pig acquires a special importance in human health studies, especially for studies of metabolic disorders. The plasticity of the species reflects that the species is phylogenetically young or belonged to a group in full adaptive radiation.

Key words: *Sus scrofa*, metabolic disorders, human model, phylogenetically young.

Introduction. Mini pig also called dwarf pig, miniature pig, micro pig, pygmy pig, pocket pig is used to refer to small breeds of domestic pig, such as Göttingen minipigs, Vietnamese Pot-Bellied pigs, Juliana pigs, Choctaw hogs or Kunekunes. Several pig lines or breeds were developed later. However, all the dwarf pig lines derived by crossbreeding with these small sized breeds (LaFeberVet 2019).

Notable traits of most dwarf pigs distinguishing them from other pig breeds may be defined by their possession of small, perked-back ears, a pot shaped belly, a small body size, a chubby face, a short snout, short legs, a short neck and a short tail with a tuft of hair at the end. Some breeds of dwarf pigs have wrinkled noses, while others have smooth noses. Their back is usually straight, or in some cases left slightly down. They can be found in black, black and white, pink, very rarely full white colors. Generally, most breeds of dwarf pigs will range from 32 kg to 68 kg (LaFeberVet 2019). American breeds weigh between 25 and 50 kg, while German breeds, which are smaller, weigh between 12 and 35 kg. Dwarf pigs live up to 12-15 years in right conditions. If grown in the normal conditions, they can become resistant to many diseases. They do not have big problems with hereditary diseases (video.bzi.ro 2011).

Why did dwarf pigs appear? Initially, they probably appeared sporadically and accidentally. Subsequently, they became interesting as pets, laboratory animals or even as organ donors. In the future, they can be of great help for patients in urgent need of transplantation.

We propose through this short article to present some information that suggests new applications of pig breeding and which reflects the qualities of the pig as a model organism, but also the genetic plasticity of this taxon, young from an evolutionary point of view.

History. In the 1960s, Chinese pigs that grew to be from 68 to 91 kg were sent to zoological gardens in Western cities (Pukite 1999) and were used for medical investigations in the fields of toxicology, but also for pharmacology, cardiology, pulmonology and aging. They were used as a source of organs for the early attempts of organ transplantation (Sachs & Galli 2009). Initially, dwarf pigs were not extremely small, but small enough to be useful for new technical applications. These smaller pigs

were easier to work with than larger pig breeds, which typically reach weights of 140-230 kg (wikipedia.org 2020).

In the middle of the 1980s, Keith Connell of the Bowmanville Zoological Garden in Ontario imported several breeding Vietnamese Pot-Bellied pigs to Canada. That reproductive nucleus became the foundation for the pot-bellied pig in North America (www.miniaturepotbelliedpigregistry.com). Above mentioned breed is known for its small stature, swayed back, and marked pot belly shape. Because of custom laws, only their offspring could be sold in the United States of America. The US zoological gardens were the main target for the piglets, but private owners soon began purchasing them as pet animals. Pet pot-bellied pigs started to appear everywhere, from New York flat complexes to small suburban residences. Up to five additional imports followed in the next ten years. To track the pedigrees, the Pot-bellied Pig Registry Service, Inc (PPRSI) was created to preserve these bloodlines and establish a breed registry in the United States of America. This registry was dissolved in the late 1990s (www.miniaturepotbelliedpigregistry.com). Nowadays, most pot-bellied pigs are very little to never purebred, as the pure breed is critically endangered (www.miniaturepotbelliedpigregistry.com).

The Miniature Pot-bellied Pig Registry Service, Inc (MPPRSI) was established in 1993 to provide a registry for those pigs who were pedigreed in the PPRSI and met the breed standard (sites.psu.edu), when fully grown not being more than 60 cm tall and weighing under 80 kg (Breed Standard 2015). All of the foundation pigs were registered both in the PPRSI and MPPRSI (www.miniaturepotbelliedpigregistry.com).

Beginning in the late 1960s at the Institute for Animal Breeding and Genetics at the University of Göttingen, Germany (in German, Institut für Tierzucht und Haustiergenetik), the Göttingen minipig was developed by crossbreeding the Minnesota minipig, the Vietnamese Pot-Bellied pig and the German Landrace pig (Bollen & Ellegaard 1996). It is considered at present the smallest breed of domestic pig in the world (Bollen & Ellegaard 1996).

There are remnants of dwarf pig lines all over the world, the most important being in Ghana, called Ashanti dwarf pig (Osei-Amponsah et al 2017; Dzormo & Richard 2019).

Health studies. Dwarf pigs have been used for medical research, including toxicology, experimental surgery, pharmacology, cardiology, pulmonology, xenotransplantation, orthopedic procedures (Schulze-Tanzil et al 2020; Høy-Petersen 2021) and animal aging studies (wikipedia.org 2020). Pigs are very good human models, especially in terms of metabolism (Hai et al 2017; Liu et al 2018; Hu et al 2018; Zou et al 2019; Cai et al 2020). Pigs can be useful in studying human disease (wikipedia.org 2020), and due to their high intelligence, are easy to manage in a laboratory setting (sites.psu.edu). For instance, scientists are working on studying the possibility of utilizing pig hearts for human heart organ transplants (wikipedia.org 2020), and work has been done to genetically modify the tissues of pigs to be accepted by the human immune system (Cooper 2017).

The plasticity of the species. As we know, there are studies in horses (Goodwin 2007), poeciliid fish (Păsărin & Petrescu-Mag 2011), rabbits (Petrescu-Mag et al 2019) and birds (Ducatez et al 2020) which suggest that the plasticity of the species under the influence of environmental factors or artificial selection denotes a young evolutionary process, or in full swing. What do we mean by the plasticity of a species? We understand that it generates under the influence of environmental factors or artificial selection various phenotypic forms of size, shape, color or behavior (Figure 1). The plasticity of the species (*Sus scrofa*) reflects that the species is phylogenetically young or belonged to a group in full adaptive radiation.



Figure 1. An image that clearly reflects the term plasticity of the species: huge rabbit and miniature piglet (source: <https://thejollybuccaneers.net/>).

Conclusions. Beyond its role as a pet, the dwarf pig acquires a special importance in human health studies, especially for studies of metabolic disorders. The plasticity of the species reflects that the species is phylogenetically young or belonged to a group in full adaptive radiation.

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Received: 19 November 2020. Accepted: 09 December 2020. Published online: 19 December 2020.

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How to cite this article:

Petrescu-Mag I. V., Proorocu M., Gavriiloaie C., 2020 Dwarf pig, another proof of pig plasticity. *Porc Res* 10(1):21-24.