

Leopold Walicki's Experiments on Cross-Breeding European Bison with Cattle in the Context of 19th century Biological Sciences

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In this paper we aim at recounting the long-forgotten achievements of Leopold Walicki, Polish landowner and naturalist, who in the years 1847–1860, successfully bred fifteen European bison — cattle hybrids. This experiment has overthrown a misconception, common in 19th-century biological sciences, about the impossibility of cross-breeding these species. Although it was a major mammalian hybridization experiment, it was nearly completely forgotten and not adequately used in the 19th-century scientific discussion, even though Walicki's experiment was mentioned by two prominent 19th-century biologists: Karl Eduard Eichwald (1853) and Franz Müller (1859). Surprisingly, head forest manager of Grodno Province, Dmitri Dolmatov, who supplied European bison from Białowieża Primeval Forest for Walicki's experiments, was far better recognized in the 19th-century scientific literature for his successful feeding of European bison calves with cow's milk. Walicki's work was for the first time described in detail by Georgy Karcov (Карцов, 1903); it is still interesting in the context of current research, as no one has yet been able to reproduce Walicki's success in obtaining a fertile male hybrid in the first generation.

Keywords: European bison, Białowieża Primeval Forest, hybrids, natural history

Introduction

European bison *Bison bonasus* was relatively common in the forests of Central and Eastern Europe in the Middle Ages, but in the second half of the 18th century, free-living lowland bison survived only in one place — Białowieża Primeval Forest (currently straddling the border between Poland and Belarus). In this forest the species enjoyed long-lasting protection as royal game of Polish kings and Lithuanian grand dukes, but it had also been promoted by the traditional utilization of the forest and, since 1700, intentional management (haystacks left for winter on forest meadows offered supplementary winter fodder for bison; see Samojlik, J drzejewska, 2010, p. 23–31). At the same time it was a species rarely occurring in naturalists' works. Most descriptions of European bison until the 18th century were based on short note published by Sigismund Herberstein¹ (1549).

By the end of the 18th century a new description of the species, based on personal observations, was published by Jean-Emmanuel Gilibert² (Gilibert 1781; 1802, p. 493–495). In sub-

¹ Sigismund von Herberstein (1486–1566) was an Austrian diplomat who, in 1517, visited Moscow with a mission from Emperor Maximilian I. On his way, he visited the kingdom of Poland, and had a chance to observe European bison and aurochs (*Bos primigenius*). In *Rerum Moscoviticarum Comentarii*, published in 1549, he included a description and illustrations of both of those species.

² Jean Emmanuel Gilibert (1741–1814), French physician and botanist, was invited to Poland in 1775 by Polish king, Stanislaus Augustus Poniatowski. Gilibert's task was to establish veterinary and medical schools in Grodno (100 km from Białowieża Primeval Forest). Apart from his duties, he engaged himself in scientific work: he organized a botanical garden with around 2,000 species of plants, took

sequent decades, his work became a milestone of the knowledge on European bison behaviour. He described his failure to feed European bison calves with cow's milk (instead, he used goats, which were placed on a table during the time of feeding), and similarly failed attempt to interbreed European bison with cattle. From that point on, the scientific world was strongly convinced that such hybridization was not possible, and that there was a biological barrier not allowing European bison calves to be fed by cows. The fact that only one known population of European bison existed in a remote forest, which, since 1795, became a part of Russian empire (the existence of the Caucasus population was called into question, Daszkiewicz, Samoilik, 2004, p. 73–75), and these animals were very rare in zoological gardens and menageries, strongly limited possibilities for such experiments.

A programme of research on the status of European bison had already been proposed in the 18th century. Georges-Louis Buffon (1707–1788) described different species of Bovidae in his "Histoire naturelle" and recommended crossing them with each other and with domestic cattle, not only to answer questions about their species status ('true species' or 'climatic forms') but also to examine the concept of domestic bovine origin, the history of domestication and 'degeneration' (a concept resulting from the observation of the decrease in body size compared with the findings from archaeological excavations and wild animals; Buffon, 1764, p. 284–336).

In 1846, head forest manager of Grodno Province Dmitri Dolmatov³ successfully fed European bison calves caught in Białowieża Primeval Forest with cow's milk. He observed the bison fed by cows and playing with domestic cattle, and his observations were published in Russia, England, France and Germany (Brehm, 1877, p. 395; Dolmatov, 1848, p. 18–19; 1849, p. 150–151; Долматов, 1849, p. 220–222; Gervais, 1855, p. 184–185; Viennot, 1862, p. 849–850). Animals caught by Dolmatov were transported to London, Tsarskoe Selo, and were also offered to Leopold Walicki,⁴ a Polish landowner and naturalist, for his experiments on cross-breeding European bison with cattle *Bos taurus*. In Wilanow near Grodno, he successfully bred fifteen hybrids in the years 1847–1859 (Krasinska, 1988, p. 15). It is important to mention that Walicki obtained fifteen hybrids, among them one fertile male hybrid from the first generation F1. This achievement — fertile F1 male — was never reached again, including contemporary experiments conducted at

up botanical expeditions to different parts of Lithuania, described several species of Lithuanian fauna, including European bison, brown bear, moose, lynx, beaver, badger, hedgehogs, and even mice.

³ Dmitri Dolmatov (Dalmatov, Dolmatoff; died 1878) was the head forest manager of Grodno Province since 1842. Apart from being a forester by training, he was also a naturalist and a painter. He has published several papers on Białowieża Primeval Forest and European bison, focusing particularly on the issue of the possibility of domestication of these animals.

⁴ Leopold Walicki, owner of the Wilanow landed estate and initiator of experiments on cross-breeding European bison with cattle. In 1847, he received two European bison from Białowieża Primeval Forest, and the year after he managed to get first hybrids. His experiments abruptly stopped in 1857, when he was arrested by Russian authorities for the pro-Polish political activities. In 1860, after returning from prison, he started the cross-breeding trial again, using two new bisons sent from Białowieża. Contrary to our previous knowledge, based mainly on a short note in Karcov (Карцов, 1903, p. 225), Walicki did not die in 1861. Latest discoveries in the Russian National Historical Archive in St. Petersburg (РГИА) show that Walicki took part in the Polish national uprising of 1863, was arrested and sent into exile to the Irkutsk province, where he died in the late months of 1875 (РГИА. Ф. 1286. Оп. 31. № 1556 and Ф. 381. Оп. 12. № 7662). The fate of hybrids obtained by Walicki is unknown. In the early 1870s one hybrid bison was seen in Swislocz (80 km from Grodno, currently in Belarus), perhaps it was in some way connected with Walicki's experiments (Карцов, 1903, p. 225). Authors are grateful to Anastasia Fedotova for her help in finding new information on Leopold Walicki's participation in the 1863 uprising and his later whereabouts in the Russian State Historical Archive (RGIA. Found 1286. Opis' 31. Delo 1556; Found 381. Opis' 12. Delo 7662).

Mammal Research Institute, Polish Academy of Sciences (Krasicka, 1988). This was undoubtedly one of the major mammalian hybridization experiments in the 19th century.

Obtaining hybrids of European bison with domestic cattle exceeded the typical mid-19th-century interest in inter-species hybridization aimed at obtaining new hybrids, often for practical purposes. This did not answer the question of the origin of domestic cattle (was its ancestor the bison or aurochs? Or perhaps some other species?), and the question of the existence of two distinctive species of Bovidae in historical times, as the difference between European bison and aurochs was still being discussed by zoologists.

Overcoming old prejudice

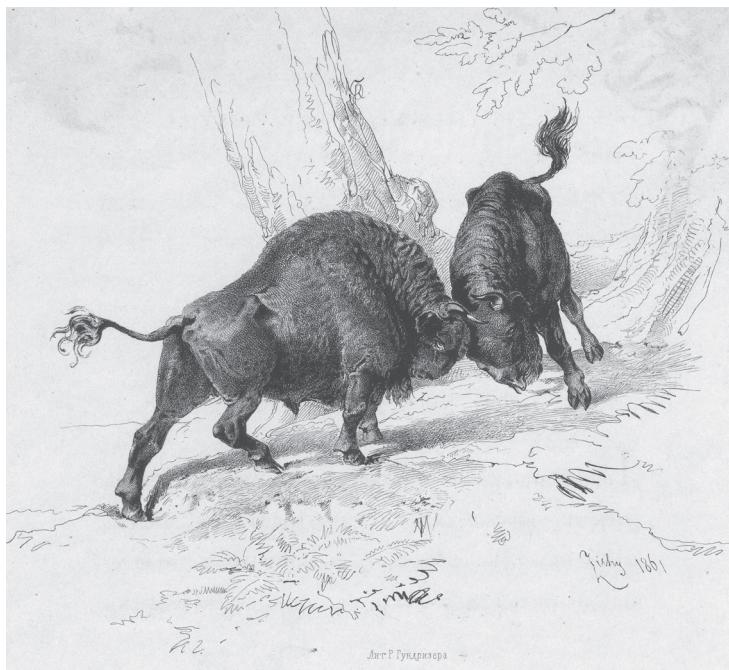
The belief that it was impossible to cross-breed European bison with cattle lasted for almost seventy years. It is thus a perfect example how one failed experiment, which reflects the prejudices of an era, can prevent the advance of science for a long time. Very little is known about bison-cattle crossing attempts prior to Gilibert's experiment. Although no descriptions of similar undertakings are known, secondary sources make it likely that such attempts took place.

Jean-Baptiste Dubois de Jancigny (1752–1808), French naturalist and writer, served as professor of natural history and librarian at the School of Knights in Warsaw in the years 1775–1759, the first state school in the Polish-Lithuanian Commonwealth. In 1776, he published his '*Essai sur l'histoire littéraire de Pologne..*' in Berlin. The book compiled older facts on Polish and Lithuanian nature, occasionally supplemented by the author's own observations and comments. He wrote about the European bison as follows:

"When it comes to European bison, it was due to [Buffon's] genius, great in the observation equally to the Nature itself, to put it in the *Bos* family. I must honestly admit that my doubts were not fully dispelled by his argument, as according to information I obtained in Poland attempts at crossing bison with domestic cow were numerous, yet all failed" (Dubois de Jancigny, 1778).

Nevertheless, no documentation concerning hybridization attempts mentioned by Dubois de Jancigny is known. The only known and documented 18th century attempt was the one conducted and described by Jean-Emmanuel Gilibert, who spent eight busy years (1775–1783) in Poland (Commonwealth of Both Nations). Gilibert received four bison calves – two males and two females – trapped by Polish royal forest wardens in Białowieża Forest. The males died soon after, but Gilibert managed to breed females, although he failed to have them fed by cows. He attempted to cross-breed a three-year-old bison female with a bull of Ukrainian breed without success (Gilibert 1781; 1802, p. 493–495).

In the 18th century, the belief in "hatred" between domesticated and wild animals was common. These beliefs were undoubtedly rooted in folk superstitions, fairy tales of Lafontaine and followers, in which animals bore human traits, and the Enlightenment ideas about the conflict between free and enslaved people transferred to the animal realm. Dubois de Jancigny wrote straight out that "the natural hatred of the free to the domesticated animal" is a "major obstacle" for the hybridization of bison with domestic cattle. Obviously, this concept was particularly close to political exiles, mainly the Polish emigration after the fall of the November uprising against the partitioners of Poland (Chodko, 1836, p. 54). Gilibert observed this "natural antipathy" and described the aggression of the bison he bred towards Dutch cows grazing next to her. For Gilibert,



European bison fighting in Białowieża Primeval Forest (drawn by Michaly Zichy, from: *Oxota...*, 1861, c. 30)

this antipathy was an obvious evidence of the species differentiation between bison and cattle: "if the bison is in fact a cattle brought to the state of slavery a long time ago, why do tamed bison retain such a strong hatred towards cattle?" Belief in "antipathy" was reinforced in the 18th and 19th century by constantly repeating Jan Ostrorog's 15th-century chronicle that bison and aurochs were not to be kept in the same enclosures, as they immediately engaged in lethal fights (Viennot, 1862, p. 850).

The failure of Gilibert's experiment marked the history of biology for many years. In subsequent decades, even after the development of science rejected the naive beliefs in "antipathy", it was still assumed that the interspecific barrier was too strong for cross-breeding, and that bison could not be fed by cows. It is noteworthy that the belief lasted despite successful attempts to cross-breed buffalo with cattle. It was the desire to correct those misconceptions that drove Dolmatov to his breeding experiments:

"I have turned my attention particularly to refute by experience the erroneous opinion, accredited by all the writers who have treated on this subject, namely that the calf of the Bison cannot be suckled by our domestic cow. This fable has been repeated even in the work of an esteemed writer of our times, Baron de Brinvers [correctly: Brincken; Daszkiewicz et al., 2004], who relying upon the recital of another writer, the learned Gilibert, asserts that two female Bison calves, caught in the forest of Bialowieza, seven weeks old, constantly refused the teats of a domestic cow; that they consented, indeed, to suck a goat, but as soon as they had had enough, they repelled their nurse with disdain, and grew furious whenever they were put to a domestic cow. M. de Brinvers had not himself the possibility of verifying this fact; and he cites traditions, communicated to him by the old inhabitants of the environs; for if any one of the forest guards, or the peasants who inhabit the forest,

had even met a Bison calf, parted by any accident from its mother, he would rather have left it, than seized and nursed it, in contravention of the severe law, which prohibits the capture or killing of a Bison. It was therefore only the supreme order of His Majesty the Emperor, emanating from the desire expressed by Her Majesty Queen Victoria to possess in her Zoological Garden two living Bisons, which has enabled me to rectify the error above mentioned" (Dolmatov, 1848).

Dolmatov managed to debunk a myth of the impossibility of feeding young bison by a domestic cow. The next step was to test whether hybridization was possible. In the case of Walicki's experiments, the practical advantages were also taken into account. As described by Franz Müller (1859, p. 155–166):

"about four years ago under the act of his highness [Tsar], a number of juveniles were transferred to surrounding landowners. An attempt to create a new breed by crossing them with cattle was made. The new breed was to be bigger, stronger and thus more useful, as in this area cattle, similar to horses, are small and weak".

Pavel Bobrovski (Бобровский, 1863) mentioned that the experiment was started to investigate

"1) the possibility to breed and multiply bison in farm conditions, maintaining the natural beauty, health and size of the animal, 2) the possibility to cross them with domestic cattle, and if the strength, size, beauty and wildness is not lost during the process".

It is easy to understand that practical problems posed this way were of more interest to the local administration than finding answers to purely scientific questions about the status of species, boundaries and hybridization, or deliberations on the history of domestic cattle and domestication processes.

Walicki's experiment and the discussion on the concept of species and hybridization

In the 19th century, the relationship between the definition of species and hybridization was still under discussion. The possibility of interbreeding individuals belonging not only to different species but even to different orders, called into question the physiological (that is based on the criterion of inability to obtain fertile interspecific hybrids) definition of species. False information on a successful hare-rabbit cross-breeding and the fertility of the obtained hybrid became the basis for a broad discussion among 19th-century biologists. It is worth to emphasize that this polemic far exceeded the frames of the scientific dispute, as this shift in the species definition justified the recognition of different species of man by some anthropologists (see the discussion in: Blanckaert, 1981).

Already in the 18th century, Buffon allowed for the existence of exceptions to the definition of "physiological" species, such as fertile dog and wolf hybrids. Shortly before Walicki's experiment, in 1840, eminent French physiologist Pierre Flourens (1794–1867) rejected Buffon's definition of species, recognizing that there can be no exceptions to the rule. Based on the criterion of the possibility of obtaining fertile hybrids, he defined not only species, but also genus. Two species of the same genus could produce infertile hybrids, and fertile hybrids could only be the result of crossing individuals belonging to different "breeds" of the same species. Also the view presented by Pierre-Honore Berard (1797–1858) should be mentioned, as he believed that two species can produce hybrids with varying degrees of fertility. Hybridization

was undoubtedly one of the most debated issues in biology in the mid-19th century. It is worth remembering that Charles Darwin devoted a separate chapter to this issue in his “Origin of species”, considering that domestication (and thus natural selection) may actually weaken the insulation barrier between species.

What role did Walicki’s experiment play in this discussion? Surprisingly, such an important event (obtaining hybrids between different genera) went virtually unnoticed and is absent in 19th-century discussion on the definition of species and hybridization. Perhaps two reasons contributed to this. The first is simply a low recognition of these experiments in the major research centers leading to the above-mentioned discussion, even though Walicki’s results were publicized by Karl Eduard Eichwald (1853, p. XVIII–XIX) and Franz Müller (1859). Interestingly, Dolmatov’s breeding of bison calves fed by domestic cows was by far more known in Western Europe than Walicki’s hybrids between bison and cattle. The second reason originated probably from the fact that back in that time many authors accounted European bison to the *Bos*, not *Bison* genus, and were thus not interested in hybrids between two species of the same genus.

Bison, aurochs and the degeneration of species

Walicki’s successful experiment could also contribute to a better understanding and acceptance or rejection of other important 19th-century biology concepts. These included a dispute on species identity or differences between European bison and aurochs, extending from the second half of the eighteenth century, and a dispute on the history of species domestication. If, according to the 19th-century understanding of species, there is a reproductive barrier between bison and domestic cattle and hybrids are not fertile in later generations, it would be logical to deduce that bison are not the ancestor of domestic cattle. Furthermore, it would be a sound argument for defining the aurochs as a separate species, thus being the probable ancestor of domestic cattle. The dispute was finally closed by August Wrześniowski (1836–1892) in “*Studien zur Geschichte des polnischen Tur*”, article that originally appeared in 1878, over thirty years after the beginning of Walicki’s experiments (Wrześniowski, 1878). In this discussion, however, Walicki was not even once quoted.

Were Walicki’s results in any way included in 19th-century discussion on the degeneration of the species? Both bison and domestic cattle were used as examples in deliberations on “degeneration” characteristic for zoology of that period, yet Walicki was almost never cited. Only R.T. Viennot (1862) using this concept when he explained the success of Dolmatov versus the failure of Gilibert’s attempts:

“Gilibert resided in Poland for a long time and had an opportunity to closely study four of these animals kept in captivity. They had to be fed by goats as a result of their stubborn refusal to suckle on cow which was first brought to them. They maintained this hostility to domestic cattle, and whenever cows were driven to the same enclosure, bison chased them away. Despite similar statements by various authors, Mr. Dimitri de Dolmatof, Grodno province forest administrator, in a memo from 1847 stated that events he repeatedly witnessed contradicted this opinion and that young bison were well fed by the domestic cow. Maybe you can reconcile these statements admitting the existence of some kind of degeneration of modern bison compared to their great ancestors”.

In the context of 19th-century concepts of zoology Walicki’s experiments were only discussed as proof that the domestication of European bison was impossible, and even hybrids of domestic cattle and bison were too strong and wild to use them for work in agriculture.

Conclusions

Although Walicki's experiments overthrew the misconception about the impossibility of cross-breeding European bison with domestic cattle that had been acknowledged for several decades, it was not adequately appreciated or used in the 19th-century scientific discussion on the concept of species and hybridization. Walicki's work was not known in the major research centers in Europe. Interruption of breeding experiments (Walicki was arrested for political reasons) and termination of the experiment caused by Walicki's death show how political repressions impacted the development of science. The fact that two prominent 19th-century naturalists Karl Eduard Eichwald (1853) and Franz Müller (1859) mentioned Walicki's successful cross-breeding of bison with domestic cattle in their work, did not change the fact that it went almost unnoticed until the twentieth century. The first detailed description of such an important experiment was published by Georgy Karcov (in Russian) in 1903, over half a century since the end of Walicki's work (Карцов, 1903).

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Эксперименты Леопольда Валицкого по скрещиванию зубров с крупным рогатым скотом в контексте биологии XIX века

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В нашей статье мы описываем забытые достижения польского помещика и натуралиста Леопольда Валицкого в гибридизации крупных млекопитающих. В 1847–1859 гг. ему удалось получить 15 гибридов между европейским зубром и крупным рогатым скотом. Эксперименты Валицкого опровергли мнение биологов XIX в. о невозможности скрещивания этих двух видов. Позднее его существенные успехи были почти забыты и редко упоминались в научных дискуссиях, хотя на них ссылались два крупных натуралиста — Карл Эйхвальд (1853) и Франц Мицлер (1859). Даже лесничий Гродненской губернии Дмитрий Долматов, который предоставил зубров из Пущи для экспериментов Валицкому, чаще упоминается в научной литературе (в связи с тем, что ему первому удалось выкормить зубрят коровьим молоком). Работы Валицкого впервые были описаны Георгием Карцовым (1903) и всё ещё заслуживают внимания со стороны исследователей, так как до сих пор никому не удалось повторить успех Валицкого — получить в первом поколении плодовитого гибридного самца.

Ключевые слова: европейский зубр, Беловежская пуща, гибриды, естественная история