



Review article

The history of breeding for polled cattle

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ABSTRACT

In this review, the history of breeding for polled cattle is compiled from literature as well as graphic representations of cattle in art and science. Domesticated taurine cattle originated around 8500 years BCE in the Near East and spread from there to Africa as well as to Europe. Earliest findings of polled domesticated cattle are from today's Slovakia and Germany from 6000 years BCE. Textual findings and especially graphic displays can be found of polled cattle in Ancient Egypt. Although archaeological finds of skulls that can be evaluated for natural polledness are rare, archaeological texts and graphical displays indicate that genetically polled cattle in Ancient Egypt were present and quite numerous. Polled cattle apparently were also kept by Germanic tribes and can be followed through medieval times into the 17th and 18th century where textual accounts are more frequent. In Scandinavian countries and Great Britain polled cattle have survived in greater proportions up to today while in the middle of Europe polled cattle were not well regarded by farmers and almost became extinct. Among the British breeds, Angus and Galloway were established as beef cattle breeds in the 17th/18th century, and still flourish. However, the British polled dairy breed Suffolk became extinct. It was one of the ancestral breeds of the Red Polled beef breed and was used in attempts to promote polled dairy cattle in France in the 19th century. Reports of single individuals in polled cattle found in predominantly horned populations possibly indicate several origins of the polled mutations. Recently, at least two different types of mutations, located on BTA01, have been found to be responsible for the mutation commonly referred to as the polled allele. One is the so-called 'Celtic' type, found in Scandinavia and Britain while the 'Friesian' type is found in cattle of the Holstein family. Today, aspects of animal welfare more and more influence farmers' attitudes towards naturally polled cattle and also governmental policies play an important role. For the important horned dairy breeds of central Europe, e.g. Holstein, Brown Swiss and Fleckvieh, as well as for the beef breed Charolais, breeding programs for the introgression of the polled allele are starting and will be aided by new tools such as genomic selection.

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1. Introduction

Throughout the history of cattle breeding, at least for breeding of the species *Bos taurus*, it is and has been widely accepted that the wild form of this animal, the

Aurochs (*Bos primigenius*) was a large long-horned animal that used its horns for fights against predators and amongst each other, and consequently that domesticated cattle should bear horns as well. However, the history of cattle breeding, e.g. as documented in classifications schemes of domesticated cattle breeds (e.g. Felius et al., 2011) also tells us that hornless or polled breeds have been around for a long time. Two prominent polled breeds,

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amongst several others, are the breeds Angus and Galloway. Both are bred as beef cattle breeds in many countries, and amongst beef cattle breeders the advantage of working with a polled breed always has been evident. Consequently in other breeds polled varieties have been created as sub-breeds. Examples are Polled Hereford and Polled Charolais.

Obviously there are two main advantages of keeping and breeding polled cattle. The first one is the animal welfare aspect as injuries arising from animals fighting each other in pasture or free-stall systems are minimized in polled breeds, and, even more importantly, the common practice of dehorning of cattle at a very young age is unnecessary. The second main argument is the protection of the caretakers of cattle, i.e. the farmers and all other people coming into contact with cattle.

In recent years, animal welfare aspects in general have been the focus of governmental regulations concerning animal breeding. Governmental policies now strongly favor systems of housing and breeding for livestock that protect, if not improve, the welfare of the animals. One example is the ALCASDE project that has been funded by the European Union concerning 'Alternatives to castration and dehorning' (www.alcasde.eu) with a final report published in 2009 (ALCASDE, 2009). Another, more recent example is the 'Declaration of Düsseldorf' (Düsseldorfer Erklärung, 2012), signed by the German state of North-Rhine-Westphalia, farmers organizations, animal welfare organizations, and the regional cattle breeders organization. In this declaration it is confirmed that all the supporting organizations and the government will actively promote the use of polled bulls. In the case of the cattle breeders' organization, even a discount on semen doses of polled bulls for farmers was announced.

However, although breeding of polled cattle is not new, in most cattle breeds and regions, practical breeders for many years have been reluctant to consider this specific hereditary trait. The reasons for this are not clear.

Most likely, farmers and society have considered polled cattle as unnatural. Regional exceptions occur; e.g. in Nordic countries, among the indigenous breeds of Scandinavia, polled cattle always has been more frequent (Arenander, 1896) and considered to be 'natural'. The question of the attitude of society towards polled cattle specifically has been addressed by Windig and Eggen (2009).

In recent years, the attitude towards polled cattle in breeds that are predominantly horned has changed considerably. The change of tie stalls to loose housing may have played a role in this. This phenomenon is also reflected by more and more reports in popular farmers' journals on individual breeders who practice breeding for polled cattle or on the question of breeding for polledness in general. Some examples are a report by Sattler (2006) on a Holstein breeder's family in Pennsylvania, USA, another report on the increase of breeding for polledness in Wisconsin, USA (O'Leary, 2009), an account of breeding for polledness in Australian Jerseys (Smith, 2012) and general views on the topic in popular breeders' journals in The Netherlands (van der Knaap, 2009) or Germany (Wemheuer, 2011).

It is undisputed that although the polled condition clearly follows a dominant mode of inheritance, breeding for polledness in cattle breeds that are predominantly horned will be difficult due to the risk of inbreeding and loss of genetic variance and also since polled animals do not have the genetic level achieved as horned cattle populations (e.g. Windig and Eggen, 2009). Hence, breeding programs that give consideration to these problems will have to be derived. Up to now, not much work has been done in this field although the methodological tools needed are available.

As already stated above, breeding for polledness has a long history and hence difficult tasks lie ahead for cattle breeding organizations willing to include polledness in their breeding goals. Another interest is that there are debates whether polledness is an unnatural phenomenon and therefore unethical, or whether polledness belongs to the species and occurs since ancient times and breeding is acceptable.

It should be worthwhile to have a look at the history of breeding for polledness in cattle. It is the objective of the present review to document existing results from the literature in this field and discuss their implications.

2. Domestication and the first testimonies regarding domesticated polled cattle

Domestication of cattle is one of the great success stories in the annals of animal domestication. The domestication of taurine cattle began about 10,500 years ago in the Middle East (Conolly et al., 2011), as archaeological finds from the Tell Dja'de al Mughara on the banks of the middle Euphrates in northern Syria (Helmer et al., 2005) and from the Çayönü Tepesi in the foothills of the Taurus Mountains in south-eastern Turkey (Hongo et al., 2009) have shown. The first evidence of successful breeding of domesticated cattle was found in the region between the Levantine, central Anatolia and western Iraq dating from a period just 1500 years later. Domesticated cattle spread extremely fast, as they became the major meat suppliers and leading livestock species (Bökönyi, 1974; Benecke, 1994).

A telltale sign for the domestication of cattle is the change in their height, the domesticated ones being markedly smaller than the wild ancestor Aurochs (Boessneck, 1958). Already Benecke (1994) compared numerous archaeozoological finds of Aurochs and domesticated cattle from the Neolithic Age and came to the conclusion that the well-proven difference in size contradicts renewed domestication or re-domestication of cattle in Europe since finds of intermediate forms do not occur. The logical consequence was that the Neolithic cattle populations in Europe arose from the reproduction or breeding of introduced domesticated cattle. Nowadays, morphometric data can be complemented by genetic analyses of ancient or modern samples (Troy et al. 2001; Beja-Pereira et al., 2006; Schibler et al., 2014), such that putative maternal, paternal, or autosomal modes of inheritance can be examined and tested. Ancient bones of early domesticated cattle are within the former geographic range of the aurochs and a debate

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