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Data collection through IT-intensive phenotyping in the Hungarian Grey Cattle

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The optometric measurement of body parameters in the Hungarian Grey Cattle species started in 2001. Then – using video cameras – we have created a computer-based optometric system, which was also able to measure moving animals.

Now the system is capable of managing images coming from several video cameras which record the image of the animal from different angles (from the side, above, and front). With the help of standard bar images defining the pixel/m ratio it is possible to perform measurements on the chosen still images.

With the method of geometric morphometrics we can describe the changes of the animals' bodies by using non-linear body parameters, concentrating on shapes. This method can also be used for performing more complex measurement tasks, such as the mathematical representation and comparison of the stages of development and the proportions of different body parts.

In the case of measurements performed on whole populations, as well as in the case of identifying different conformation types, the fast and simple VATEM-Video Aided Body Measurement Method) was a great help. For example, with the help of the archived measurement frames it was even possible to show the population-scale body parameter changes occurred during a period of 15 years, caused by the changes of the effective breeding goal and selection methods.

Such a population-scale phenotyping (4K video recordings, recording the point clouds from 3D sensors) provides a cost-effective solution which, if combined with metasyntesis, may also be helpful in the analysis and interpretation of a continuously increasing amount of data.

Our case study consists of a metasyntesis showing the genetics of the Hungarian Grey Cattle's horn colours, using NGS genotyping and phenotyping.

After the phenotyping of the animals recorded during the 2018 VATEM measuring trip we assessed the data of a genotyping performed in 2017. This was the point when we started to examine the inheritance and genetic background of the green, „cardy“ (mixed green and white) and white colour types of the horn, through a common metasyntesis also using the data resulting from an earlier genotyping project.

Based on the 840 phenotypes identified with the help of the VATEM images and after processing the data of the breed registry we identified a simple Mendelian inheritance pattern. During the examination of the histological background it was proven that the green colour was not of endogenous origin. The metasynthesis started by examining the loci connected to the production and structural buildup of keratin, and the identified cause was the settlement of symbiotes in the horn. Based on our preliminary results, it seems so that the genes encoding the structure of keratin are responsible for the synthesis of structural variant which is susceptible to be infiltrated by the symbiotes.

With the cost effective method of phenotyping using the optometric method the amount of data obtained can be multiplied. Even in the case of externally kept cattle populations this method may be a safe, fast and cheap way of phenotyping, which can be performed on a large sample.

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