



Researchers Identify the “Dominant Red” Gene in Holsteins

A team of researchers were recently successful in identifying the specific gene responsible for causing red coat colour in Holsteins, commonly referred to as “Variant Red”, which is distinctly different than the longstanding traditional recessive red gene. This significant outcome is the result of a research project funded by the Dairy Cattle Genetics Research and Development (DairyGen) Council of Canadian Dairy Network (CDN) on behalf of industry partners involved with dairy cattle improvement in Canada.

The Gene Origin

The first known expression of the “Variant Red” gene occurred when Surinam Sheik Rosabel-Red (HOCANF3541221) was born on October 21, 1980 and neither of her confirmed parents were carriers of the recessive red gene traditionally responsible for producing Red & White Holsteins. As the original source of this gene, Rosabel-Red is the oldest animal to which Holstein Canada has assigned the codes of “RW”, as a Red & White animal, “VRC” as a carrier of the Variant Red gene, and “BKC” to indicate that she also carried the gene responsible for Black & White coat colour.

In total, Rosabel-Red produced 30 progeny registered by Holstein Canada of which 15 were born Red & White, clearly reflecting that this source of red acted in a “dominant” nature over the Black & White gene. To date, there have been over 5,000 female descendants of Rosabel-Red born and registered in Canada with the youngest being as far as 11 generations away. In terms of male descendants, the current tally exceeds 150 born in Canada plus another group of at least 75 bulls born in other countries. Rosabel-Red now has descendants born in at least 12 different countries suggesting that her “Dominant Red” gene has crossed many international borders as a source for producing Red & White Holsteins.

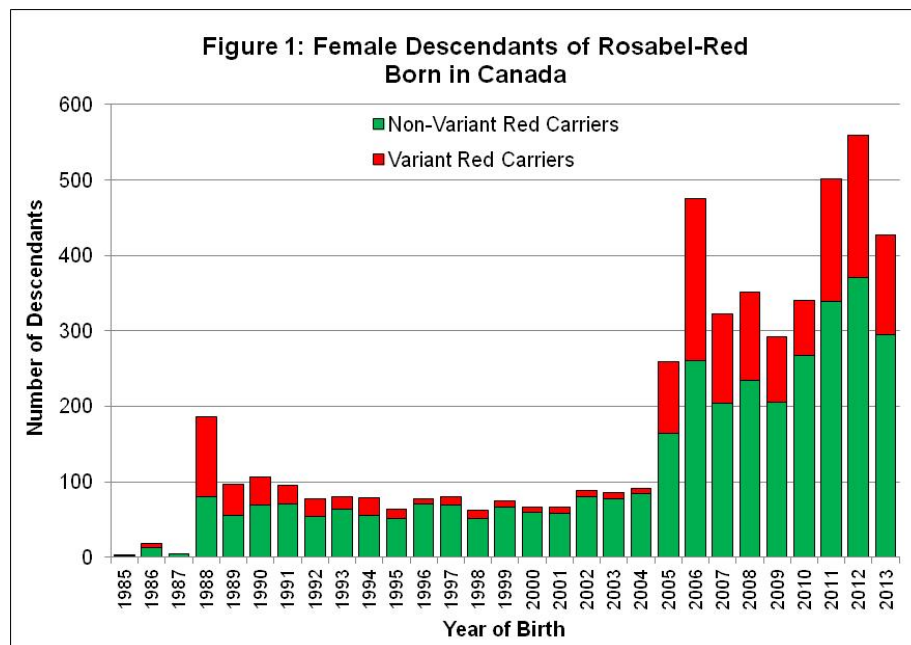
Successful Research

In 2011, the DairyGen Council of CDN approved funding for a research project led by Dr. Graham Plastow at the University of Alberta in collaboration with Dr. Ben Dorshorst (Uppsala University in Sweden and Virginia Tech in Blacksburg, VA, USA) and Dr. Leif Andersson at Uppsala University. A variety of significant factors contributed to the successful outcome of this project but the most important was the collaboration received from a handful of breeders in Canada and the United States that owned animals that carried the gene of interest. In fact, within one herd there was a single half-sib family (i.e.: daughters of one carrier bull) that had 15 “Variant Red” animals and 17 Black & White animals. By genotyping the sire in question, these 32 daughters and their respective dams, the research team could narrow down the location of the “Dominant Red” gene. The database of genotyped animals and their pedigrees at CDN was used to identify other families of interest for genotyping. All genotyping for this research initiative was coordinated through Holstein Canada and all costs were covered by the project budget.

In the end, the research team was able to identify the exact causal mutation responsible for the “Dominant Red” gene in Holsteins and confirm its mode of transmission. This gene acts totally independent from the traditional recessive red gene known to yield red coat colour in Holsteins. The fact that it behaves in a dominant manner over the gene responsible for Black & White coat colour makes it much easier to obtain Red & White Holsteins, if desired. To date, all breeding age animals have been carriers of only one copy of this “Dominant Red” gene, meaning that, on average, 50% of their progeny would be born red. As interest in this gene increases as a source of producing Red & White Holsteins, the development of a homozygous “Dominant Red” carrier would be possible and such animals would produce red progeny 100% of the time, regardless of the colour of the other parent.

Carriers of “Dominant Red” Gene

Figure 1 shows the count of female descendants of Rosabel-Red in Canada by year of birth with 2013 still being incomplete. Carriers of the “Dominant Red” gene have traditionally been labeled by Holstein Canada as *VRC, meaning Variant Red Carrier. Although the number of active heifers and cows in the Canadian Holstein population that carry the “Dominant Red” gene is still relatively small, at just over 600, there is now a huge potential for breeders to take advantage of this gene for producing Red & White Holsteins. Without any high ranking proven sires that carry the “Dominant Red” gene, breeders can use the CDN web site query to find dozens of young sires that have a Parent Average or Genomic Parent Average over 2500 LPI. On the female side, the highest “Dominant Red” cow surpasses 2800 LPI while the most elite heifers have reached the 3000 LPI mark.



Future Testing for Carriers

As an outcome of this very successful industry-funded research effort, this discovered gene responsible for “Dominant Red” in Holsteins will be added to future genotyping panels, similar to the existing test for the traditional recessive red gene. This new test will become part of the publicly available results for animals genotyped with these

upcoming panels. Given that the “Dominant Red” gene is automatically expressed by producing a Red & White animal when it carries at least one copy of the gene, the genotyping test will be most valuable for identifying animals that possess two copies of the gene (i.e.: homozygous) and for identifying carriers of the “Dominant Red” gene when both parents of the animal are carriers of the traditional recessive red gene.

Summary

For 15 years now, the DairyGen Council of CDN has allocated funds to industry priority research projects carried out in universities and research institutions across Canada. These funds are collected as part of the service fee structure applied to A.I. organizations, breed associations, milk recording agencies and Dairy Farmers of Canada. The recent research investment aimed at identifying the “Dominant Red” gene in Holsteins, which has existed for over 30 years, was highly successful. Going forward, breeders in Canada and worldwide will be able to select for Red & White Holsteins in a much easier way and the genetic potential of carriers of the “Dominant Red” gene, labelled as *VRC for Variant Red Carrier, is rapidly increasing.

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