Researchers uncover key to barley domestication

July 31 2015

An international team of researchers including the University of Adelaide have unlocked the genetic key in barley that led to the start of cropping in human agriculture.

Published today in the journal *Cell*, the researchers have discovered two genes in wild barley that allowed its domestication from a wild grass to what today is the world's fourth most important cereal crop in both area of cultivation and in quantity of grain produced.

"Barley was one of the first crops in the world to be cultivated and farmed — well before wheat," says co-author Emeritus Professor Geoff Fincher, Australian Research Council (ARC) Centre of Excellence in Plant Cell Walls at the University's School of Agriculture, Food and Wine.

"But despite this long history, until now we've not been able to answer the important question of how wild barley shifted from dropping its grain to the ground at maturity to the grain staying in the ear – a genetic change that was necessary to allow efficient harvesting of grain. We also haven't known whether barley domestication stemmed from the one location and time, or happened multiple times."

Led by Professor Takao Komatsuda of the National Institute of Agrobiological Sciences, and the Okayama University Institute of Plant Science and Resources, both in Japan, the researchers discovered two genes, Btr1 and Btr2, involved in grain dispersal in wild barley at

maturity.

These 'brittle rachis' genes control the strength of the attachment point between maturing grains and the barley spike. In wild barley the maturing grain snaps off easily — facilitating seed dispersal and survival of the species but making the harvest of large amounts of grain virtually impossible.

The researchers identified the molecular genetic change by which this attachment point lost its brittle characteristic through isolated natural mutation events, resulting in mature grains remaining attached to the head. This was associated with a change in cell wall thickness at the point of attachment of the grain to the spike. Scientists at the ARC Centre of Excellence in Plant Cell Walls compared the compositions of cell walls at the attachment points.

"Ancient farmers recognised that they could now harvest all the grains at the same time," says Professor Fincher. "They could then select the best barley plants for cultivation."

The team also compared the DNA of these two newly discovered genes in a number of wild and cultivated barleys. The result showed that barley domestication occurred with two independent mutations, firstly in the area of southern Levant (modern Israel) about 10,000 years ago, and later in the area of northern Levant (modern northwest Syria and southeast Turkey).

"Today we can see this difference in the extremely high genetic diversity that exists in barley," says Professor Fincher. "This latest genomic information and the potential to introduce as yet unused wild barley traits may offer great new potential in our barley breeding programs."

Provided by University of Adelaide