IWYP International Wheat Yield Partnership
Research to Deliver Wheat for the Future

IWYP SCIENCE BRIEF

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Floral morphology for hybrid wheat

One solution to significantly raise wheat yields and improve the genetic potential of the crop is by exploiting heterosis, also known as hybrid vigor. It has been estimated that a commercial hybrid system in wheat could lead to yield increases of 3.5% to 15% or more in farmers' fields above current levels. The production of hybrid seed requires a "female parent" plant to be pollinated by a genetically different "male parent" plant. However, wheat has evolved as an "in-breeder" and therefore does not possess floral characters that facilitate cross pollination at high efficiency. Further, there is debate if genetic variation for the traits required for efficient cross pollination exists in modern wheat lines. A project, "**Isolation of Genetic Variation for Flowering Morphology for Hybrid Wheat Production**", led by Julie King at The University of Nottingham, UK, with other colleagues at CIMMYT is finding suitable genetic variation for male and female floral traits by screening wild relatives of wheat, with particular emphasis on biological "out-breeding" species. When selected, the new traits are introgressed into modern bread wheat lines and assessed for floral morphology. If proven to be effective, the new traits will be incorporated into elite wheat parental lines by breeders to facilitate more efficient and cost-effective commercial hybrid wheat seed production.

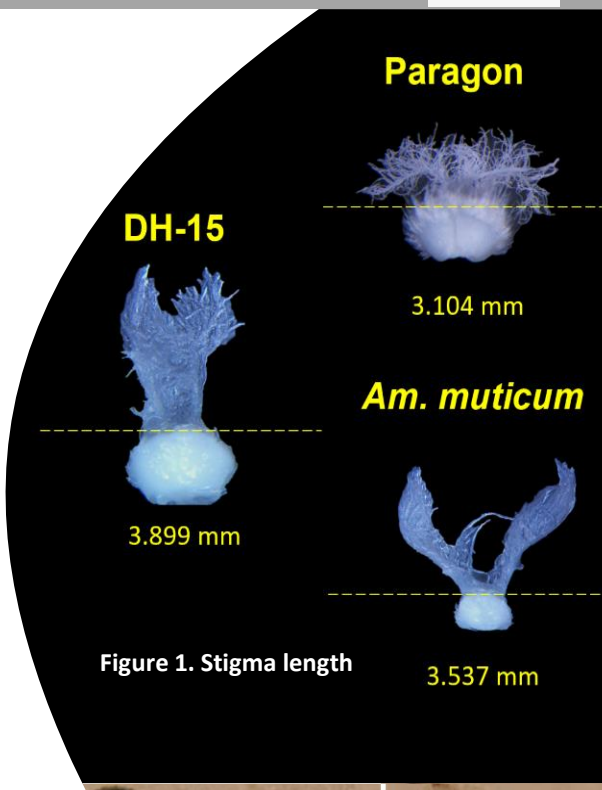

Figure 1. Stigma length

What Solutions have been Identified?

- Screening of homozygous wheat/wild relative introgression lines using novel methods has identified new variants for floral traits of interest to enhance commercial hybrid wheat breeding and seed production. Traits include longer stigma length (**Fig. 1**), smaller pollen size (**Fig. 2**), longer anther and filament length (**Fig. 3**), greater anther extrusion, and greater stigma exertion and floret gaping.

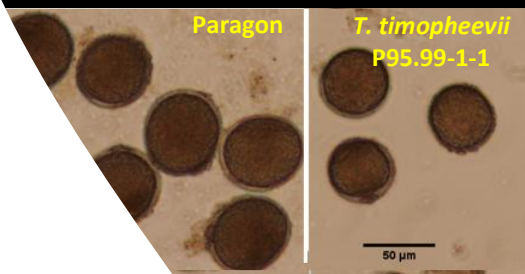

Figure 2. Pollen size

What has been Transferred to the Wheat Improvement Pipelines?

- Introgression Lines containing chromosomal segments from *Triticum timopheevii* (Zhuk.) Zhuk with prolonged stigma receptivity and small pollen grains. A stigma receptive to pollen for longer increases the likelihood for cross pollination. Smaller and lighter pollen grains can travel further when wind-blown and so potentially increase the total amount of hybrid seed produced by cross pollination.

Figure 3. Flowering heads of three *T. timopheevii* accessions showing long filament length, including P95-99.1-1 (also with small pollen grains) used to produce the wheat/*T. timopheevii* introgression lines.

IWYP140: J. King, University of Nottingham (lead); I. King, S. Grewal, S. Edwards, University of Nottingham; B. Basnet & M. Kishii, CIMMYT. https://iwyp.org/funded-projects/. Supported by BBSRC Grant Number: BB/S012796/1