

Semi-automatic method for evaluating aphid-resistant wheat genotypes using image analysis

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Cereal aphids cause yield and profit reduction both by direct feeding damage and as vectors of phytoviruses in wheat. In Brazil, aphid populations usually do not achieve levels at which direct damages are significant. However, by transmission of *Barley yellow dwarf virus* (BYDV), the annual average reduction on the potential yield is around 20 % if no chemical control is applied. Aphid resistance can reduce BYDV transmission and the rate of progress of epidemics in the field, increasing yield and reducing insecticide applications. We are developing a method that allows evaluation of several wheat genotypes at the same time, considering different resistance mechanism interactions and using image analysis to improve precision and reduce processing time. Tested genotypes are arranged in plots in randomized lines with aphids placed in central plants of each genotype line. Aphids are free to move between lines and multiply on plants, allowing populations to reach the exponential growth phase. After that, aphids are taken off plants, transferred to Petri dishes and scanned at a resolution of 7000x7000 pixels and 1200 dpi. The software AphidsCV, developed to count and classify aphid developmental stages, uses Java programming language 7, image processing (OpenCV 3.0 library), computer vision and deep learning methods (TensorFlow r1.1). In a pilot study, 28 samples of the database were randomly processed, obtaining a correlation of 95.5% between manual and automatic countings. The automation of the image readings reduces the time spent by evaluators in insect counting, minimizes errors and increase the number of genotypes evaluated.