



LJUPCHO JANKULOSKI: Macedonia

Mapping and Validating Disease Resistance and Drought Tolerance Genes in Wheat.



Ljupcho Jankuloski, a researcher from the Faculty of Agricultural Sciences and Food in Skopje, Republic of Macedonia, is currently on a nine month, IAEA-sponsored training fellowship in the wheat molecular genetics and breeding program of Dr. Jorge Dubcovsky at the University of California, Davis. This program, well known for its development of genomic resources for wheat as well as for its pioneering work in identifying, cloning, and characterizing genes which regulate important agronomic and physiological traits in wheat, offers Ljupcho an ideal opportunity to learn techniques for gene discovery and validation in this important crop.

Of the world's major staple crops, wheat is grown across the largest diversity of latitudes and environments, an impressive plasticity that is a direct result of wheat's polyploidy combined with a high frequency of deletions and insertions caused by the abundant retroelements present in the wheat genome. The lack of complete sequence information for wheat's large, polyploid genome complicates the genetic and breeding work in this species. The training Ljupcho is receiving in comparative genomics and bioinformatics in Dr. Dubcovsky's laboratory is essential for working with this complex crop species and, ultimately, for translating these findings into improved cultivars through a well-designed marker-assisted breeding program.

Upon arrival in Davis, Ljupcho completed a course in Applied Bioinformatics, offered through the University's major degree program in Biotechnology. Concurrently, he joined a team of researchers in Dubcovsky's lab to work on dissecting a newly discovered QTL for stripe rust resistance. Ljupcho is screening the DNAs of 700 plants from an $F_{3:2}$ population segregating for a single QTL using a set of five molecular markers in the QTL region. In this process, he has learned how to troubleshoot and optimize molecular markers and has already identified several critical recombinants in the region. Next, he will "immortalize" these recombination events by selecting individuals homozygous for these events in progeny tests. Ljupcho will produce a high-density map of this QTL region as a first step towards cloning this stripe rust resistance gene. At the same time, he is saturating the region with new molecular markers, taking advantage of the collinearity of the wheat genome with that of rice and *Brachypodium*.

Ljupcho has also initiated an independent project to genotype a population of rye-wheat recombinant lines for use in mapping gene(s) for drought tolerance. This is the first step in a long-term research program in drought tolerance and gives Ljupcho the opportunity to work on a gene discovery project in its very early stages. As part of his training, Ljupcho is also learning how to use the lab's novel wheat TILLING populations to search for induced mutations in targeted genes. The TILLING populations are an invaluable tool in gene validation work, providing an efficient, non-transgenic method for inactivating candidate genes.

This IAEA-sponsored fellowship is providing Ljupcho the chance to improve his skills in molecular genetics and breeding in the context of one of the world's most important crops, skills which will provide a firm foundation for his own research program once he returns to Macedonia.