Assessment of Resistance and Inheritance to Barley Yellow Dwarf Virus Disease (BYDV) in Five Wheat Cultivars (*Triticum aestivum* L.)

by

Jaime Tola

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Completed May 11, 1983

Commencement June 1984

SUMMARY AND CONCLUSIONS

The objectives of this investigations were: (1) to evaluate methods of detecting and measuring resistance among cultivars, (2) to identify sources of BYDV resistance and (3) to determine the nature of inheritance controlling BYDV resistance.

Experimental materials included four winter-type and one spring-type wheat and the resulting F_1, F_2, F_3, BC-a and BC-2 generations from crosses among the five cultivars.

Two studies were conducted. The first was conducted in the greenhouse where an assessment of the parental lines was made with regard to the injury of aphid feeding and aphids plus the virus. A field experiment was established to obtain information on the nature of inheritance.

The following observations were made based on the performance of the experimental material used in this investigation:

Study 1

1. Visual symptoms were difficult to detect with the most susceptible cultivar, Stephens, showing only moderate yellowing.
2. Aphid feeding, per se, appeared not to be a factor in terms of damage with only Anza and Yamhill showing a reduction in plant weight when exposed to non-viruliferous aphids.
3. Despite the low visual symptom expression, all cultivars were affected by the virus for most parameters measured. Stephens and Riebesel exhibited the greatest reduction for traits like grain yield, plant weight and plant height. Yamhill, Novi Sad and Anza showed the least damage.

4. No complete immunity was observed for any of the cultivars. In general, significant differences can be attributed to the virus rather than the feeding of aphids.

Study 2

1. PAV-BYDV strain and Sitophion avenae (Fabricius) vector were confirmed as being prevalent in this experiment.
2. No immunity nor high levels of resistance was found. However, there were different levels of resistance among cultivars.
3. Stephens appeared to be the most visibly susceptible cultivar by most parameters measured, however, Riebesel showed the highest yield reduction.
4. Yamhill showed the lowest BYDV score and appears to have the highest potential for resistance, followed by Novi Sad and Anza.
5. The BYDV visual scale was useful in assessing the BYDV effects in this study with significant negative correlations between BYDV score and agronomic traits measured. This was especially true for kernel weight, grain yield, plant height and plant weight. Harvest index and tiller number appeared to be the least affected.
6. The F_1 and F_2 segregating populations favored the resistant parent in susceptible x resistant crosses. For susceptible x susceptible and resistant x resistant crosses, the F_1 mean values were similar to the mid-parent values.
7. F_2 and F_3 frequency distributions suggested that resistance to BYDV was quantitative. Transgressive segregation was detected in all crosses.

8. Low Narrow Sense Heritability Estimates suggest that there is a large environmental component influencing the expression of BYDV resistance.
9. General combining ability values indicated that part of the genetic variability for BYDV resistance is controlled by genes which are additive in action. However, the specific combining ability also suggests the importance of nonadditive gene action.
10. A recurrent selection program using the cultivars in this study followed by intermating between and within F_2 generations would be a sound approach in increasing the levels of BYDV resistance.