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Plant Pathology Fact Sheet

Wheat Streak Mosaic Virus in Kentucky

Donald E. Hershman
Extension Plant Pathologist

INTRODUCTION

Wheat streak mosaic (WSM) is a potentially devastating virus disease of wheat. In the United States, WSM is most prevalent in hard red wheat grown in the central Great Plains region. Soft red winter wheat produced in the mid-south and Midwest is infrequently impacted by WSM. Epidemics are rare in Kentucky with the only recorded ones occurring in 1989 and 2000.

Losses due to WSM may range from negligible to complete crop failures. The entire range of disease severity was evident during a spring 2000 epidemic in Kentucky. The most extensive damage was found in scattered fields in Fulton, Simpson, and Warren Counties. Approximately 10 percent of the wheat fields in those counties were heavily damaged; many of those fields were destroyed and replanted to either corn or soybean. The disease was also evident in most of the other wheat-producing counties of the state, but damage was limited primarily to test weight reductions.

FIGURE 1. FOLIAR SYMPTOMS OF WHEAT STREAK MOSAIC.

SYMPTOMS

Symptoms of WSM in individual leaves appear as discontinuous, narrow, white-yellow streaks and dashes which run parallel to the leaf veins (FIGURE 1). Severely diseased plants are significantly stunted and yellowed, and may appear to have difficulty standing. Symptomatic leaves and entire tillers may eventually turn brown and die as the season progresses. If symptoms are severe prior to heading, heads may be partially or completely sterile. In fall-planted

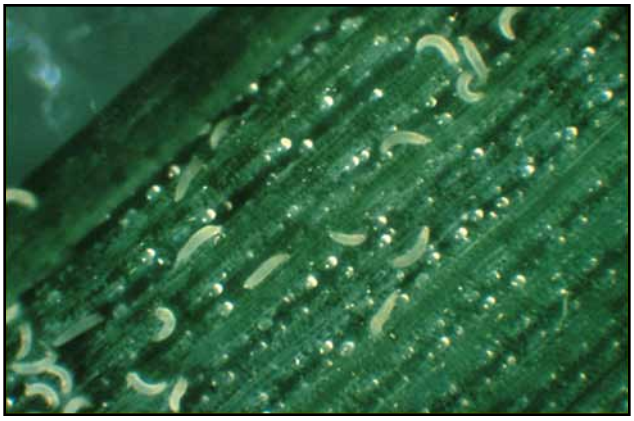

FIGURE 2. WHEAT CURL MITES.

wheat, severe symptom expression is an indication of fall or early winter infection by the virus. Plants thus infected may look unthrifty as early as crop green-up in March. Spring infections result in light to moderate foliar symptom expression and little or no plant stunting. Late-infected plants may remain symptomless through crop head emergence.

Although WSM symptomatology is fairly distinctive, infections may be easily confused with or confounded by other virus diseases, such as wheat spindle streak mosaic, soil-borne wheat mosaic, and/or barley yellow dwarf. For this reason, it is recommended that you seek the assistance of a qualified plant disease diagnostic laboratory to positively identify the virus or viruses involved. For obvious reasons, it is best to do this prior to making any major, and potentially costly, crop management decisions, such as applying nitrogen or pesticides, or undertaking crop destruction and replanting to a different crop.

CAUSE AND DISEASE DEVELOPMENT

Wheat streak mosaic virus (WSMV) is transmitted to wheat by the wheat curl mite, *Aceria tulipae* (FIGURE 2). The epidemiology of the disease is directly linked to the population dynamics and biology of this tiny mite pest. For more detailed information on the biology of the wheat curl mite, consult University of Kentucky Department of Entomology publication ENTFACT-117 available on the Web and at Kentucky County Extension offices.

Wheat curl mites and WSMV survive the summer months prior to wheat planting on/in a range of grassy crop and weed species, especially volunteer wheat. Grass species often differ in their potential to support either the mite or the virus. Fescue, for example, is an excellent mite host, but it is immune to WSMV. Corn is a moderate host for both the virus and the mite. Common weed species which are good hosts for both the mite and virus include: cheat (*Bromus secalinus*), crabgrass (*Digitaria* spp.), and barnyardgrass (*Echinochloa crusgalli*). Although these species are extremely common in Kentucky, apparently none of them contribute significantly towards WSM epidemics. If they did, we would see more evidence of WSM each year. This thesis is backed up by observations and studies from areas where WSM is common. Apparently volunteer wheat (i.e., wheat as a weed) is the only significant host plant (for the virus and mite) which contributes significantly towards the development of WSM epidemics in Kentucky.

In situations where significant levels of volunteer wheat exist, virus and mite populations are maintained at high levels in and on wheat, respectively, during wheat's "off season" (that is, the time between the harvest of one wheat crop and emergence of the next crop). Then, if the volunteer wheat is not killed at least two weeks prior to the emergence of wheat in the same or adjacent fields, the mite will move onto the emerging wheat and spread the virus to the young wheat seedlings. Mites move to the emerging wheat by wind.

Prior to the spring 2000 epidemic, there was an abundance of volunteer wheat in Kentucky because of poor weed control in doublecrop

soybean due to a summer 1999 drought. Observation of many fields exhibiting WSM during 2000, in fact, showed an association with volunteer wheat in neighboring fields. However, this was not true in all situations and many fields that were severely affected by WSM were not closely associated with volunteer wheat. This suggests that mites moved into those fields from distant sources in wind currents. Another weakness in the link between volunteer wheat and WSM epidemiology is that many fields throughout the state had minimal WSM, even though significant volunteer wheat problems existed. Apparently other as yet undetermined factors also played an important role in promoting or limiting WSM in fields during the fall of 1999 and spring of 2000.

Management Issues

There is some evidence that soft red winter wheat varieties may differ slightly in their reaction to WSM. However, because of the highly sporadic occurrence of WSM in KY and neighboring states, very little work has been done on assessing varietal resistance to WSMV. When epidemics occur, disease ratings are taken. However, by the time the next WSM epidemic occurs, few of the cultivars rated during the previous epidemic are still available for sale. Presently, all soft red winter wheat varieties currently available for planting in Kentucky should be considered to be highly susceptible to WSM. Similarly, there are no data to suggest that any chemical treatment aimed specifically at the wheat curl mite vector will be of value. Thus, the only practical means of managing WSM, is managing volunteer wheat on an area-wide basis. This is good news for Kentucky producers since in a normal season volunteer wheat is not a serious problem due to effective weed control, particularly in doublecrop soybean fields. However, any situation which results in large volunteer wheat populations throughout the summer months should be a cause for concern. In those instances, farmers must make a collective effort to eliminate volunteer wheat, either through chemical or mechanical means, at least two weeks before wheat planting in an area begins. This two-week period will greatly reduce wheat curl mite populations due to a lack of available host tissue. The key, however, is that this effort be undertaken communally. Mite control in individual fields will have little impact on area-wide populations of wheat curl mites. The risk for WSMV infection will still be quite high as long as any significant populations of volunteer wheat remain anywhere within a community.

In situations where extensive WSM is confirmed, it may be necessary to destroy the current crop and replant the field to a different crop. Although the issues regarding the planting and management of a different crop are beyond the scope of this fact sheet, one important point needs to be made regarding future wheat crops in the same field. Specifically, it would be highly risky to plant wheat in the fall in a field after having destroyed a wheat crop in the same field the previous spring. The main concern in that situation is the build-up of fungal disease pathogens in the field since wheat was in the field in consecutive seasons. In this regard, the greatest concern would be take-all disease, a highly destructive root and crown disease of wheat. Back-to-back wheat crops, even if the first wheat crop was destroyed, will encourage the development of unacceptable levels of take-all in the second wheat crop.

Additional Resources

Disease management and crop production advice can be found in the following University of Kentucky publications available at County Extension offices, as well as on the Internet.

- Comprehensive Guide to Wheat Management in Kentucky: Disease Management (Section 7) ID-125 (2009) http://www.ca.uky.edu/agc/pubs/id/id125/07.pdf
- Importance of Scouting Wheat for Plant Diseases, PPFS-AG-SG-12 (2011) http://www.ca.uky.edu/agcollege/plantpathology/ext_files/PPFShtml/ppfsagsg12.pdf
- Kentucky Integrated Crop Management Manual for Small Grains, IPM-4 (2009) http://www.uky.edu/Ag/IPM/manuals/ipm4smgr.pdf
- Wheat Streak Mosaic Virus and the Wheat Curl Mite, ENTFACT-117 (1996) http://www.ca.uky.edu/entomology/entfacts/ef117.asp

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Photos by Don Hershman, University of Kentucky (foliar symptoms) and Texas A&M (wheat curl mites)