# Short Shoot Syndrome of Grapes in the Pacific Northwest

EM 8944-E
November 2007

V. Walton, A.J. Dreves, and P. Skinkis

Figure 1. Leaf symptoms include a "drawstring effect." Leaves farther from the base of the shoot display symptoms less frequently.

Short shoot syndrome (SSS) is an increasingly important problem of grapevines in Oregon and, more recently, in Washington. Symptoms associated with SSS include puckered or malformed basal leaves, scarred and severely stunted shoot growth, and loss of grape clusters. In severe cases, complete crop loss results from abortion of affected shoots and clusters. Vine structure can be affected due to shoot dieback, possibly reducing crop quality.

SSS symptoms started to emerge in Oregon during 2001. Symptoms have been observed in the Willamette, Rogue, and Umpqua valleys, and in the Walla Walla, Milton-Freewater, Yakima Valley, and Columbia Valley grape-growing areas of Oregon and Washington.

Several possible explanations for SSS have been suggested, including boron deficiency, low carbohydrate reserves, and damage from thrips or arthropods (for example, bud and rust mites). Another possible explanation is wound response to feeding injury (possibly from thrips or arthropods) that occurred during the previous season when shoot and flower buds were forming for the next season of growth.

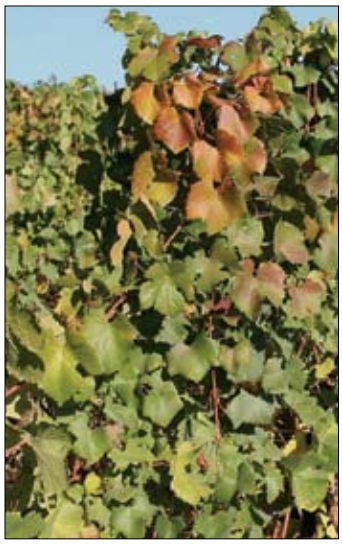

Figure 2. Leaf bronzing associated with rust and bud mite infestations.

Increased rust mite (*Calepitrimerus vitis*) and bud mite (*Colomerus vitis*) populations were associated with SSS symptoms in a 5-year study in Australian vineyards. Initial surveys have shown correlations between rust and bud mite infestations and SSS symptoms in Oregon and Washington.

This publication will help producers identify short shoot syndrome. We also discuss observed patterns of SSS within vineyards as well as mite sampling methods.

## Symptoms

**Leaves.** The basal or oldest leaves on affected shoots are darker green than normal and are puckered. These leaves have a "drawstring" effect; it looks like the leaf surface (petiole) has been pulled back, something like a loose thread being pulled in a piece of fabric. Leaf appearance does not change as the season progresses, and leaves farther from the base of the shoot do not display these symptoms (Figure 1).

During late summer and into autumn, many affected plants show bronzing of leaves (Figures 2 and 3). However, this observation has not been consistent in all SSS-affected vineyards and may be related to water status and/or mite populations.

Vaughn Walton, horticultural entomologist; Amy J. Dreves, Extension entomologist; and Patty Skinkis, Extension viticulture specialist; all of Oregon State University.

Oregon State University | Extension Service

Figure 3. Bronzing of leaves is most visible in early morning or late afternoon.

Figure 4. Affected (left) and unaffected (right) shoots during the early growing season.

**Shoots**. Bud break is delayed. SSS-affected shoots are significantly shorter than unaffected shoots (Figure 4) and may have a zigzag growth pattern (Figure 5). These shoots typically have few or no grape clusters (flowers) (Figure 6) and look as if they developed from secondary or tertiary buds.

The primary shoots lose apical dominance early in the season, due to damage to the growing points, and lateral shoots begin to grow. In many cases, affected shoots die (Figure 7), and secondary shoots with small or no clusters develop from these nodes. As the season progresses, affected canes may continue to grow and seem unaffected, except for the lack of clusters and the altered vine architecture, particularly at the base of affected shoots.

Figure 5. Affected shoots show a zigzag pattern. In many cases, clusters die and eventually abort.

Figure 6. Affected shoots have few or no clusters, have a zigzag growth pattern, and lose apical dominance. Secondary shoots become dominant later in the season.

Figure 7. In many cases, the primary shoots die, and secondary shoots appear. These secondary shoots do not display scarring, but typically do not bear any clusters.

Figure 8. Affected shoots display “railroad-track” scarring. Note the “drawstring effect” of the basal leaf on the bottom right.

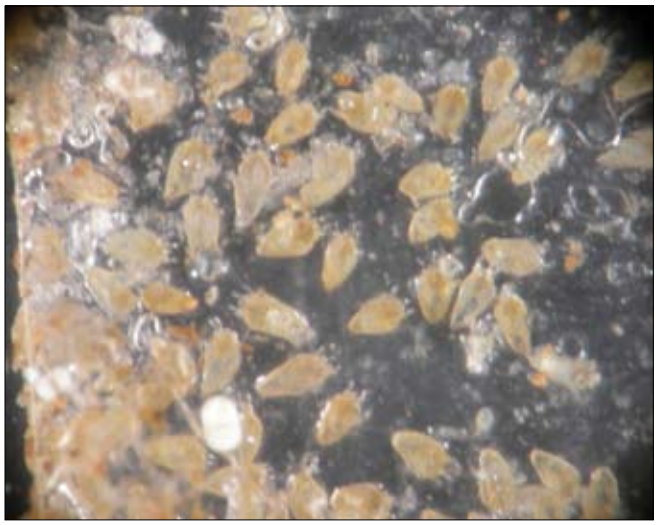

Figure 9. Rust mites found on double-sided sticky tape traps during autumn in Willamette Valley vineyards.

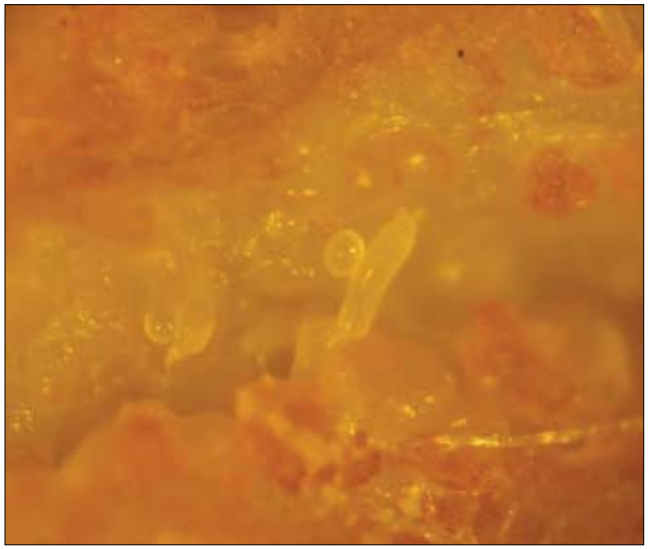

Figure 10. Bud mite found inside a dissected bud during autumn in a Willamette Valley vineyard.

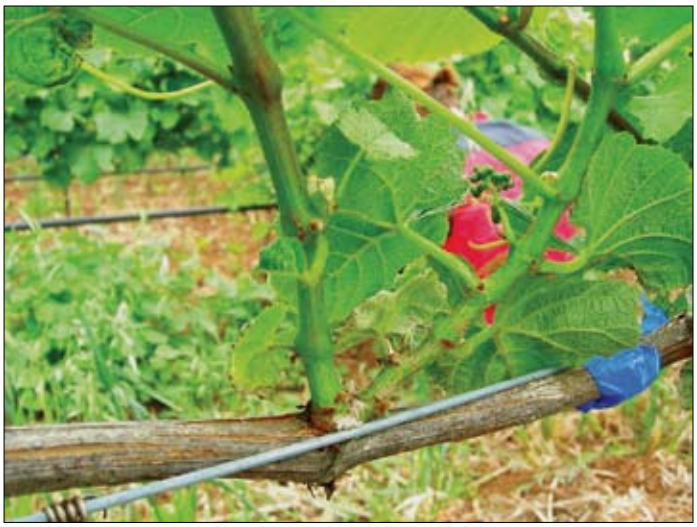

Figure 11. Effects of cluster loss. Often, producers leave blocks unharvested due to low yield. Some scarring of tissue can be seen on the shoot on the right.

Affected shoots also display railroad-track-like scars (Figure 8), which closely resemble thrips injury. These scars are found on the first one-to-four internodal regions of the shoots and on the main veins of the underside of leaves. These symptoms were found on most of the 400 SSS-affected shoots we examined in Oregon.

In addition, in both the Willamette and Yakima valleys, many bud and rust mites have been found on double-sided sticky tape traps attached to affected shoots (Figure 9) as well as in dissected buds (Figure 10).

**Whole vines.** Cane-pruned vines display symptoms on the current-season shoots nearest the head of the vine or trunk. Shoots farther from the head show fewer symptoms or are not affected. Cordon-pruned vines display symptoms on most of the spurs, with more uniform distribution of symptoms on the vine.

**Vineyard blocks.** In many cases, SSS symptoms are clustered in certain areas of highly affected blocks. Crop damage can reduce yield so much that harvest is not justified in these blocks (Figure 11), although symptoms may not be present on every vine. In less severe cases, only 1 or 2 percent of the vines show symptoms, although patterns of SSS symptoms are still found.

Vineyard blocks can display the following patterns.

- Heavily affected blocks can be adjacent to blocks with or without symptoms.
- Not every block in a production unit or vineyard (defined as a contiguous set of vines and blocks run by the same manager[s]) shows symptoms in the same year.
- Different blocks within a production unit can show symptoms from year to year.
- Blocks show symptoms for about 2 years, and then symptoms become less severe.

As the season progresses, a vineyard may seem to overcome the SSS problem and look "better." Closer inspection, however, reveals crop loss and tissue damage.

## Verification of mite infestation with winter bud samples

Bud and rust mites are microscopic. Infestations can be verified by sampling during the late dormant period during pruning. Recommendations regarding control options can be made only after infestations have been verified.

Collect samples from previously affected vineyards as described below. Sampling areas can be between 1 and 4 acres.

1. Collect one basal shoot from each of 40 evenly spaced vines in the affected vineyard area, totaling 40 shoots. Cut each shoot at the base. Each shoot should contain three internodes to allow proper investigation.
2. Tie shoots together and place inside clearly marked plastic bags. Be sure to include the following details: date, cultivar, year planted, location in field, contact name and address, and other pertinent information that might help researchers understand the problem.
3. Refrigerate samples and keep out of direct sunlight. You can hold samples for as long as 2 weeks before submitting them for analysis. Send samples to:

   Vaughn Walton
   Department of Horticulture
   4127 ALS
   Oregon State University
   Corvallis, OR 97330

Figure 12. Wooly bud stage (Eichhorn Lorenz stage 3).

## Controlling mite infestations

Research in Australia, South Africa, and Switzerland, combined with preliminary data from Oregon, suggests that sulfur sprays applied early in the spring can control mite populations. Sulfur sprays applied at the onset of the wooly bud stage (Eichhorn Lorenz stage 3, Figure 12), followed by a second spray approximately 10 days later, have minimized symptoms associated with mite infestations.

Timing of sprays is crucial. At the wooly bud stage, buds start to open, and mites become active. Sprays during this growth stage allow targeting of pesticides to control mites. After late-developing buds open, previously protected mites are susceptible to the second spray.

Several compounds are registered for control of rust mite populations, including various formulations of sulfur and miticides. No information is available on the effectiveness of dusting sulfur or of dormant lime sulfur applications.

Growers who suspect that they have rust or bud mites should refer to the current edition of the *PNW Insect Management Handbook* or contact their local Extension agent or crop advisor for recommendations regarding management options.

## Summary

Short shoot syndrome symptoms associated with rust and bud mites are having an increasing impact in Pacific Northwest vineyards. Symptoms have appeared consistently for several years, and research is being funded by the winegrape industries in Oregon and Washington to determine the cause and to develop management strategies.

SSS is a complex issue. Current research is focused on early warning tools and economic thresholds. Future work will include the impact of SSS on crop quality, effects of sulfur sprays on natural enemies, alternatives and timing of pest and disease control, and understanding the causal agents.

## For more information

Bernard, M.B., P.A. Horne, and A.A. Hoffmann. 2005. Eriophyoid mite damage in *Vitis vinifera* (grapevine) in Australia: *Calepitrimerus vitis* and *Colomerus vitis* (Acari: Eriophyidae) as the common cause of the widespread "restricted spring growth" syndrome. Exp. and Appl. Acarol. 35: 83–109.

De Lillo, E., G. Bari, and R. Monfreda. 2005. Preliminary study on the distribution of *Calepitrimerus vitis* (Nalepa) on tendone trained vineyards in Apulia, Southern Italy. De Lillo, Phytophaga, XIV (2004): 605–610.

Dennill, G.B. 1986. An ecological basis for timing control measures against grape vine rust mite *Eriophyes vitis.* Pgst. Crop Prot. 5: 12–14.

James, D.G. and D. Prischmann. 2006. The impact of sulfur on biological control of spider mites in Washington State vineyards and hop yards. Proc. 12th Int. Congr. Acarol. *In press.*

James, D.G., T.S. Price, L.C. Wright, and J. Perez. 2002. Abundance and phenology of mites, leafhoppers, and thrips on pesticide-treated and untreated wine grapes in southcentral Washington. J. Agr. Urban Entomol. 19: 45–54.

Hollingsworth, C.H., ed. *Pacific Northwest Insect Management Handbook.* Revised annually. Extension Services of Oregon, Washington, and Idaho.

Walton, V.M., A.J. Dreves, D.H. Gent, D.G., James, R.R. Martin, U. Chambers, and P.A. Skinkis. 2007. Relationship between rust mites, *Calepitrimerus vitis* (Acari: Eriophyidae), bud mites *Colomerus vitis* (Acari: Eriophyidae) and short shoot syndrome in Oregon vineyards. Internat. J. Acarol. *Accepted for publication.*

© 2007 Oregon State University. This publication may be photocopied or reprinted in its entirety for noncommercial purposes.

This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties.

Oregon State University Extension Service offers educational programs, activities, and materials without discrimination based on age, color, disability, gender identity or expression, marital status, national origin, race, religion, sex, sexual orientation, or veteran's status. Oregon State University Extension Service is an Equal Opportunity Employer.

Published November 2007.