

Strain of aster yellows virus associated with

Spindling Sprout of Potato

in studies of disorder in California

An abnormal sprouting condition in potato tubers has been observed in California sporadically for the past 15 years. The disorder, termed spindling sprout or hair sprout, appears as weak, threadlike sprouts initiating from the eyes of apparently sound tubers. Spindling sprouts have been attributed to such varied causes as potato viruses, fungus infections, psyllid insects and adverse environmental conditions. Preliminary investigations have implicated the aster yellows virus as contributing to spindling sprout in California.

During the course of these studies, young White Rose and Russet Burbank potato plants in the greenhouse were leafhopper-inoculated with a strain of aster yellows virus collected in Tulelake, and transplanted to the field. Symptoms of Tulelake aster yellows virus in potato appeared first in the tops as narrow, chlorotic, curled leaflets, with or without purple pigmentation. Growth of the terminals was restricted, followed by stimulation of growth in the leaf axils as leafy

shoots or tuberous swellings—aerial tubers. Infected plants rapidly wilted, and died before any tubers were formed.

Leaf buds from symptomatic insect-inoculated plants were grafted to 54 healthy 45-day old field plants. Two Russet Burbank plants from this first graft series developed definite aster yellows symptoms 20 days after grafting. The two plants provided virus-infected scions for grafting an additional 20 healthy plants of each variety. The stock plants used for this late graft series were 65 days from planting.

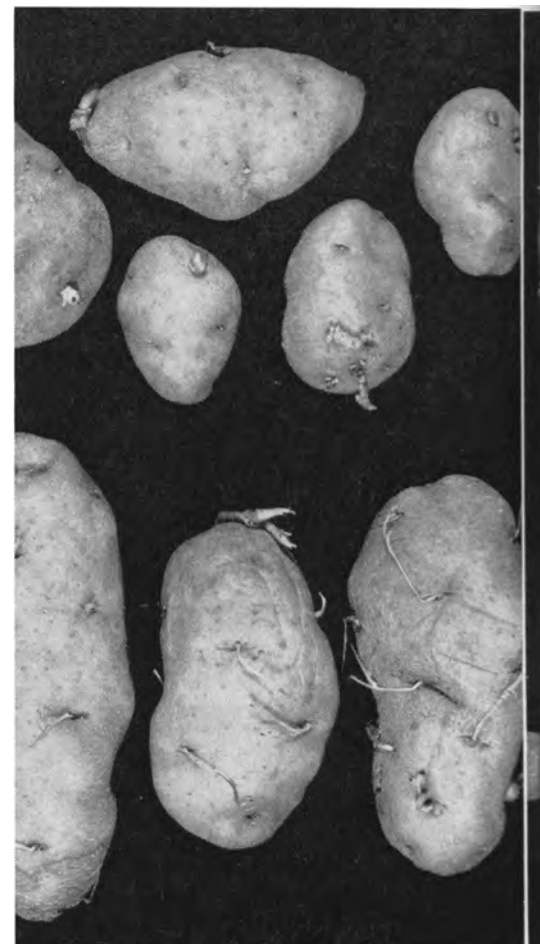
Additional grafting experiments were conducted to determine the relationship of age of plant at time of infection and resultant spindling-sprout condition of the tubers. Groups of 10 each White Rose and Russet Burbank plants in the field were grafted with virus-infected scions at two-week intervals. Five groups of plants were grafted 30, 44, 58, 72 and 86 days after planting.

Records were made of plant symptoms during the season and tubers from indi-

vidual plants were harvested at 120 days and stored for sprout germination.

Definite aster yellows symptoms were produced on 25 of 114 plants grafted with infected potato scions. The remain-

Left—Spindling- and normal-sprouted tubers inoculated with the Tulelake strain of aster yellows virus. Right—Spindling-sprouted tubers. Right—Spindling-sprouted tubers.



OLIVE SCALE

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tions are that spray applications by ground rigs do not influence biological control from more than three or four tree rows into the grove, but dust applications by airplane may have adverse effects at greater distances.

A regular program of adequate pruning to open up the tree, reduce clumping of branches and foliage, and to force long new leaders is conducive to full control by parasites. Successful control has been achieved in olive groves under gravity-flow and under sprinkler irrigation systems.

During the necessary time between the initiation of a biological control program and the achievement of general control by the parasites, a good oil spray may be used where needed. The oil interferes

with the program much less than does parathion, for example, which kills the parasite, and oil treatments do not disrupt parasite control the following year.

Specific studies on the biological control of the olive scale on its many host plants in orchards, gardens, parks, and landscaped roadways, have not been conducted but the total value gained from control of the scale on such host plants by the parasitic Persian wasp may exceed the value gained in olive groves even if all the acreage of olives were under successful biological control.

C. B. Huffaker is Entomologist in Biological Control, University of California, Berkeley.

C. E. Kennett is Laboratory Technician in Biological Control, University of California, Berkeley.

Photographs by F. E. Skinner, Laboratory Technician, Department of Biological Control, University of California, Berkeley.

A. M. Boyce, Dean of the College of Agricul-

ture, Riverside, imported the original stock of the Persian wasp from Iran and Iraq in 1951.

R. L. Doult, Associate Professor of Biological Control, University of California, Berkeley, initiated the program of colonization in 1952.

G. L. Finney, Associate Specialist in Biological Control, University of California, Berkeley, and his associates propagated the colonization

ing plants showed wilting, or death, of the grafted stem only or remained apparently healthy. One or more spindling-sprouted tubers were produced on 10 of the 25 symptomatic plants, but an additional 28 of the remaining grafted plants also produced abnormal tubers. Typical spindling sprouts were produced on 150 of the 324 tubers—46%—from plants giving rise to abnormal tubers. The severity of infection and symptoms did not increase the percentage of tubers with abnormal sprouts. Therefore it was possible to verify the influence of aster yellows in the production of spindling-sprouted tubers, but the incidence of the tuber disorder could not be predicted wholly by plant symptoms.

Spindling-sprouted tubers were produced by one-to-four of the 10 Russet Burbank plants from each of the grafting dates in the time of infection study, totaling 13 of 50 plants with tuber symptoms. Only five White Rose plants, three from the 30-day and one each from the 58- and 72-day graft dates produced spindling-sprouted tubers. Weights and numbers of tubers indicated that infections initiated 30 days from planting resulted in tubers reduced in size and number, but nearly 100% subject to spindling sprouts. Infections initiated 44 or more days after planting produced tubers of normal number, but slightly reduced in size, of which approximately 50% sprouted abnormally.

measured in the higher—1.065–1.090—specific gravity ranges. Hand refractometer readings for percentage soluble solids expressed as sucrose appeared reliable to separate abnormal tubers by high readings—7%–12%—and normal tubers by lower values—4%–8%.

Microscopic examination of tubers verified the presence of excessive callose deposits in the internal phloem of spindling-sprouted tubers. Comparable callose deposits were not evident in normal-sprouted tuber tissues.

It appears from the data obtained in these studies and from those reported by other investigators that spindling sprout is an expression of an abnormal condition in the tuber caused by a number of varied conditions or diseases, and is not to be considered a separate disease. Available evidence indicates that abnormal development within the phloem tissues is most directly responsible for the weakened sprout development.

The aster leafhopper is unable to extract and transmit virus from infected potato plants, so secondary spread in the field is not a problem. The extent of spindling sprout incidence due to aster yellows virus is dependent on leafhopper populations and on sources of virus in perennial weed and ornamental hosts. No satisfactory method has been developed to eliminate spindling sprouts.

L. F. Lippert is Assistant Olericulturist in Vegetable Crops, University of California, Riverside.

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Tubers producing spindling sprouts were not distinguishable from normal tubers by external or internal appearance. Abnormal tubers could be identified only by their characteristic elongated and weak sprouts after germination. Tubers predisposed to spindling sprouts germinated earlier than non-affected tubers and sprouted from all eyes concurrently, indicating a loss of apical dominance.

Several rapid tests were conducted to evaluate a reliable method for detecting and separating spindling-sprouted tubers from seed stock or commercial samples. These tests were made on sprouted tubers to provide known spindling- and normal-sprouted samples. Specific gravity measurements of individual tubers provided a gross separation of the abnormal tubers due to their low—1.050–1.065—specific gravity value. Normal tubers generally

W. H. LANGE and L. K. MANN

Fumigation controls

Microscopic Mite

attacking garlic

A microscopic eriophyid mite—*Aceria tulipae* (Keifer)—causes virus-like symptoms on garlic: a distorting, twisting, and yellow and light-green streaking of the leaves. Severe attacks of this mite occurred in several California localities in 1960.

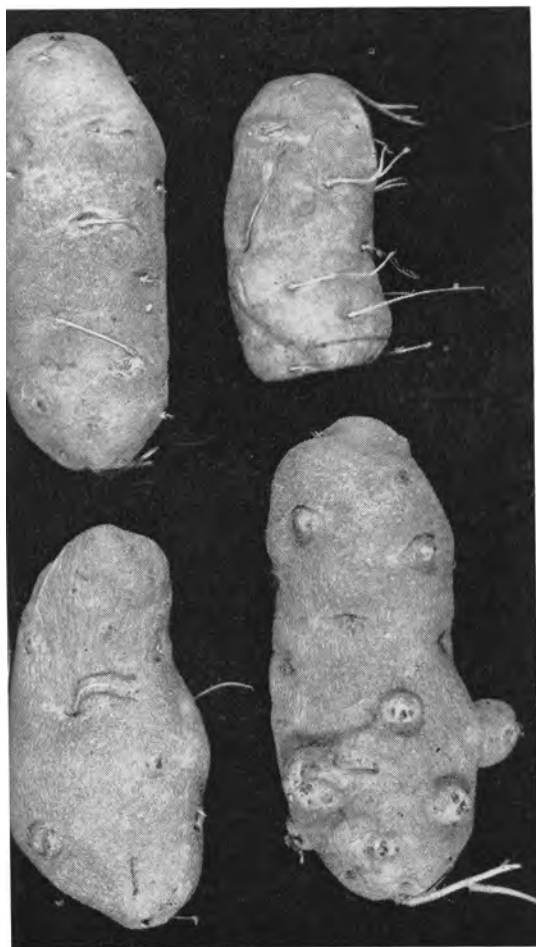
Most of the damage caused by the mite is due to feeding of the mites on the sur-

faces of the cloves while the bulbs are in storage, a scarifying and drying of the growing surfaces. Mites attain entrance to the growing points of the garlic and usually concentrate their attacks on such new growth. From several to thousands of mites can occur on individual bulbs.

Extent of mite damage depends upon

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produced on a White Rose potato plant grafted with yellow virus. Note loss of apical dominance in sprouts on tubers from graft-inoculated Russet Burbank plant.



stock for the distribution program in the University Insectary.

The California State Department of Agriculture, County Agricultural Commissioners and County Farm Advisors of the University of California Extension Service assisted in the distribution and release of the parasitic wasp in scale infested olive orchards.