

Wheat Spindle Streak Mosaic Virus in Nebraska

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ABSTRACT

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Plants from a Nebraska wheat field were tested to determine the cause of mosaic symptoms. Electron microscopy of leaf-dip preparations showed thin, flexuous rods 12–15 nm in diameter and mostly 100–1,600 nm long. The virus was tentatively identified as wheat spindle streak mosaic virus on the basis of morphology, concentration of rods in leaf-dip preparations, morphology of inclusion bodies, pattern of occurrence in the field, and other factors. This is the first report of wheat spindle streak mosaic virus in Nebraska.

A field of wheat (*Triticum aestivum* L.) in Pawnee County, southeast Nebraska, was brought to our attention in March 1981 because it apparently had soilborne mosaic even though it was supposedly planted to Homestead, a resistant variety. Upon inspecting the field, we found scattered plants with symptoms typical of soilborne wheat mosaic virus (SBWMV). In addition, all plants in one area of the field had symptoms typical of those

described for wheat spindle streak mosaic virus (WSSMV) (8). The pattern in the field was characteristic of a soilborne disease. Electron microscopy of leaf-dip preparations from samples brought to the laboratory showed stiff, hollow rods typical of SBWMV in the scattered plants that had mosaic characteristic of this disease (2). A few thin, flexuous rods and no stiff, hollow rods were found in plants with WSSMV-like symptoms (Fig. 1A). The thin, flexuous rods were 12–15 nm in diameter and mostly 100–1,600 nm long. The number of rods was an order of magnitude less than for wheat streak mosaic virus (WSMV) and was insufficient for a determination of average length. In all these respects, the rods resembled WSSMV (10).

To test for WSMV, which also has thin, flexuous rods, we rubbed extracts of the infected leaves from field plants on leaves of young Michigan Amber wheat plants growing in the greenhouse at 25 ± 5 C. No symptoms developed within 30 days, indicating absence of WSMV, which is readily transmitted and shows

symptoms in 5 days at this temperature. Leaf-dip serology (1,5) further indicated the absence of WSMV because the rods from the field plants did not become decorated, whereas known WSMV rods were decorated with antibodies to WSMV (Fig. 1A). Thin sections of leaves from plants with WSSMV-like symptoms contained pinwheel inclusions and membranous bodies (Fig. 1B), which have been reported to be an early stage in pinwheel formation for this virus but not for others (6,11).

Approximately 250 Homestead, 80 Michigan Amber, and 30 Scout plants were inoculated by the method of Brakke et al (3) with debris screened from the soil from the affected area of the Pawnee County field. Plants were grown in a growth chamber at 10 C with 12 hr per day of cool, white fluorescent light, 20,000 lumen per square meter, conditions conducive to development of both SBWMV and WSSMV. Three Michigan Amber, one Scout, and none of the Homestead plants developed symptoms of WSSMV between 1 and 2 mo after inoculation. Long, flexuous rods that could not be decorated with antiserum to WSMV were found by electron microscopy in each of the four plants with symptoms. Forty control plants remained free of symptoms.

Extracts from the plants that became infected in the above experiment were rubbed on leaves of 120 Michigan Amber plants, which were also kept in the growth chamber at 10 C. Four of these plants developed symptoms. Three of the plants

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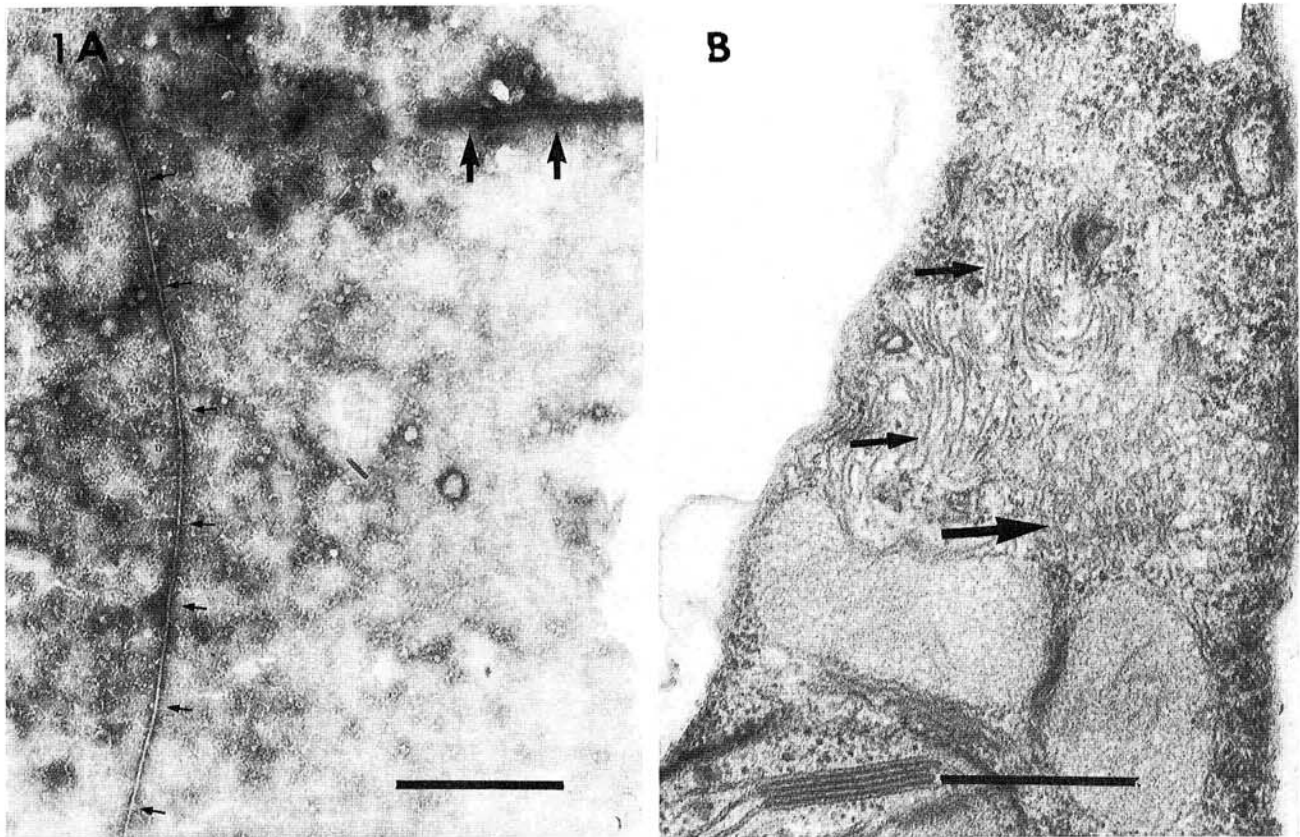


Fig. 1. Identification of wheat spindle streak mosaic virus (WSSMV): (A) Leaf-dip serology, in anti-wheat streak mosaic virus (WSMV) antiserum diluted 1/200, of wheat leaf infected with WSSMV followed by a wheat leaf infected with WSMV. WSMV was decorated with antibody (medium arrows), and WSSMV (small arrows) was not. (B) Ultrathin section of wheat leaf cell infected with WSSMV. Flexuous WSSMV virions (medium arrows) and pre-pinwheel membranous body (large arrow) characteristic of WSSMV infection as well as pinwheels (not shown) were present. Bars are 500 nm.

with symptoms were examined by electron microscopy, which revealed the widely scattered, thin, long, flexuous rods.

The presence of scattered plants infected with SBWMV suggests that the wheat planted in the field was not pure Homestead. Further investigation will be needed to find whether Homestead is susceptible to WSSMV.

Both WSSMV and SBWMV reportedly are transmitted by *Polymyxa graminis* Led. (4,9). Some wheat cultivars resistant to SBWMV in the field are susceptible by manual inoculation and may be resistant to the fungal vector rather than to the virus (7). Such varieties should be resistant to both WSSMV and SBWMV in the field if these two viruses are indeed transmitted by the same strains of *P. graminis*. The possible occurrence of WSSMV in cultivars resistant to SBWMV should be investigated further.

This virus was tentatively identified as

WSSMV on the basis of its morphology, concentration of rods in leaf-dip preparations, morphology of its inclusion bodies, pattern of occurrence in the field, transmission from soil, symptom production at low temperatures, and low rate of manual transmission.

This is the first report of WSSMV in Nebraska. The virus may also occur in Kansas, where observations similar to the above were made on Newton wheat in 1981 (J. Uyemoto, *personal communication*).

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