

## Properties of Soil-Borne Wheat Mosaic Virus

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Reports on the physical properties of soil-borne wheat mosaic virus (SBWMV) deal with the green (rosette) strain (4). Properties of the yellow (common) strain which is generally found in Kansas have not been studied. Serological relations have not been established either among the SBWMV strains or between SBWMV and wheat streak mosaic virus (WSMV).

Our objectives were (i) to delineate the physical properties of the common SBWMV, to facilitate comparisons among all known SBWMV strains; and (ii) to determine whether or not any serological relationships exist among the different strains of SBWMV and WSMV.

Hosts were either winter rye, probably Balbo (7) (*Secale cereale* L.) or Pawnee winter wheat (*Triticum aestivum* L.). Extracts used to find the dilution end point, thermal inactivation point, and aging in vitro were obtained by blending 10 g of SBWMV-infected leaves in 10 ml of either sterile, distilled water or 0.01 M phosphate buffer at pH 7.5. Six replicates of either 10 or 20 plants were inoculated for each dilution, temp, and time. The plants were grown in a greenhouse at  $18 \pm 3$  C.

To obtain purified virus suspensions, 150 g of 8-week-old greenhouse-grown SBWMV-infected rye or wheat leaves were frozen 2 to 3 weeks, ground, then emulsified in 300 ml of 0.5 M sodium citrate, pH 7.0, which contained 0.42 ml of mercaptoethanol and 462 mg of sodium diethyldithiocarbamate. The crude extract was further emulsified in an equal volume of chloroform, then centrifuged at 3,000 g for 15 min. That preparation was differentially centrifuged for 3 cycles at 140,000 g for 2 hr and 10,000 g for 10 min. The suspending medium for the crude and final viral pellets was 2 to 5 ml of 0.01 M Tris [tris (hydroxy-

methyl) amino methane] adjusted to pH 7.0 with 1.0 N HCL.

Antisera from healthy wheat or rye were obtained by the methods we used to obtain purified virus. Antisera to SBWMV and to healthy wheat or rye from rabbits were prepared according to methods described by Matthews (5) using alternate intravenous and intramuscular injections.

Microprecipitin tests were conducted according to methods summarized by Ball (1). We used K-SBWMV antiserum and SBWMV isolates from Kansas (K-SBWMV), Nebraska (N-SBWMV), and Illinois (I-SBWMV). WSMV also was used to determine if a serological relationship existed between the two viruses.

We found that the dilution end point for K-SBWMV was between  $10^{-3}$  and  $10^{-3.5}$ . The virus did not resist aging in vitro for 96 hr, but retained a small amount of infectivity for 48 hr. Thermal inactivation was between 58 and 60 C for 5-min exposure.

The titers of K-SBWMV antiserum were 1:2048, 1:1024, and 1:256 to K-SBWMV, N-SBWMV, and I-SBWMV, respectively. There was no reaction between WSMV and K-SBWMV antiserum or between normal healthy wheat or rye antigens and K-SBWMV antiserum.

Staining K-SBWMV particles with phosphotungstic acid or shadowing them with platinum alloy, as described by Gold et al. (3), demonstrated that they were rod-shaped and had hollow centers. They ranged from 35 to 442  $m\mu \times 24$  to 28  $m\mu$ , averaging  $161 \times 26$   $m\mu$ . This is within the size range of SBWMV particles studied by others (2, 3, 4, 6, 8).

### LITERATURE CITED

1. BALL, E. M. 1961. Serological tests for the identification of plant viruses. Amer. Phytopathol. Soc. p. 1-16.
2. BRAKKE, M. K., A. P. ESTES, & M. L. SCHUSTER. 1965. Transmission of soil-borne wheat mosaic virus. Phytopathology 55:79-86.
3. GOLD, A. H., H. A. SCOTT, & H. H. MCKINNEY. 1957. Electron microscopy of several viruses occurring in wheat and other monocots. Plant Dis. Repr. 41: 250-253.
4. HEBERT, T. T., & N. T. COLEMAN. 1955. Rod-shaped particles associated with soil-borne wheat mosaic. Phytopathology 45:358 (Abstr.).
5. MATTHEWS, R. E. F. 1957. Plant virus serology. Cambridge Univ. Press, London. p. 4-8.
6. SAITO, Y., K. TAKANASHI, & Y. IWATA. 1961. Purification and morphology of Japanese soil-borne wheat mosaic viruses. Ann. Phytopathol. Soc. Japan. 26:16-18.
7. SILL, W. H., JR. 1955. A winter rye useful in identifying soil-borne wheat mosaic virus. Phytopathology 45: 637.
8. SMITH, K. M. 1957. A textbook of plant virus diseases. [2nd ed.] Little, Brown & Co., Boston. p. 602-604.