

# Histological observations on maize leaf tissues infected with rayado fino virus\* ————— E W KITAJIMA\*\*, RODRIGO GAMEZ\*\*\*

## COMPENDIO

*Observaciones realizadas al microscopio electrónico mostraron que las células del parénquima de hojas de maíz infectadas con el virus del rayado fino (VRF) aparecían ligeramente contraídas en relación a las de hojas sanas. A bajas ampliaciones no se observó ningún cambio apreciable en los componentes celulares. A ampliaciones mayores se apreciaron masas densas a los electrones en las vacuolas de células del parénquima de la epidermis y del parénquima vascular, formadas por agregados de partículas isométricas de 25 nm de diámetro entremezcladas con material amorfo. Estas partículas no se observaron en células de plantas sanas, y son similares a las descritas para el VRF en preparaciones purificadas. Los efectos citopáticos de este virus y del virus del rayado del maíz de Brasil son idénticos, lo cual confirma observaciones anteriores sobre la similitud de estos virus. — Los autores.*

### Introduction

**M**AIZE rayado fino virus (RFV) (5, 6, 7) and the Brazilian corn streak virus (CSV) (11) are small isometric viruses, 25-27 nm in diameter, transmitted in a persistent manner by the cicadellid leafhopper *Dalbulus maidis* DeLong & Wolcott. In a preliminary communication (10) we indicated that these viruses were serologically identical and induced similar cytopathic effects in leaf cells of infected maize plants. For these reasons RFV and BCSV are considered identical or closely related viruses. In this paper we describe some observations on intracellular location and cytopathic effects induced by RFV in cells of maize plants and compare these effects with those caused by the BCSV and other maize viruses.

### Materials and methods

Leaf samples from both uninoculated control and RFV-infected maize plants were fixed with 3% glutaraldehyde and post-fixed in 1% OsO<sub>4</sub>, buffered in phosphate, dehydrated and embedded in Epon at the University of Costa Rica. The blocks were sectioned at

the University of Brasilia with a Porter-Blum MT-1 or with LKB ultratome III microtomes equipped with an IVIC diamond knife. Thin sections were then stained with uranyl acetate and lead citrate and examined in a Zeiss EM9 electron microscope.

### Results

There was an accidental change in the labels of the blocks sent from Costa Rica; thus the material considered as healthy was indeed RFV-infected and vice-versa. This, in part, was interesting because it eliminated possible bias in the examination of the sections. Preservation of the tissues was reasonable, with some few cells showing slight plasmolysis. Leaf parenchyma cells from RFV-infected plants were somewhat shrunken in relation to those from control plants. At low magnification, however, no remarkable changes could be noticed in the cell components. Vacuoles from cells of both RFV-infected and uninoculated control plants commonly exhibited electron dense specks (Fig. 1, 2, 6). At higher magnifications it was possible to notice that these dense specks in the vacuoles from RFV-infected cells were made up of an aggregate of isometric particles, ca. 25 nm in diameter, commonly interspersed with an amorphous material (Fig. 3-5). In uninfected cells, these specks were composed of nonparticulated material (Fig. 6), and in no instance could the 25 nm particles be observed in these cells.

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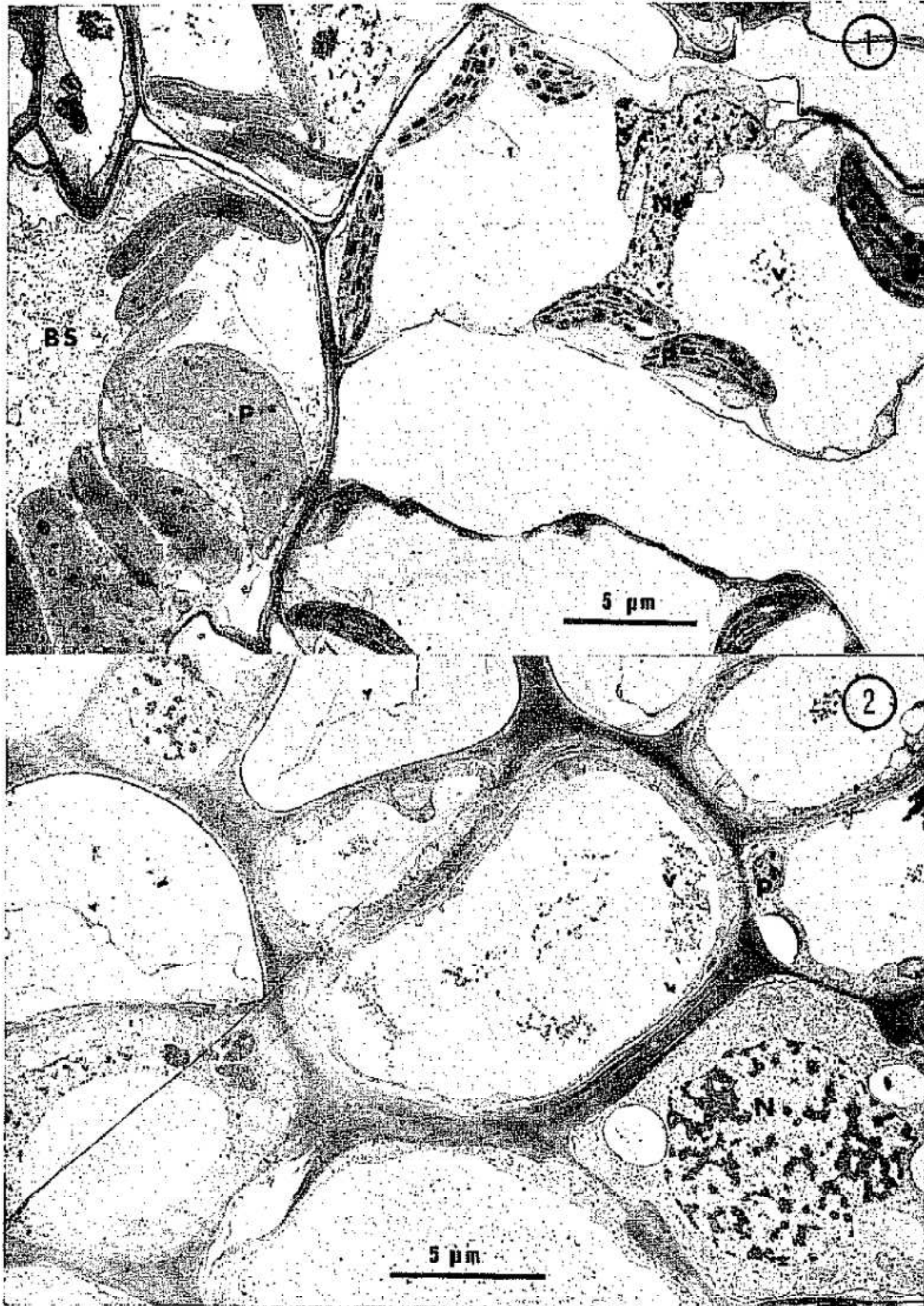


Fig. 1-2—Virus-infected epidermal (Fig. 1) and phloem parenchyma (Fig. 2) cells. Electron dense specks containing virus particles appear in the vacuoles. BS bundle sheath. N: nucleus; P: plastid; V: virus.

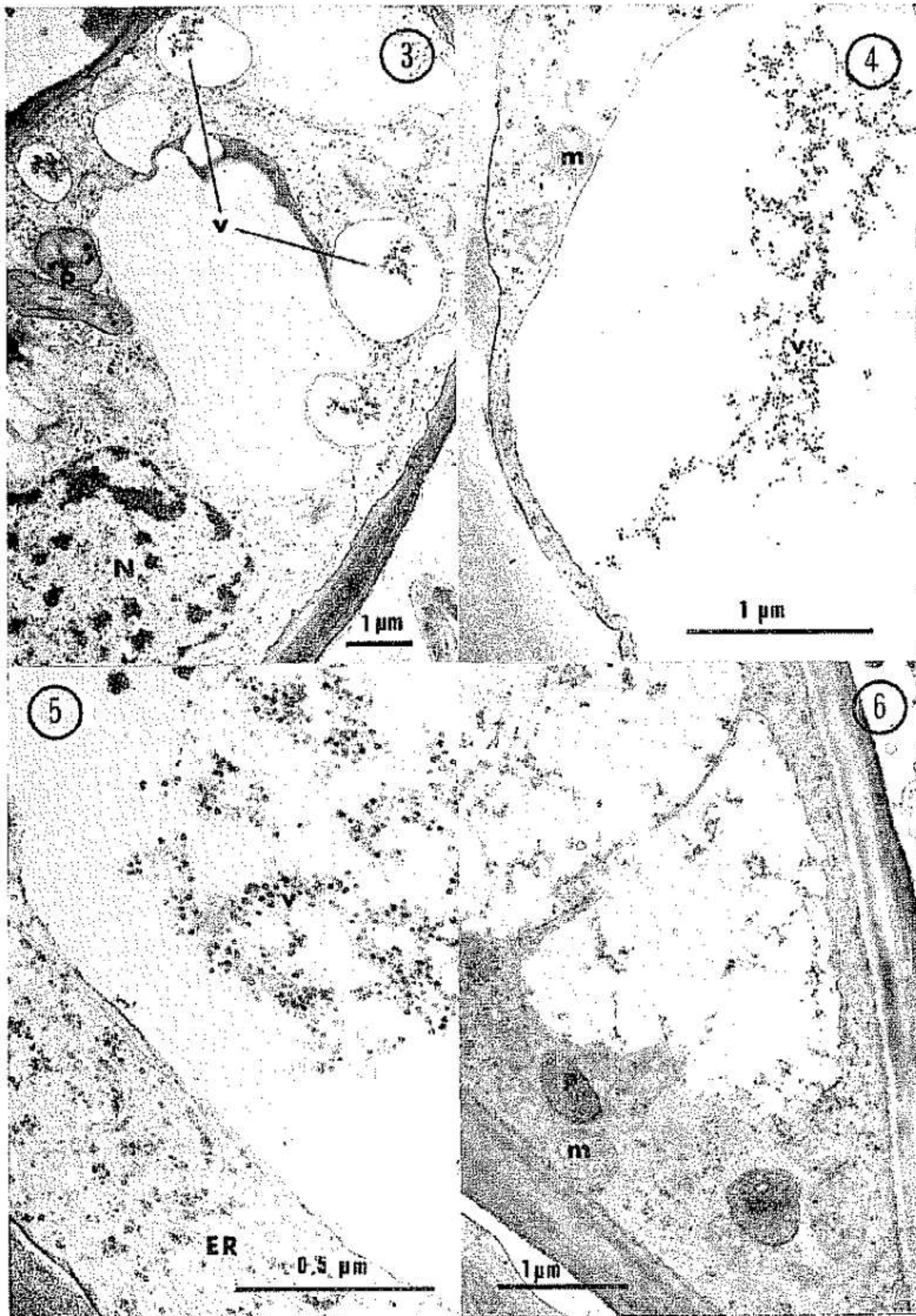


Fig 3-5 —Aggregates of isometric particles interspersed with amorphous material in vacuoles of virus-infected epidermal parenchyma cells. ER endoplasmic reticulum, m mitochondria, N nucleus, P plastid, V virus

Fig 6 —Electron dense specks of nonparticulated material in healthy phloem parenchyma cell

### Discussion

The isometric particles observed in the vacuoles of RFV-infected cells from epidermis mesophyll and phloem parenchyma must represent the RFV *in situ*. Their presence only in RFV-infected tissues and their morphological similarity with the polyhedral particles found in purified and infective preparations (8, 11) are considered evidence in favor of this view. The present results are also in agreement with previous studies that showed RFV and BCSV to be serologically similar or identical (10). Presumptive BCSV particles also occur in the vacuole of different types of leaf cells and were also observed in some few cases in the cytoplasm, associated with areas rich in vesicles (11). This was not observed in RFV-infected cells, but it could be due to the examination of a relatively small number of samples.

The similarity in the cytopathic effects of RFV and BCSV supports the view that both viruses are part of the same complex.

The "rayado Colombiano" virus of maize is also serologically related to both RFV and BCSV (Gómez, R. and Martínez-López, G., unpublished data; Gómez, R. and Kitajima, E. W., unpublished data). Originally it was thought to be 50 nm in diameter (13), but was recently shown to be identical to RFV and BCSV in size and morphology (14). The histological effects in maize of this virus are not known. Although there are other isometric viruses reported infecting maize such as the African corn streak (1,15), the maize stripe and maize line (12), the chlorotic dwarf (2,3), the chlorotic mottle (9), and the cucumber mosaic (4), most of them differ in several pathological and/or morphological properties, as well as in their insect-vector and virus-vector relationships, and are thus probably unrelated to RFV and BCSV.

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