A Disease of Lentil Caused by Bean Yellow Mosaic Virus in Egypt

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ABSTRACT

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Bean yellow mosaic virus was isolated in Egypt from plants of *Lens esculenta* L. showing stunting, mild systemic mosaic of the leaflets, and deformed pods. The virus was identified by the response of differential hosts, particle morphology, sedimentation properties, electron microscopy, and serology. Symptoms developed on mechanically inoculated healthy lentil seedlings.

Lentil (*Lens esculenta* L.) is an important crop in Egypt where it is cultivated on a wide scale in the southern regions. In 1979, plants showed reduced growth and mild mosaic of the leaves. Pods and seeds were generally reduced in size and deformed. A virus was isolated from the plants and identified as a strain of bean yellow mosaic virus (BYMV). This paper reports some of its characteristics.

MATERIALS AND METHODS

Infected leaves were ground in a mortar in the presence of 0.1 M phosphate buffer, pH 7.2. Extracts of systemically infected broad bean plants (*Vicia faba* L. var. *major* Harz.) were used for determining the stability of the virus in crude sap by using conventional methods (3) and *Chenopodium amaranticolor* Coste et Reyn. as assay host. The virus was purified from infected broad bean, and an antiserum was produced by a procedure previously described (10).

Serologic tests were done by treating the antigen (crude sap or purified virus) with sodium dodecyl sulfate (SDS) and using SDS-immunodiffusion plates (7). For electron microscopy, leaf dip or purified preparations were mounted in 2% neutralized potassium phosphotungstate and examined with a Philips 201 C electron microscope. The normal length of particles was determined by using tobacco mosaic virus as internal standard (2,9). For cytological studies, pieces of infected broad bean tissue were fixed in 4% glutaraldehyde, postfixed in 2% osmium tetroxide, dehydrated with ethanol and propylene oxide, and embedded in Araldite. Thin sections were stained with uranyl acetate and lead citrate.

RESULTS

C. amaranticolor (local selection), *C. quinoa* Willd., and *Gomphrena globosa* L. (local selection) showed localized symptoms only. *Nicotiana benthamiana* Domin., *V. faba* var. *major*, *V. faba* L. var. *minor* (Pieterm.) Beck., *Pisum sativum* L., and *Lupinus albus* L. were infected systemically.

Of the seven hosts (*C. amaranticolor*, *Glycine* max (L.) Merr. cv. Bragg and Davis, *Phaseolus vulgaris* L. cv. Bountiful, Black Turtle Soup, and Pinto III, *V. faba* var. *minor*) suggested as differential indicators reacting with visible symptoms to BYMV in northern temperate regions (5), only *V. faba* was infected systemically. *C. amaranticolor* showed local lesions only. The remaining hosts were not infected. Although the local selection of *G. globosa* was infected systemically, the A. F. Ross strain of this host (5) was not infected.

Crude sap of infected *V. faba* lost infectivity at a dilution between 10^{-3} and 10^{-4}, after storage at room temperature for about 4 days, or after heating at 55–65 C for 10 min.

The virus was readily purified from broad bean (2–3 mg of virus per 100 g of infected tissue) if young leaves with symptoms were used for purification. It banded as a single component after centrifugation in sucrose density gradients. The virus from the ultraviolet-absorbing zone, dialyzed against phosphate buffer, gave a spectrophotometric profile with a maximum at 260 nm, a minimum at 246 nm, and a pronounced shoulder at 290 nm. Ratios E_{280} E_{260} and E_{max} E_{min} were 0.86 and 1.1, respectively; these values were uncorrected for light scattering.

Purified virus preparations were composed of unaggregated particles (Fig. 1). They were infective, and inoculated lentils had symptoms similar to those of naturally infected plants. Measurements of virus particles from crude sap showed one modal length (792 nm). Thin sectioned cells of infected broad bean leaves contained many crystalline bodies with ribosomelike particles attached to their surface, few scattered virus particles, and pinwheel inclusions typical

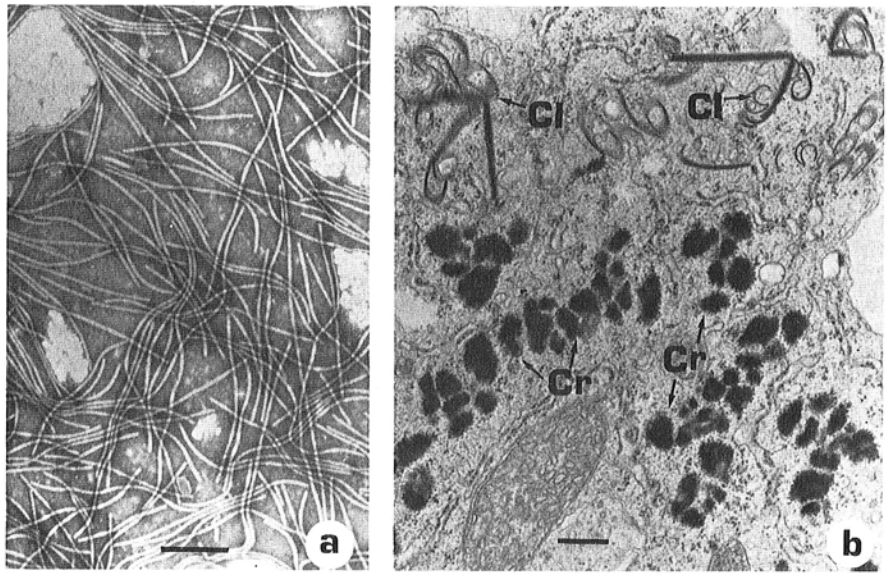

Fig. 1. Bean yellow mosaic virus: **(A)** Purified preparation from lentil mounted in potassium phosphotungstate. Scale bar represents 300 nm. **(B)** Section through a broad bean cell; CI = cylindrical inclusions, Cr = aggregates of electron-opaque bodies. Scale bar represents 400 nm.

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of the potyviruses of Edwardson's (4) subdivision II, which includes BYMV (Fig. 1). Small crystals were also embedded in the nucleolar mass in the nucleus.

Antiserum to the lentil virus had a titer 1:2,048, determined in the ring-precipitin test. In SDS-immunodiffusion plates, it reacted with homologous antigen, forming a precipitin line that merged with the lines formed by an Italian and an American isolate of BYMV.

DISCUSSION

These results indicate that the virus isolated from diseased lentil plants in Egypt is an isolate of BYMV. To our knowledge, BYMV has been reported causing a similar disease of lentil only in Iran (6).

The characteristics of the lentil isolate of BYMV from Egypt are similar to those of the pea mosaic strain of this virus (1), which has also been found in pea in Egypt (*unpublished data*). An isolate with host range responses similar to those of the mosaic strain of BYMV was isolated from artichoke in Italy (8), indicating its ability to infect nonleguminous hosts in nature.

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