

Relationships Among Isolates of Pea Seed-Borne Mosaic Virus From the United States and Japan

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ABSTRACT

A seed-borne virus disease of peas described in Washington, Oregon, and Wisconsin was found to be related serologically to pea seed-borne mosaic virus described in Japan. The discrepancies among particle length measurements reported for the U.S. and Japanese isolates appear to be due to methods which were used to prepare the U.S. isolates for electron microscopy.

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Additional key words: symptomatology, epidemiology.

In 1969 a seed-borne virus disease of peas was reported almost simultaneously from Washington (7), Oregon (3) and Wisconsin (10). In each case symptoms on diseased plants resembled those caused by the pea seed-borne mosaic virus (PSbMV) described in Japan (4). Furthermore, the virus associated with diseased plants in each state had many properties in common with the Japanese virus. The particles were flexuous rods (3, 10), aphid-transmitted in the stylet-borne manner (2, 7), seed-transmitted in a relatively high percentage of seeds from diseased plants (5), and readily transmitted by sap inoculation to a restricted host range which includes both legume and nonlegume species (7). However, the Japanese virus was not transmitted by *Acyrothosiphon pisum*, an effective vector of the American viruses. In addition, particle lengths reported for all of the American isolates were significantly shorter than the 750 nm reported for PSbMV (4). Isolates from Oregon, Washington, and Wisconsin had particle lengths near 517 nm (3), 590 nm (*unpublished*), and 650 nm (10), respectively. As a result of these apparent discrepancies, some confusion arose as to the relationships among the virus isolates reported from the USA and PSbMV. This report provides evidence that the Washington virus isolate is related to PSbMV.

During the fall of 1971, two of us (G. I. M. and T. I.) visited the pea growing region near Gobo, Wakayama Prefecture, Japan, where PSbMV occurs in epiphytotic proportions annually. Field observations confirmed

similarities in symptomatology and epidemiology between the seed-borne diseases in the U.S. and Japan. In both countries, symptoms on young plants consisted of various degrees of stunting, downward rolling of leaflets, and a transient vein-clearing and swelling. In Japan, the predominant symptom on field-grown plants of the cultivar 'Olanda' after flowering was mild rolling of leaflets. In the U.S., some cultivars are often symptomless at this stage of growth, whereas other cultivars, particularly the Perfection-types, may be severely stunted with prominent rolling of the leaves and tendrils. In Japan, as in the U.S., no wild species has been found that serves as a reservoir host; field spread originates from aphids that feed on seedlings which originate from infected seed.

Antisera prepared against virus isolates from Washington (6) and Japan (4) were exchanged and tested at each location against purified preparations of the local virus isolate. Virus isolates were not exchanged because of quarantine restrictions, thus precluding reciprocal tests in each laboratory. The appropriate normal serum and healthy tissue controls were included. The results of microprecipitin tests (Table 1) show that the viruses found in Washington and Japan react with antisera from both locations, indicating that they are related serologically. In microslide gel-diffusion tests the Washington isolate reacted with antisera from both locations (Fig. 1). Although the viruses from Washington and Japan appear to be related, until both can be compared in the same laboratory, the degree to which they are related will not be known. Antisera prepared in Washington also reacted with virus isolates from Oregon and Wisconsin.

We found that clarification and preparative treatments had a pronounced effect on the apparent length of PSbMV particles unless preparations were fixed with glutaraldehyde prior to negative staining. Details of these studies are being published separately. We established that one isolate having a normal particle length of 590 nm when prepared by standard leaf dip procedures, produced particles with a modal length near 770 nm when prepared under optimum conditions (6). This is in agreement with the 750 nm value published by Inouye (4) and further supports the hypothesis that the American viruses are

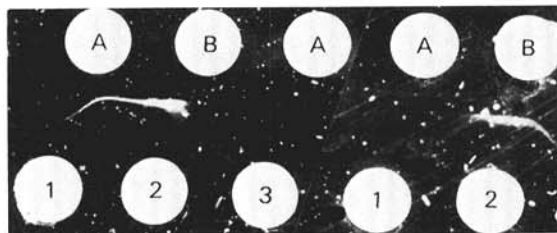


Fig. 1. Microslide gel-diffusion test. A = Washington antiserum, B = Japanese antiserum, 1 = healthy plant extract, 2 = purified Washington isolate (0.1 mg/ml), 3 = unrelated virus with particles about 750 nm (0.1 mg/ml).

strains of PSbMV, perhaps strains more susceptible to particle breakage than the Japanese strain.

Other viruses have been reported which are seed-borne in peas and have some properties in common with PSbMV. These are: pea leaf roll virus (8) later renamed pea leaf rolling mosaic virus (9); Falsches Blattrollvirus der Erbse (11); and pea leafroll mosaic virus (1). We were unable to test the relationship between PSbMV and these viruses. However, should any or all of them be related to PSbMV, only the name pea leaf roll virus appears to have precedence over PSbMV. In accordance with Musil's (9) suggestion that this name be avoided, we propose that PSbMV be used.

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TABLE 1. Reciprocal titers of antisera prepared against seed-borne pea mosaic virus isolates from Washington and Japan

Antigen		Antiserum source	
Source	Type	Washington	Japan
Washington ^a	Healthy	0	0
	Virus	200	1,600
Japan ^b	Healthy	0	0
	Virus	160	1,280

^aMicroprecipitin tests made in Washington.

^bMicroprecipitin tests made in Japan.