Dasheen Mosaic Virus Infecting Taro in People's Republic of China

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ABSTRACT

Zettler, F. W., Tsai, J. H., Faan, H. C., Ke, C., and Lu, K. C. 1987. Dasheen mosaic virus infecting taro in People's Republic of China. Plant Disease 71: 837-839.

Dasheen mosaic virus (DMV) was detected serologically in 52% of 139 taro (*Colocasia esculenta*) samples representing four important cultivars from the provinces of Fujian, Zhejiang, and Guangdong in the People's Republic of China. This virus was also detected in taro plants grown from corms purchased in Chinese markets in Hong Kong and in San Francisco, CA. Precipitin reactions with dasheen mosaic virus capsid and cylindrical inclusion antisera in immunodiffusion tests did not reveal differences between Chinese DMV isolates and DMV isolates from Florida, Egypt, Fiji, Nigeria, and Hawaii.

Additional key words: *Alocasia*, cocoyam, *Xanthosoma* sp.

Taro (*Colocasia esculenta* (L.) Schott) has been cultivated in China since 100 B.C. (7). Today, it is still widely cultivated in the provinces of Anhui, Zhejiang, Jiangsu, Guangxi, and Guangdong in southeastern China. It is estimated that about 264,000 ha of taro are planted annually in China, and production is about 530 million kg. Four cultivars commonly grown are Bing-Long Yu, Pei Yu, Pei-Gan Yu, and Heng-Ya Yu (i.e., "fragrant," "white," "white stem," and "red sprout" taro, respectively). The origins of these cultivars are unknown, but each appears to be phenotypically homogeneous.

Dasheen mosaic virus (DMV) is common in many areas of the world where taro and other aroids are cultivated (11,13). Very little information is available, however, regarding its occurrence in People's Republic of China (PRC). DMV-like symptoms were observed and flexuous-rod virus particles were isolated from taro in Guangdong (5), but these results have not been confirmed by more specific diagnostic methods. This paper documents the widespread occurrence of DMV in PRC.

MATERIALS AND METHODS

In 1983 and 1984, surveys were made of taro plantings in Fujian, Zhejiang, and

Florida Agricultural Experiment Stations Journal Series No. 7751.

Accepted for publication 19 February 1987.

Guangdong provinces. At each location, efforts were made to select plants with viruslike foliar mosaic symptoms. Leaf samples from these locations were dried and forwarded under USDA import permit to Gainesville, FL, where they were assayed serologically for DMV. In 1982, Pei Yu taro corms imported from PRC were purchased from Chinese markets in Hong Kong and San Francisco and forwarded under USDA import permit to Florida, where they were planted. Likewise, the wild *C. esculenta* and *Alocasia odora* (Lodd.) Spach. specimens from PRC were forwarded to Florida under USDA import permit.

Samples were assayed by double radial immunodiffusion methods described by Purcifull and Batchelor (8). The diffusion medium consisted of a 0.8% Noble agar, 1% NaN_3, and 0.5% sodium dodecyl sulfate (SDS). The DMV capsid and cylindrical inclusion rabbit antisera used were prepared by Abo El-Nil et al (2) and Zettler et al (11), respectively. The antisera were not diluted. Dried leaves received from PRC were pulverized and soaked 5–10 min in 1.5% aqueous SDS, then the hydrated leaf tissue could readily be transferred by forceps to antigen wells. To ensure liquid contact between the leaf tissues and agar medium, 1.5% SDS was added to each of the wells containing plant samples. As controls, normal serum and reference antigens representing healthy and DMV-infected taro tissues were incorporated in all tests (1). Fresh leaf extracts representing the Hong Kong and San Francisco samples were diluted 1:2 (w/v) with 1.5% SDS.

Epidermal strips from lower leaf surfaces of taro plants from Hong Kong were stained with calcomine orange and Luxol brilliant green and examined by light microscopy for virus-induced inclusions (4). Extracts of these leaves were negatively stained in 2% aqueous uranyl acetate and examined for virus particles with a Hitachi model H-600 electron microscope.

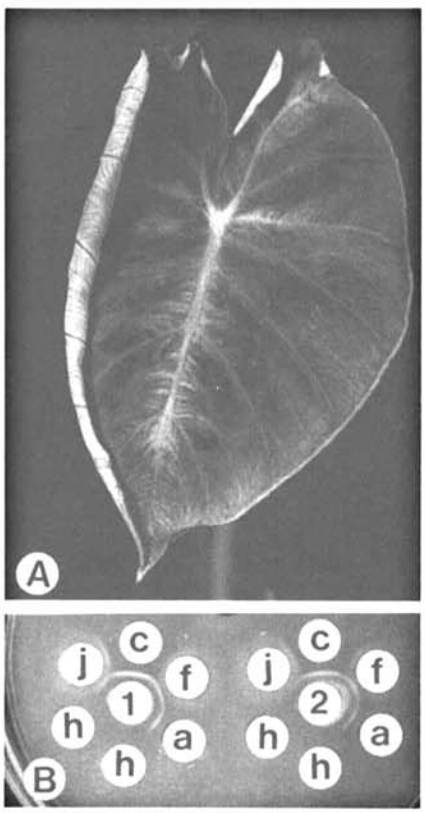

Fig. 1. (A) Dasheen mosaic virus-infected Pei Yu taro leaf showing typical feathering symptoms. The plant was originally from Hong Kong. **(B)** Serological reactions in immunodiffusion tests. Center wells 1 and 2 contain dasheen mosaic virus (DMV) capsid and cylindrical inclusion antisera, respectively. Peripheral wells, which contain taro leaf extracts in 1.5% SDS, represent healthy taro (h) and DMV isolates from Fiji (j), People's Republic of China (c), Florida (f), and Hawaii (a).

RESULTS

DMV was detected in Chinese taro plants from all three provinces surveyed and in each of the four cultivars. Three of 20 and 38 of 55 Bing-Long Yu samples from Fuzhou City in Fujian Province and Guangzhou City in Guangdong Province, respectively, reacted positively when tested with either DMV capsid or cylindrical inclusion antisera. Similarly, three of the 10 Pei Yu samples from Fuzhou City and 11 of the 16 Pei Yu and 11 of the 16 Heng-Ya Yu samples from Huazhou City in Guangdong Province reacted positively to either capsid or cylindrical inclusion antiserum. Six of the 22 Pei-Gan Yu samples from Hanzhou City in Zhejiang Province also reacted to either antiserum. No reactions were obtained with any of the 15 samples of wild *C. esculenta* or the 13 samples of *Alocasia odora* from Guangzhou City. Plants with foliar mosaic and/or feathering symptoms attributed to DMV (1,5,11,12) were found at all sample locations. Similar symptoms were observed on the Pei Yu plants from Hong Kong and San Francisco that were grown in Florida (Fig. 1A).

Of the 72 dried leaf samples that reacted positively in immunodiffusion tests, 44 reacted with both capsid and cylindrical inclusion antisera, 23 with only the former, and five with only the latter. Pei Yu samples from Hong Kong and San Francisco reacted with both capsid and inclusion antisera. Precipitin lines of these samples fused, without spur formation, with DMV-infected taro isolates from Egypt (1), Fiji (2), Florida (2), and Hawaii (3) (Fig. 1B). These samples reacted likewise with a cocoyam (*Xanthosoma* sp.) isolate from Nigeria (10).

Flexuous-rod-shaped viruslike particles were seen in negatively stained leaf extracts of the Pei Yu samples collected from Hong Kong and San Francisco and grown in Florida. Cytoplasmic inclusions like those previously described for DMV (1,11,12) were also noted in epidermal tissues of these samples.

DISCUSSION

This study confirms the presence of DMV infections of taro in PRC. The virus occurs in all three major taro-growing provinces and in all four cultivars tested from there. During recent trips to Taiwan, plants such as *Caladium* × *hortulanum* Birdsey, *Dieffenbachia maculata* (Lodd.) G. Don, and *Colocasia esculenta* (L.) Schott also had typical DMV symptoms (F. W. Zettler, J. H. Tsai, and N.-J. Ko, *unpublished*). That taro may be ubiquitously infected in China is not surprising considering that this crop is propagated exclusively by vegetative means and that DMV is efficiently transmitted by aphids (11,13). It is unlikely that any of the Chinese taro samples that did not react in immunodiffusion tests were from virusfree plants. Symptoms of DMV in taro and most other aroids are intermittently expressed, and the virus may be absent or in very low titers in symptomless tissues (9,11,13).

The Chinese taro isolates of DMV were serologically similar to those from Egypt, Florida, Fiji, Hawaii, and Nigeria. The similarity between Chinese and Florida taro isolates of DMV is not surprising, considering that the latter, a Pei Yu type locally referred to as dasheen, originated from China and was introduced into the United States from the West Indies (6). Taro has been cultivated for more than 2,000 yr in China, and although Chinese plants have been exported throughout the world, relatively few aroids of any kind have ever been imported into that country. It is therefore highly unlikely that DMV is a recent introduction to China. Rather, as described for taro in Egypt (1), the virus has probably been there for a long period of time.

ACKNOWLEDGMENTS

We thank M. S. Elliott for excellent technical assistance and Pui-Yu Yam, Fun-Kuei Chen, and De-Bao Li for help during surveys. This work was supported in part by funds from USDA-ARS Cooperative Agreement 58-7B30-2-442 and 83-CRSR-2-2150. Appreciation is extended to the Committee on Scholarly Communication with People's Republic of China, the National Academy of Sciences, Washington, DC, and to the University of Florida's Faculty Development Program for grants awarded to J. H. Tsai.

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