

Survey of sweetpotato viruses in China

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Summary. – Ten sweetpotato viruses were surveyed in 3 major sweetpotato planting region (covering 11 provinces) in China from 2006 to 2010 to understand the distribution of sweetpotato viral diseases. Nine out of the 10 viruses were found in every major planting region. The most frequently detected virus in the Northern and the Yangtze River region was SPMSV. In the Southern region, SPVG was the most frequently detected virus. Compared to the results of the survey done in 1989, the incidences of all the viral diseases increased.

Keywords: virus; sweetpotato; SPMSV; SPVG

Sweetpotato (*Ipomoea batatas* Lam.) is an important crop for food, animal feed and industrial raw materials. Its advantages include high productivities, rich nutrients and stable yields. In recent years, the annual sweetpotato planting areas in China were about 6.6 million hm² and the total yields were about 100 million tons, accounting for about 80% of the world totals. However, the widespread occurrence of sweetpotato viral diseases resulted in lower yields, lower quality and degeneration of the planting varieties (Song, *et al.*, 1997). It has been estimated that the average loss of sweetpotato yields by viral diseases is about 30%. Viral diseases have been considered a major cause of degeneration of varieties and a major limiting factor in raising the yields to a higher level (He, *et al.*, 2002).

In 1989, the Center for International Potato (CIP) carried out a survey to investigate the distribution of sweetpotato viral diseases in several Chinese provinces and examined the types and severity of these diseases. From 2006 to 2010, the Chinese National Sweetpotato Improvement Center (CNSIC) and CIP

jointly carried out a new survey to further investigate sweetpotato viral diseases in 3 major sweetpotato zonings in China. This short communication reports the results of the new survey.

The 3 major sweetpotato zonings surveyed were the Northern region (including provinces of Hebei, Shandong, Anhui, Henan and Jiangsu), the Yangtze River region (including Sichuan, Hubei and Chongqing) and the Southern region (including Hainan, Guangdong and Fujian) (Fig. 1). Three sites were selected from each province, and 10 plots from each site were randomly chosen. At least 5 samples with and 5 without disease symptoms were taken. Altogether, about 800-1000 samples were tested in each province.

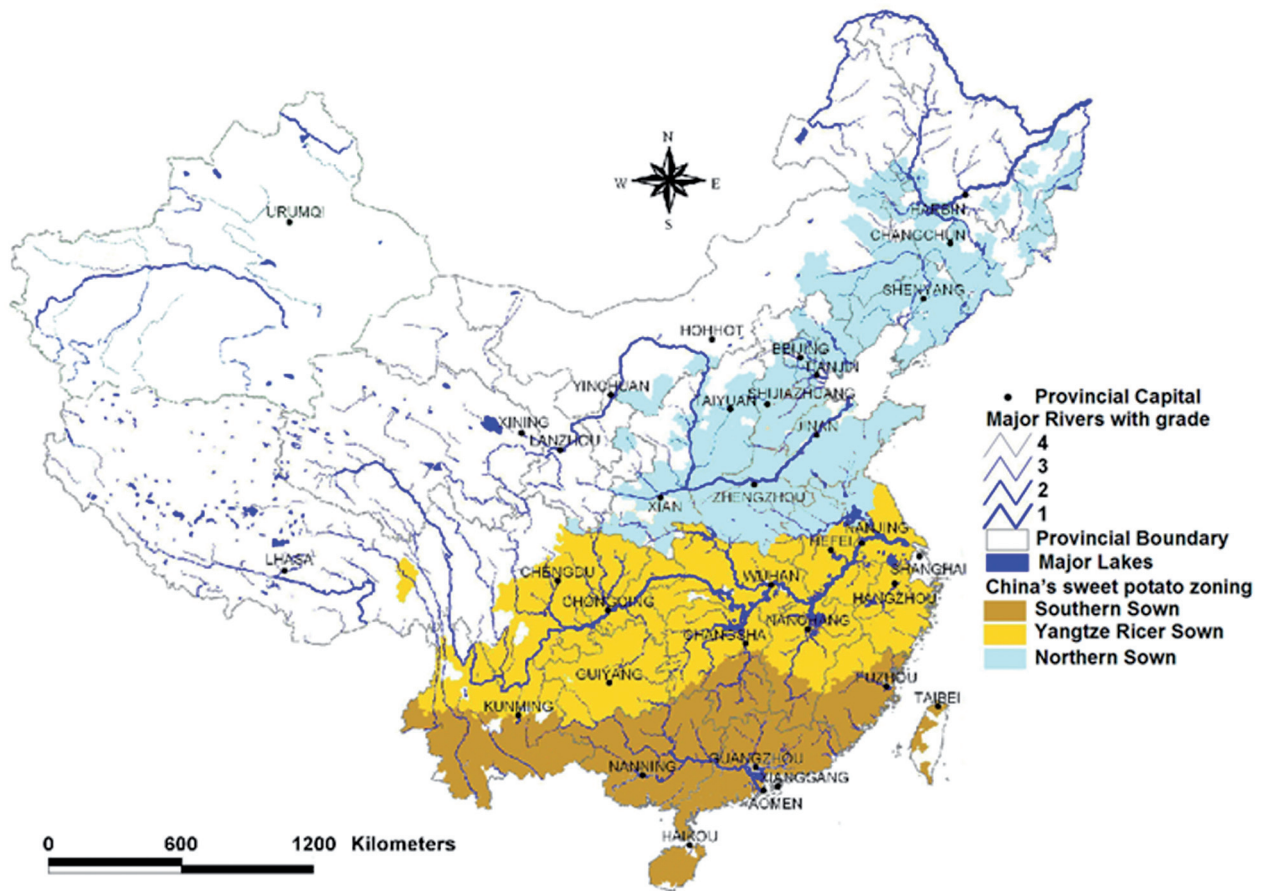
The viruses tested in this survey were sweetpotato feathery mottle virus (SPFMV), sweetpotato virus G (SPVG), sweetpotato latent virus (SPLV), sweetpotato mild speckling virus (SPMSV), sweetpotato mild mottle virus (SPMMV), sweetpotato chlorotic stunt virus (SPCSV), sweetpotato chlorotic fleck virus (SPCFV), sweetpotato C-6 virus (SPC-6), sweetpotato caulimo-like virus (SPCaLV) and cucumber mosaic virus (CMV). The assays were performed using NCM-ELISA (Nitrocellulose Membrane Enzyme-Linked ImmunoSorbent Assay) kits provided by CIP and following the instructions of the kits.

Distribution of sweetpotato viruses in 3 major planting regions in China

With the exception of SPC-6, all the viruses surveyed were found in all 3 major sweetpotato zonings with vary-

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Abbreviations: CMV = cucumber mosaic virus; SPC-6 = sweetpotato C-6 virus; SPCaLV = sweetpotato caulimo-like virus; SPCFV = sweetpotato chlorotic fleck virus; SPCSV = sweetpotato chlorotic stunt virus; SPFMV = sweet potato feathery mottle virus; SPLV = sweetpotato latent virus; SPMMV = sweetpotato mild mottle virus; SPMSV = sweetpotato mild speckling virus; SPVG = sweetpotato virus G



ing degrees of incidence (Table 1). Overall, sweetpotato viral diseases in the Southern region were more severe than those in the Yangtze River region, which were in turn more severe than in the Northern region. In the Northern and the Yangtze River region, the most frequently detected virus was SPMSV, with the average rate of incidence of 55% and 81%, respectively. The most frequently found virus in the Southern region was SPVG, averaging at 46%. SPFMV was the second most frequently found virus in all three zonings, with an average incidence of 25%, 38%, and 36% in the Northern, Yangtze River and Southern region, respectively. Compared to the 1989 survey, four more viruses, SPVG, SPCSV, SPCaLV, and CMV, were tested in the present survey. SPVG was not only the most frequently found virus in the Southern region, but also a relatively common viral disease in the Northern and Yangtze River region, with an average rate of incidence of 20% and 31%, respectively. On the other hand, SPCSV was not as serious: with the exception of Hebei province, its incidences in other provinces were 0–22%.

The occurrence and changes of sweetpotato viral diseases during last 20 years

A survey of sweetpotato viral diseases in major planting areas in China was carried out by CIP in 1989 (Li *et al.*, 1990). In the past 20 years, a number of surveys at provincial level were initiated to investigate local disease situations (Yang, *et al.*, 1990). The CNSIC also tested viral diseases in preserved sweetpotato germplasms (Xing, *et al.*, 1998). But the present survey was the first to test 10 major viruses in 30 counties of 11 provinces. Comparing the present results in four provinces with the results of the 1989 survey, the incidence of all viral diseases tested increased (Table 2). SPMV, which was not found in 1989, was detected in the present survey, although at low incidence. In Jiangsu province, the rate of SPCaLV was increased from 0% in 1989 to 40.94% in 2008. Due to the lack of regulation in introducing new varieties, new viral diseases were brought in and spread rapidly. On the other hand, thanks to the efforts of the CNSIC in viral disease control and using virus-free seeds in the past 15

Table 1. Frequencies of sweetpotato viral diseases in major Chinese planting regions

Planting region	Province	Sample number	Positive detection rate of sweetpotato virus (%)									
			SPFMV	SPVG	SPLV	SPMSV	SPMMV	SPCSV	SPCFV	SPC-6	SPCaLV	CMV
Northern planting region	Hebei	100×10	44	39	16	18	5	67	26	0	0	18
	Shandong	100×10	39	60	7	18	0	13	17	0	0	11
	Henan	96×10	5	2	1	68	0	3	1	0	15	1
	Anhui	134×10	24	0	3	94	0	0	47	0	-	0
	Jiangsu	149×10	11	0	7	75	0	6	12	0	41	4
	Average		25	20	7	55	1	18	21	0	14	7
MURYR*	Sichuan	100×10	46	31	15	82	2	1	25	0	3	0
	Chongqing	100×10	36	30	8	84	4	14	14	0	5	7
	Bebei	100×10	33	33	13	78	4	3	28	0	3	3
	Average		38	31	12	81	3	6	22	0	4	3
Southern planting region	Guangdong	96×10	45	54	13	3	0	0	25	0	0	0
	Fujian	96×10	55	71	26	31	0	23	54	0	-	17
	Hainan	60×10	8	13	3	7	0	8	20	0	17	5
	Average		36	46	14	14	0	10	33	0	9	7

MURYR, the Middle and Upper Reach of Yangtze River region.

Table 2. Comparison of sweetpotato viral diseases survey results between 1989 and 2008 in 4 Chinese provinces

Province	Sample number		Positive detection rate of sweetpotato virus (%)									
			SPFMV		SPMMV		SPLV		SPCFV		SPCaLV	
	1989	2008	1989	2008	1989	2008	1989	2008	1989	2008	1989	2008
Jiangsu	138×5	149×10	12	11	0	0	9	7	8	12	0	41
Hebei	77×5	100×10	30	44	0	5	19	16	0	26	0	0
Sichuan	99×5	100×10	4	46	0	2	0	15	0	25	2	3
Shandong	100×5	100×10	15	39	0	0	2	7	4	17	0	0
Average			15	35	0	2	8	11	3	20	1	11

years, the once severe SPFMV disease was now under effective control.

In this survey, the main symptoms of the viral diseases could be divided into four types, mottle spotted leaves, misshaped leaves, withered and necrotized leaves, and leaves with changed color. The main types of viruses were SPMSV, SPVG, SPFMV and SPCaLV. The symptoms of the infected plants were related to the genotypes of the sweetpotato varieties, the growth environment and the viral clones. Different sweetpotato varieties infected by the same viral species often displayed different symptoms. The ELISA results indicated that two or more viruses could be detected in many sweetpotato samples. As many as 7 viral species were detected in a single sample, making it a more challenging task to combat the viral diseases.

In this work, the viruses were detected by ELISA. While simple and easy to perform, the broader use of this method is limited by the availability and affinity of current antisera. All ten antiviral sera used in this work were provided by CIP. Other

viruses could not be detected and confirmed as no antisera were available. Therefore, developing new sweetpotato virus antisera is an important task in promoting research on sweetpotato viral diseases and extending the use of virus-free seed plants.

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