

甘蔗新品种及主栽品种对褐条病的抗性评价

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Evaluation of resistance to brown stripe disease in new and main cultivated sugarcane varieties WANG Xiao-yan[#], LI Jie[#], YANG Kun, SHAN Hong-li^{*}, ZHANG Rong-yue, WANG Chang-mi, CANG Xiao-yan, YIN Jiong, LUO Zhi-ming, LI Wen-feng, HUANG Ying-kun^{*}
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Abstract: In 2016-2019, sixty new varieties and 31 main cultivated varieties were evaluated for their resistance to sugarcane brown stripe disease under field condition. The results showed that 32 (53.33%) of 60 new sugarcane varieties were highly to moderately resistant, and 28 (46.67%) were susceptible to highly susceptible. Twenty-one (67.74%) of 31 main cultivated sugarcane varieties were highly to moderately resistant, and ten (32.26%) were susceptible to highly susceptible. This work may facilitate brown stripe resistance breeding and provide new elite resistant varieties for effectively control of sugarcane brown stripe.

Key words: sugarcane; new and main cultivated varieties; brown stripe disease; natural resistance

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褐条病是为害甘蔗叶部的重要真菌病害, 严重发病田块, 一眼望去似“火烧状”, 一般减产 18% ~ 35%, 蔗糖分降低 15% ~ 30%^[1]。该病于 1924 年在古巴首次发现^[2], 至今已有 20 多个国家报道发生此病, 常造成不同程度经济损失^[3]。在中国, 尤其近年, 感病品种加上多雨高湿导致褐条病在云南及广西等主产蔗区大面积暴发流行, 减产减糖严重^[1]。

选育种植抗病品种是防治甘蔗褐条病最经济、有效的措施^[1]。近年来, 在国家糖料体系支持下, 已培育出一批优良新品种, 但迄今未对这些新品种及主栽品种进行褐条病抗性评价, 因此, 本研究结

合甘蔗新品种区域化试验和蔗区病情调查, 于 2016~2019 年对我国近年选育的 60 个新品种及 31 个主栽品种进行自然抗性评价, 以期明确各品种对褐条病的抗性水平, 为生产用种选择提供科学依据和优良抗源种质。

1 材料与方法

1.1 供试材料

供试材料为近年选育的 60 个甘蔗新品种(表 1)和云南、广西蔗区 31 个主栽品种(表 2), 区试对照品种‘ROC 22’, 抗病对照‘ROC 10’, 感病对照

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‘ROC 25’。

1.2 新品种田间发病调查与抗性评价

60 个新品种于 2016~2017 年和 2018~2019 年分 2 批种植在云南开远和临沧区域化试验站,采用随机区组排列,3 次重复,每小区长 6 m 和宽 5 m,每小区 5 行,行距 1 m,小区面积 30 m²。为保证最大限度侵染,高感品种‘ROC 25’在试验田周围和每隔 2 个供试材料即种植 2 行。

每年 10~11 月,感病对照‘ROC 25’充分发病时调查各供试材料 1 年新植和 1 年宿根发病情况。各供试材料选定中间 3 行连续调查 100 株有效蔗株的发病情况,3 次重复共调查 300 株,目测完全展开的全部叶片感病状况及侵染面积百分比。按 1~6 级分级标准^[4]进行自然抗性评价,其中,叶片无病斑为 1 级高抗,病斑占叶面积<10%为 2 级抗病,病斑占叶面积 11%~25%为 3 级中抗,病斑占叶面积 26%~40%为 4 级中感,病斑占叶面积 41%~65%为 5 级感病,病斑占叶面积 66%~100%为 6 级高感。

1.3 主栽品种田间发病调查与抗性评价

2017~2019 年,每年 10~11 月,感病对照‘ROC 25’充分发病时,对云南临沧、普洱、玉溪和广西宜州蔗区代表性主栽品种新植蔗和宿根蔗发病情况进行调查。选择代表性田块采用 3 点取样,每点连续调查 100 株有效蔗株的发病情况,3 点共调查 300 株,目测完全展开的全部叶片感病状况及侵染面积百分率。按 1.2 的方法进行自然抗性评价。

2 结果与分析

2.1 新品种抗病性

田间调查结果表明,无论是新植还是宿根栽培,在云南开远和临沧 2 个试验点,抗病对照‘ROC 10’均表现高抗,感病对照‘ROC 25’均表现高感;60 份供试品种在 2 个试验点的抗性表现也基本一致,高抗至中抗的有 32 份,占 53.33%;中感到高感的有 28 份,占 46.67%(表 1)。

2.2 主栽品种抗病性

从表 2 可见,无论是新植还是宿根栽培,31 个主栽品种在不同蔗区的抗性表现基本相同,高抗至中抗的有 21 个,占 67.74%;中感到高感的有 10 个,占 32.26%。

3 讨论

我国甘蔗主栽区位于热带亚热带,多雨高湿及感病品种大面积种植极易导致褐条病暴发成灾。不同甘蔗品种对褐条病抗性不一,防治甘蔗褐条病最为经济有效的措施是选种抗病品种^[1,5]。研究结果显示主栽品种‘ROC 25’、‘粤糖 93-159’、‘云引 3 号’、‘桂糖 11’、‘桂糖 42’等高度感病,而近年选育的‘粤甘 48’、‘福农 09-2201’、‘福农 10-14405’、‘闽糖 12-1404’、‘桂糖 44 号’、‘桂糖 11-1076’、‘柳城 09-15’、‘中蔗 13 号’、‘云蔗 08-1095’、‘云蔗 08-1609’、‘云蔗 11-1204’、‘德蔗 07-36’等新品种高度抗病,建议生产上合理使用这些抗病品种,加大淘汰感病品种控制褐条病流行成灾。此外,可利用云南丰富的野生甘蔗资源^[5],建立抗病种质基因库,挖掘优良抗病基因,为选育抗病甘蔗品种提供抗源种质^[6]。

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Table 1 Evaluation of resistance to brown stripe in new sugarcane varieties

Comprehensive resistance response	Source	Varieties	Kaiyuan				Lincang			
			Newly planted		Ratoon		Newly planted		Ratoon	
			Grade	Resistance response	Grade	Resistance response	Grade	Resistance response	Grade	Resistance response
HR	Guangdong	Yuegan 48	1	HR	1	HR	1	HR	1	HR
R		Yuegan 47	2	R	2	R	2	R	2	R
		Yuegan 51	2		2		2		2	
MR		Yuegan 53	3	MR	3	MR	3	MR	3	MR
MS		Yuegan 46	4	MS	4	MS	4	MS	4	MS
		Yuegan 52	4		4		4		4	
S		Yuegan 49	5	S	5	S	5	S	5	S
HS		Yuegan 43	6	HS	6	HS	6	HS	6	HS
		Yuegan 50	6		6		6		6	
HR	Fujian	Funong 09-2201	1	HR	1	HR	1	HR	1	HR
		Funong 10-14405	1		1		1		1	
		Mintang 12-1404	1		1		1		1	
R		Funong 09-7111	2	R	2	R	2	R	2	R
MR		Funong 07-3206	3	MR	3	MR	3	MR	3	MR
MS		Funong 10-0574	4	MS	4	MS	4	MS	4	MS
S		Funong 11-2907	5	S	5	S	5	S	5	S
		Mintang 06-1405	5		5		5		5	
		Mintang 07-2005	5		5		5		5	
HS		Funong 08-3214	6	HS	6	HS	6	HS	6	HS
		Funong 09-4095	6		6		6		6	
		Funong 09-6201	6		6		6		6	
		Funong 09-12206	6		6		6		6	
		Mintang 11-610	6		6		6		6	

Table 1 Evaluation of resistance to brown stripe in new sugarcane varieties (Continued)

Comprehensive resistance response	Source	Varieties	Kaiyuan				Lincang			
			Newly planted		Ratoon		Newly planted		Ratoon	
			Grade	Resistance response	Grade	Resistance response	Grade	Resistance response	Grade	Resistance response
HR	Guangxi	Guitang 44	1	HR	1	HR	1	HR	1	HR
		Guitang 11-1076	1		1		1		1	
		Liucheng 09-15	1		1		1		1	
		Zhongzhe 13	1		1		1		1	
R		Guitang 06-1492	2	R	2	R	2	R	2	R
		Guitang 08-1180	2		2		2		2	
		Guitang 13-386	2		2		2		2	
		Liucheng 07-150	2		2		2		2	
MR		Liucheng 09-19	2		2		2		2	
		Guitang 06-2081	3	MR	3	MR	3	MR	3	MR
		Guitang 08-1589	3		3		3		3	
		Zhongzhe 10	3		3		3		3	
MS		Zhongzhe 1	4	MS	4	MS	4	MS	4	MS
		Zhongzhe 6	4		4		4		4	
		Guitang 08-1533	5	S	5	S	5	S	5	S
HS		Guitang 40	6	HS	6	HS	6	HS	6	HS
		Guitang 08-120	6		6		6		6	
		Liucheng 07-506	6		6		6		6	
HR	Yunnan	Yunzhe 08-1095	1	HR	1	HR	1	HR	1	HR
		Yunzhe 08-1609	1		1		1		1	
		Yunzhe 11-1204	1		1		1		1	
		Dezhe 07-36	1		1		1		1	

Table 1 Evaluation of resistance to brown stripe in new sugarcane varieties (Continued)

Comprehensive resistance response	Source	Varieties	Kaiyuan				Lincang			
			Newly planted		Ratoon		Newly planted		Ratoon	
			Grade	Resistance response	Grade	Resistance response	Grade	Resistance response	Grade	Resistance response
R		Yunzhe 09-1601	2	R	2	R	2	R	2	R
		Yunzhe 11-1074	2		2		2		2	
		Yunzhe 11-3208	2		2		2		2	
MR		Yunrui 12-263	3	MR	3	MR	3	MR	3	MR
		Dezhe 09-73	3		3		3		3	
MS		Yunrui 10-701	4	MS	4	MS	4	MS	4	MS
S		Yunzhe 11-3898	5	S	5	S	5	S	5	S
		Yunrui 11-450	5		5		5		5	
HS		Yunrui 10-187	6	HS	6	HS	6	HS	6	HS
		Dezhe 12-83	6		6		6		6	
R	Hainan	Zhontang 1201	2	R	2	R	2	R	2	R
MR		Zhontang 1301	3	MR	3	MR	3	MR	3	MR
MS		Haizhe 28	4	MS	4	MS	4	MS	4	MS
S		Haizhe 22	5	S	5	S	5	S	5	S
		Zhontang 1202	5		5		5		5	
HR	Taiwan	ROC 10	1	HR	1	HR	1	HR	1	HR
		(Resistant control)								
R		ROC 22	2	R	2	R	2	R	2	R
HS		ROC25	6	HS	6	HS	6	HS	6	HS
		(Susceptible control)								

HR: Highly resistant; R: Resistant; MR: Moderately resistant; S: Susceptible; HS: Highly susceptible.

Table 2 Evaluation of resistance to brown stripe in main sugarcane varieties

Comprehensive Resistance response	Sugarcane fields	Varieties	Newly planted		Newly planted	
			Grade	Resistance response	Grade	Resistance response
HR	Lincang , Yunnan	Yuetang 83-88	1	HR	1	HR
		Chuantang 61-408	1		1	
		Yunzhe 05-51	1		1	
R		ROC 22	2	R	2	R
		Yingyu 91-59	2		2	
		Liucheng 03-182	2		2	
MR		Liucheng 05-136	2		2	
		Yuetang 86-368	3	MR	3	MR
		Yuetang 60	3		3	
MS	Yuetang 79-177	3		3		
	ROC 20	4	MS	4	MS	
	Yuetang 00-236	4		4		
S		Liucheng 03-1137	5	S	5	S
HS		ROC 25	6	HS	6	HS
		Yuetang 93-159	6		6	
HR	Puer , Yunnan	ROC 10	1	HR	1	HR
		Yunzhe 03-258	1		1	
		Yunzhe 05-51	1		1	
		Guitang 21	1		1	
R		ROC 22	2	R	2	R
		Yunzhe 05-49	2		2	
		Yunyin 10	2		2	
		Chuantang 79-15	2		2	
MR		ROC 16	3	MR	3	MR
	Yuetang 86-368	3		3		
	Yuetang 60	3		3		
	Dezhe 03-83	3		3		
MS	ROC 20	4	MS	4	MS	
	Yuetang 00-236	4		4		
HS		Yuetang 93-159	6	HS	6	HS
HR	Yuxi , Yunnan	ROC 1	1	HR	1	HR
		ROC 10	1		1	
		Yunzhe 05-51	1		1	
R		ROC 22	2	R	2	R
MR		ROC 16	3	MR	3	MR
MS		Yuetang 00-236	4	MS	4	MS
S		Mintang 69-421	5	S	5	S
HS		Yuetang 93-159	6	HS	6	HS
		Yunyin 3	6		6	
	Guitang 11	6		6		

Table 2 Evaluation of resistance to brown stripe in main sugarcane varieties (Continued)

Comprehensive Resistance response	Sugarcane fields	Varieties	Newly planted		Newly planted	
			Grade	Resistance response	Grade	Resistance response
HR	Yizhou, Guangxi	Guitang 21	1	HR	1	HR
		Guitang 44	1		1	
R		ROC 22	2	R	2	R
		Guitang 36	2		2	
		Liucheng 05-136	2		2	
MR		ROC 16	3	MR	3	MR
MS		ROC 20	4	MS	4	MS
S		Guitang 29	5	S	5	S
		Liucheng 03-1137	5		5	
HS		Guitang 42	6	HS	6	HS
HS	Susceptible control	ROC 25	6	HS	6	HS
HR	Resistant control	ROC 10	1	HR	1	HR

HR: Highly resistant; R: Resistant; MR: Moderately resistant; S: Susceptible; HS: Highly susceptible.

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