Field resistance evaluation of rapeseed varieties to club root disease caused by *Plasmodiophora brassicae* in southwestern China

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Introduction

- Clubroot disease is an important disease of rapeseed caused by *Plasmodiophora brassicae,* Clubroot disease coverage 900hm^2 in serious occurrence year and yield loss reach 20% ~ 30 to more than 60% in China .
- Resistant varieties are the most effective measures to control clubroot disease,but the resistance will be loss due to the physiological race multiple and mixed.
- The terrain and rapeseed varieties in southwestern China is complex and diverse, field resistance of rapeseed to clubroot disease is unclear.

Objectives

Field resistance evaluation of rapeseed varieties to clubroot disease caused by *Plasmodiophora brassicae* in southwestern China based on identification of *Plasmodiophora brassicae* physiological race in nurseries so that distribute varieties reasonable and reduce losses of clubroot.

Experimental

The materials: 80 rapeseed varieties of major varieties in south-western China were evaluated resistance to clubroot disease in Guanghan, Dayi and Anxian, and 22 of which were evaluated for 3 consecutive years in Anxian.

Identification of physiological race of *Plasmodiophora brassicae* : *P. brassicae* resting spores were prepared from root galls and extracted DNA, then subjected to PCR analysis with pathotype-specific gene(s).

Identification of resistance to clubroot disease: (1)Natural disease nursery ;(2) Rapeseed seeded and keep the field soil moist;(3) Investigate the incidence of clubroot disease after 60 days.

Statistic Analysis: Disease index was calculated , stipulated the relative disease index of the control variety was 50, and the correction coefficient was obtained by comparing with the actual disease index, then calculated the relative disease index(R_{DI}) of the tested varieties. Statistic analysis for these experiments was done using the EXCEL program.

Rusults

- The *Plasmodiophora brassicae* from three areas belonged to pathotype 4 with genetic differentiation.
- There was no rapeseed immunity to clubroot and the rapeseed accounted for 88.75%, 83.75% and 87.50% respectively in Anxian, Dayi and Guanghan susceptible, including 55 rapeseeds susceptible in three disease nursery and explained these rapeseeds planted unsuitable in the area where the physiological races were pathotype 4. Zheyou 50 and You guanguan planted suitable in Anxian,Huang jinjia,Jin you88,You yan No.9,Zhong duyou998 and Yu huangyou No.4 planted suitable in Dayi,Zhi yuanyou planted suitable in Guanghan.
- The resistance stability of rapeseed was different. Clubroot resistance of Mian fengyou No.5 and De mengyou No.1 showed a trend of loss and Feng youjing and Gao you No.48 unstable , the resistance of Ai jiazao loss completely,these rapeseeds cloud not plant in test area.

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Fig1. The PCR map of *Plasmodiophora brassicae* physiological race M means DNA marker, ck means water contrast,No1 to 6 means the sources of *Plasmodiophora brassicae,* Sichuan, Pixian, Kangding, Guanghan, Dayi, Anxian and Xiandu in turn.

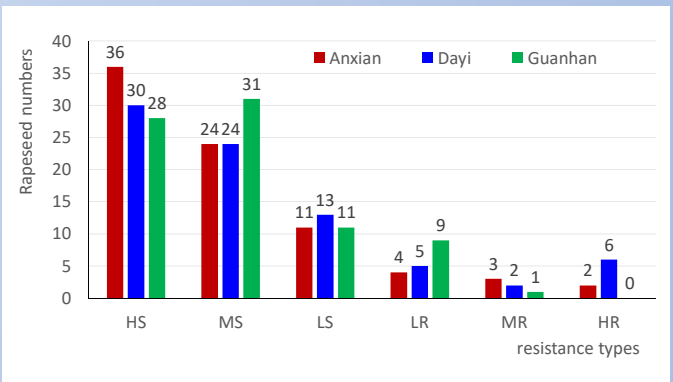

Fig2 The different resistance types of rapeseed in different areas

Tab1 Compare disease-resistance of rapeseed to clubroot in different years

Years	2015		2016		2017	
Varieties	R_{DI}	Resistant grade	R_{DI}	Resistant grade	R_{DI}	Resistant grade
Huang jin jia	68.07	HS	50.14	HS	50.78	HS
Mian feng you No.5	16.67	LR	47.06	MS	42.22	MS
Feng you jing	36.12	MS	5.4	MR	53.23	HS
You yan No.10	34.73	MS	21.6	LS	44.66	MS
Lu you za No.1	23.62	LS	60.94	HS	51.83	HS
Zhong du you No.998	43.07	HS	12.34	LS	46.06	MS
De ming you No.1	15.28	LR	34.71	MS	45.89	MS
Jia you No.50	56.96	HS	28.54	LS	45.89	MS
De ming you No.100	20.84	LS	43.2	MS	36.1	MS
Zhi yuan you No.8	45.84	MS	37.95	MS	53.84	HS
De duo you No.528	65.29	HS	30.86	MS	50.78	HS
Gao you No.48	34.73	MS	14.66	LR	48.95	MS
Shulong you No.2	36.12	MS	57.55	HS	42.92	MS
Yellow rape	100	HS	67.63	HS	56.9	HS
Ai gan zao	59.74	HS	43.20	MS	38.55	MS
Feng you No.10	80.58	HS	62.49	HS	37.32	MS
Ke yuan you No.1	43.07	MS	53.23	HS	29.37	LS
Ai jia zao	8.34	MR	17.90	LR	36.1	MS
De you No.5	31.95	MS	79.15	HS	42.74	MS
Ban jin you	33.34	MS	59.86	HS	48.34	MS
Zhong Shuang No.7	91.69	HS	33.43	MS	45.89	MS
De duo you No.5	100	HS	55.39	HS	53.23	HS