Indian J. Genet., 67(4): 334-336 (2007)

Inheritance of resistance to Fusarium wilt [*Fusarium pallidoroseum* (Cooke) Sacc.] in chilli (*Capsicum annuum* L.)

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(Received: September 2007; Revised: November 2007; Accepted: November 2007)

Abstract

The present study was undertaken to investigate the inheritance pattern of resistance to *Fusarium* wilt. Arka Lohit which showed resistance to *Fusarium* wilt under field conditions as well as artificial epiphytotics was crossed to susceptible but well adapted and high yielding parental lines like Kashmir Long-1 (having moderate to susceptible reaction), SH-C-101 and Local Pampori (both showing highly susceptible reaction to the disease). Resistance to *Fusarium* wilt was inherited as a monogenic dominant trait.

Key words: Chilli, *Fusarium pallidoroseum*, gene action, inheritance, resistance

Introduction

In Kashmir, wilt of chilli caused by *Fusarium pallidoroseum* (Cooke) Sacc. is the principal disease of chilli crop and has assumed a serious proportion during the last few years and is causing a great concern to vegetable and seed growers. Average losses due to this disease are upto 30 to 40 per cent and in some fields it was so serious that every plant was killed by wilt before first picking [1]. Being soil borne the control of this disease by chemical methods is very difficult without adverse effects on the physico-chemical and biological properties of soil, it is imperative to develop cultivars with inbuilt resistance to this disease. Since the disease has threatened cultivation of chilli crop in Kashmir, preliminary work to find resistant sources of this disease was initiated about a decade ago [2, 3]. The varieties identified as resistant to a particular pathogen may not necessarily have other desirable traits and thus, may not be directly introduced for wide scale cultivation but can be used as donors for resistant genes under breeding programme. However, before undertaking such breeding programme it becomes imperative to study genetics of resistance of both the pathogens and the varieties. Therefore the present study was undertaken to investigate the inheritance pattern of resistance to *Fusarium* wilt in order to devise appropriate breeding strategies for its transfer to the potential high yielding chilli lines.

Materials and methods

For studying the genetics of resistance, a resistant parent having zero per cent disease infection, namely Arka Lohit was selected after screening both under field and artificial epiphytotic conditions and subsequently crossed to susceptible but well adapted and high yielding parental lines like Kashmir Long-1 (having moderate to susceptible reaction), SH-C-101 and Local Pampori (both showing highly susceptible reaction to the disease) in the year 2004. The F_1's produced during 2004 were planted in Kharif 2005 to produce F_2's along with the parents to produce back cross generations (BC_1 and BC_2). During kharif 2006, the causal pathogen was isolated from the diseased chilli samples, after surface sterilization and were aseptically transferred to potato dextrose agar (PDA) medium in Petri-plates/slants and incubated at 25 ± 2°C for 7 days. The isolates were purified by single spore and hyphal tip isolation methods. The pathogen, was identified with the help of descriptions [4], their morphological/cultural characteristics and Koch's postulates were studied. The culture was maintained by periodical sub-culturing on freshly prepared PDA slants and stored at 4°C. The fungus was mass cultured in sand maize meal medium. The medium was prepared by autoclaving one part of maize meal with 4 parts of sand and 1 part of water in 250 ml. Erlenmeyer flasks at 1.05 kg cm^{-2} pressure for half an hour .The medium was inoculated, with the fungus, the flasks were incubated for three weeks at 25 ± 2°C, shaking the flasks every day to get uniform master

culture of the fungus. Earthen pots of 22.5 cm diameter were filled with sterilized and autoclaved soil and the inoculum was mixed thoroughly with the top layer at the rate of one master culture flask per pot. Inoculated pots were placed under controlled conditions for 07 days for development of fungus to make the soil sick. Six week old apparently healthy seedlings of six generations were transplanted in those pots after thoroughly washing of roots. 10 plants of P_1, P_2 and F_1; 100 plants from F_2 and 60 plants each from BC_1 and BC_2 were transplanted in the pots containing inoculated soil. The pots were then placed in growth chamber for disease development.

Each generation was planted over three replications and plants were screened for resistant and susceptible reaction at four days interval regularly till resistant plants reached maturity. Periodical watering was done to provide requisite moisture for plant and pathogen growth. In order to make sure that infection does take place and there is no disease escape, a second inoculation was made after two weeks of transplanting by pouring water suspension containing spores and mycelium around root zone with the help of pipette (15 ml) as suggested earlier [5].

Results and discussions

Fusarium wilt development is affected by day length, light intensity, temperature and soil moisture. For consistent results to avoid any escapes that confound genetic ratios, all environmental factors that favour disease development were provided as far as possible. Both dip method and foliar application of the spore suspension of Fusarium wilt pathogen was applied to all the individual plants of six generations and data on wilt incidence was recorded. The symptoms developed in nearly 7 days after inoculation but were more pronounced after 10-14 days. The data recorded on three different crosses namely Arka Lohit x Kashmir Long-1, Arka Lohit x SH-C-101 and Arka Lohit x Pampori (Table 1) indicated that resistant parent Arka Lohit used in all the three crosses showed 100 per cent resistance both under natural and under artificial epiphytotic conditions whereas the susceptible parents namely Kashmir Long-1, SH-C-101 and Local Pampori showed 75.00,100.00 and 90.00 percent wilt incidence respectively. Further it was observed that symptoms in Local Pampori appeared from 5th day to 10th day of inoculation while in Kashmir Long-1 the symptoms appeared late starting from 14th to 25th day of inoculation. In SH-C-101 the symptoms appeared from 8th to 14th days of inoculation. In all the three crosses the F_1 progenies were as resistant as Arka Lohit indicating dominance of wilt resistant genes. F_2 progenies segregated into 232 resistant and 68 susceptible plants in the cross Arka Lohit x Kashmir Long-1; 222 : 78 in the cross Arka Lohit x SH-C-101 and 230 : 70 in the cross Arka Lohit x Pampori fitting into the ratio of 3:1 indicating a single dominant gene

Table1. Segregation pattern of resistance to *Fusarium pallidoroseum* (Cooke) Sacc. in progeny of cross between resistant line Arka Lohit (AL) and susceptible inbred cultivar Kashmir Long-1, Pampori, SH-C-11

Cross	F_1	F_2		BC_1		BC_2	
		Resistant	Susceptible	Resistant	Susceptible	Resistant	Susceptible
Arka Lohit x Kashmiri Long-1	Resistant	232	68	120	0	10	78
χ^2		0.87		-		3.2	
P		0.35		-		0.07.	
Arka Lohit x SH-C-101	Resistant	230	70	120	0	100	80
χ^2		0.44		-		2.22	
P		0.50		-		0.13	
Arka Lohit x Pampori	*Resistant*	*222*	*78*	*120*	*0*	*99*	*81*
χ^2		0.16		-		1.8	
P		0.06		-		0.17	

Assuming single dominant gene for resistance c^2 and p indicated the non-significance of the deviation of observed from expected.

responsible for resistance. All 120 plants in BC_1 cross were resistant when F_1 back crossed to Arka Lohit (resistant parent), while in BC_2 a segregation ratio of 1 resistant : 1 susceptible was recorded when F_1 was back crossed to the susceptible parents with number of plants segregating into102 : 78, 99 : 81 and 100 : 80 in the BC_2 of Arka Lohit x Kashmir Long-1; Arka Lohit x SH-C-101 and Arka Lohit x Pampori respectively, confirming further the monogenic dominant inheritance of resistance to *Fusarium pallidoroseum* (Cooke) Sacc.

The studies on inheritance of resistance from three crosses indicated that the resistance to *Fusarium pallidoroseum* (Cooke) Saccardo is conditioned by a single dominant gene.The inheritance pattern in all the three crosses clearly showed that resistance was governed by single dominant gene However, Salgodo *et al.* [6] reported complex pattern in which recessive gene controlled the resistance in common bean to pathogenic race of *Fusarium oxysporum* phaseoli, Breeding F_1 hybrid chilli with resistance to *Fusarium palldoroseum* (Cooke.) Sacc. could be accomplished even if either of the two parents of hybrid is resistant to disease or resistant segregants having desirable yield and quality traits can be isolated from segregating generations and carried forward in subsequent generations to develop true breeding resistant lines. Incorporation of gene for resistance into high yielding and locally adopted commercial cultivars (Kashmir Long-1; SH-C-101 and Pampori) would expand cultivation of this commercial crop which otherwise is threatened by the disease occurrence

Reference

1. **Najar A. G., Mushtaq Ahmed, Bhat M. S. and Bhat Z. Z.** 2006. Effect of various soil amendments on chilli wilt (*Fusarium pallidorosenm* (Cooke) Sacc.). SKUAST J. Research, **8**: 236-239.
2. **Ahmed N., Tanki M. I. and Mir N. M.** 1994. Screening of advance breeding lines of chilli, sweet and hot pepper cultivars against Fusarium wilt. Plant Disease Res., **9**: 153-154.
3. **Nayeema J., Ahmed N., Tanki M. I. and Dar G. M.** 1995. Screening of hot pepper germplasm for resistance to Fusarium wilt [*Fusarium pallidorosenm* (Cooke) Sacc.]. Capsicum and Eggplant Newsletter, **14**: 68-71.
4. **Brayford D.** 1993. The identification of Fusarium species. Integrated Mycological Institute, Kew Surrey, England, p. 27.
5. **Mishra B. K. and Baris C.** 1987. Studies on seedling blight and root rot of barley caused by *Sclerotum rolfsii*. Indian Phytopathology, **40**: 161-167.
6. **Salgado M. O., Schwartz H. F. and Brich M. A.** 1995. Inheritance to a Calorado race of *Fusarium oxysporium* f.sp.phaseoli in common bean. Plant Disease, **79**: 279-281.