Indian J. Genet., **66**(1): 19-21 (2006)

Gene effects for resistance to thrips and mites in chilli (*Capsicum annuum* L.)

R. C. Jagadeesha[1] and M. C. Wali

Department of Genetics and Plant Breeding, K.R.C. College of Horticulture, Arabhavi 519 310

(Received: May 2005; Revised: January 2006; Accepted: January 2006)

Abstract

Thrips and mite cause leaf curl complex of chilli (*Capsicum annuum* L.) resulting in extensive damage to yield. Information on nature of gene effects of these pest is limited. Nine crosses involving six parents having varied level of resistance were studied in a six generation mean anlysis. Leaf curl index (LCI) for thrips was found to be predominantely under the control of non additive gene action with duplicate type of gene interaction. Whereas, non additive gene interaction was observed for LCI mites. Recurrent selection followed by pedigree breeding or population improvement approach are suggested to develop resistant varieties.

Key words: Chilli, gene effects, leaf curl index, thrips, mites

Introduction

Leaf curl complex of chilli (*Capsicum annuum* L.) is caused by thrips *Scirtothrips dorsalis* and mites *Polyphagotarsenomous latus* banks are important sucking pest. Thrips are known as a vector for the transmission of viruses. The extent of yield losses due to leaf curl complex ranged from 25-80 percent [1].

Development of disease resistant cultivars will probably be the most effective strategy to control these pests. To date the information available about genetic control of these pests is very limited. Therefore, the present study was initiated to investigate the nature of gene effects on a set of nine crosses involving six varieties to asses the gene effects for thrips and mites. For evaluating resistance in plants two highly susceptible local premier cultivars *viz.*, Byadagi Kaddi and Byadagi dabbi were crossed with moderately resistant cultivars like Pusa Jwala, GPC-82 and Arka Lohit. Tolerance to chilli genotypes have been reported by other workers [2-4].

Material and methods

Six chilli varieties were selected to represent various degrees of resistant to thrips and mites. Two local premier varieties Byadagi kaddi and Byadagi dabbi are having high fruit quality standards like high colour, low pungency, wrinkleness on dry fruit, good aroma and they are susceptible to thrips and mites. Another chilli line VN-2 is maintained at Genetics and Plant Breeding department at Agriculture college Dharwad. These are crossed with moderately resistant varieties *viz.*, Pusa Jwala (IARI, New Delhi), GPC-82 (UAS, Dharwad), Arka Lohit (IIHR, Bangalore). The experiment comprised of six generations P_1, P_2, F_1, F_2, BC_1 and BC_2 were evaluated for thrips and mites at Agricultural Research Station Hanumanamatti, district Haveri of Karnataka State under field conditions during *kharif* season of 1998. The experimental material was sown in a completely randomized block design with replicated thrice each having 20 plants in parents and F_1 while in F_2 having 200 and 40 plants each in BC_1 and BC_2. All the plants were scored for pest attack under field condition and the percent disease intensity was obtained by using the formula:

$$LCI = \frac{\text{frequency} \times \text{grade point} \times 100}{\text{Number of plant stand} \times \text{maximum grade}}$$

Where, LCI is the leaf curl index

Angular transformed values were used for analysis to obtain the information on nature of gene action governing and was estimated as per the equation given by Hayman [5].

Results and discussion

It is evident from the studies (Table 1) the Byadagi Kaddi and Byadagi Dabbi are susceptible to the pests. However Pusa Jwala, Arka Lohit, GPC-82 are regarded as moderately resistant where VN-2 considered to be resistant parent. Significant differences were observed for both the pests revealed the genetic variability among the varieties.

The estimates of gene effects for thrips and mites (Table 2) revealed the operation of epistasis for both

[1]Present address: Department of Genetics and Plant Breeding, Kittur Rani Channamma College of Horticulture, Arabhavi 591 310

Table 1. Reaction of parents to resistance to thrips and mites in chilli

Parents	LCI thrips	Reaction	LCI mites	Reaction
Byadagi Kaddi	53.01	Sussceptible	47.01	Sussceptible
Byadagi Dabbi	57.74	Sussceptible	47.60	Sussceptible
VN-2	18.31	Resistant	22.26	Resistant
Pusa Jwala	32.99	Moderately resistant	25.96	Moderately resistant
GPC-82	34.44	Moderately resistant	26.55	Moderately resistant
Arka Lohit	26.83	Moderately resistant	27.44	Moderately resistant

Disease scale for LCI for thrips and mites: 1-10 = Highly resistant; 11-25 = resistant; 26-40 = moderately resistant; 41-75 = susceptible; more than 75 = highly susceptible

Table 2. Gene effects for thrips and mites in chilli

Cross	m	d	h	i	j	l	Type of epistasis
Leaf curl index for thrips							
1. Kaddi × Pusa Jwala	33.51±1.047	0.51±1.564	−23.76±5.318*	−14.32±5.23**	−10.88±1.725**	43.72±7.775**	D
2. Kaddi × GPC-82	31.54±0.886	3.65±1.503*	−7.89±4.762	−1.75±4.648	−5.0739±1.57**	30.77±7.282**	D
3. Kaddi × Arka Lohit	35.47±0.995	8.54±3.643**	2.17±8.53	10.90±8.303	−1.85±3.717	−4.369±15.59	D
4. Dabbi × Pusa Jwala	34.52±0.866	−0.39±1.05	−19.26±4.245**	−9.64±4.051**	−12.31±1.244**	33.60±6.009**	D
5. Dabbi × GPC-82	35.38±1.435	3.66±2.234**	1.149±7.44	10.73±7.277	−6.88±2.229**	−9.28±11.065	D
6. Dabbi × Arka Lohit	39.73±1.595	3.63±1.394**	−20.90±7.059**	−12.58±6.963**	−5.939±1.59**	22.54±8.786**	D
7. VN-2 × Pusa Jwala	27.74±1.030	−0.10±0.965	−74.72±4.775**	−11.57±4.553**	0.517±1.173	23.24±6.340	D
8. VN-2 × GPC-82	30.39±0.914	−5.23±0.658**	−0.36±4.06	−4.279±3.887	−2.554±0.871**	13.89±5.083**	D
9. VN-2 × Arka Lohit	30.192±0.897	0.52±1.984	−6.981±5.476	−7.868±5.35	4.085±2.054**	17.21±9.017	D
Leaf curl index for mites							
1. Kaddi × Pusa Jwala	30.13±0.837	1.219±1.224	−11.07±4.389**	−5.79±4.149	−4.97±1.596**	26.08±6.588**	D
2. Kaddi × GPC-82	33.20±0.920	−0.15±1.079	−17.77±4.441**	−9.472±4.268**	−5.20±1.287**	21.52±6.184**	D
3. Kaddi × Arka Lohit	33.52±0.677	4.91±1.814**	24.15±5.04**	−16.648±4.530**	−3.535±2.406	33.296±8.920**	D
4. Dabbi × Pusa Jwala	31.222±1.015	0.786±1.807	−3.79±5.67	3.44±5.438	−4.98±2.146**	1.91±8.895	D
5. Dabbi × GPC-82	39.18±2.188	−0.16±1.884	−22.79±9.659**	−20.26±9.529**	−4.66±2.201**	31.42±11.97**	D
6. Dabbi × Arka Lohit	28.41±1.171	6.618±1.953**	15.45±6.327**	23.22±6.100**	0.39±2.26	−35.25±9.710**	D
7. VN-2 × Pusa Jwala	28.04±0.942	0.364±1.300	−9.97±4.91**	−7.80±4.578**	2.881±1.445**	15.78±7.328**	D
8. VN-2 × GPC-82	28.66±0.815	−6.20±1.043**	−1.07±4.225	−1.92±3.872	−3.60±1.289**	6.098±6.28	D
9. VN-2 × Arka Lohit	27.725±1.008	−3.71±1.943**	2.126±5.682	3.51±5.588	−2.47±2.103	−12.46±8.986	D

respectively. Where the magnitude of dominance × dominance (1) gene effect was more. The role of additive action for imparting resistance is not observed whereas dominance gene action was significant and negative in Kaddi × Pusa Jwala, Dabbi × Pusa Jwala, Dabbi × Arka Lohit, VN-2 × Pusa Jwala there by indicating the importance of dominance effect for resistance which might be due to contribution from male parent from Pusa Jwala. High magnitude of dominance gene effects and dominance × dominance in the crosses Kaddi × Pusa Jwala, Dabbi × Pusa Jwala, Dabbi × Arka Lohit, VN-2 × Pusa Jwala it is difficult to exploit them due to presence of duplicate epistasis. Hence heterosis breeding is proposed. Both additive, additive × additive gene effects were significant thrips and mites indicating the non-allelic interaction for the manifestation of resistance. Dominance gene effects had a predominant role in the inheritance of resistance to thrips and mites.

Leaf curl index for thrips was predominantly under the control of non-additive gene effects with duplicate type of gene interaction. Additive (d) component was significant and negative in VN-2 × GPC-82 where dominant effect (h) was significant in Kaddi × Pusa Jwala, B. Dabbi × Pusa Jwala, B. Dabbi × Arka Lohit and VN-2 × Pusa Jwala and the magnitude of dominance component was more compare to additive. The h, j, l interaction component was significant in Kaddi × Pusa Jwala, Dabbi × Pusa Jwala, Dabbi × Arka Lohit crosses in cross VN-2 × GPC-82, where homozygous purelines can be developed through hybridization by selection.

The gene effects for LCI mites indicated that dominance component was significant in six crosses of which Dabbi × Arka Lohit had positive effects where others are in negative direction. Additive component was significant in four crosses where two were positive. Among the interaction component six crosses showed significant 'j' and 'h' interaction, the component of l type of interaction was more predominant in the inheritance and duplicate type of interaction noticed which might hinder progress in selection.

Dominant and non-additive type of gene action was prevailing in the crosses where susceptible parent

was involved. When both the parents are involved in the cross VN-2 × GPC-82 and VN-2 × Arka Lohit, additive type of gene action was prevailing with insignificant interaction component which can be improved through pedigree method. When both the parents having resistance the level of resistance is increased. When one susceptible parent is involved F_1 is resistant followed by additive gene action. The crosses Kaddi × GPC-82, Dabbi × GPC-82 showed significant negative h, i, j component hence can be exploited through heterosis.

Leaf curl index for thrips and mites, the presence of non additive gene interaction type seems to be a limiting factor when the main objective is to evolve pure lines. In such a situation maintaining considerable heterozygosity through mating of selected plants in early segregating generation could attain maximum gain or if some form of recurrent selection is practised with repeated back crosses with resistant parent. Intermating of segregants in early segregating generation would certainly enhance the possibility of various recombinants, which may result in the accumelation of favourable genes in the ultimate homozygous line. Therefore, few cycles of recurrent selection followed by pedigree breeding or population improvement approach will be effective in the development of mite and thrips resistant varieties.

References

1. **Prabhu S. T. and Jagadeesha R. C.** 1999. Identification of resistance sources against thrips Scirtothrips dorsalis Hood and mites polyphagatarsonemus latus Banks in chilli germplasm (*Capsicum annuum* L.), Indian J. Spices, 91-95.
2. **Tewari G. C., Deshapande A. A. and Anand N.** 1985. Chilli pepper genotype resistant to thrips *Scirtothrips dorsalis* Hood. Capsicum Newsletter, **4**: 73-74.
3. **Amin P. W.** 1979. Leaf curl disease of chilli peppers in Maharastra, India. PANS, **25**: 131-134.
4. **Amin P. W., Reddy D. V. R., Ghanekar A. W. and Reddy M. S.** 1981. Transmission of tomato spotted wilt virus casual agent of bud necrosis of parents by *Scirtothrips dorsalis* and *Franklienella schluttzei*. Plants Disease, **65**: 663-665.
5. **Hayman B. I.** 1958. The seperation of epistatic from additive and dominance variations in generation means. Heridity, **12**: 371-390.