Pak. J. Bot., 43(5): 2593-2595, 2011.

RELATIONSHIP OF QUANTITATIVE TRAITS WITH TWO VIRAL DISEASES IN MUNGBEAN (*VIGNA RADIATA* (L.) WILCZEK)

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Abstract

Mungbean germplasm comprising 262 lines was evaluated for resistance and susceptibility of MYMV and ULCV. Data on 9 quantitative characters viz., branches per plant, Pod length, pods per plant, seeds per pod, grain yield per plant, 100-grain weight, biological yield per plant and harvest index (%) showed that 211 accessions which were 80.53% of the population, proved to be resistant to MYMV, whereas remaining 51 (19.47%) were susceptible to the disease. In case of ULCV, 242 accessions which were 92.37% of the population, proved to be resistant, whereas remaining 20 (7.637%) were susceptible to the disease. Relationship of the disease with QTLs using 't' statistics revealed that MYMV was associated significantly with all the characters except with pod length and 100 seed weight. Similarly ULCV was also associated significantly with all the characters except pod length, pods per plant and 100 seed weight.

Introduction

Mungbean is one of the important grain legumes of Pakistan. The knowledge of genetic variation of disease resistance and susceptibility, and their interrelationship with quantitative traits should lead to more understanding of yield components and yield potential in mungbean. Plant virus diseases cause severe constraints on the productivity of a wide range of economically important crops worldwide. Many different types of viruses can infect mungbean. However, two viral diseases, Mungbean yellow mosaic virus (MYMV) and Urdean leaf crinkle virus (ULCV) cause economic losses to mungbean crop in Pakistan (Bashir *et al*., 1988). MYMV, a whitefly transmitted geminivirus, causes one of the most serious diseases of mungbean in all of South Asia. Disease incidence as high as 100% in farmers' fields is common in the Indian subcontinent , often resulting in considerable losses (Varma *et al*., 1992). Urdbean leaf crinkle disease caused by urdbean leaf crinkle virus is an important disease of mungbean and blackgram in Pakistan (Bashir & Zubair, 2002). Ghafoor *et al*., (1998) evaluated blackgram germplasm and selected 25 lines resistant to both MYMV and ULCV to utilize in breeding programme. Sandhu *et al*., (1988) screened mungbean germplasm against MYMV and ULCV and found less than 10% lines resistant to both diseases. The present study was conducted to investigate association of two important viral diseases of mungbean and quantitative traits. For mungbean, this type of study has not yet been carried out, although many researchers including Paroda & Thomas, (1988), Ghafoor *et al*., (1992), Ghafoor *et al*., (2000) and Zubair *et al*., (2007) have studied germplasm of this important grain legume.

Materials and Methods

Two hundred and sixty two mungbean germplasm accessions/genotypes were evaluated for various agronomical traits in an augmented design under field condition at NARC, Islamabad (33.40 o N and 73.07o E). Forty five genotypes were advanced breeding lines developed by Pulses Programme, NARC, Islamabad, 16 of exotic origin, 6 commercial varieties whereas other 195 accessions were obtained from the Plant Genetic Resources Institute (PGRI), NARC, Islamabad. These accessions were collected by the PGRI staff from various parts of the country. The germplasm accessions were planted during July, 2000 for agronomic evaluation. One row of 4m length for each accession was planted with 60cm and 10cm inter and intra-row spacing, respectively. Three approved varieties viz., NM-92, NM-98 and Chakwal Mung-97 were repeated as check after every 20 rows. Basal fertilizer dose of N P (@ 25 kg N + 60 kg P2O5 per hectare) was applied, and during crop growth period agronomic practices were used as recommended for mungbean crop. Pesticide (Karate 2.5EC @ 750 ml/ha) was sprayed to save the crop from infestation of pests especially white fly, a vector for MYMV. Data were recorded following Annon., (1985) descriptors for *Vigna* spp., on 9 quantitative characters viz. days to maturity, branches per plant, pod length, pods per plant, seeds per plant, 100-grain weight, grain yield per plant, biological yield per plant and harvest index (%). The data regarding days to maturity were recorded when about 90% pods turned brown/black after planting. Other quantitative data i.e., number of branches, number of pods, grain yield (g) and biological yield (g) were recorded on 10 guarded plants selected randomly and then averaged to per plant basis. Pod length (cm) and number of seeds per pod were recorded on 10 pods selected.

Another set of germplasm was planted under field condition during the year 2001 for screening against MYMV and ULCV. After every 10 lines local mung (highly susceptible to MYMV) and local mash (highly susceptible to ULCV) were planted as disease spreader. Since both these viral diseases spread by insect vectors, the crop was not sprayed by any pesticide so that vectors population could increase for disease spread. The disease data were recorded on visual basis for two categories under natural condition; resistant (0) or susceptible (1) for preliminary investigation. The diseases data for mungbean yellow mosaic virus (MYMV) and urdbean leaf crinkle virus (ULCV) were used for mean comparison based on resistance and susceptibility using 't' statistics. This analysis was conducted to detect the response of disease data on Quantitative Traits Loci (QTLs). Therefore disease reaction was analyzed for significance of MYMV and ULCV with QTLs using 't' statistics.

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Results and Discussion

Mungbean yellow mosaic virus (MYMV): MYMV is vectored by white fly (*Bemisia tabaci*) and the disease spread is favoured by hot dry climate. The data recorded were summarized for frequency distribution and it was observed that 211 accessions which were 80.53% of the population, proved to be resistant to MYMV, whereas remaining 51 (19.47%) were susceptible to the disease. Sandhu *et al.,* (1988) screened 2028 mungbean germplasm lines against MYMV and reported only 5% as resistant. The results are presented in Table 1. The data were also analysed to see the relationship of the disease with QTLs using 't' statistics. It was observed that MYMV was associated significantly with all the characters except with pod length and 100 seed weight. Maximum differences were observed in pods per plant (8.46±3.01), grain yield per plant (4.85±0.82), biological yield per plant (10.71±3.10) and harvest index (7.93±1.54). The susceptible accessions were noticed to be late in maturity. The decrease for susceptible accessions was recorded as branches (19.59%), pods per plant (18.97%), seeds per pod (6.89%), grain yield per plant (35.04%), biological yield per plant (24.26%) and harvest index (22.78%).

Table 1. Classification of MYMV and its significance for QTLs in mungbean germplasm.

Traits	Mean values			
	Resistant	Susceptible	Difference	Difference (%)
Days to maturity	72.95 ± 0.36	75.04 ± 0.74	2.09 ± 0.81*	2.86
Branches per plant	9.75 ± 0.45	7.84 ± 0.47	1.91 ± 0.56*	19.59
Pods per plant	44.59 ± 1.25	36.14 ± 2.77	8.46 ± 3.01**	18.97
Pod length	7.37 ± 0.06	7.31 ± 0.18	0.06 ± 0.19	0.81
Seeds per pod	12.77 ± 0.10	11.89 ± 0.29	0.88 ± 0.31*	6.89
100-grain weight	3.33 ± 0.05	3.26 ± 0.14	0.06 ± 0.15	1.80
Grain yield per plant	13.84 ± 0.41	8.99 ± 0.74	4.85 ± 0.82**	35.04
Biological yield per plant	44.14 ± 1.79	33.43 ± 2.75	10.71 ± 3.10**	24.26
Harvest index (%)	34.81 ± 0.62	26.88 ± 1.42	7.93 ± 1.54**	22.78
Frequency	211 (80.53%)	51 (19.47%)		

*, ** = Significant at 5 and 1% level of probability, respectively

Urdbean leaf crinkle virus (ULCV): Urdbean leaf crinkle virus (ULCV) is vectored by a beetle (*Hemosepilachna dodecastigma*) and transmitted in a non-persistent manner. The summarized data regarding frequency distribution and 't' statistics are presented in Table 2. It was observed that 242 accessions which were 92.37% of the population, proved to be resistant to ULCV, whereas remaining 20 (7.637%) were susceptible to the disease. Ghafoor *et al.,* (1998) evaluated 285 blackgram accessions and reported 25 lines as resistant to both MYMV and ULCV.

Relationship of the disease with QTLs revealed that ULCV is associated significantly with days to maturity, branches per plant, seeds per pod, grain yield per plant, biological yield per plant and harvest index (%). Maximum differences were observed in branches per plant (10.30±0.55), seeds per pod (2.06±0.43), grain yield per plant (7.28±1.16), biological yield per plant (48.90±4.75) and harvest index (9.32±1.94). The resistant accessions were early in maturity, while they produced lesser number of seeds. The decrease in grain yield (40.49%), biological yield (58.46%) and harvest index (41.18%) was noticed in susceptible accessions.

Table 2. Classification of ULCV and its significance for QTLs in mungbean germplasm.

Traits	Mean values			
	Resistant	Susceptible	Difference	Difference (%)
Days to maturity	70.6 ± 0.32	75.85 ± 1.56	5.25 ± 1.58*	7.44
Branches per plant	17.3 ± 0.41	7.0 ± 0.28	10.3 ± 0.55**	59.54
Pods per plant	48.3 ± 1.18	40.0 ± 4.47	8.3 ± 4.56	17.18
Pod length	7.25 ± 0.06	7.16 ± 0.17	0.09 ± 0.18	1.24
Seeds per pod	10.83 ± 0.10	12.89 ± 0.42	2.06 ± 0.43**	19.02
100-grain weight	3.65 ± 0.05	3.33 ± 0.26	0.32 ± 0.26	8.77
Grain yield per plant	17.98 ± 0.39	10.70 ± 1.13	7.28 ± 1.16**	40.49
Biological yield per plant	83.64 ± 1.62	34.74 ± 4.63	48.90 ± 4.75**	58.46
Harvest index (%)	22.63 ± 0. 63	31.95 ± 1.89	9.32 ±1.94**	41.18
Frequency	242 (92.37%)	20 (7.63%)		

*, ** = Significant at 5 and 1% level of probability, respectively

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(Received for publication 23 December 2009)