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Evaluation of Lentil Genotypes for Resistance to Pea Seed-borne Mosaic Virus

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ABSTRACT

Sixty-four lentil genotypes obtained from International Center for Agricultural Research in Dry Areas (ICARDA), Syria were evaluated against pea seed-borne mosaic virus (PSbMV). There was a wide range of variability in disease reaction among the genotypes. Most of the genotypes were found tolerant to this disease. Out of 64 lines, 21 were found resistant, 28 tolerant, and 15 susceptible. This study reports some additional sources of resistance in world collection of lentil germplasm against PSbMV which may be useful for breeding programmes.

Key Words: Lentil; Pea seed; Mosaic virus; PsBMV; Resistance; Genotypes

INTRODUCTION

Lentil (*Lens culinarus* Medik) is one of the important legume crops of Pakistan. It is imported in a large quantity to meet domestic requirement putting huge burden on the national exchequer. During 2000–2001 alone, around 40,000 tonnes of lentil was imported (GOP, 2001). This is because of many factors and among the biotic factors, pea seed-borne mosaic virus (PSbMV) seriously affect the lentil crop. Pea seed-borne mosaic virus (PSbMV) is commonly detected in lentil seed (Bashir *et al.*, 1998; Makkouk *et al*., 1998). Under field conditions, the virus can over-winter in hairy vetch (*Vicia villosa* Roth.) and volunteer peas (Steven & Hagedorn, 1973). Naturally, it occurs in peas, lentil, faba bean and vetch (Bashir *et al*., 2000). The virus is transmissible to susceptible pea cultivars planted nearby (Steven & Hagedorn, 1973). This virus is also transmissible from peas to lentils by aphid species *Aphis craccivora* (Muehlbauer, 1977).

Lentil plants affected by PSbMV bore very few flowers and pods (Aftab *et al.*, 1992). Yield losses in lentil due to this disease vary from 6 to 61% based on the lentil genotype and virus strain (Kumari & Makkouk, 1995; Kumari *et al*., 1996). The frequency of virus transmission in lentil seed is estimated to range from 32 to 44% (Hampton & Muchlbaur, 1977).

The most ideal and feasible control of this disease is the cultivation of resistant varieties. Therefore, the purpose of this study is to evaluate lentil germplasm received from International Center for Agricultural Research in the Dry Areas (ICARDA) Syria, against PSbMV for the identification of resistant sources for incorporation in breeding programmes to develop cultivars resistant to PSbMV.

MATERIALS AND METHODS

Sixty-four genotypes of lentil obtained from ICARDA having the origin of Syria, Turkey and Jordan were evaluated against lentil strain of pea seed borne mosaic virus (PSbMV). Masoor 93 was used as a local check. The experiment was planted in last week of October 2003 at National Agricultural Research Center (NARC) Islamabad in two row plot with 4 m length and 30 cm width. Disease observations were recorded 20 days before harvesting, i.e., at podding stage in the month of March 2004. Total number of affected plants of each genotype in both replications were counted. The infection percentage was also calculated and rated on 1-9 scale (ICARDA, 2003), where 1= no plant showing symptoms (immune), 3= 1-10% plants affected (resistant), 5= 11-20% (medium resistant), 7= 21-40% (susceptible) and 9= 40% and above (highly susceptible).

RESULTS AND DISCUSSION

A considerable variation was observed for disease reaction among lentil genotypes. Mainly four types of disease responses i.e. resistant, tolerant, susceptible and highly susceptible were observed (Table I). Most of the lines were tolerant to PSbMV. Out of 64 lines, 21 were resistant and 28 were tolerant whereas 14 lines were found susceptible to PSbMV. One genotype FLIP 2003-19L was highly susceptible. Abraham and Makkkouk (2002) tested 270 lentil samples for PSbMV and found different incidence rate in different parts of Ethiopia.

There was not even a single genotype, which was immune to PSbMV in this study, however Haddad *et al*. (1978) found immunity in four lentil lines obtained from USA and studied inheritance of resistance to this disease.

They concluded that immunity was due to single recessive gene sbv and SBV gene for susceptibility. Lentil plant also showed variation of infection to PSbMV at different maturity stages. Plants artificially inoculated with PSbMV at pre flowering, flowering and post flowering showed 65.5, 58.0, and 9.6% loss, respectively (Mabrouk & Mansour, 1998). Makkouk *et al*. (2003) detected the same virus in lentil during 2001 and 2002 in Iran. PSbMV,

Table I. Reaction of lentil germplasm against PSbMV under natural disease conditions during 2004 at NARC, Islamabad

Entry No.	Name	Pedigree	Rating	Disease Reaction
1	PI 339319	-	7	Susceptible
2	81 S 15	UJL197 x ILL 5722	5	Medium Resistant
3	FLIP 90-25L	ILL 5588 x ILL 99	5	Medium Resistant
4	FLIP 96-47L	-	7	Susceptible
5	FLIP 97-28L	ILL 4399 x ILL 5722	3	Resistant
6	FLIP 99-1L	ILL 1939 x ILL 6453	3	Resistant
7	FLIP 2002-7L	ILL 323 x ILL 7155	7	Susceptible
8	FLIP 2002-8L	ILL 1939 x ILL 6245	3	Resistant
9	FLIP 2002-9L	ILL 4400 x ILL 5883	5	Medium Resistant
10	FLIP 2002-10L	ILL 5883 x ILL 7010	7	Susceptible
11	FLIP 2002-11L	ILL 6430 x ILL 5883	3	Resistant
12	FLIP 2002-15L	ILL 7201 x ILL 1939	5	Medium Resistant
13	FLIP 2002-16L	ILL 5588 x ILL 6243	7	Susceptible
14	FLIP 2002-17L	ILL 358 x ILL 2580	5	Medium Resistant
15	FLIP 2002-24L	ILL 7201 x ILL 5728	5	Medium Resistant
16	FLIP 2002-28L	ILL 7005 x ILL 6243	3	Resistant
17	FLIP 2002-29L	ILL 5588 x ILL 6246	5	Medium Resistant
18	FLIP 2002-30L	ILL 5722 x ILL 6246	5	Medium Resistant
19	FLIP 2002-31L	ILL 5883 x ILL 6246	7	Susceptible
20	FLIP 2002-32L	ILL 7005 x ILL 6246	7	Susceptible
21	FLPI 2002-34L	ILL 2573 x ILL 4402	3	Resistant
22	FLIP 2002-37L	ILL 6155 x ILL 5883	3	Resistant
23	FLIP 2003-8L	ILL 7617 x ILL 2501	3	Resistant
24	FLIP 2003-9L	ILL 8010 x ILL 2573	5	Medium Resistant
25	FLIP 2003-10L	ILL 8010 x ILL 2573	3	Resistant
26	FLIP 2003-11L	ILL 8010 x ILL 2573	3	Resistant
27	FLIP 2003-12L	ILL 7115 x KM 400	5	Medium Resistant
28	FLIP 2003-13L	ILL 5883 x ILL 2130	7	Susceptible
29	FLIP 2003-14L	ILL 5582 x 94S 132	3	Resistant
30	FLIP 2003 –15L	ILL 5883 x ILL 6246	5	Medium Resistant
31	FLIP 2003-16L	ILL 5883 x ILL 6246	3	Resistant
32	FLIP 2003-18L	ILL 7012 x ILL 1939	3	Resistant
33	FLIP 2003-19L	ILL 7012 x ILL 1939	9	Highly Susceptible
34	FLIP 2003-22L	ILL 6434 x ILL 2126	5	Medium Resistant
35	FLIP 2003-23L	ILL 2125 x ILL 7005	5	Medium Resistant
36	FLIP 2003-24L	ILL 7005 x ILL 1939	5	Medium Resistant
37	FLIP 2003-25L	ILL 7005 x ILL 1939	5	Medium Resistant
38	FLIP 2003-26L	ILL 5722 x ILL 5728	5	Medium Resistant
39	FLIP 2003-27L	ILL 7005 x ILL 5728	5	Medium Resistant
40	FLIP 2003-28L	ILL 7201 x ILL 6243	5	Medium Resistant
41	FLIP 2004-2L	ILL 4400 x ILL 5883	5	Medium Resistant
42	FLIP 2004-4L	ILL 5883 x ILL6996	5	Medium Resistant
43	FLIP 2004-5L	ILL 5883 x ILL 7010	7	Susceptible
44	FLIP 2004-6L	ILL 2125 x ILL 7005	3	Resistant
45	FLIP 2004-7L	ILL 2125 x ILL 7005	5	Medium Resistant
46	FLIP 2004-10L	ILL 7201 x ILL 5728	5	Medium Resistant
47	FLIP 2004-13L	ILL 7134 x ILL 7157	3	Resistant
48	FLIP 2004-14L	ILL 7155 x ILL 6206	5	Susceptible
49	FLIP 2004-15L	ILL 6434 x ILL 4400	7	Susceptible
50	FLIP 2004-17L	ILL 6155 x ILL 5722	3	Resistant
51	FLIP 2004-20L	ILL 5582 x 94S 132	5	Medium Resistant
52	FLIP 2004-21L	ILL 2285 x 94S 135	7	Susceptible
53	FLIP 2004-22L	ILL 4400 x 94S 141	3	Resistant
54	FLIP 2004-28L	ILL 5883 x ILL 6246	7	Susceptible
55	FLIP 2004-29L	ILL 5883 x ILL 6475	3	Resistant
56	FLIP 2004-30L	ILL 5883 x ILL 6475	3	Resistant
57	FLIP 2004-34L	ILL 5883 x ILL 6991	7	Susceptible
58	FLIP 2004-35L	-	5	Medium Resistant
59	FLIP 2004-46L	ILL 4400 x ILL 5883	3	Resistant
60	FLIP 2004-47L	ILL 7155 x ILL 6206	5	Medium Resistant
61	FLIP 2004-48L	ILL 6434 x ILL 4400	3	Resistant
62	FLIP 2004-49L	ILL 2125 x ILL 7005	5	Medium Resistant
63	FLIP 2004-50L	ILL 7005 x ILL 1939	7	Susceptible
64	Local check (Masoor-93)	-	5	Medium resistant

basically a disease of peas has been found to be transmitted to lentil. It is suggested that these two crops should not be planted near each other. The other possible control measure is the selection of resistance varieties. Attempts should be made to eliminate neighboring leguminous weeds, which act as a source of virus and vectors. If healthy seeds collected from virus-free plants were sown, the disease by as much as 50%,can be controlled because the virus is readily seed transmitted (Mink *et al*., 1969; Hampton & Muehlbauer, 1977). Symptoms of this disease observed in the present study were similar to those reported by Hampton and Muehlbauer (1977) i.e., stunting of plants, mild systematic mosaic, deformed pods, shortening of the internodes and downward curling of the leaflets. In the present study, 21 lines were identified as resistant which could be used for future breeding for developing disease resistant cultivars.

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