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Identification of lentil genotype (s) resistant to the *Fusarium oxysporum* f. sp. *Lentis*

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Abstract
Lentil (*Lens culinaris Medik*.) is a major pulse crop in India, and grown in Rabi season. Among soil borne diseases Fusarium wilt caused by Fusarium oxysporum f. sp. lentis is a major disease of lentil in all growing areas of the country where it is grown after paddy, for minimizing of economic loss due to the wilt resistant varieties. Out of 130 genotypes, only 55 genotypes were found resistant against F. oxysporum f. sp. Lentis screening in field condition.

Keywords: lentil, resistant varieties and genotype

Introduction
Lentil is recognized as one of the most nutritious pulse crop ranking next to chickpea amongst *Rabi* pulses. Dehuled lentil seed contain 24-26 % protein, 3.2 % fiber and 57-60 % carbohydrate, 1.3 % total fat. It is a rich source of minerals containing 69 mg calcium, 300 mg phosphorus and 7 mg Iron per 100 g of seed. It is also rich in 10-15 mg vitamin C, (450 IU) vitamin A, and 9 % riboflavin (Ali and Mishra, 2000) [1]. If you want healthy hairs and scalp, then include lentil in your diet at least 3-4 times a week because lentil are rich in folic acid (Anonymous, 2013) [3]. The total area under lentil in India was 1.47 m ha with a total production of 1.03 mt and 705 Kg/ha productivity (Anonymous, 2015-16) [2]. In India, lentil is mostly grown in northern plains, central and eastern parts of India. The major lentil producing states are Madhya Pradesh, Uttar Pradesh, Bihar, Uttarakhand and Bengal. It is grown as a *Rabi* crop or winter crop in India and sown from October to November. It can be grown on a wide range of soil from light loam to black cotton soils and can stand even less fertile moderately alkaline soils and rainfed conditions. The crop matures between 90 to 120 days. In This region, *Fusarium* wilt caused by *F*. *oxysporum* f. sp. *lentis* is the important disease asit caused the significant annual loss in yield, present status of disease problem in the lentil growing areas of the country, non-availability of suitable management practices and gaps in our knowledge about this disease.

Method
One hundred thirty genotypes of lentil were obtained from the Department of Genetics and Plant Breeding, N. D. University of Agriculture and Technology, Kumarganj, Faizabad and IIPR, Kalyanpur, Kanpur (U.P.). The genotypes will be screened through pot screening techniques in glass house using the method by (Nene *et al*., 1982).

Table 1: List of lentil genotypes used for screening

Name of genotypes
LL 1370, IPL 333, PL4, RLG 195, RVL 14-4, L4737, RKL 607-1, WBL 77, JL3, KLS218. LL1320, LL1397, VL525, LL1379, VL526, RVL14-5, L4717, VL126, L4076, RLG191, VL150, RKL1003-24C, L4726, PL220, L4764, L4735, IPL534, DPL15, BPL15, RL3-5,KLS 09-5, IPL 321, L 4711, IPL 219, IPL 215, L 4076, IPL 315, IPL 324, IPL 513, IPL 316, IPL 526, IPL 220, IPL 225, PL-129, LL-1231, RLS 113, L-4707, L-4588, VL-142, VL- 143, RLG 147, RVL13-7, IPL227, NDL14-22, LL1318, JL3, KLS218, VL 148, LL 151, LL 1375, PL 213, L 4769, L 4147, L 4751, LL 1374, PL 194, DL 14-2, L 4771, K 75, NDL 12-1, K-75, IPL 529, RLG-109, VL-138, PL024, TRCL-1, KLS 14-23, PL 406, LH 84-8, L 4755, PL 210, IPL 406, L 4727, NDL 12-1, KLB 343, IPL-533, NDL 11-2. NDL-7-401, NDL 6-1-10, RLG- 73, IPL-314, VL-133, LL-1020, L-4589, LH 07-27, L-4595, IPL-325, PLO-98, LL 1404, L 4710, IPL 326, IPL 222, LL 1161, RLG 156, IPL 533, IPL 406, DPL 15, IPL-219, IPL-406, IPL-81, LL1210, PL-101, PL-104, VL- 521, LH-484-8, LH 08-10, NDL-11-1, L-4591, DPL-62, KLB102, LL 1255, NDL 12-2, SKUL 9, RKL 604-5, IPL 529, LL 1203, L 9-12. IPL 220, IPL 325, IPL 221, KLS 113, RLG 147.

After germination**,** observation, were recorded regularly up to 24 days for the appearance of wilt symptoms and severity. The disease was recorded using 1-9 scale for the wilt disease of lentil as described in (Table-3).

Table 2: Disease rating scale for *Fusarium oxysporum* f.sp. *Lentis* (Iqbal et. al., 2005)

Rating scale	Description	Reaction
1.	0-10% wilted plant	Highly resistance
3.	11-20% mortality	Resistance
5.	21-30% mortality	Moderate resistance
7.	31-50% mortality	Susceptible
9.	51% or more mortality	Highly susceptible

Fig 1: Wilt infected lentil crop in field

Result

To evaluate the performance of genotypes against *Fusarium oxysporum* F.sp. *lentis*

One hundred thirty genotypes of lentil were screened for their reaction to *Fusarium oxysporum* f.sp. *Lentis* by following sick pot technique. The genotypes were grouped in various categories of resistant and susceptible on the basis of per cent wilting in sick pots as described by Iqbal *et al*., 2005 and the result are summarized in (Table 7).Out of 130 genotypes, 55 genotypes were found highly resistant, 25 genotypes resistant, 18 genotypes moderately resistant, 20 genotypes susceptible and 12 genotypes highly susceptible to *Fusarium* wilt (Table 7)

Table 3: Performance of Lentil genotypes against *Fusarium oxysporum* f.sp. *Lentis* under natural field condition during *Rabi* crop season 2016

Rating scale	Reaction	No. of genotypes	Name of genotypes
1.	Highly resistance	55	LL 1370, IPL 333, PL4, RLG 195, RVL 14-4, L4737, RKL 607-1, WBL 77, LL1320, LL1397, VL525, LL1379, VL526, RVL14-5,L4717, VL126, L4076, RLG191, VL150, RKL1003-24C, L4726, PL220, L4764, L4735, IPL534, DPL15, BPL15, RL3-5, KLS 09-5, IPL 321, L 4711, IPL 219, IPL 215, L 4076, IPL 315, IPL 324, IPL 513, IPL 316, IPL 526, IPL 220, IPL 225, PL-129, LL-1231, RLS 113, L-4707, L-4588, VL-142, VL- 143, RLG 147, RVL13-7, IPL227, NDL14-22, LL1318, JL3, KLS218.
3	Resistance	25	VL 148, LL 151, LL 1375, PL 213, L 4769, L 4147, L 4751, LL 1374, PL 194, DL 14-2, L 4771, K 75, NDL 12-1, K-75, IPL 529, RLG-109, VL-138, PL024, TRCL-1, KLS 14-23, PL 406, LH 84-8, L 4755, PL 210, IPL 406.
5	Moderately resistance	18	L 4727, NDL 12-1, KLB 343, IPL-533, NDL 11-2. NDL-7-401, NDL 6-1-10, RLG- 73, IPL-314, VL-133, LL-1020, L-4589, LH 07-27, L-4595, IPL-325, PLO-98, LL 1404, L 4710.
7	Susceptible	20	IPL 326, IPL 222, LL 1161, RLG 156, IPL 533, IPL 406, DPL 15, IPL-219, IPL-406, IPL-81, LL1210, PL-101, PL-104, VL- 521, LH-484-8, LH 08-10, NDL-11-1, L-4591, DPL-62, KLB102.
9	Highly susceptible	12	LL 1255, NDL 12-2, SKUL 9, RKL 604-5, IPL 529, LL 1203, L 9-12. IPL 220, IPL 325, IPL 221, KLS 113, RLG 147.

Discussion

In India a very narrow genotype based is involved in existing lentil varieties and the resistant varieties for *Fusarium* wilt could not be expected to be permanently resistant. Number of genotypes are still known/identified to possess desirable degree of resistance in lentil. Therefore, the search for the source of donors with a high degree of resistance for use as parental material in breeding programme for *Fusarium* wilt always has been desirable. There is no doubt about the fact that the use of resistant variety is one of the best method of disease management. Therefore, studies were planned to search out the genotypes against *Fusarium* wilt through sick pot technique**.** Out of 130 genotypes, 55 genotypes were found highly resistant and 25 genotypes moderately resistant, 18 genotypes resistant, 20 genotypes susceptible, 12 genotypes were found highly susceptible (Table 7).

Summary

130 genotypes of lentil were screened against *Fusarium oxysporum* f. sp. *lentis* following sick pot technique in 1-9 rating disease scale. Out of 130 genotypes, 55 genotypes were found highly resistant, 25 genotypes resistant, 18 genotypes moderately resistant, 20 genotypes susceptible and 12 genotypes were found highly susceptible to *Fusarium* wilt (Table 7).

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