Int.J.Curr.Microbiol.App.Sci (2020) Special Issue-11: 3813-3817

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-11 pp. 3813-3817**
Journal homepage: http://www.ijcmas.com

Original Research Article

Identification of Resistance Sources of Lentil against Wilt Disease Caused by *Fusarium oxysporum* f. sp. *lentis*

Subhash Chandra[1]*, Rajeev Kumar[1], Manish Kumar Maurya[1], Vikash Kumar Yadav[2], S. K. S. Rajpoot[2], Ajay Kumar[3] and Kumari Punam[4]

[1]Department of Plant Pathology, [2]Department of Entomology, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India
[3]Department of Plant Pathology, Amar Singh P.G. College, Lakhavaoti, Bulandshahar, Uttar Pradesh, India
[4]Department of Botany, Jai Prakash University, Chapra, Bihar, India

**Corresponding author*

A B S T R A C T

Lentil is affected by the wilt disease caused by fungus *Fusarium oxysporum* f. sp. *lentil* which causes an economic yield loss. The fungus seed and soil borne in nature and reported from almost all lentil growing areas where this crop is grown. The present study is carried out to find the resistant sources against Fusarium wilt of lentil. 100 genotypes were screened under glass house condition. The genotypes were categorized into Highly resistant (25 genotypes) resistant (11 genotypes), moderately resistant (19 genotypes), susceptible (23 genotypes) highly susceptible (22 genotypes) reaction against the pathogen. Twenty five genotypes were found highly resistant namely, PL 269, PL 4, Pant L – 8(PL 063), PL 252, PL 276, L 4717, LH 84-8, LL 1525, IPL 220, IPL 238, IPL 540, IPL 342, IPL 344, IPL 233, IPL 81, IPL 234, DPL 15, VL 152, VL 156, VL 531, VL 532, VL 157, KLB-1442, KLS 1451, RKL 14-112.

Keywords

Fusarium, genotypes, lentil, resistance, wilt

Introduction

Lentil (*Lens culinaris* Medik) ranks third in the world after chickpea and pea (FAO 2015). It is an annual, autogamous, diploid crop (2n=14) and self pollinated crops. Lentil also known as 'Poor man's meat' as it is rich in nutrients, include 60-67% carbohydrates, 20-36% protein, <4% lipid, and 2-3% ash on dry weight basis (Bhatty, 1988). It is widely used in a range of dishes and reputed to have many uses in traditional medicine (Yadav *et al.*, 2007). Major lentil growing states in India are Madhya Pradesh (42.50%), Uttar Pradesh (31.25%), West Bengal (9.38%) and Bihar (8.75%). In India, lentil was grown in 1.49 mha with production of 1.61 mt with an average production of 1006 kg/ha (Anonymous, 2018).

Lentil crop is affected by many fungal diseases. Among them Fusarium wilt caused by *Fusarium oxysporum* f. sp. *lentis* is one of the major soil borne disease causes an economic loss all over the world (Bayaa *et al.*, 1998 and Taylor, 2007). *Fusarium*

oxysporum f. sp. *lentis* infection range from 25-95 per cent depending on the cultivars tested. It was first reported from Hungary (Fleischmann, 1937) and later from many countries including India (Padwick, 1941), USA (Wilson and Brandsberg, 1965), USSR (Kotava *et al.,* 1965), Syria (Bayya *et al.,* 1986), Turkey (Bayya *et al.,* 1998) and Italy (Toshi and Cappelli, 2001). *Fusarium oxysporum* f. sp. *lentis* Vasudeva and Srinivasan affect lentil at every growth stage like seed, seedling, flowering and at crop maturity in stem and root which causes seed rot, stem rots, damping off, wilt and root (Vasudeva and Srinivasan, 1952). Warm and dry conditions are the most ideal condition for the development of the disease (Bayaa and Erskine, 1990). In India, *Fusarium wilt* is major constraint in production of lentil in the states of Uttar Pradesh, Madhya Pradesh, Himachal Pradesh, Bihar, West Bengal, Assam, Rajasthan, Haryana and Punjab (Chaudhary *et al.,* 2009; 2010).

The most sustainable and effective solution to this problem is the development of resistant cultivars. Lentil germplasm can be screened in fields with high levels of natural inoculum of *Fusarium oxysporium* f.sp. *lentis* (Kraft *et al.,* 1994, Bayaa *et al.,* 1994).

The most economical and effective way to control this disease through host resistance i.e. resistant cultivars. Field screening has some limitation like involvement of other root rot pathogens or drought. Therefore, genotypes were screened under glass house condition. So, the aim of the present study is to find out the source of resistance against the wilt of lentil.

Materials and Methods

One hundred genotypes of lentil were obtained from the Department of Genetics and Plant Breeding, A.N.D. University of Agriculture and Technology, Kumarganj, Ayodhya and Indian Institute of Pulse Research, Kalyanpur, Kanpur (U.P.). The genotypes will be screened through pot screening techniques under glass house condition using the method (Nene *et al.,* 1981).

After germination, observations were recorded regularly up to 24 days for the first appearances of the disease i.e. wilt. The disease was recorded by using 1-9 scale given by (Nene *et al.,* 1981) as

Results and Discussion

One hundred genotypes of lentil were screened for their reaction to *F. oxysporum* f. sp. *lentis.* Out of 100 genotypes, 25 genotypes were found highly resistant namely, PL 269, PL 4, Pant L – 8(PL 063), PL 252, PL 276, L 4717, LH 84-8, LL 1525, IPL 220, IPL 238, IPL 540, IPL 342, IPL 344, IPL 233, IPL 81, IPL 234, DPL 15, VL 152, VL 156, VL 531, VL 532, VL 157, KLB-1442, KLS 1451, RKL 14-112; 11 genotypes were noticed resistant namely, IPL 234, PL 406, PLL 1801, PLE 1801, L4147, IPL 541, DPL 62, VL 126, KLS218, RKL 16-304, IPL 406; 19 genotypes were recorded moderately resistant i.e., PLR 1801, LP 18-13, PL 279, PL 247, PLS 1802, L 4751, PLL 1802, L4757, LL 1427, LL 1522, IPL 602, IPL 343, IPL 237, VL 507, KLS 1431, RL 11, WBL 77, L 4727, RL 13-05; 23 genotypes were found susceptible i.e. PL 7, PL 254, PLS 1801, PLR 1801, PLE 1802, PLR 1802, L 4729, PL 247, LL 1576, IPL 316, PIL 601, IPL 539, SJL 6-3, Sehore 74-3, K-75, RKL 605-3, RL 10, RKL14-276, RVL 17-11, RVL 17-1, JL 3, HUL 57 and 22 genotypes were recorded highly susceptible i.e., L 9-12, KLS 113, RVL-48, L-4590, LL 1255, NDL 12-2, RLG 147, SKUL 9, RKL 604-5, HUL-57, RLGF-109, SKUL 9, L 4709, LL 1203, L-4706, PL-122, PL-099, RVL -48, KLB-314, L- 4590, DL-11-4, DPL-62, KLV-314 reaction against the pathogen.

Table.1 Disease Ratting Rating scale for Fusarium wilt

Scale	Description	Disease reaction
1	No symptoms on any plant	Resistant
3	10 % or less mortality	Moderately resistant
5	11-20 % mortality	Tolerant
7	20-50 % mortality	Susceptible
9	51 % or more mortality	Highly Susceptible

Table.2 Performance of lentil genotypes against *F. oxysporum* f. sp. *lentis* in pot condition during *Rabi* – 2019 – 2020

Disease ratting scale	Reaction	No. of genotypes	Name of genotypes
1	Highly resistant	25	PL 269, PL 4, Pant L – 8(PL 063), PL 252, PL 276, L 4717, LH 84-8, LL 1525, IPL 220, IPL 238, IPL 540, IPL 342, IPL 344, IPL 233, IPL 81, IPL 234, DPL 15, VL 152, VL 156, VL 531, VL 532, VL 157, KLB-1442, KLS 1451, RKL 14-112
3	Resistant	11	IPL 234, PL 406, PLL 1801, PLE 1801 , L4147, IPL 541, DPL 62, VL 126, KLS218, RKL 16-304, IPL 406
5	Moderately resistant	19	PLR 1801, LP 18-13, PL 279, PL 247, PLS 1802, L 4751, PLL 1802, L4757, LL 1427, LL 1522, IPL 602, IPL 343, IPL 237, VL 507, KLS 1431, RL 11, WBL 77, L 4727, RL 13-05
7	Susceptible	23	PL 7, PL 254, PLS 1801, PLR 1801, PLE 1802, PLR 1802, L 4729, PL 247, LL 1576, IPL 316, PIL 601, IPL 539, SJL 6-3, Sehore 74-3, K-75, RKL 605-3, RL 10, RKL14-276, RVL 17-11, RVL 17-1, JL 3, HUL 57
9	Highly Susceptible	22	L 9-12, KLS 113, RVL-48, L-4590, LL 1255, NDL 12-2, RLG 147, SKUL 9, RKL 604-5, HUL-57, RLGF-109, SKUL 9, L 4709, LL 1203, L-4706, PL-122, PL-099, RVL -48, KLB-314, L- 4590, DL-11-4, DPL-62, KLV-314

The result was also corroborative to our result as Soomro *et al.*, (2018) revealed that NIAMasoor-05, lentil-25 was comparatively resistant against infection of wilt pathogen followed by Masoor-93 and Markaz-09. Koleva *et al.*, (2018) reported six lentil accessions (two cultivars and four lines) as moderately resistant phenotype after inoculation with *Fusarium oxysporum* f. sp. *lentis*. Arya and Kushwaha (2019) screened ninety two germplasm, none were found immune, Highly Resistant (11 germplasm), Resistant (13 germplasm), Moderately Resistant (18 germplasm), Susceptible (40 germplasm) and Highly Susceptible (10 germplasm) depending on the disease reaction. Chandra *et al.*, (2019) screened 150 genotypes in which 66 genotypes were

resistant, 37 genotypes moderately resistant, 34 moderately susceptible, 9 susceptible and 4 highly susceptible.

References

Anonymous (2018). Project Coordinator's Report. Annuals Groups Meet, *Rabi* 2018. All India Coordinated Research Project on MULLaRP. IIPR, Kanpur. 2018, 16-22.

Arya, A. and Kushwaha, K. P. S. (2019). Management of Lentil Wilt through Host Resistance, *Int. J. Curr. Microbiol. App. Sci.*, 8(3):438-444.

Bayaa, B. and Erskine, W. (1990). Screening technique for resistance to vascular wilt in lentil. *Arab J. Plant Prot*., 8:30-33.

Bayaa, B., Erskine, W. and Hamdi, A. (1994). Evaluating different methods for screening lentil germplasm for resistance to lentil wilt caused by *Fusarium oxysporum* f. sp. *lentis*. *Arab J. Plant Prot.*, 12: 83-91.

Bayaa, B., Erskine, W. and Khoury, L. (1986). Survey of wilt damage on lentil in Northwest Syria. *Arab J. Plant Prot.*, 4: 118-119

Bayaa, B., Kumari, S. G., Akkaya, A., Erskine, W, Makkouk, K. K., Turk, Z. and Ozberk, I. (1998). Survey of major biotic stresses of lentil in Southeast Anatolia. *Turkey. Phytopathol. Medit*. 37: 88-95.

Bhatty, R. S. (1988). Composition and quality of lentil (*Lens culinaris* Medik): A Review. *Can. Inst. Food Sci. Tech. J.*, 21: 144-160.

Chandra, S., Rajvanshi, N. K. and Kumar, A. (2019). Evaluation of lentil genotypes against *Fusarium oxysporum* f. sp. *lentis* under artificial epiphytotic condition. *J. Pharmaco. Phytochem.*, SP2: 955-956.

Chaudhary, R. G., Dhar, V. and Singh, R. K. (2009). Association of fungi with complex of lentil at different crop growth stages and moisture regimes. *Arch. Phytopathol. Plant Prot.* 42: 340-343.

Chaudhary, R. G., Saxena, D. R., Dhar V. and Singh, R. K. (2010). Prevalence of wilt root rots and their associated pathogens at reproductive phase in lentil. *Phytopathol. Plant Prot*. 43: 996-1000.

Fleischmann, A. (1937). Observations on lentil wilt. *Pflanzenbau*, 14: 49-56.

Koleva, M., Stanoeva, Y., Kiryakov, I., Ivanova, A. and Chamurlyiski, P. (2018). Evaluation of lentil cultivars and lines for resistance to *Fusarium oxysporum* f.sp. *lentis*. *Agricultural Science and Technology*. 10(1): 25-28.

Kraft, J. M., Haware, M. P., Jim´enez-Diaz, R. M., Bayaa, B. and Harrabi, M. (1994). Screening techniques and sources of resistance to root rots and wilts in cool season food legumes. *Euphytica*, 73: 27–39.

Nene, Y. L., Kannaiyan, J. and Reddy, M. V. (1981). Pigeonpea diseases resistance screening techniques. Information Bulletin No. 7 ICRISAT, Patancheru, P.O. Andhra Pradesh, India. pp. 3-4.

Soomro, M. P., Wagan, K. H., Dhiloo, K. H., Soomro, S. P., Soomro, M. H., Hassan, S., Yaseen, M., Hajano, J., Mastoi, S. M. and Mastoi, P. M. (2018). Response of lentil varieties against *Fusarium wilt*. *J. Entom. Zool. Stud.*, 6(1): 858-862.

Taylor, P., Lindbeck, K., Chen, W. and Ford, R. (2007). Lentil diseases. In Lentil: Springer. DOI: 10.1007/978-1-4020-6313-8_18.

Toshi, L. and Cappelli, C. (2001). First report of *Fusarium oxysporum* f. sp. *lentis* of Lentil in Italy. *Pl. Dis.*, 85(5): 562.

Vasudeva, R. S. and Srinivasan, K. V.

(1952). Studies on the Wilt disease of Lentil (*Lens esculenta* Moench). *India Phytopath*. 5: 23-32.

Wilson, V. E. and Brandsberg, J. (1965). Fungi isolated from diseased lentil seedlings in 1963-64. *Plant Disease Reporter*, 49: 660-662.

Yadav, S. S., McNeil, D. L. and Stevenson, Ph. S. (2007). Lentil: an ancient crop for modern times. Dordrecht, the Netherlands: Springer.