EVALUATION OF LENTIL GERMPLASM FOR DISEASE RESISTANCE TO FUSARIUM WILT (FUSARIUM OXYSPORUM F.SP. LENTIS)

УСТОЙЧИВОСТ НА ОБРАЗЦИ ЛЕЩА КЪМ ФУЗАРИЙНО УВЯХВАНЕ (FUSARIUM OXYSPORUM F.SP. LENTIS)

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ABSTRACT

Lentil (Lens culinaris Medic.) is one of the oldest known protein-rich food legumes. Lentil is the second pulse crop after dry bean in Bulgaria. Diseases such as Ascochyta blight and Lentil wilt play a major role in reducing lentil yield.

Thirty two lentil genotypes with different geographical origin were screened for reaction to Fusarium oxysporum f.sp. lentis during 2003-2004 from the Institute for Plant Genetic Resourses, Sadovo under greenhouse conditions.

Three of the studied accessions (91-001, 91-028 and 98-001) were susceptible with 45 and 50 % of total wilted plant.

KEYWORDS: Lentil, evaluation, disease, Fusarium, germplasm

РЕЗЮМЕ

Лещата (Lens culinaris Medic.) е една от най-старите зърнено бобови култури богати на протеин. Болести като чернилка /Ascochyta blight/ и фузарийно увяхване /Fusarium oxysporum f.sp. lentis/ играят важна роля в редуциране добива при тази култура.

Тридесет и два образци с различен географски произход бяха изпитани срещу причинителя на фузарийното увяхване. Изследването се проведе през 2003-2004 при условията на изкуствен инфекциозен фон.

Три от образците (91-001, 91-028 и 98-001) представляват интерес за включване в селекционния процес.

КЛЮЧОВИ ДУМИ: леща, оценка, болести, фузариум, генплазма

INTRODUCTION

Lentil (Lens culinaris Medic.) is one of the oldest known protein-rich food legumes. Lentil is also called "poor man's meat" [2]. Lentil seeds are reach in protein, their mean value is at about 28,5% [14].

Lentil is the second pulse crop after dry bean in Bulgaria. It is grown mainly in North-Eastern part of the country.

Owing to biotic and abiotic stresses, the crop yields is below attainable levels. Among the biotic factors diseases are serious threat to lentil production in many parts of the world. Lentil (Lens culinaris Medic.) suffers from a number of diseases which are caused by fungi, bacteria, viruses, nematodes and plant parasites [9].

Diseases such as Ascochyta blight and Lentil wilt play a major role in reducing lentil yield [6]. Lentil wilt, caused by Fusarium oxysporum f.sp lentis is one of the main limiting factors to successful cultivation. The effects of various environmental factors on pathogen growth and disease expression have been studied

[13], [4]. At ICARDA, sources of wilt resistance have been identified. These were distributed in the Lentil International Fusarium Wilt Nursery (LIFWN) for testing under field conditions at different locations. Mihov et al., (1987) [12], reported four cultivars with resistance under field conditions in Bulgaria.

This pathogen is responsible for severe grain losses [5], [10], [1]. The disease appears either in the early stage of crop growth (seedling wilt) or during reproductive growth (adult plant wilt) [11]. Environmental conditions have always been a major constraint for stable lentils yields [16]. Moderately high soil temperature (20 to 25° C) which favor fungal growth and sunlight, which enhances transpiration, seem to be the key factors determining symptom expression.

The objective of this study was to identify the availability of resistance among 32 lentil genotypes to Fusarium oxysporum f.sp lentis under glasshouse conditions.

MATERIAL AND METHODS

Thirty two lentil genotypes with different geographical origin (were screened for reaction to Fusarium oxysporum f.sp. lentis during 2003-2004 from the Institute for Plant Genetic Resourses, Sadovo under greenhouse conditions.

Pure culture of the lentil pathogen are maintained in autoclaved soil [15], and then mixed with the planting soil [8]. Seeds from each accession were sown in a dish with size 30-30-10cm. The spore concentration of 2.5 x 10^2 macroconidia ml^{-1} was used to inoculate sterilized field soil in the greenhouse to screen for wilt.

The resistance to Fusarium oxysporum f.sp. lentis was established by method of Dobrev, 1987, [3]. Disease symptoms on each plant were assessed two times per week till flowering stage. The observations on seedling/ plant mortality are converted to percent wilt for use on a 1 to 5 where: 1(I) = 0% infection, 2 (R) = 1 to 15% plants wilted, 3 (MS) = 15 to 25%plants wilted, 4 (S) = 25 to 50%, 5 (HS) =50 % or more plants wilted.

In reporting resistance, it is very important to mention the crop growth stage of the screening. More lentil accessions, exhibiting resistance at the seedling stage, lose their resistance at the adult stage as it was reported from ICARDA (1990), [7].

RESULTS AND DISCUSSIONS

In their resistance to Fusarium oxysporum f.sp. lentis under glasshouse conditions, 9 accessions, namely 91-009, 91-011, 93-002, 93-040, 95-005, 98-001, 98-013, 2000LEN464, 2000LEN466, were with seedling mortality to 15% during all the experiment, 2003-2004 (Table 1, 2). Accessions numbers: 93-002 (Russia) from 2004, 95-005 (Greece), 91-011(Germany) and 2000LEN466 (Syria) from 2003 were free from disease at seedling stage. Highly susceptible (HS) with 50% or more at this

Fig. 1. Lentil plants, 1st free of symptoms and 2nd with symptoms of Fus. ox. f. sp. lentis

Table. 1 Resistance to *Fusarium oxysporum f. sp. Lentis* of Lentil genotypes, 2003 г.

№	Cat. №	Sown seeds	Seedlings	Mortality seedl. ns.	Mortality seedl. %	Mortality plants Ns	Mortality plants %	Total mortality pl. Ns.	Total mortality pl. %
1	2	3	4	5	6	7	8	9	10
1	302	20	10	10	50.0	2	20.0	12	60.0
2	345	20	3	17	85.0	2	66.7	19	95.0
3	82-001	20	3	17	85.0	1	33.3	18	90.0
4	82-003	20	6	14	70.0	4	66.7	18	90.0
5	91-001	20	17	3	15.0	8	47.0	11	55.0
6	91-002	20	16	4	20.0	9	56.2	13	65.0
7	91-006	20	0	20	100.0	-	-	20	100.0
8	91-009	20	19	1	5.0	13	68.4	14	70.0
9	91-010	20	11	9	45.0	5	45.5	14	70.0
10	91-011	20	20	0	0.0	18	90.0	18	90.0
11	91-017	20	4	16	80.0	1	25.0	17	85.0
12	91-028	20	13	7	35.0	3	23.1	10	50.0
13	93-002	20	19	1	5.0	12	63.2	13	65.0
14	93-021	20	2	18	90.0	1	50.0	19	95.0
15	93-024	20	6	14	70.0	2	33.3	16	80.0
16	93-040	20	17	3	15.0	11	64.7	14	70.0
17	93-046	20	7	13	65.0	6	85.7	19	95.0
18	93-050	20	3	17	85.0	3	100.0	20	100.0
19	93-051	20	13	7	35.0	10	76.9	17	85.0
20	93-058	20	3	17	85.0	3	100.0	20	100.0
21	95-003	20	8	12	60.0	8	100.0	20	100.0
22	95-005	20	20	0	0.0	13	65.0	13	65.0
23	98-001	20	17	3	15.0	7	41.2	10	50.0
24	98-004	20	11	9	45.0	8	72.7	17	85.0
25	98-005	20	17	3	15.0	10	58.8	13	65.0
26	98-007	20	12	8	40.0	12	100.0	20	100.0
27	98-011	20	14	6	30.0	11	78.6	17	85.0
28	98-013	20	15	5	25.0	8	53.3	13	65.0
29	2000 LEN 463	20	11	9	45.0	6	54.5	15	75.0
30	2000 LEN 464	20	15	5	25.0	8	53.3	13	65.0
31	2000 LEN 465	20	0	20	100.0	-	-	20	100.0
32	2000 LEN 466	20	20	0	0.0	12	60.0	12	60.0
33	2000 LEN 468	20	6	14	70.0	3	50.0	17	85.0
34	2000 LEN 470	20	13	7	35.0	5	38.5	12	60.0
35	2000 LEN 471	20	6	14	70.0	4	66.7	18	90.0
36	2000 LEN 472	20	11	9	45.0	5	45.5	14	70.0

stage were 16 of studied accessions with 60, 75, 80 and 90% mortality seedling plants. The genotypes 91-006 (Hungary) and 2000LEN465 (Syria) were classified as highly susceptible with 100% of mortality seedling plants during both years.

The accessions 93-050 and 93-058 showed highly susceptible during all the experiments in the next phase (adult plants) before flowering, the remaining plants were mortality (Table. 1, 2). The accessions 345, 82-003, 91-002, 91-009, 91-011, 93-002, 93-040, 93-046, 93-051, 95-005, 98-004, 98-005, 98-011, 98-013, 2000LEN463, 2000LEN464 and 2000LEN471 were susceptible to Fusarium ox. f.sp. lentis with more than 50% mortality plants during two years. The accessions 302, 82-001, 91-001, 91-010, 91-017, 91-028, 93-024, 98-001, 2000LEN470 and 2000LEN472 were with plants mortality less than 50% during 2003 (Table. 1). Three accessions (302, 91-017, 91-028) were moderately susceptible with results: 20%, 25% and 23% respectively. The remaining accessions from above group were susceptible with mortality plants between 25 and 50%.

During 2004 the accessions 302, 91-001, 91-002, 91-028, 93-024, 98-001, 98-005 were moderately susceptible with results between 31.2% and 50% mortality plants at this stage (Table 2).

The only accessions were susceptible at this stage during all the experiment (2003-2004) 302, 91-001, 91-028, 93-024, 98-001.

Four accessions (91-001, 91-028 and 98-001) were identified as susceptible with total mortality plants till 50% during 2003 (Table 1). During the experiment in second year the same three accessions and 2000LEN466

Table. 2 Resistance to *Fusarium oxysporum f. sp. Lentis* of Lentil genotypes, 2004 г.

№	Cat. №	Sown seeds	seedlings	Mortality seedl.		Mortality plants		Total mort. Pl.	
				Ns	%	ns.	%	Ns.	%
1	2	3	4	5	6	7	8	9	10
1	302	20	12	8	40.0	5	40.7	13	65.0
2	345	20	2	18	90.0	2	100.0	20	100.0
3	82-001	20	5	15	75.0	4	80.0	19	95.0
4	82-003	20	8	12	60.0	5	62.5	17	85.0
5	91-001	20	15	5	25.0	5	33.3	10	50.0
6	91-002	20	14	6	30.0	7	50.0	13	65.0
7	91-006	20	0	20	100.0	-	-	20	100.0
8	91-009	20	17	3	15.0	9	52.9	12	60.0
9	91-010	20	13	7	35.0	8	61.5	15	75.0
10	91-011	20	19	1	5.0	19	100.0	20	100.0
11	91-017	20	5	15	75.0	4	80.0	19	95.0
12	91-028	20	16	4	20.0	5	31.2	9	45.0
13	93-002	20	20	0	0.0	12	60.0	12	60.0
14	93-021	20	4	16	80.0	4	100.0	20	100.0
15	93-024	20	6	14	70.0	2	33.0	16	80.0
16	93-040	20	18	2	10.0	10	55.6	12	60.0
17	93-046	20	5	15	75.0	3	60.0	18	90.0
18	93-050	20	4	16	80.0	4	100.0	20	100.0
19	93-051	20	10	10	50.0	6	60.0	16	80.0
20	93-058	20	6	14	70.0	6	100.0	20	100.0
21	95-003	20	7	13	65.0	4	57.1	17	85.0
22	95-005	20	18	2	10.0	10	55.6	12	60.0
23	98-001	20	19	1	5.0	9	47.4	10	50.5
24	98-004	20	13	7	35.0	9	69.2	16	80.0
25	98-005	20	16	4	20.0	8	50.0	12	60.0
26	98-007	20	9	11	55.0	8	88.9	19	95.0
27	98-011	20	15	5	25.0	13	86.7	18	90.0
28	98-013	20	18	2	10.0	11	61.1	13	65.0
29	2000 LEN 463	20	12	8	40.0	8	66.7	16	80.0
30	2000 LEN 464	20	18	2	10.0	10	55.6	12	60.0
31	2000 LEN 465	20	0	20	100.0	-	-	20	100.0
32	2000 LEN 466	20	19	1	5.0	9	47.4	10	50.0
33	2000 LEN 468	20	7	13	65.0	5	71.4	18	90.0
34	2000 LEN 470	20	15	5	25.0	8	53.3	13	65.0
35	2000 LEN 471	20	6	14	70.0	5	83.3	19	95.0
36	2000 LEN 472	20	14	6	30.0	10	71.4	16	80.0

were moderately susceptible. The total wilted plants were between 45% and 50%. The rest of the accessions which gave susceptible to highly susceptible reaction under glasshouse conditions showed variable reaction to Fusarium oxysporum f.sp. lentis during both years of the experiment.

None of the studied accessions were immune or resistance to this pathogen under glasshouse conditions.

CONCLUSIONS

The tested genotypes with different geographical origin were divided into three groups based on the symptoms observed, accessions. The first group consisted accessions with highly susceptible to Fusarium oxysporum f. sp. lentis. This group is the biggest with reaction to Fusarium more than 50% wilted plants.

The second and third were consisted from the accessions which gave MS to S reaction to Fusarium oxysporum f. sp. lentis under glasshouse conditions. They showed variable reaction during all the experimental period.

Three of the studied accessions (91-001, 91-028 and 98-001) were susceptible with 45 and 50 % of total wilted plant.

These genotypes could be used for developing cultivars especially for late-sown conditions.

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