ZIBELINE INTERNATIONAL PUBLISHING

ISSN: 2521-2931 (Print)
ISSN: 2521-294X (Online)
CODEN: MJSAEJ

Malaysian Journal of Sustainable Agriculture (MJSA)

DOI: http://doi.org/10.26480/mjsa.01.2020.22.25

RESEARCH ARTICLE

IDENTIFICATION OF LENTIL VARIETIES/LINES RESISTANT TO STEMPHYLIUM BLIGHT CONSIDERING DISEASE REACTION AND YIELD

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ARTICLE DETAILS

Article History:

Received 01 December 2019
Accepted 06 January 2020
Available online 05 February 2020

ABSTRACT

A piece of study was carried out to identify the resistant varieties to stemphylium blight disease of lentil at Plant Pathology Division, Bangladesh Agriculture Research Institute, Joydebpur, Gazipur during the period of September 2013 to April 2014. The experimental design was RCB in field condition having three replications. Eleven lentil test entries along with 2 check variety BARI masur-1 and BARI masur-7 were evaluated. At maturity 4 lines showed Moderately Resistant (MR) and 7 lines showed Moderately Susceptible (MS) types of reaction. The line BLX-06004-12 gave the highest yield (1456 kg ha^{-1}) followed by BLX-06004-2 (1113.30 kg ha^{-1}) and BLX-05001-6 (1106.30 kg ha^{-1}) which were designated as moderately resistant to stemphylium blight disease. The lowest yield (987.30 kg ha^{-1}) was recorded in BLX-05008-21 which was designated as moderately susceptible to stemphylium blight disease.

KEYWORDS

Lentil, Disease, Stemphylium, Resistant, Yield.

1. INTRODUCTION

Lentil (*Lens culinaris* Medik) is one of the most important food legumes crops of Bangladesh. It ranks second in respect of acreage (162 thousands hectares) and production (211 thousands metric tons) in the country (Anonymous, 2012). Greater Faridpur, Jessore, Kushtia, Pabna and Rajshahi are the major lentil growing areas in Bangladesh. The disease is a serious constraint in lentil cultivation and is widespread throughout the country with the highest severity in Jessore, Pabna, Kushtia,Faridpur, Madaripur and Dhaka (Bakr and Ahmed, 1992). In the recent years, the disease is also a threat to lentil cultivation in the southern parts of the country like Barisal and Bhola districts. The most important diseases of lentil in Bangladesh are stemphylium blight, rust and foot and root rot. Among them stemphylium blight caused by *Stemphylium botryosum* has created panic in the lentil growers as well as researchers in the country. Stemphylium blight, a damaging major disease of lentil, attacked the crop at any growing stage of damage depending upon how early the disease was appeared.

The disease is a serious concern not only in Bangladesh but also in northeast India and Nepal causing up to 100% yield losses under epidemic conditions. The climatic conditions in Bangladesh are favorable for the rapid development and growth of various plant pathogens. Although some fungicides are available to manage the stemphylium blight disease but it is necessary to develop alternate and more effective control measures with fungicides. Chemical control measure of this disease was to some extent costly and cumbersome. Among the alternation means of disease management, development of resistant variety is the most widely preferred method. Growing of resistant cultivar like "Utfala" the first improved *Lens culinaris* varity in Bangladesh was therefore, easy, cheap and environment friendly (Sarker et al., 1992).

It showed consistently higher yield over years across locations and exhibited yield potential of up to 3.45 ton/ha in favorable climatic conditions at ishurdi during 1983-84. Beare reported that resistant varieties provide a more effective and more consistent method of stemphylium blight control (Beare, 2002; FRG, 2012; Bakr and Ahmed, 1993; Rashid et al., 2009; Podder, 2012). On the other hand, BARI Masur-4 was selected from the cross ILL5888 × FLIP84-112L in 1995 and produced an average seed yield of 2300 kg/ha. BARI masur-4 has an erect growth habit and was suitable for intercropping with sugarcane and mixed cropping with mastard. It had combined resistance to rust and Stemphylium blight (*Stemphylium botryosum)* (Sarker and Erskine, 1998). Besides, there were 21 lentil lines that were blight resistant with higher yield (Rashid et al., 2009). In view of the above facts research works have been undertaken to screen out the resistant/tolerant source(s) of lentil germplasms against Stemphylium blight disease.

2. MATERIALS AND METHODS

2.1 Experiment site details

The experiment was conducted at the research field of Plant Pathology Division, Bangladesh Agricultural Research Institute (BARI), Gazipur during September 2013 to April 2014.The experimental field was high land with highly sandy loam texture belonging to the Madhupur tract under AEZ-28.

2.2 Collection and preservation of Seeds

Seeds of 11 lentil lines i.e. BLX-05001-6, BLX-05002-3, BLX-05002-6, BLX-

Quick Response Code	Access this article online	
	Website: www.myjsustainagri.com	DOI: 10.26480/mjsa.01.2020.22.25

Cite the Article: Md. Amirul Islam, Shah Md. Ariful Islam, Maria Akter Sathi (2020). Identification Of Lentil Varieties/Lines Resistant To Stemphyl ium Blight Considering Disease Reaction And Yield. *Malaysian Journal of Sustainable Agriculture*, 4(1): 22-25.

05008-2, BLX-05008-5, BLX-05008-15, BLX-05008-21, BLX-05009-7, BLX-06004-2, BLX-06004-12, FLIP-95-12 and two check varieties i.e BARI masur-1 (Susceptible check) and BARI masur-7 (Resistant check) were collected from Pulses Research Sub Station (PRSS), Gazipur for conducting this experiment. The collected seeds received from PRSS were immediately stored in a well-ventilated room at room temperature. Special care was taken and the seeds were duly registered. After registration, seeds were preserved in a deep fridge in the Plant Pathology laboratory of BARI till they were used for field experiment.

2.3 Experimental design and layout

The experimental plot was nicely prepared mechanically in late October 2013. Weeds and other rubbishes were removed. Fertilizers were applied at the time of final land preparation as per recommendation (FRG, 2012). The experiment was conducted in Randomized Complete Block (RCB) design with three replications. The row length was 5m and width was 30 cm. The distance between the block was 1m. Susceptible check variety BARI masur-1 was sown after every two test lines. Resistant check variety BARI masur-7 was sown at the beginning and end of each block/replication.

2.4 Seed sowing and management

Furrows were made with power tiller driven furrows maintaining a distance of 30 cm. The required amounts of seeds for each row were sown in the furrow. The furrows were covered with soil soon after sowing. The length of line was 5m with continuous sowing of seed in the lines. The seed were sown in the morning on 21 November, 2013. To minimize the seed borne pathogen, seeds were treated with Provax-200 @ 2.5g/kg seed. Intercultural operation was done in order to maintain the normal hygienic condition of crop growth. Weeding was done three times during the growing period of the crop at 20, 35 and 50 days after sowing. Insecticide 'Karate (0.2%) was applied for controlling pod borer and aphid of lentil.

2.5 Data recording on yield and yield contributing parameters

Days to 1st flowering was recorded when 1st flowering is open. Days to 50% Flowering (DFLR) was recorded in number of days after sowing when 50% plants in the row sets the first flower. Days to maturity (DMAT) was recorded in number of days after sowing when 90% of the row is ready for harvest. Ten plants of each unit plots were randomly selected for recording the data on plant height, number of branch per plant, number of pods per plant, seed per pod after harvest. Thousand seeds were counted by a seed counter and weight taken through digital high precision balance (0.001g). Grain yield of lentil kg ha-1 was calculated by converting the weight of row yield into hectare and was expressed in kg.

2.6 Analysis of data

The collected data were analyzed statistically. The experimental data were analyzed by Statistix 10.0 software at 5% level of significance. Treatment means were compared by DMRT.

3. RESULT

3.1 Disease Reaction to Stemphylium Blight of lentil at three different stages during rabi season of 2013-2014

The lentil lines were evaluated for their reaction to Stemphylium blight under natural epiphytotic condition during the winter season of 2013-14 and showed significant difference in reaction to *Stemphylium botryosum*. In flowering stage i.e. at 45 days after sowing out of 11 lines 3, 6 and 2 lines showed Highly Resistant (HR), Resistant (R) and Moderately Resistant (MR) reaction, respectively. The 3 highly resistance lines were BLX-05002-3, BLX-06004-12 and BLX-06004-2 in the flowering stage (Figure 1). In flowering stage, out of 11 lines 2, 7 and 2 lines were showed Resistant (R), Moderately Resistant (MR) and Moderately Susceptible (MS) reaction, respectively in the pod setting stage (Figure 1). The resistant 2 lines were BLX-06004-12 and BLX-06004-2. The data was taken 60 days after sowing. At maturity stage, 4 lines showed Moderately Resistant (MR) and 7 lines showed Moderately Susceptible (MS) type of reaction (Figure 1). None of the 11 entries showed either resistant or susceptible reaction against the disease. The Moderately Resistant (MR) lines were BLX-06004-12, BLX-06004-2, BLX-05002-3 and BLX-05001-6. The data was taken 75 days after sowing.

3.2 Performance of test lines / varieties in yield and yield contributing characteristics during Rabi season of 2013-14

3.2.1 Days to 1st Flowering, Days to 50% Flowering (DFLR), Days to maturity (DMAT), Plant height and No. of branch plant-1

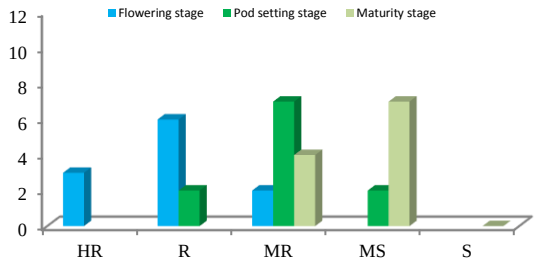

Figure 1: Reaction on Stemphylium blight disease of 11 lentil lines at different stages

There was no variation regarding disease reaction at 1st flowering among different lentil lines/varieties. Days to the 1st flowering ranged from 49.93 days to 47.77 days. It was observed that BARI masur-7 started flowering 2 days later than the other lines. The highest (49.33) and the lowest (47.77) days to start flowering were recorded in BARI masur-7 and BLX-05001-6 line (Table 1). DFLR showed variation among the lines/varieties. It ranged from 55.63 to 53.17 while the highest was recorded in BLX-05008-5 and the lowest was recorded in BARI masur-1. DMAT of all the test and check lines/varieties ranged from 99.03-95.97. The highest days of maturity was observed in FLIP-95-12 followed by BLX-05002-3 (98.37), BLX-05001-6(97.70) and the lowest (95.97) in BLX-05009-7 followed by BARI masur-7 (96.40), BLX-05008-21(96.40), BARI masur-1(96.53). The tested 11 lines and two check varieties showed significant difference to each other in the field condition. The plant height ranged from 33.40 cm to 43.40 cm while the tallest plant (43.40 cm) was found in BLX-06004-12 line and the shortest plant (33.40 cm) was recorded in BLX-06004-2 line. Plants in some of the lines were taller than the check variety. Number of branch per plant was counted as the primary branch of plant that is the first branching of the plant. It was found that most of the lines/varieties gave two primary branches yet only a few lines gave about three primary branches. The highest (2.98) Number of branch per plant was observed in BLX-06004-12 and lowest (2.53) in BLX-05008-5 (Table 1).

3.2.2 Number of pod plant^{-1}, Number of seed pod^{-1} and 1000-seed weight

Number of pod per plant was recorded after harvesting of plants. Pods were counted from ten (10) plants in every lines/varieties and showed significant difference from one to others (Table 2). Number of pod ranged from 58.23 to 86.57 while minimum number of pod was recorded in BLX-05008-21(58.23) followed by BLX-05009-7(58.33) and maximum number of pod was recorded in BLX-06004-12(86.57) followed by BARI masur-7(85.37). The number of seed per pod was recorded after harvesting of the plant by counting seed in each pod from ten (10) plants in every lines/varieties. Number of seed per pod ranged from 1.80 to 2.00 (Table 2). The highest number of seed per pod was recorded in BARI masur-7 and BLX-06004-12 and lowest in BLX-05009-7. In respect of 1000 seed weight marked variation has been found. The thousand seed weight under different lines/ verities ranged from 15.50 to 21.10 g (Table 2). The highest weight was recorded in BLX-06004-12 followed by BARI masur-7(20.73 g) and lowest (15.5 g) 1000 seed weight was recorded in BLX-05008-2 followed by BLX-05002-6 (15.53 g).

3.2.3 Grain yield

The grain yield per hectare differed significantly among the test entries under field condition (Table 2). The yield ranged from 987.30 to 1456.00 kg ha^{-1} whiles the highest (1456.00 kg ha^{-1}) grain yield was recorded in BLX-06004-12 followed by BARI masur-7 (1451.00 kg ha^{-1}) and BARI masur-1 (1125.00 kg ha^{-1}) and lowest (987.3 kg ha^{-1}) yield was recorded in BLX-05008-21 followed by BLX-05008-2 (995.00 kg ha^{-1}) and BLX-05008-5 (996.30 kg ha^{-1})

Table 1: Days to 1st flowering, 50% flowering, maturity, Plant height and No. of branch plant^{-1} of 11 selected lentil germplasms and two check varieties

Sl. No.	Name of lines/varieties	Days to 1st Flowering	Days to 50% Flowering	Days to Maturity	Plant height (cm)	No. of branch plant^{-1}
1	FLIP-95-12	48.80 ab	55.07 ab	99.03 a	37.80 c	2.77 abc
2	BLX-05002-3	47.80 b	55.10 ab	98.37 ab	35.63 def	2.63 bcd
3	BLX-06004-12	47.93 b	54.87 ab	96.63 bc	43.40 a	2.98 a
4	BLX-05009-7	49.20 ab	54.83 ab	95.97 c	34.10 gh	2.57 cd
5	BLX-06004-2	48.10 b	54.33 bc	97.03 abc	33.40 h	2.60 bcd
6	BLX-05001-6	47.77 b	54.60 ab	97.70 abc	35.30 efg	2.63 bcd
7	BLX-05002-6	48.30 ab	55.10 ab	97.60 abc	34.90 fg	2.80 ab
8	BLX-05008-21	47.83 b	54.57 ab	96.40 bc	36.93 cd	2.60 bcd
9	BLX-05008-15	48.10 b	54.80 ab	97.07 abc	35.00 fg	2.57 cd
10	BLX-05008-2	47.97 b	55.03 ab	97. 33 abc	36.63 cde	2.57 cb
11	BLX-05008-5	49.37 ab	55.63 a	97.10 abc	34.30 fgh	2.53 d
12	BARI masur-1	48.54 ab	53.17 c	96.53 bc	34.57 fgh	2.67 bcd
13	BARI masur-7	49.93 a	53.87 bc	96.40 bc	39.87 b	2.93 a
CV (%)		2.03	1.37	1.34	2.43	5.05
LSD (0.05)		1.65	1.25	2.20	1.49	0.23

Table 2: Number of pod plant^{-1}, Number of seed/pod, 1000 seed weight and grain yield of selected 11 lentil germplasms and two check varieties

Sl. No.	Name of lines/varieties	No. of pod plant^{-1}	Number of seed/pod	1000 seed weight (g)	Grain yield (kg ha^{-1})
1	FLIP-95-12	68.47 b	1.82 bc	16.27 cd	1011.00 ef
2	BLX-05002-3	64.07 c	1.81 c	15.67 de	1020.30 e
3	BLX-06004-12	86.57 a	2.00 a	21.10 a	1456.00 a
4	BLX-05009-7	58.33 e	1.80 c	15.80 de	1005.00 fg
5	BLX-06004-2	58.53 de	1.83 bc	18.27 b	1113.30 bc
6	BLX-05001-6	59.87 de	1.82 bc	16.33 cd	1106.30 cd
7	BLX-05002-6	69.10 b	1.83 bc	15.53 e	1101.00 d
8	BLX-05008-21	58.23 e	1.82 bc	16.50 c	987.30 h
9	BLX-05008-15	59.60 de	1.85 bc	15.90 cde	1006.00 fg
10	BLX-05008-2	61.27 cd	1.84 bc	15.50 e	995.00 gh
11	BLX-05008-5	59.03 de	1.82 bc	16.33 cd	996.30 gh
12	BARI masur-1	71.30 b	1.88 b	20.73 a	1125.00 b
13	BARI masur-7	85.37 a	2.00 a	20.47 a	1451.00 a
CV (%)		2.55	2.17	2.30	0.64
LSD (0.05)		2.84	0.07	0.67	11.20

4. Discussion

In the present investigation stemphylium blight of lentil caused by *Stemphylium botryosum* showed typical symptoms on lentil plants. This study was carried out to investigate the performance of different lentil lines/varieties under natural condition. The lentil lines/varieties were evaluated for their resistance to stemphylium blight disease caused by *stemphylium botryosum*. The tested lentil lines/varieties showed wide variation in reaction to stemphylium blight under field condition at different growth stages. The sensitivity of the tested lentil lines/varieties increased with the increase in age of the plants. The prevalence of stemphylium was as follows: vegetative stage > flowering stage > pod setting stage. But this tendency may not be always a regular pattern to all the lines/varieties. From this research, the tested lentil variety/genotypes differed significantly from one to another in respect of disease, yield and yield contributing characters under field condition.

In flowering stage, out of 11 lines 3, 6 and 2 lines showed Highly Resistant (HR), Resistant (R) and Moderately Resistant (MR) type of reaction respectively. In the pod setting stage the scenario was changed and 2, 7 and 2 lines showed Resistant (R), Moderately Resistant (MR) and Moderately Susceptible (MS) reaction respectively. At maturity stage actual scenario was observed, only 4 and 7 lines showed Moderately Resistant (MR) and Moderately Susceptible (MS) type of reaction respectively. The Moderately Resistant (MR) lines were BLX-06004-12, BLX-06004-2, BLX-05002-3 and B LX-05001-6. None of the lines showed resistant type of reaction against the disease. Bakr and Ahmed studied on 110 genotypes and found only one genotype resistant to Stemphylium blight and 11 genotypes were tolerant (Bakr and Ahmed, 1993). Beare screened lentil lines/verities against stemplylium blight under natural condition and obtained some lines/varieties as moderately resistant and susceptible (Beare, 2002).

The finding of the present study revealed that the tested lentil lines/verities showed different types of reaction to stemphylium blight under field condition. Some researcher screened lentil lines and found that 21 entries were Resistant (R) to stemphylium blight (Rashid *et al.,* 2009). From this research, it was observed that the tested lentil lines/verities differed significantly in respect of plant height, number of pod per plant, number of branch per plant and yield. Plant height was found maximum in the BLX-06004-12 lines followed by BARI masur-7, FLIP-95-12, BLX-05008-21 and BLX-05008-2 and the minimum in the BLX-06004-2. Number of pod per plant was maximum in the BLX-06004-12 lines followed by BARI masur-7, BARI masur-1, BLX-05002-6 and FLIP-95-12 and the minimum in the BLX-05008-21. The highest grain yield was recorded from the BLX-06004-12 lines followed by BARI masur-7 and both were statistically identical.

Considering the yield performance, it was observed seven lines/varieties produced more than 1 ton yield with a range from 1456 to 1020.30 (kg ha^{-1}). The lines are: BLX-06004-12, BARI masur-7, BARI masur-1, BLX-06004-2, BLX-05001-6, BLX-05002-6 and BLX-05002-3. The findings of the study is closely related with the study (Sarker *et al.,* 1992; Rashid *et al.,* 2009; Podder, 2012; Sarker and Erskine, 1998). They reported that the lentil lines differed significantly in respect of agronomic traits and yield parameters. The variation in yield of lentil was mainly due to Stemphylium

blight disease. This variation may be due to i) the effect of Stemphylium botryosum on formation of pod. ii) variations of genetic make up of lentil lines/verities and iii) growing conditions of plants. A group researchers reported yield reduction of lentil due to Stemphylium blight (Bakr, 1993; Mwakutuya *et al.,* 2002; Neubauer, 1998). They were described that yield reduction of lentil increased with the increasing of Stemphylium blight disease severity. With the findings of the present study it may be concluded that the lentil lines showed appreciable difference reaction to *S. botryosum* which need to be tested further for more confirmation of the result of this study.

5. Conclusion

This piece of experiment was designed to screen resistant/tolerant lentil varieties/lines against stemphylium blight disease. Eleven lentil lines along with a susceptible and a resistant check was evaluated and it was observed that the line BLX-06004-12 gave the highest yield (1456 kg ha-1) followed by BLX-06004-2 (1113.30 kg ha-1) and BLX-05001-6 (1106.30 kg ha-1) and were moderately resistant to stemphylium blight disease. The lowest yield (987.30 kg ha-1) was recorded in BLX-05008-21 followed by BLX-05008-2 and BLX-05008-5. So, the line BLX-06004-12, BLX-06004-2 and BLX-05001-6 may be selected for next year up-scaling due to synchronous maturity, higher yield and low disease severity.

From the above study it can be concluded that

- Three lentil lines viz. BLX-06004-12, BLX-06004-2 and BLX-05001-6 showed moderately resistant reaction against stemphylium blight disease
- These three lines can be used in the resistant breeding program as a stemphylium blight disease resistant source

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