Indian Journal of Agricultural Sciences **85** (10): 1269–72, October 2015/Article

Evaluation of resistance in different varieties/genotypes of bottle gourd *(Lagenaria siceraria)* against *Cercospora* leaf spot under field conditions

S K MAHESHWARI[1], B R CHOUDHARY[2], D SINGH[3], B D SHARMA[4] and S K SHARMA[5]

ICAR-Central Institute for Arid Horticulture, Bikaner, Rajasthan 334 006

Received: 19 June 2015; Accepted: 8 July 2015

ABSTRACT

Cultivation of resistant or tolerant cultivars is one of the best options to minimize the losses due to diseases. Seventeen bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] varieties/genotypes (Pusa Naveen, Pusa Samridhi, Udaipur Local, Pusa Santushti, Pusa Sandesh, PSPL, Chomu Local, Azad Harit, Panchmahal Local, Arka Bahar, Thar Samridhi, PN 22, DBG 5, DBG 6, Jodhpur Local, IC 567538 and Sriganganagar Local) were evaluated for resistance against *Cercospora* leaf spot during the rainy season of 2011 and 2012 under hot arid field conditions of Rajasthan. Among them, none was found immune or resistant, four varieties (Pusa Naveen, Pusa Santushti, Pusa Samridhi and Pusa Sandesh) were found to be moderately resistant and four (PSPL, Arka Bahar, PN22 and DBG6) were moderately susceptible and the remaining nine were susceptible.

Key words: Bottle gourd, *Cercospora* leaf spot, Disease incidence, Disease severity, Evaluation

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] is one of the most commonly grown cucurbitaceous vegetable crops in India and showed wide variability for different traits (Kumar *et al.* 2011). It is grown in warmer regions of the world. Nowadays, it is becoming popular for several health benefits. The fruits can be used as a vegetable or for making sweets. As a vegetable, it is easily digestible even by patients (Thamburaj and Singh 2000). It is gaining importance due to its high yield potential, steady market price throughout the season. The fruits contain 0.2% protein, 2.9% carbohydrates, 0.5% fat and 11 mg of vitamin C per 100 g fresh weight (Aykroyd 1963). It also has a wide medicinal property such as laxative, digestive and to prevent constipation. Bottle gourd is an important crop of Rajasthan and widely grown in open field conditions as well as in river beds to harvest early crop. The crop is affected by various viral and fungal diseases. Among fungal diseases, *Alternaria* leaf blight, downy mildew, powdery mildew, *Cercospora* leaf spot and anthracnose are the important, out of which *Cercospora* leaf spot caused by *Cercospora citrulina* is one of the most serious diseases and causes heavy losses to the crop of bottle gourd. *Cercospora* leaf spot caused by *C. citrulina* Cooke was observed on cucurbits (Sarbhoy 2006). First record of *Cercospora citrulina* leaf spot on bottle gourd in Pakistan was reported by Mukhtar *et al.* (2013). Symptoms of this disease in bottle gourd occur primarily on foliage. On older leaves, small, circular to irregular circular spots with tan to light brown lesions with dark margins appear. The number and size of lesions increases, eventually coalescing and causing entire leaves to become diseased. Severely infected leaves turn yellow and finally fall off.

Chemical control is expensive and less environmental friendly. The residual effect of fungicides causes health hazards to human being. This is especially, when there is growing public sensitivity about the environmental pollution and residual effects on produce due to the indiscriminate use of hazardous chemicals and emergence of new races. Plant resistance is an effective and environmentally safe means of reducing losses caused by the fungal diseases. The cheapest, practical and economical control of the disease can be achieved by identification of resistant genetic stock to the disease (Jadhav and Sharma 1983). Cultivation of resistant or tolerant cultivars is one of the best options to minimize the losses due to disease occurrence. For the identification/development of a resistant variety, sources of resistance are the prerequisite. Resistant sources may be present in the indigenous cultivars, land races, folk cultivars, semi-wild relatives and allied species of the vegetable crops (Singh *et al.* 2009). So far, information available on the screening bottle gourd varieties/genotypes against *Cercospora* leaf spot under arid condition is scanty. Keeping in view above facts in background, the present study was undertaken to evaluate and identify resistant varieties/ genotypes of bottle gourd against *Cercospora* leaf spot under hot arid conditions of Rajasthan.

[1]Senior Scientist (e mail: maheshwariskciah@gmail.com), [2]Senior Scientist (e mail:choudharybr71@gmail.com), [3]Head (e mail:dhuren6@gmail.com), [4]Head (e mail: drbrijeshdutt @yahoo.co.in) and [5] Director (e mail: ciah@nic.in)

MATERIALS AND METHODS

For conducting screening study, 17 bottle gourd genotypes were collected from different sources such as ICAR Institutes, Agricultural Universities and other areas of Rajasthan as well as Gujarat states. The collected material of bottle gourd, viz. Pusa Sandesh, PSPL, Arka Bahar, Thar Samridhi, Udaipur Local, Pusa Santushti, Chomu Local, Pusa Naveen, Pusa Samridhi, Azad Harit, Panchmahal Local, PN22, DBG5, DBG6, Jodhpur Local, IC567538 and Sriganganagar Local were screened against resistant to *Cercospora* leaf spot at Pathology Block of ICAR-Central Institute for Arid Horticulture, Bikaner. The seed of each variety/genotype was sown on 30 June and 3 July during the years of 2011 and 2012, respectively in a randomized block design (RBD) with three replications. Two rows of each variety/genotype were raised and maintained 30 plants in each replication. The spacing maintained between rows was 2.5 m and between plants 0.50 m.

Pathogenicity was done on bottle gourd plants by isolating *C. citrulina* from infected leaves of bottle gourd. Pathogenicity was established on healthy plants of bottle gourd genotype Chomu Local, which was susceptible to the disease. For this study, the plants were raised in plastic pots of 30 cm diameter filled with sterilized soil and 1 plant per pot was maintained. After 30 days, the plants were artificially inoculated by spraying spore-cum-mycelial suspension, prepared in sterile water. Leaves were used for inoculation purpose. The inoculated plants were covered with polythene bags for 48 hr to provide sufficient humidity for infection. Disease symptoms were produced in the plant leaves. The fungus was reisolated from the artificially inoculated infected plants and was similar with the original isolate. The recommended packages of practices for this crop were adopted. No plant protection measures were taken up during study period in both the years of experimentation. A susceptible germplasm Chomu Local was sown after every five rows of different test varieties/ genotypes as check which was also grown around the border of the field to serve as infector rows. Infector rows were line of susceptible genotype, which are planted to provide ample numbers of hosts for early disease development and rapid dispersal of infection to other varieties/genotypes. Infector rows registered 50% and 32.63% disease incidence and severity, respectively. Disease incidence was calculated on the basis of per cent plants infected. Total number of plants and number of infected plants by this disease in each replication of varieties/genotypes were counted and disease incidence was calculated by following formula:

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Data on disease incidence and disease severity were recorded on maturity stage of this crop. Disease severity was recorded on the basis of per cent leaf area affected (Singh *et al.* 2006). For recording disease severity, 25 infected leaves were randomly selected from each row of varieties/genotypes. The per cent data were angular transformed to attain normal distribution of recorded data and statistically analyzed by off campus CCSHAU, Hisar (Haryana) OPSTAT statistical analysis software in RBD using one factor analysis. Disease reactions were categorized for resistance for varieties/genotypes against *Cercospora* leaf spot by using a 0- 9 rating scale (Mayee and Datar 1986) where, 0 = No symptoms (immune), 1 = 1% or less symptoms (resistant), 3= 1-10% plants exhibiting

Table 1 Disease severity of different varieties/genotypes in bottle gourd for resistance against *Cercospora* leaf spot (pooled data of 2011 and 2012)

Varieties/Genotypes	Disease incidence (%)*	Disease severity (%)*
Pusa Naveen	16.67 (24.06)	5.98 (13.99)
Pusa Samridhi	14.29 (22.18)	8.7 (16.97)
Pusa Santushti	16.67 (24.06)	6.85 (14.90)
Pusa Sandesh	16.67 (24.06)	9.38 (17.74)
PSPL	25.0 (29.83)	11.99 (20.12)
Arka Bahar	16.67 (24.06)	14.05 (21.93)
PN 22	20.0 (26.53)	16.33 (23.79)
DBG 6	25.0 (29.83)	19.58 (26.21)
DBG 5	20.0 (26.53)	22.25 (28.10)
Azad Harit	25.0 (29.83)	22.1 (27.98)
Sri Ganganagar Local	20.0 (26.53)	25.12 (30.02)
Udaipur Local	33.33 (35.24)	28.45 (32.20)
Panchmahal Local	25.0 (29.83)	27.0 (31.26)
Thar Samridhi	20.0 (26.53)	28.83 (32.43)
Jodhpur Local	25.0 (29.83)	31.28 (34.04)
IC 567538	33.33 (35.24)	30.12 (33.25)
Chomu Local	50.0 (44.98)	32.63 (34.80)
CD (P = 0.05)	4.15	3.42
CV	8.63	7.92

*Figures in parentheses are angular transformed values for analysis.

Table 2 Disease reaction of bottle gourd varieties/genotypes against *Cercospora* leaf spot

Rating scale	Disease reaction	Varieties/Genotypes
0	Immune	Nil
1	Resistant	Nil
3	Moderately resistant	Pusa Naveen, Pusa Santushti, Pusa Samridhi and Pusa Sandesh
5	Moderately susceptible	PSPL, Arka Bahar, PN 22 and DBG 6
7	Susceptible	Azad Harit, DBG 5, Sri Ganganagar Local, Panchmahal Local, Udaipur Local, Thar Samridhi, IC 567538, Jodhpur Local and Chomu Local
9	Highly susceptible	Nil

Table 3 Periodic weather data for the year 2011

Fourteen days interval	Average temperature (°C)		Average RH (%)		Total rainfall (mm)
	Max.	Min.	Max.	Min.	
14-07-2011	39.8	28.9	66.5	31.5	13.5
28-07-2011	39.6	28.7	62	33	11.2
11-08-2011	38.1	27.1	73	44	30.2
25-08-2011	37.1	26.3	71.5	57	30
08-09-2011	34.1	25.7	86	56	18.3
22-09-2011	34.0	25.6	87	59	18.8
06-10-2011	34.5	27.2	82.5	48.5	
20-10-2011	34.7	21.7	79	30.5	
03-11-2011	35.9	19.8	54.5	20.5	
17-11-2011	33.6	15.7	60	23.5	
01-12-2011	32.8	14.0	62	27	

symptoms (moderately resistant), 5 = 11-20% symptoms (moderately susceptible), 7= 21-50% symptoms (susceptible) and 9 = More than 51% symptoms (highly susceptible) (Table 2). Periodic weather data during the crop season was also recorded for the year 2011 (Table 3) and 2012 (Table 4).

RESULTS AND DISCUSSION

To the best of our knowledge, this is the first report on the resistance evaluation *Cercospora* leaf spot in bottle gourd under hot aid conditions of Rajasthan. Data indicated that range of average disease incidence and disease severity in bottle gourd varieties/genotypes was 14.3 to 50.0% and 5.98 to 32.63%, respectively (Table 1). Disease incidence and disease severity in susceptible check were found 50.0% and 32.63%, respectively. Variety Pusa Samridhi showed lowest disease incidence (14.29%) followed by Pusa Naveen, Pusa Santushti, Pusa Sandesh and Arka Bahar having 16.67% disease incidence which did not differ statistically at par with another. The highest disease incidence (50.0%) was recorded in case of germplasm Chomu Local, followed by Udaipur Local and genotype IC 567538 with 33.3% disease incidence. Varieties, viz. Pusa Naveen, Pusa Santushti and Pusa Samridhi showed the minimum disease severity (5.98, 6.85 and 8.70) which were found statistically at par. Pusa Naveen (5.98% disease severity) and Pusa Sandesh (9.38%) found statistically at par with each other. Next two varieties (PSPL and Arka Bahar) exhibited less disease severity of 11.99 and 14.05% which were found statistically at par with each other. The highest disease severity (32.63%) was recorded in case of germplasm Chomu Local, followed by Jodhpur Local (31.28%).

Table 4 Periodic weather data for the year 2011

Fourteen days interval	Average temperature (°C)		Average RH (%)		Total rainfall (mm)
	Max.	Min.	Max.	Min.	
14-07-2012	41.7	29.3	60	22.5	
28-07-2012	40.9	29.7	57.5	31.5	
11-08-2012	40.2	29.3	61	29.5	
25-08-2012	37.1	27	69.5	41.5	18.9
08-09-2012	34.5	25.4	81.5	55.5	25.50
22-09-2012	34.2	25.8	88	58.5	43.00
06-10-2012	34.7	24.5	78	46.5	
20-10-2012	36.7	20.3	58	24.5	
03-11-2012	34.8	16.9	57.5	22.5	
17-11-2012	32.4	13.7	55.5	26	
01-12-2012	31.6	10.9	54	17	

Out of 17 genotypes, none was found immune or highly resistant to this disease. Four varieties (Pusa Naveen, Pusa Santushti, Pusa Samridhi and Pusa Sandesh) showed moderately resistance with 5.987–9.38% disease severity, two varieties (PSPL and Arka Bahar) and two genotypes (PN22 and DBG6) were categorized as moderately susceptible having 11.99 to 19.58% disease severity while the remaining nine varieties/genotypes proved their susceptibility with disease severity from 22.10 to 32.63%. Carmody *et al.* (1985) screened muskmelon cultivars and recorded resistant cultivars (TAM-Mayan Sweet, TAM-Uvalde and Greenflesh Honeydew) against *Alternaria* leaf blight. Mark *et al.* (2005) found Hannahs Choice F1 as resistance source against powdery mildew, *Fusarium* race 2 and potyviruses in muskmelon. Resistance source was reported in wild taxa such as *Abelmoschus crinitus, A. moschatus, A. angulosus* and *A. pungens* of okra against *Cercospora* blight (Dhankar *et al.* 2005, Singh *et al.* 2007). Borkar and Umaharan (2007) found resistant cowpea genotypes, viz. IT97K-1069-8, IT97K-556-4 to *Cercospora* leaf spot. Singh and Gurha (2007) screened different genotypes/varieties of mung bean and they found that 5 genotypes (BM 4, CO 4, CO 5, ML 515 and TM 98-50) were resistant against *Cercospora* leaf spot caused by *Cercospora* sp. Kimber and Paul (2011) reported that all cultivars commercially available to the faba bean were susceptible to *Cercospora* leaf spot. Chauhan and Bhatia (2013) screened 22 germplasm lines/cultivars of bottle gourd for resistance and found that lines such as GH 3 and GH 9 showed resistant to anthracnose disease.

During the study period, varieties/genotypes did not show high disease severity due to prevailing dry atmospheric conditions, typical of the arid environment and erratic rainfall, which was unfavourable for the disease development under field conditions of Rajasthan. Previously, no such study was undertaken for resistance evaluation of bottle gourd under arid environment; therefore, field screening under prevailing climatic conditions, seems effective for selection of tolerant bottle gourd genotypes for their cultivation by growers of arid region. Cultivation of resistant or tolerant cultivars is one of the best options to minimize the losses due to disease occurrence. However, keeping in mind the unpredictable and fluctuating weather conditions, particularly in view of global climate change, it is advisable to grow moderately resistant varieties (Pusa Naveen, Pusa Santushti, Pusa Samridhi and Pusa Sandesh) against *Cercospora* leaf spot for better growth and also

yield production of bottle gourd. This disease may attain an alarming status and may wreak havoc in bottle gourd growing areas if not taken care well in time. Therefore, it is need of the hour to identify resistant varieties for effective management strategy against this dreaded disease of the crop.

REFERENCES

Aykroyd W R. 1963. *The Nutritive value of Indian Foods and Planning of Satisfactory Diet*. ICMR Special Rep. Series No. 42.

Borkar H M and Umaharan P. 2007. Identification of resistance to *Cercospora* leaf spot of cowpea. *European Journal of Plant Pathology* **118**(4): 401–10.

Carmody B E, Miller M E and Grisham M P. 1985. A technique to screen muskmelons for resistance to *Alternaria* leaf blight. *Plant Disease* **69**: 426–8.

Chauhan R S and Bhatia J N. 2013. Screening of bottle gourd genotypes against anthracnose disease under natural as well as artificial epiphytotic conditions. *Plant Disease Research* **28** (1): 92–3.

Dhankar B S, Mishra J P and Bisht I S. 2005. (*In*) *Plant Genetic Resources: Horticultural Crops*, pp 59–74. Dhillon B S, Tyagi R K, Saxena S and Randhwa G J (Eds). Narosa Publishing House, New Delhi.

Jadhav V M R and Sharma B L. 1983. Field reaction of mungbean (*Vigna radiata* L.) Wilczek varities to *Cercospora* leaf spot in north Madhya Pradesh. *Legume Research* **6**: 99–100.

Kimber R B E and Paul J G. 2011. Identification and genetics of resistance to *Cercospora* leaf spot (*Cercospora zonata*) in germplasm of faba beans (*Vicia faba*). *Euphytica* **117**: 419–29.

Kumar A, Singh B, Kumar M and Naresh R K. 2011. Genetic variability, heritability and genetic advance study for yield and its components in bottle gourd. *Progressive Horticulture* **43**(2): 268–70.

Mark J H, Henry M M, and Moly M J. 2005. Hannahs Choice F1: a new muskmelon hybrid with resistant to powdery mildew, Fusarium race 2 and potyviruses. *Horticulture Science* **40** (2): 492–3.

Mayee C D and Datar V V. 1986. Phytopathometry. Technical Bulletin–I, Marathwada Agricultural University, Parbhani, India, p 146.

Mukhtar I, Mushtaq S, Khokhar I and Hannan A. 2013. First record of *Cercospora citrulina* leaf spot on *Lagenaria siceraria* in Pakistan. *The Journal of Animal and Plant Sciences* **23**(6): 1 756–7.

Sarbhoy A K. 2006. *Text Book of Mycology*, pp 242–91. IBH Publishing Ltd, New Delhi.

Singh A K, Tripathi D P and Singh S B. 2006. Effect of different dates of transplanting on disease intensity and yield of tobacco caused by *Alternaria alternata*. *Annals of Plant Protection Sciences* **14:** 251–2.

Singh R A and Gurha S N. 2007. Stable sources of resistance to *Cercospora* leaf spot in mung bean. *Annals of Plant Protection Sciences* **15**: 501–2.

Singh B, Rai M, Kalloo G, Satpathy S and Pandey K K. 2007. Wild texa of okra (*Abelmoschus* species): reservoir of genes for resistance to biotic stresses. *Acta Horticulturae* **752**: 323–8.

Singh B, Sanwal S K, Rai, Mathura and Rai A B. 2009. Sources of biotic stress resistance in vegetable crops: a review. *Vegetable Science* **36**(2): 133–46.

Thamburaj S and Singh N. 2000. *Textbook of Vegetables, Tuber Crops and Spices*, p 469. DIPA, ICAR, New Delhi.