Screening of bottle gourd varieties against root-knot disease

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Abstract: A pot experiment was conducted in the nethouse of the Seed Pathology Centre, Bangladesh Agricultural University, Mymensingh, Bangladesh during August 2011 to November 2012 to screen out the bottle gourd varieties that are susceptible to root-knot disease. Eight varieties of bottle gourd such as, BARI lau-3, BARI lau-4, Hi-green, Sundari, Green rubi, Marshal, Borsa and Martina were screened against *Meloidogyne incognita.* Experiment was laid out in Randomized Complete Block Design (RCBD) with three replications of each variety. It was two factors factorial experiment and the factors were Treatments **(**I_0= Uninoculated (Control), I_1= inoculated with egg mass**)** and Varieties **(**V_1= BARI lau-3, V_2=BARI lau-4,V_3= Hi-green, V_4= Sundari, V_5= Green rubi,V_5=Marshal, V_5=Borsa and V_5=Martina**).** The screening of bottle gourd varieties (Taylor and Sasser's rating scale, 1978) revealed that all of the bottle gourd varieties were highly susceptible to root-knot nematode, though the incidence varied from variety to variety.
Key words: Bottle gourd varieties,root-knot disease, screening.

Introduction

Nowadays, Bottle gourd (*Lagenaria siceraria* [(Molina) Standl.] is cultivated all the year round in homestead and commercial plots in Bangladesh. But its cultivation is affected by many diseases, among them root-knot is a serious one caused by *Meloidogyne* spp. Root-knot nematodes are serious and economically most important pest of many cultivated crops around the world (Trifonova *et al.* 2009). They are particularly damaging vegetables in tropical and sub-tropical countries (Sikora and Fernandez, 2005.) and cause losses up to 80% in heavily infested fields (Kaskavalci, 2007). Sharma and Baheti (1992) estimated avoidable losses due to *Meloidogyne* sp. on *L. siceraria* between 46 to 56 percent. Nahar *et al.* (1996) estimated yield loss in bottle gourd due to *M. incognita* as 26.44 percent. Significant damage may occur to the crop independently or in association with fungal or bacterial root rots (Singh, 1973). Due to their frequency of occurrence, root-knot nematodes cause high level of infestation along with other pathogens and these have been recognized as a major limiting factor in food production. In susceptible plants, the nematode population build up to a maximum usually as crop reach maturity and in some cases the plants die even before reaching maturity (Singh and Khurma, 2007). After selection of control measures, it is necessary to know is there any resistance variety against *Meloidogyne incognita* or the susceptibility scale of the popular varieties. This is why the pot experiment was laid down to screen out the susceptible bottle gourd varieties against *Meloidogyne incognita* for future research.

Materials and Methods

Eight varieties of bottle gourd BARI lau-3, BARI lau-4, Hi-green, Sundari, Green rubi, Marshal, Borsa and Martina were screened against *Meloidogyne incognita* to find out the varieties that to be highly susceptible with gall index. The pot experiment was conducted in the nethouse of the Seed Pathology Centre, Bangladesh Agricultural University, Mymensingh, Bangladesh during August 2011 to November 2012. Experiment was laid out in Randomized Complete Block Design (RCBD) with three replications of each variety. It was two factors factorial experiment and the factors were Treatments **(**I_0= Uninoculated (Control), I_1= inoculated with egg mass**)** and Varieties **(**V_1= BARI lau-3,V_2=BARI lau-4,V_3= Hi-green,V_4= Sundari,V_5= Green rubi,V_5=Marshal, V_5=Borsa and V_5=Martina**).** The mixed soil including soil, sand and cowdung at the ratio of 3:1:1 was sterilized with 0.1% formalin at the rate of 5 ml/kg soil (Dasgupta, 1988) and covered by polythene sheet for 72 hours without disturbance. Then the sterilized soil was exposed to air drying for 48 hours in order to remove vapour of formalin. Forty eight earthen pots (25 cm diameter of mouth) were filled with 6 kg sterilized dried soilprovided with a small broken piece of earthen pot at the bottom pore. The fertilizers Triple Super Phosphate (TSP), Muriate of Potash (MOP) and Gypsum were applied @ 2.50 g, 1.50 g and 1.00 g/pot and mixed with soil before 7 days of seed sowing. Urea @ 2.00 g per pot was applied by side dressing after 30 days of germination. Before sowing, seeds were treated with 10% chlorox solution for one minute and subsequently rinsed with sterilized distilled water for three times. Ten days after emergence of seedlings, thinning was done to keep only one plant per pot and the plant was supported with bamboo sticks. Since there was no incidence of disease or insect attack, fungicidal or insecticidal spray was not needed.The pots with plants were arranged randomly on the floor of the pot shade. At the height of 3-4 fits, to give supports to the growing plantbranches (vines) cross wise nylon nets were placed on bamboo poles as platform. Fourteen days old plants were inoculated with the egg massesthat were collected from the infected plants of mass culture of *Meloidogyne incognita*. Two holes, each of 2.5 cm were made around the rhizosphere of each plant and four egg-masses were inserted into each hole with the help of forceps. After 60 days of inoculation, plants were carefully uprooted from the pots and the six parameters such as, length of shoot (m), length of root (cm), fresh weight of shoot (g), fresh weight of root (g), number of branches and number of galls/root systemof plants were studied. The whole root system was visually rated for galling on a 0 to 5 scale (immune to highly susceptible) of Taylor and Sasser's (1978).

Results and Discussion

Shoot length of bottle gourd was significantly influenced by inoculation of egg masses of *Meloidogyne incognita*. Under uninoculated condition the mean shoot length ranged from 5.38 m to 6.31 m and under inoculated condition it ranged from 3.74 m to 4.85 m. It was found that the variety Matrina showed the highest decrease

(35.29%) followed by Hi-green (32.21%) over uninoculated ones (Table 1). Uninoculated control was significantly different from the inoculated ones. Under uninoculated condition shoot weight ranged from 478.30 g to 497.70 g and under inoculated condition it ranged from 303.00 g to 372.30 g. Higher decrease of shoot weights 36.65% and 35.63% were recorded with variety Martina and Hi-green, respectively (Table 1).

Table 1. Interaction effects of treatments and varieties on shoot length and Shoot weight of bottle gourd plants and % decrease with inoculation

Treatment	Shoot length (m)			Shoot weight (g)		
Variety	Un inoculated	Inoculated	% Decrease	Un inoculated	Inoculated	% Decrease
BARI lau-3	5.75 bcd	4.24 f	26.26	482.70 a	346.30 c	28.26
BARI lau-4	6.24 a	4.38 f	29.81	491.70 a	339.00 cd	31.06
Hi-green	5.93 abc	4.02 fg	32.21	484.70 a	312.00 ef	35.63
Sundari	5.57 cd	4.18 f	24.96	486.70 a	329.70 cde	32.26
Green rubi	6.11 ab	4.23 f	30.77	494.30 a	325.00 de	34.25
Marshal	5.38 d	4.18 f	22.25	480.70 a	318.70 def	33.70
Borsa	6.31 a	4.85 e	23.14	497.70 a	372.30 b	25.20
Martina	5.78 bcd	3.74 g	35.29	478.30 a	303.00 f	36.65
Significant level	*	*	*	**	**	

Data represent the means of three replications, Similar letter(s) in a column are not significantly different at 5% level by DMRT, * = Significant at 5% level of probability

Table 2. Interaction effects of treatments and varieties on root length andRoot weightof bottle gourd plants and % decrease with inoculation

Treatment	Root length (cm)			Root weight (g)		
Variety	Un inoculated	Inoculated	% Decrease	Un inoculated	Inoculated	% Decrease
BARI lau-3	126.00 d	102.00 fgh	19.05	35.06	28.03	20.05
BARI lau-4	132.70 bcd	104.00 fg	21.63	39.16	32.69	16.52
Hi-green	128.30 cd	93.00 h	27.51	32.03	24.75	22.73
Sundari	140.70 ab	115.00 e	18.27	33.55	27.00	19.52
Green rubi	145.30 a	106.30 f	26.84	36.79	30.46	17.21
Marshal	130.30 cd	98.67 fgh	24.27	30.89	24.64	20.23
Borsa	127.00 cd	105.70 fg	16.77	37.20	31.42	15.54
Martina	136.00 bc	96.67 gh	28.92	31.54	24.34	22.83
Significant level	*	*	*	NS	NS	NS

Data represent the means of three replications, Similar letter(s) in a column are not significantly different at 5% level by DMRT, * = Significant at 5% level of probability and NS= Not significant

Table 3. Interaction effects of treatments and varieties on branch number of bottle gourd plants and % decrease with inoculation

Treatment	Branch number		% Decrease
Variety	Uninoculated	Inoculated	
BARI lau-3	3.00	2.00	33.33
BARI lau-4	3.33	2.33	29.94
Hi-green	3.33	1.67	49.85
Sundari	3.00	1.67	44.33
Green rubi	3.33	2.33	30.03
Marshal	2.67	1.67	37.45
Borsa	3.33	2.33	30.03
Martina	3.33	1.66	49.94
Significant level	NS		

Data represent the means of three replications, NS= Not significant

Root length was significantly decreased in all inoculated varieties as compared to uninoculated ones. Under uninoculated condition the root length ranged from 126.00 cm to 145.30 cm and in inoculated condition it ranged from 93.00 cm to 115.00 cm. The highest decreases of root length 28.92% followed by 27.51% were recorded with Martina and Hi-green, respectively over uninoculated ones (Table 2). No significant influence was found in all inoculated varieties as compared to uninculated with respect to root weight. Under uninoculated and inoculated condition the highest root weight was observed in BARI lau-4 followed by Borsa. The higher decrease of root weights were 22.83% and 22.73% in Martina and Hi-green, respectively over uninoculated ones (Table 2).

No significant influence was found in all inoculated varieties as compared to uninculated with respect to branch number. The highest decrease of branching 49.94% followed by 49.85% was recorded with Martina and Hi-green, respectively (Table 3).The result of the study revealed that *Meloidogyne incognita* suppressed the

growth of bottle gourd with the increased galling level. Karssen and Moens (2006) reported that highly susceptible host plants allowed the juveniles to enter the roots, reached maturity and produced many eggs, while the resistant plants suppressed their development and thus, do not allow reproduction. Allelopathic chemicals is generally considered to provide resistance in plants to various pathogens. In this study all bottle gourd varieties showed highly susceptible reaction to root-knot nematode which might be due to absence or very little presence of allelopathic chemicals in the root tissue. Ahire *et al.* (2012) stated that the Allelopathic chemicals was very little or nothing in bottle gourd roots.

Table 4. Effect of inoculation by eggmasses of *Meloidogyneincognita* on galling of different varieties of bottle gourd

Variety	No. of galls/ inoculated plant	Gall index	Response
BARI lau-3	360.70 bcd	5	Highly Susceptible
BARI lau-4	341.30 de	5	Highly Susceptible
Hi-green	411.30 a	5	Highly Susceptible
Sundari	350.00 cde	5	Highly Susceptible
Green rubi	382.70 b	5	Highly Susceptible
Marshal	371.30 bc	5	Highly Susceptible
Borsa	331.30 e	5	Highly Susceptible
Martina	429.00 a	5	Highly Susceptible
Significant level	**		

Gall index was assessed using a visual rating based on rating scale of Taylor and Sasser (1978), Data represent the means of three replications, Similar letter(s) in a column are not significantly different at 5% level by DMRT, ** = Significant at 1% level of probability

The screening of bottle gourd varieties (Taylor and Sasser's rating scale, 1978) revealed that all of the bottle gourd varieties were highly susceptible to root-knot nematode, though the incidence varied from variety to variety which might be due to absence of nematode resistant gene (Table 4). Similar result was observed by Levi *et al.* (2009) and they reported that two clusters of *Lagenaria siceraria* (One cluster includes groups of plants collected mostly in South Asia (India) and a few plants collected in the Mediterranean region and in Northeast Africa. The second cluster includes groups of plants collected mainly in Southern Africa and in North, Central and South America and plants collected in China, Indonesia and Cyprus) were susceptible to root-knot nematode, *M. incognita.*

Recommendations: Considering the % decrease of shoot length, shoot weight, root length, root weight and number of branches, two varieties Hi-green and Martina were found to be mostly affected by root-knot nematode (*Meloidogyne incognita*).

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