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Shoot and Root Growth and Yield of Eggplant Cultivars as Affected by Wilt Disease

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ABSTRACT: An experiment was conducted in the Field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh to screen out the resistant cultivars of eggplant against wilt disease. Eight cultivars viz. Nayantara, Singhnath, Dhundul, Kazla, Marich Begun Luffa, Kata Begun and Uttara were used as treatments. The highest shoot height was recorded in the cultivar Kata Begun and the lowest shoot height was recorded in the cultivar Singhnath. The highest gall number was recorded in the cultivar Luffa and the lowest gall number was recorded in the cultivar Kata Begun. The highest yield per hectare (29.84 t/ha) was recorded in the cultivar Nayantara and the lowest yield (10.50 t/ha) was recorded in the cultivar Dhundhul. Among the cultivars Kata Begun graded as resistant for both Bacterial, Fungal and Nemic wilt.

Key words: Brinjal, Bacterial wilt, Nematode, Disease incidence, Yield, Morphology

Introduction

Eggplant or Brinjal (*Solanum melongena* L.) belongs to the family is the second most important vegetable crop next to potato in Bangladesh in respect of acreage and production (BBS, 2005).The total area of eggplant cultivation is 60100 hectare where 22500 ha in Kharif season and 37500 ha in Rabi season with total annual production of 358400 mt. and the average yield is 6.0 t/ha in 2003-04 (BBS, 2005). The yield potential of eggplant is low in Bangladesh compared to other countries. Of many reasons for high price of eggplant, lower production rate is important. Incidence of insect pests and diseases greatly hampered the production of eggplant. This crop suffers from the various diseases; about 13 different disease so far recorded in Bangladesh (Das *et al.* 2000; Khan *et al*. 1998 and Rashid, 2000). Among those diseases wilt of eggplant has been treated as one of the major constrains in eggplant cultivation in the country (Ali, 1993). Eggplant cultivation in Bangladesh is severly impaired by three important wilt causing pathogens viz. *Pseudomonas solanacearum*, *Fusarium oxysporum* and *Meloidogyne incognita*, the causal agent of Bacterial wilt, Fusarium wilt Nemic wilt, respectively and caused considerable damage of eggplant (Timm and Ameen, 1960; Talukder, 1974; Ahmed and Hossain, 1985; Mian,1986; Ali *et al.*, 1994). These are also the major limiting factors for eggplant production throughout the world (Hinata, 1986). Wilt problems are especially severe in the humid tropics. In some cases 100% of the plants are found to die in Kitchen gardens of Bangladesh due to wilt problem (Ali *et al.*, 1994).

The Fusarium wilt and Nemic wilt are very acute in Bangladesh. Once the plant is affected by wilting organisms, it does not produce yield and gradually die. The nematode infection is expressed by gall formation in the root system and ultimately the plant become weak due to interruption in nutrient uptake from the soil. Moreover, due to nematode infection, the root system becomes injured facilitating easy entry of the wilt causing organisms into the plant root system. Root-knot nematode caused by Melodoigyne incognita is another widely distributed important disease in the country (Talukder, 1974; Tamim and Ameen, 1960; Ahmed and Hossain, 1985; Mian, 1986). In Bangladesh root knot may cause as much 27.2% loss in fruit yield of eggplant (Bari, 2001). Bacterial wilt caused by *Ralostonia solanacearum* is a wide spread crop disease in the tropical, subtropical and temperate regions of the world. In recent year, bacterial wilt has become a great problem for eggplant cultivation in Bangladesh (Rashid, 1976). Bacterial wilt caused by *P. solanacearum* (E.F. Smith) is not new in Bangladesh. At present it is noted as a widely distributed disease of eggplant. In this country, studies on bacterial wilt have been done in limited scale on eggplant for resistant varieties. But available information suggests that very few of the cultivars were reported as resistant to this disease. Screening of germplasms of eggplant to evaluate their resistance against *R. solanacearum* have immense value for the management of the disease in this country. Seveal workers attempted to search for bacterial wilt resistant varieties of eggplant (Ali *et al*. 1990; Rahman and Hoque 1986; Hossain *et al*. 1991).

For the management of such important bacterial, Fusarial and Nemic diseases a few evidence of research work exists in Bangladesh. Search of resistant germplasms for the management of crop disease is considered as a ecofriendly approach. Besides, the use of chemicals for controlling soil-borne pathogen like wilt pathogens is very costly to the growers. Thus the experiment was undertaken to screenout the resistant germplasm against Bacterial (*R. solanacearum*), Fungal (*Fusarium oxysporum*), Nemic (*Meloidogyne spp*) wilt of eggplant.

Materials and Methods

Experimental site

The experiment was conducted in the Field of SAU (Sher-e-Bangla Agricultural University) farm allotted for the Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka-1207. The experiment was carried out during the period form September 2005 to April 2006. The soil of the experimental plot was loam to clay loam in texture belonging to the Madhupur Tract (AEZ-28). The soils of the site was non-calcareous with loam to clay loam in texture.

Climate

The climate of the experimental area was of sub-tropical in nature characterized by high temperature associated with heavy rainfall during Kharif season (April to September) and scanty rainfall with moderately low temperature during Rabi season (October to March).

Eggplant variety used

Eggplant varieties Nayantara, Kazla, Uttara, Singhnath, Dhundul, Katabegun, Marichbegun, Luffa-s were used in the experiment for screening against wilt diseases. Healthy, mature and disease free seeds of eggplant varieties were collected from different sources like IPM Lab of Bangladesh Agricultural University, Bangladesh Agricultural Research Institute, and local market of eggplant growing areas on the second week of September. Ten grams (10g) of Healthy seeds were collected for each varieties.

Treatments of the experiment and design

In this study eight (8) varieties were used treatments were used as designated by T_1, T_2, T_3, T_4, T_5, T_6, T_7 and T_8 which were as follows:

1) T_1 = Noyantara; 2) T_2 = Shingnath; 3) T_3 = Dhundul; 4) T_4 = Kazla; 5) T_5 = Marich Begun; 6) T_6 = Luffa; 7) T_7 = Kata Begun and; 8) T_8 = Uttara.

The experiment was laid out in Randomized Block Design (RBD) with three replications. The whole plot was divided into three blocks each containing eight (8) plots of 3.5m x 1.0m size giving 24 unit plots. Each of the treatment put once at each block. The space kept between the blocks was 1m wide and between plots it was 0.5m.

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Crop husbandry
Then the land was well-prepared before planting. Manure and fertilizers were applied as per standard recommendation. The following doses were used for carrying out the field experiment. After preparation of main pot in the net house 45 days old seedling were be uprooted from the seedbed and transplanted in the experimental pot on the 16th November 2005 in the afternoon of the same day. A sufficient irrigation was given just after transplantation with the help of a bucket sprinkler. Shading and watering was continued till the seedlings were established in the field. Weeding, gap filing, manuring and pest control were done as per requirements.

Data collection and analysis
The whole plant along with soil attached to roots was lifted from the soil and dipped in a bucket full of water. Before placing the roots in the bucket a sieve was placed at the bottom of bucket. Then by gradual movement of the roots in water, the roots were separated from the soil. Roots were further cleaned in gently running tap water and peat masses were removed with forceps. Any broken root portion collected in the sieve was carefully washed out. The root portion was separated from shoot. The length of the shoot was measured from the base of the stem to the growing point of the youngest leaf. The length of root was measured from the growing point of root to the longest available lateral root apex. For fresh weight of shoot and root the portion was blotted dry and the weight was recorded before the materials could get dessicated. The number of primary and secondary branching also counted by eye estimation. After washing the roots were preserved in 5% formalin solution. For easy observation the bigger roots were cut into small pieces and individual piece was examined for counting the number of galls formed. The galls were indexed on a 0-4 scale to score galling level as followed by Ahmed (1977) as described below:

Scales	Specification	No of galls
0	No galling	0
1	Light galling	<10
2	Moderate galling	10-15
3	Heavy galling, mostly discreate	50-100
4	Very heavy galling, many coalesced	>100

Analysis of data
The data were statistically analyzed using analysis of variance to find out the variation of results from experimental treatments. Treatment means were compared by DMRT (Duncan's Multiple Range Test). Correlation and Regression study was done to establish relationship between shoot length, shoot weight, root length, root weight with galling incidence among the treatments.

Results and Discussion

Shoot height/plant
Eggplant cultivar showed statistically significant variation in respect of shoot height under the present trail. Different cultivars performed different shoot height and it varied from 41.06 cm to 69.45 cm (Table 1). The highest shoot height (69.45 cm) was recorded in the cultivar Kata Begun which was statistically identical with the cultivar Marich Begun (68.55 cm). The lowest shoot height (41.06 cm) was recorded in the cultivar Singhnath which was closely followed by the cultivar Uttra, Dhundal and Kazla (46.80 cm, 48.05 and 48.18 cm, respectively). Rashid *et al.,* (2001) screened 70 germplasms. Where the shoot height ranged from 23.87 to 53.37 cm. The highest shoot height was recorded in BL 111 followed by ISD 06, BL 093, ISD 411, BL, 158 and Kaz1a. The variation of shoot weight ranged from 6.50 to 57.67 g.

Shoot weight/plant
Eggplant cultivar showed statistically significant variation in terms of shoot weight under the present experiment. Cultivar performed unusual and diverse shoot weight and it varied from 27.08 g to 73.20 g (Table 1). The highest shoot weight (73.20 g) was recorded in the cultivar Dhundul which was closely followed by the cultivar Nayantara (52.25 g). The lowest shoot weight (27.08 g) was recorded in the cultivar Singhnath which was closely followed by the cultivar Uttra (31.37 g).

Root length
Eggplant cultivar showed statistically significant variation in respect of root length under the present trail. All the cultivars performed medium root length and the average root length varied from 10.35 cm to 22.27 cm (Table 1). The highest root length (22.27 cm) was recorded in the cultivar Uttara which was closely followed by the cultivar Kata Begun (21.40 cm). The lowest root lengths (10.35 cm) was recorded in the cultivar Singhnath which was closely followed by the cultivar Dhundal and Nayantara (16.75 cm and 17.36 cm). Miller *et al.,* (2005) reported that wilt organism usually enters the plant through young roots and then grows into the water conducting vessels of the roots and stem. As the vessels are plugged and collapse, the water supply to the leaves is blocked. Talukder, 1974; Ahmed and Hossain, 1985 and Mian, 1986 reported same results earlier (Figure 2).

Root weight
Statistically significant variation among the root weight was recorded in eggplant cultivars under the present trail. Root length varied from 8.90 g to 17.36 g (Table 1). The highest root weight (17.36 g) was recorded in the cultivar Nayantara which was closely followed by the cultivar Kazla (16.35 g). The lowest root weight (8.90 g) was recorded in the cultivar Uttara which was closely followed by the cultivar Singhnath (9.61 g).

Average Gall number
Eggplant cultivar showed statistically significant variation in terms of average gall number under the present trail. All the cultivars performed medium to highest gall number and it varied from 30.50 to 52.50 (Table 1). The highest gall number (52.50) was recorded in the cultivar Luffa which was closely followed by the cultivar Dhundul (50.00). The lowest gall number (30.50) was recorded in the cultivar Kata Begun which was closely followed by the cultivar Uttara (35.83). Anonymous *et al.,* (2001) screened 34 germplasms, only 7 were found moderately resistant and the rest gave susceptible reaction to root knot nematode. The shoot height ranged from 31.90 to 45.17 cm. Most of the germplasms showed higher gall indexing value due to higher nematode population in the soil. Rashid *et al.,* (2002) screened 36 eggplant varieties against root knot nematode. Results indicated that gall number varied from 11 to 64 for eggplant whereas gall indices varied from 1.33 to 5.67 for eggplant.

Table 1. Yield contributing characters of wilt infected different eggplant varieties

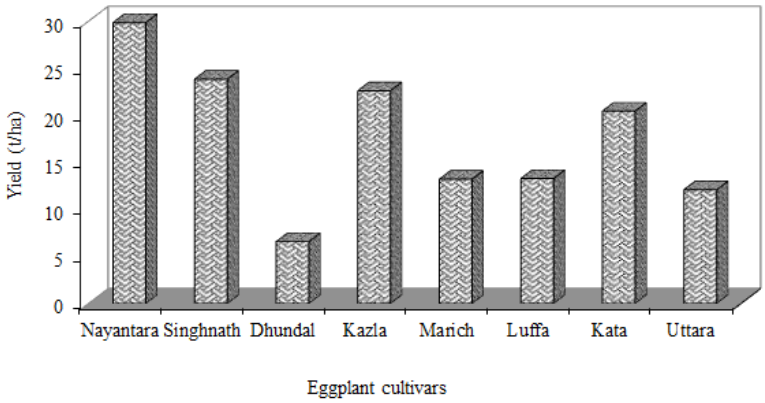
Treatments	Shoot height / plant (cm)	Shoot weight / plant (g)	Root length (cm)	Root weight (g)	Average Gall number
Nayantara	63.52 c	52.25 b	17.36 e	17.36 a	46.00 c
Singnath	41.06 e	27.08 f	10.35 f	9.61 g	37.67 e
Dhundal	48.18 d	73.20 a	16.75 e	10.65 f	50.00 b
Kazla	48.05 d	30.55 c	18.80 d	16.35 b	40.00 d
Marich	68.55 a	50.05 c	18.32 d	14.85 d	36.50 f
Luffa	66.30 b	44.95 d	19.75 c	15.80 c	52.50 a
Kata	69.45 a	49.15 c	21.40 b	13.95 e	30.50 g
Uttara	46.80 d	31.37 e	22.27 a	8.90 h	35.83 f
$LSD_{(0.05)}$	1.562	1.982	0.814	0.525	0.824
Level of Significance	**	**	**	**	**
CV (%)	4.48	3.56	5.55	3.85	5.89

In a column means having similar letter (s) or without letter are identical and those having dissimilar letter (s) differ significantly as per 0.05 level of probability.

Yield of different eggplant varieties

Average yield per hectare under the present trail eggplant cultivar showed statistically significant variation. The average yield per hectare varied from 6.57 to 29.84 ton (Fig. 1). The highest per hectare yield (29.84 t/ha) was recorded in the cultivar Nayantara which was closely followed by the cultivar Singhnath (23.83 t/ha). The lowest yield (6.57 t/ha) was recorded in the cultivar Dhundul (Fig. 1).

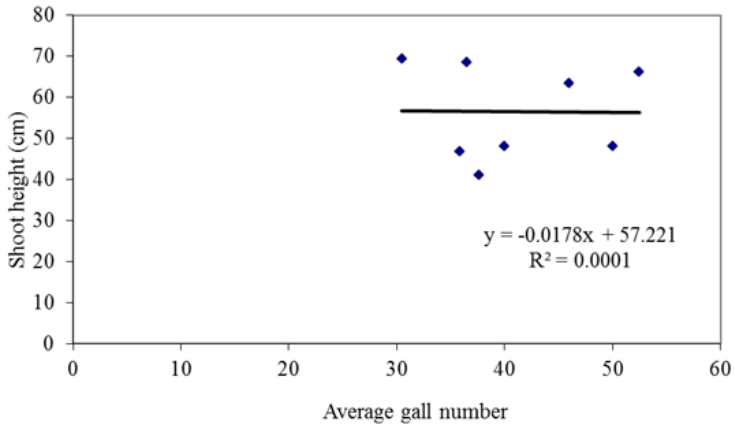
Fig. 1. Yield of different eggplant varieties



Relationship between wilt incidence and gall number and shoot length

A positive non significant relationship between gall number and shoot length due to wilt was recorded (Fig. 2). The equation Y = -0.0178x + 57.221 gave a good fit the data and the co-efficient determination (R^2 = 0.0001) showed that the fitted regression line had a significant regression efficient.

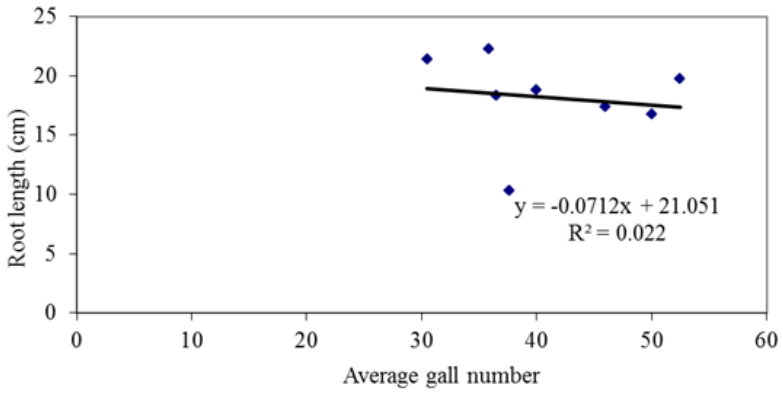
Fig. 2. Relationship between gall number and shoot length



Relationship between gall number and root length

Gall number and shoot length performed a positive non-significant relationship in terms of wilt was recorded (Fig. 3). The equation Y = -0.712x + 21.051 gave a good fit the data and the co-efficient determination (R^2 = 0.022) showed that the fitted regression line had a significant regression efficient.

Fig. 3. Relationship between gall number and root length



Relationship between gall number and yield

A positive non significant relationship between gall number and yield was recorded (Fig. 4). The equation Y = -0.0794x + 19.406 gave a good fit the data and the co-efficient determination (R^2 = 0.0131) showed that the fitted regression line had a significant regression efficient.

Fog. 4. Relationship between gall number and yield

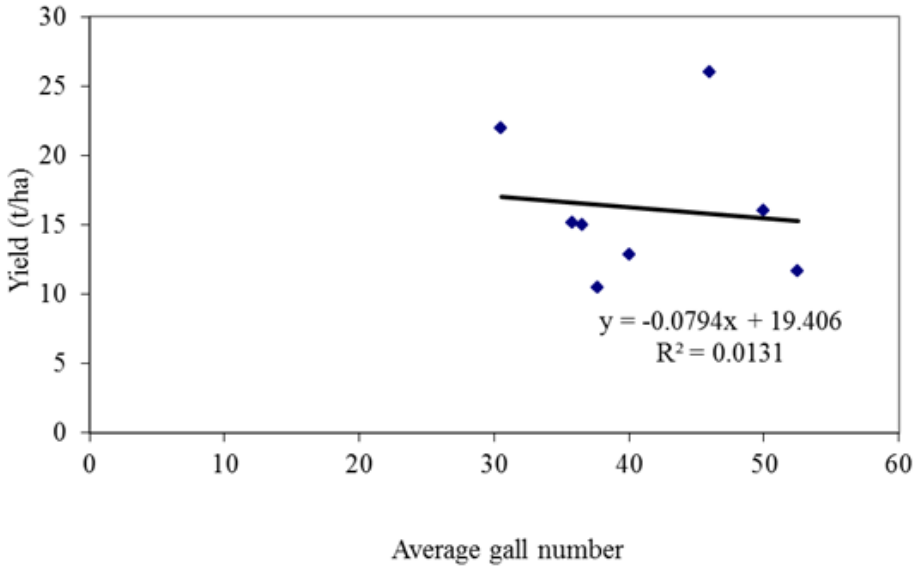


Fig. 5. Eggplant affected by Bacterial wilt (*Ralstonia solanacearum*)

Fig. 6. Eggplant affected by nemic wilt (*Meloidogyne sp.*)

References

Ahmed, H. U. and Hossain, M. (1985). Crop disease survey and establishment of herbarium at BARI. Final report of the project (1982-85), Plant Pathology Div. BARI, Joydebpur Gazipur. 107 pp.

Ahmed, M. U. (1977). A review of plant Parasititic Nematodes in Bangladesh. A paper presented in a seminar in the Imperial College of Science and Technology, University of London, U.K. 3 p.

Ali, M. Alam. M.Z. and Akanda, M.A.M. (1994). Grafting : A technique of control soil borne diseases of tomato and eggplant. IPSA-JICA publication No. 4. Institute of Post graduate Studies in Agriculture (IPSA), Gazipur-1703. Bangladesh. 10 pp.

Ali, M. Quadir, M. A. Okubo, H. and Fujieda, K. (1990). Resistance of eggplant / tomato, its wild relatives and their hybrids to different strains of *Psedomonas solanacearum. Scientia Hort.* 45 :1-9 pp.

Ali, M., (1993). Workshop on Research and Development of vegetable crops. 9-10 March. 9-10, Institute of Post graduate Studies in Agriculture (IPSA), Gazipur-1703.pp 68-75.

Bari, M.A. (2001). Biological Control of soil borne diseases of vegetables. Contract Research Project , Plant Pathology Division, Bangladesh Agril. Res. Inst., Joydevpur, Gazipur. 21-49 pp.

BBS, (2005). Year Book of Agricultural Statistics of Bangladesh. Statistics Division, Bangladesh Bureu of Statistics (Monthly Statistical Bulletin, Bangladesh, December 2003). Ministry of Planning, Government of the peoples Republic of Bangladesh. 55 p.

Das, G. P.; Ramaswamy S. and Bari, M. A. (2000). Integrated crop management practices for the control of the brinjal shoot and fruit borer in Bangladesh. DAE-DANIDA Strengthening Plant Protection Services (SPPS) Project. Dept. of Agril. Extension. Khamarbari, Dhaka. l2pp.

Hinata, K. (1986). Eggplant (*Solanum melongena* L.). in : Y.P.S. Bajaj (Ed). Biotechnology in Agricultural and Forestry, Springer Verlag, Berlin, Heidelberg. 2(1) : 363-370 pp.

Hossain, M. M., Islam, T. and Rahman, S. (1991). A note on the incidence of bacterial wilt of tomato. *Bangladesh J. Agril. Sci*. 18(2): 291-292.

Khan, A. A., Badshah, K. and Khan, M. W. (1998).Resistance of aubergine cultivars to root-knot nematodes. *Tests-of-Agrochemicals-and-Cultivars*. 19. 40-41.

Mian, I. H. (1986). Plant parasitic nematodes associated with some crop species in Bangladesh. *Bangladesh J. Plant Path*. 23: 73.

Rahman, M.A. and Hoque, M.O. (1986). Screening of eggplant varieties/lines against bacterial wilt. *Bangladesh. Plant Pathol.* 2(1): 15- 18.

Rashid, M. M. (1976). "Bangladesher Sabji" I[st] Edn., Bangla Academy, Dhaka Bangladesh. 119-136 pp.

Rashid, M. M. (2000). A Guidebook of Plant Pathology. Dept. of Plant Pathology. HSTU. Dinajpur. 58pp.

Talukdar, M. J. (1974). Plant diseases in Bangladesh. *Bangladesh. J. Agril. Res*. 1(1):71.

Timm, R.W. and Amen, M. (1960). Nematodes Associated with commercial crops in East Pakistan. *Agric Pak.* 11(3) : 355-363.