

INCIDENCE OF GUAVA (*PSIDIUM GUAJAVA* L.) WILT CAUSED BY *FUSARIUM OXYSPORUM* SCH. F. SP. *PSIDII* IN BANGLADESH

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Abstract

A survey was conducted in eighteen orchards in respect of incidence of guava wilt caused by *Fusarium oxysporum* f. sp. *psidii* located in eight districts of Bangladesh. Observation of 2907 plants yielded 22.94% wilt in an average irrespective of varieties. The highest wilting (50%) was found in the Agricultural Research Station, Thakurgaon on cv. 'Kazi peyara' followed by 34.78% on cv. BARI peyara-2 at Gazipur; 32.39% on cv. Mukundapuri in Brahmanbaria, 22.58% on cv. 'Kazi peyara' in Faridpur, and 17.24% on cv. Kanchannagar in Chittagong and 12.50% on cv. Swarupkathi in the Pirojpur district, whereas the lowest percentage (8%) of wilted plants were observed on cv. BARI peyara-2 and cv. 'Kazi peyara' at the RARS, Rahmatpur, Barisal, and at Pahartali, Chittagong. After initiation of wilt symptom, it took 15 to 170 days for completion of wilt in 2006. Wilting was recorded 25.51% within the first 30 days and 78.57% cumulative wilting was recorded after 60 days in 2006. Higher wilt incidence was recorded in August, September and October, whereas remarkable decrease of the disease was recorded during winter i.e. November and December in both the years.

Key words: Guava, Wilt, *F. oxysporum*

Introduction

The most common and widely cultivated guava is *Psidium guajava* L., belongs to the family Myrtaceae which contains about 150 species (Hayes 1974). Guava was domesticated more than 2000 years ago (Cobley and Steele 1976) but its domestication in the Indian sub-continent was around 17th Century (Hayes 1974). It is considered as a common man's fruit and called the "apple of the tropics" (Adsule and Kadam 1995) and particularly rich in ascorbic acid (Menzel 1985).

With all other factors of crop management, diseases of guava considered the limiting effect on production (Meah and Al-Mamun 1991). Among the diseases of guava, wilt caused by *Fusarium oxysporum* f. sp. *psidii* is considered one of the major guava diseases in Bangladesh (Ali *et al.* 1988, Meah and Al-Mamun 1991 and Meah and Khan 1987) and 10-25% plant died due to wilt every year (Ali *et al.* 1988) and 18-36% guava wilt was reported from different districts of Bangladesh (Meah and Al-Mamun 1991). In

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India, a number of fungal, algal, bacterial, physiological disorders are the constraints of guava production (Prakash and Pandey 2005). Among guava diseases, wilt is the most destructive (Misra 2007, Verma and Prakash 1996, Edward 1960, Meah and Khan 1987, Prakash and Misra 1993 and Akanda and Wadud Mian 1981). In West Bengal, it could reduce the yields by 80% (Prakash and Pandey 2005). The wilt of guava has also been reported from other tropical countries of the world like Florida, Cuba, Taiwan, South Africa and Brazil (Prakash 2002).

Wilt disease was identified as slow and sudden or quick wilt (Chakraborty and Singh 1989 and Prakash and Pandey 2005). Generally 7-15 days are required for complete wilting, in some cases it may take up to one year (Misra 2007 and Prakash and Pandey 2005). There are much variation of opinion regarding the progressive wilting and time for symptom development of guava plants. It has been reported that wilting was markedly observed during rainy season and decreased with advancing winter (Prakash and Pandey 2007, Das Gupta and Rai 1947 and Edward 1960). Disease appeared in the beginning of June but its spread accelerated with the onset of rain (Edward 1960) and soon after rainy season, guava plants die within a period of 3-4 weeks and some times 6 to 8 months required for complete wilting (Suhag 1976). The disease is characterized by yellowing and browning of leaves at the tip of twigs and finally the tree became defoliated (Prakash and Pandey 2007).

Limited information on progressive natural wilting of guava plants is available in Bangladesh. The present study deals with the incidence of wilt disease at major guava growing areas of Bangladesh and to observe the natural progressive wilting in relation to environmental and time factors in the farmer's field.

Material and Methods

Temporal and progressive natural wilting was recorded from July 2006 to December 2007 in a farmer's guava orchard planted with cv. Kazi at Nagarkanda upazila in Faridpur district. In the present study, survey was conducted in the eight districts of Bangladesh where 18 orchards were visited. The districts were Barisal, Brahmanbaria, Chittagong, Faridpur, Gazipur, Khagrachari, Pirojpur and Thakurgaon. The surveyed areas covered farmers' field as well as a few research stations of Bangladesh Agricultural Research Institute (BARI). In each district, 1-5 established guava orchards were randomly selected. Total number of plants of the orchard was counted and mortality due to wilt was recorded. Interview of owners were also made where necessary.

Field diagnosis of Fusarium wilt disease was conducted following the key symptoms stated by Simone and Cashion (1997): 1) Progressive branch death from oldest to newest canopy; 2) One sided leaflet death on a declining branch (Partial wilting) and 3) Discolored vascular bundles of roots or stem.

Root and stem samples were collected from guava plants of different areas showing typical wilt symptoms (Fig.1). The pathogen was isolated from root and stem tissues following standard methods (Meah and Al-Mamun 1991, Schoeman *et al.* 1997). Purified isolates were preserved at 4°C in PDA slants and in wheat bran culture for future use.



Fig.1. Fire scorched appearance of a wilted guava plant in an orchard at Santashi, Nagarkanda, Faridpur.

To observe the natural wilting, a farmer's guava orchard with cv. Kazi at Nagarkanda upazila of Faridpur district was selected. The orchard was raised in the year of 2002. Total number of counted plants was 510; each plant was given a 3-digit random serial number and tagged. Observation on progressive natural wilting was carried out by documenting wilt incidence in monthly interval from July 2006 to December 2007. Wilting percentages were also correlated with weather parameters, viz, air temperature,

relative humidity and rainfall to correlate the environmental factors on the development of wilt.

To find out the minimum and maximum time needed for wilting, first six months initial visible wilt symptoms and time needed for complete wilting in each plant was documented in weekly interval using a 0-2 scale stated by Misra and Pandey (2000). Where 0 = healthy; 1 = initial wilting or yellowing of leaves; and 2 = complete or 100% wilting of the plant.

Results and Discussion

The incidences of wilt disease of eighteen guava orchards located at different districts of Bangladesh are presented in Table 1. The highest wilting (50%) was found in the ARS, Thakurgaon on cv. 'Kazi peyara' followed by 34.78% on cv. BARI peyara-2 at Gazipur; 32.39% on cv. Mukundapuri at Brahmanbaria, 22.58% on cv. 'Kazi peyara' in Faridpur, and 17.24% on cv. Kanchannagar in Chittagong and 12.50% on cv. Swarupkathi in the Pirojpur district. The lowest percent of wilting (8%) was recorded on cv. BARI peyara-2 in Barisal and cv. 'Kazi peyara' in Chittagong.

Results on progressive natural wilting during eighteen months of investigations showed that wilt percentages were comparatively less during January to June, November and December. The highest disease incidence was observed in August, September and October during 2006 and 2007. On analyzing the wilt incidence in 2006, 4.51, 4.90 and 4.31% wilting were found in the month of August, September and October respectively. After this period, wilting percentage gradually decreased to 0.59 % in December, 2006. In the following year 2007, higher per cent of wilting were also recorded in the months of August (5.69), September (7.06) and October (4.51), and disease incidence were lower 1.57, 1.96 and 1.18 per cent in January, November and December respectively (Table 2). During August to October in 2006 the average maximum and minimum air temperature were 32.20°C and 25.57°C, with average RH 83% and rain fall 244.33 mm. In 2007 the corresponding environmental factors were 31.9°C and 25.83°C, 80.67% and 175.33mm respectively.

On the other hand during November, December the average maximum air temperature ranging from 25.7-29.40°C and minimum 13.90-19.90°C, RH 77-79% and average rainfall was 00-94mm. It seems that higher minimum-maximum air temperatures, RH and rainfall were positively correlated with wilt incidence.

Table 1. Incidence of wilt disease at different areas in several varieties/cultivars of guava orchards.

Location	Variety	Year of plantation of the orchards	Number of transplant survived	Number of plant wilted up to 2006	Wilted only in 2006	Average wilt (%)
Mukundapur, Brahmanbaria	Mukundapuri	1994	110	65	10	32.39
		1996	110	61	7	
		2000	70	5	2	
		2000	99	54	2	
		2002	250	22	22	
Sub total			639	207	-	
*RARS Rahmatpur, Barisal	BARI peyara-2	2001	150	12	8	8.00
Chandanais Chittagong	Kanchannagar	2000	140	28	12	17.24
		2000	150	22	10	
Sub total			290	50		
Santashi, Nagarkanda Faridpur	Kazi peyara (BARI peyara 1)	2000	50	47	40	22.58
		2001	320	96	38	
		2003	530	110	80	
		2004	300	18	18	
Sub total			1200	271	-	
BARI	BARI peyara-2	2002	30	8	2	34.78
Bhora Sadar, Gazipur	BARI peyara-2	2006	108	40	40	
Sub total			138	48	42	
**ARS Khagrachari	BARI peyara-2	2001	110	12	8	10.90
Swarupkathi Pirojpur	Swarupkathi	1994	200	25	10	12.50
Pahartali Chittagong	Kazi peyara (BARI peyara 1)	1999	150	12	5	8.00
ARS Thakurgaon	Kazi peyara (BARI peyara 1)	2001	30	30	15	50.00
Cumulative			2907	667		22.94

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Table 2. Effects of environmental factors on wilting of guava plants (cv. 'Kazi peyara') at Nagarkanda, Faridpur, during July 2006 to December 2007.

Year	Month	No. of wilted plants	% Wilting	Average maximum air temperature (°C)	Average minimum air temperature (°C)	Average relative humidity (%)	Total Rainfall (mm)	
2006	July	12	2.35	32.1	26.6	85	340	
	August	23	4.51	32.1	26.2	83	192	
	September	25	4.90	32.0	25.9	85	486	
	October	22	4.31	32.5	24.6	81	55	
	November	13	2.55	29.4	19.3	77	01	
	December	3	0.59	26.6	14.1	77	00	
	Sub-total	98	19.21					
	2007	January	8	1.57	24.5	10.9	76	00
		February	17	3.33	26.7	15.8	78	59
		March	20	3.92	31.6	18.1	63	04
April		22	4.31	33.7	23.8	72	60	
May		18	3.53	34.8	25.3	74	93	
June		11	2.16	32.7	25.4	84	528	
July		13	2.55	31.3	25.8	87	676	
August		29	5.69	32.2	26.9	80	216	
September		36	7.06	32.0	26.4	82	130	
October		23	4.51	31.5	24.2	80	180	
November		10	1.96	28.9	19.9	79	94	
December		6	1.18	25.7	13.9	76	00	
Sub-total	213	41.77						
Cumulative	311	60.98						

On analyzing the data for temporal natural wilting from first six months in 2006, it was found that 98 plants were wilted during that time. It was observed that minimum time took for wilting was 15 days whereas maximum time was 170 days. It was also observed that 25.51% plants wilted during the first 30 days and most of the plants (53.06%) wilted within 60 days i.e, cumulative 78.57% wilted within the 2 months of time from the date of initial visible wilt symptoms and 12.25% plants took three months, only 1.02% plants required more than 5 months for complete wilting (Fig.2).

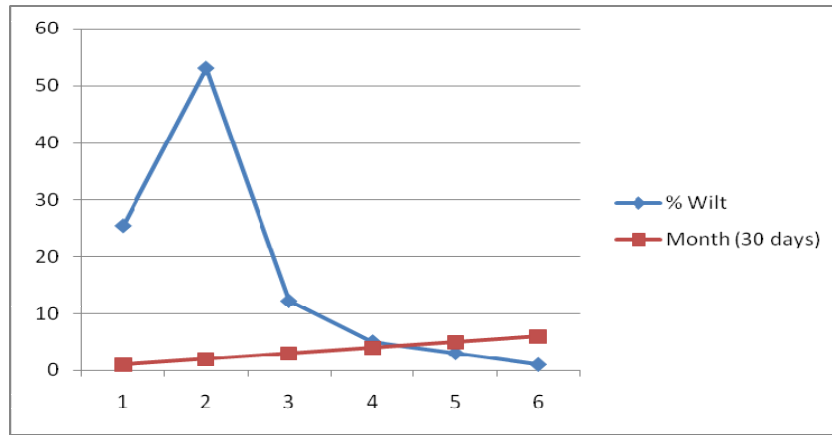


Fig. 2. Days needed for wilting of 'Kazi peyara' at Nagarkanda, Faridpur during July- December, 2006.

Variation in the symptoms during different months was also observed. During September generally drooping of leaves was observed with lesser number of lighter green leaves on the plants. During October, wilted plants were observed with almost dried leaves with some dried black stony fruits on the branches. Some plants showed partial wilting while others showed yellowing of leaves in different months but escape wilting and then started recovering. A total of 60.98% plants wilted during July 2006 to December 2007. Out of 510 plants (Table 2) it was also observed that maximum plants took two months period for complete wilting (53.06%) after the appearance of first visible symptoms (Fig.2), though minimum time taken in complete wilting was only 15 days and maximum time recorded was 170 days. Data on progressive natural wilting revealed that during August, September, October, in 2006 and 2007 the highest wilting percentages were recorded as 4.51, 4.90, 4.31 and 5.69, 7.06, 4.51, respectively (Table 2).

Observation of 2907 plants yielded 22.94% wilt in an average not depending on varieties. This information is in agreement with the findings of Akanda and Mian 1981 and Meah and Khan 1987. Meah and Al-Mamun (1991) also found that wilting of guava plants in general was 5% in a week and the rate had been increasing up to 20% in a week in the orchard located at Bangladesh Agricultural University campus, Mymensingh. In Thakurgaon, about 50% wilting of guava was observed on cv. 'Kazi peyara' only in the year 2006 which may be considered as havoc. Similar information is also available in India (Edward 1960) and South Africa (Prakash and Pandey 2005).

During August to October, 2006 and 2007, the average maximum air temperature, average RH and rain fall was 31.90-32.20°C, 82% and 175-244mm respectively. It was observed that high degree of air temperature, RH and rainfall enhanced guava wilt during the study period. Results of the present investigation are supported by Das Gupta and

Rai (1947). August, September and October were identified as most favorable months for wilt disease incidence (Misra and Pandey 2000). They also reported that higher rainfall during July-September along with maximum air temperature 31.5-33.5°C and minimum 23-25°C followed by high humidity above 76% seemed conducive for wilting of guava plants. Suhag (1976) reported that wilting took place soon after the rainy season and he identified the month September and October for wilting. In the present study, wilting was observed more after the rainy season and as well as in the months of August-September. The highest wilt incidence was observed in the month of September which could be due to high density of pathogenic fungal inocula in soil. Similar information was reported by the earlier workers (Misra and Pandey 2000 and Du Preez 1996).

Similar trend of guava wilt was reported earlier (Misra and Pandey 2000) where the authors stated that minimum time taken for complete wilting was 16 days and maximum was 252 days in 1996-1997 after the appearance of visible symptoms. Prakash and Pandey (2007) reported during rainy season affected plants may die within a week or a month but sometimes it needs one year. Available all commercial guava varieties were found wilt susceptible. August, September and October months are the favourable time for wilt symptoms development which causes serious loss of guava plantations during this time.

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References

- Adsule, R. N. and S. S. Kadam. 1995. Guava. *In: Hand book of fruit science and technology. Production, composition, storage and processing.* (eds. D. K. Salunkhe and S. S. Kadam). Marcel Dekker Inc. 270, Madison Avenue, New York. 419-433 pp.
- Akanda, S. I. and M. A. Wadud Mian. 1981. *Wilting of guava (Psidium guajava L.)*. M. Sc.(Ag.) Thesis. Department of Plant Pathology, BAU, Mymensingh.
- Ali M. A., M. B. Meah and I. Hossain. 1988. Survey of the diseases of some important fruit and vegetable crops of Bangladesh. *Proc. BAU Res. Sys. Workshop.* 93-101pp.
- Chakraborti, D. K. and R. N. Singh. 1989. Guava wilt-correlation between variation in disease syndrome and edaphic factors. *Indian Phytopathology.* **42**(2): 310.
- Cobley, L. S. and W. M. Steele. 1976. *An Introduction to the Botany of Tropical Crops.* Longman, New York. 185-187pp.
- Das Gupta, S. N. and J. N. Rai. 1947. Wilt disease of guava (*Psidium guajava L.*) *Current Science.* **16**(8): 256-258.
- Du Preez, R. 1996. *Breeding and Selection Programme at the ITSC: Guava.* ITSC information bulletin. **292**:1-4.

- Edward, J. C. 1960. Penetration and establishment of *Fusarium oxysporum* f. sp. *psidii* in guava root. *Indian Phytopathology*. **13**:168-171.
- Hayes, W. B. 1974. *Fruits growing in India*. Kitabistan, Allahabad. 283pp
- Meah, M. B. and M. A. A. Khan. 1987. Survey of diseases of some important fruit and vegetable crops of Bangladesh. *BAU Res. Prog.* (ed. Lutfur Rahman) **1**: 251-268.
- Meah, M. B. and S. Al-Mamun. 1991. Investigation of wilting of guava (*Psidium guajava* L.). *Proc. BAU Res. Prog.* **5**: 17-24.
- Menzel, C. M. 1985. Guava: An exotic fruit with potential in Queensland. *Queensland Agril. J.* March-April. 93 – 98pp.
- Misra, A. K. 2007. Present Status of Important Diseases of Guava in India with Special Reference to Wilt. (ed. G. Singh *et al.*), *Proc. of 1st International Symposium on Guava. Acta Hort.* 735.
- Misra, A. K. and B. K. Pandey. 2000. Progressive natural wilting of guava plants during different months. *Indian Phytopathol.* **53**(4): 423 - 427.
- Prakash, O. M. 2002. Wilt of guava Problem and Prospects: Lead paper presented in National symposium of guava held at CSAUA & T, Kanpur. 13p.
- Prakash, O. M. and A. K. Misra. 1993. Fungal diseases of subtropical horticultural fruit crops. In: *Advances in Horticulture*, (eds. K. L. Chadha and O. P. Pareek), Malhotra Publishing House, New Delhi, India. **Vol. 3**, pp. 1275-1348.
- Prakash O. M. and B. K. Pandey. 2005. Current scenario of guava diseases in India and their integrated management. Paper presented in souvenir at first International guava symposium held at Lucknow from 5-8 Dec. pp. 65-74.
- Prakash O. M. and B. K. Pandey. 2007. Current scenario of guava diseases in India and their integrated management. In: *Acta Hort.* 735 (eds. G. Singh *et al.*), *Proc. of first International symposium on guava.* Acta Hort. 735.
- Schoeman M. H., E. Benade and M. J. Wingfield. 1997. The symptoms and cause of guava wilt in South Africa. *J. Phytopathol.* **145**(1): 37-41.
- Simone G. W. and G. Cashion. 1997. Fusarium wilt of Canary Island Date Palms in Florida. *Plant Pathology Fact Sheet*. University of Florida. 44p.
- Suhag L. S. 1976. Observation on guava decline in Haryana and its control. *Pesticides*. **10** (11): 42-44.
- Verma A. and O. M. Prakash. 1996. Handling practices and losses in the post harvest system of guava. *Proceedings of National Seminar on "Phalsamskarana"* 1995. UAS, Bangalore, 7-9 August, pp. 334-337.

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