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Original Article

Incidence and Severity of Blight Disease of *Tagetes erecta* and *T. patula*

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ABSTRACT: Blight symptom was recorded on different parts of *Tagetes erecta* and *T. patula* during the tenure of 2009 to 2014. Disease incidence was started from January and gradually increased up to May. The Lowest disease severity (DS 1) was recorded in the month of January and the highest DS was (DS 9) in the month of May. Rainfall and humidity did not show any effect on disease development but temperature shows noticeable effect on disease development. A total of 20 species of fungi were isolated from *Tagetes erecta* and *T. patula.* Among the isolated fungi *Alternaria alternata, Aspergillus fumigatus* and *Curvularia lunata* were found to be pathogenic to *Tagetes erecta* and *T. patula.*

Key words: Incidence, Severity, blight disease, *Tagetes erecta, Tagetes patula*

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INTRODUCTION

Linnaeus was described the genus *Tagetes* in 1753. It is mostly herbaceous plants in the sunflower family Asteraceae (Compositae). It has 56 species. Three species of marigold - *Tagetes erecta* L., *T. patula* L. and *T. tenuifolia* Cav. are widely cultivated in India and Thailand, particularly the species are native to North and South America, but now has become naturalized around the world. This plant is most effective against the nematode species *Pratylenchus penetrans*[1,2]. The ingredient of thiophenes has been shown to kill gram negative and gram positive bacteria *in vitro*. The oil of the flower may be added to perfumes to infuse an apple scent into them. The essential oil of the flower contains antioxidants[3-6]. *Tagetes erecta* is used by Cherokee as a skin wash and for yellow dye. Today, *T. erecta* is grown to extract lutein, a common yellow/orange food colour. *Tagetes patula* is used mainly as an edging plant on herbaceous borders. The essential oil from this plant is being investigated for antifungal activity, including treatment of candidiasis and treating fungal infections in plants. The plant is used in companion planting for many vegetable crops. Its root secretions are believed to kill nematodes in the soil and it is said to repel harmful insects, such as white flies on[7-9]. Both the species are used in Ayurvedic treatment[10]. reported mosqutocidal potentiality of the plant. Ninety five per cent farmers in Jessore and Jhenaidah district cultivate marigold as commercial basis. The yield of marigold was 2,650,447 flowers per hectare. The gross margin and net return were Tk.1, 62,186 and 1, 17,812 per hectare, respectively. The net return was 80% higher than lentil, 85% higher than mustard and 6% lower than potato cultivation [11]. Diseases were major constrain for marigold cultivation. In Bangladesh, due to rapid expansion of commercial marigold cultivation many diseases appear on the plants. However, reports on the occurrence of diseases of marigold in Bangladesh are scanty . Though marigold is presently a profitable cultivated crop to the farmers in Bangladesh but socioeconomic data and information of this flower are very scare. Leaf spot and blight are two common diseases of *Tagetes*

erecta and *T. patula* Mukerji and Bhasin (1986) and Dhiman *et al.* (1990) reported disease of *Tagetes* from India. From Bangladesh Rahman and Rashid. (2008) reported powdery mildew and Sultana and Shamsi (2011) reported gray mold of *T. erecta* [12,15]. Present investigation was undertaken to detect the incidence and severity of blight disease of *T.* erecta and *T. patula* [12-15].

MATERIALS AND METHODS

During the tenure of 2009 and 2014. One hundred eighty four samples with characteristic diseased symptom were collected from BARI, Joydebpur, Gazipur, Dhaka, Chittagong, Comilla, Dhaka city, Khulna, Pabna, Rajshahi, Sylhet and Rangpur. Effect of temperature, humidity and rainfall on disease incidence and disease severity were intensively studied. Temperature, humidity and rainfall data were recorded for the year of 2012-2014 (Collected from Bangladesh Meteorological Department, Agargaon, Dhaka).

The survey was conducted in Dhaka city from January to May during the year of 2012-2014. The incidence and severity of blight symptom of *Tagetes* spp. were recorded from gardens of Curzon Hall, Dhaka University, Gulshan, Mirpur Mohakhali and Rampura. Disease incidence was measured following Hossain[17]. Fifty leaves and plants were counted per plot per visit. Each plot was visit and data were recorded twice in a month. Data were expressed in percentage. The formula in calculating the disease incidence and severity is:

$$\% \text{ Leaf / fruit infection} = \frac{\text{Number of leaves / Plants infected} \times 100}{\text{Total number of leaves/plants counted}}$$

For visual estimation of severity, 0-9 point DS scale were used for rating of all foliar diseases studied (PDI=McKinney's Index, Ghos *et al.* 2009)[16]. No infection = 0, 0 – 10% leaf area infected = 1, 10 – 20% leaf area infected = 2, 20 – 30% leaf area infected = 3, 30 – 40% leaf area infected = 4, 40 – 50% leaf area infected = 5, 50 – 60% leaf area infected = 6, 60 – 70% leaf area infected = 7, 70 – 80% leaf area infected = 8, 80 – 90% or more leaf area infected = 9. The fungi associated with the collected samples were isolated following 'Tissue planting' method on PDA (Potato Dextrose Agar) medium and 'Blotter method'[13]. Microscopic details of the associated fungi with *Tagetes* spp. were studied following standard techniques [17-18] ·Identification of the fungi were confirmed following relevant literatures[19-231]

RESULTS AND DISCUSSION

In Bangladesh *Tagetes erecta* and *T. patula* are commonly grown by the gardeners as annual ornamental plants. A total of 184 samples were examined to record the diseases of *Tagetes* spp. in Bangladesh. Diseased samples were collected from BARI, Joydebpur, Gazipur, Dhaka, Chittagong, Comilla, Dhaka city, Khulna, Pabna, Rajshahi, Sylhet and Rangpur. Blight symptom was recorded on leaves , calyx, buds and flowers of *T. erecta* and *T. patula* during the period of 2009-2014 (Plates 1-4).

Plate 1. *Tagetes erecta*: Diseased samples collected from different locations: A-B. BARI, Joydebpur Gazipur, C. Bangabandu Sheikh Mujibur Rahman Novo Theater , D. Mohakhali, E. Mirpur and F. Curzon Hall, Dhaka.

Plate 2. *Tagetes patula*. Diseased plant collected from different locations A. Curzon Hall, B. Mirpur, C. Bangabandu Sheikh Mujibur Rahman Novo Theater, D. Joydebpur, Gazipur, E. Mohakhali and F. Gulshan, Dhaka.

Plate 3. Disease plants of *Tagetes erecta.* : A. Leaves, B Calyx, C. Bud and D. Petals

Plate 4. Diseased plant parts of *Tagetes patula*: A. Leaves, B. Calyx, C. Bud and D. Petals.

Disease incidence and severity of *T. erecta* and *T. patula* were recorded from 2012 to 2014.Figure 1 shows that in *Tagetes erecta* blight incidence was started from January and gradually increased up to

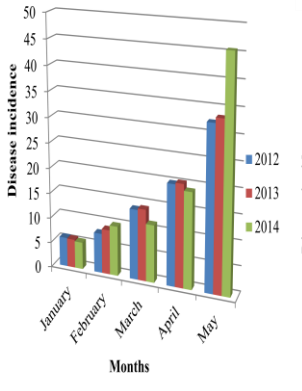

Fig. 1. Disease incidence of *Tagetes erecta* from January - May (2012-2014).

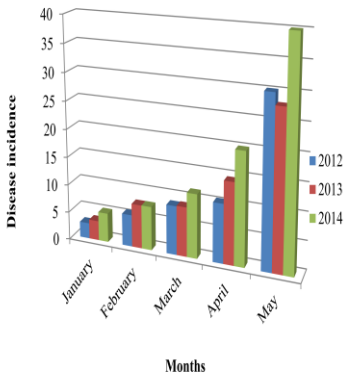

Fig. 2. Disease incidence of *T. patula* from January - May (2012-2014).

May during all the years studied. Lowest disease incidence was recorded (5.4–5.8%) in *T. erecta* in the month of January (2012-2014) whereas highest disease incidence was recorded (32.4 - 45.6%) in the month of May 2012-2014. Figure 2 shows that in case of *T. patula*, lowest disease incidence was recorded (2.8–5.2%) in January (2012-2014) where highest disease incidence was recorded

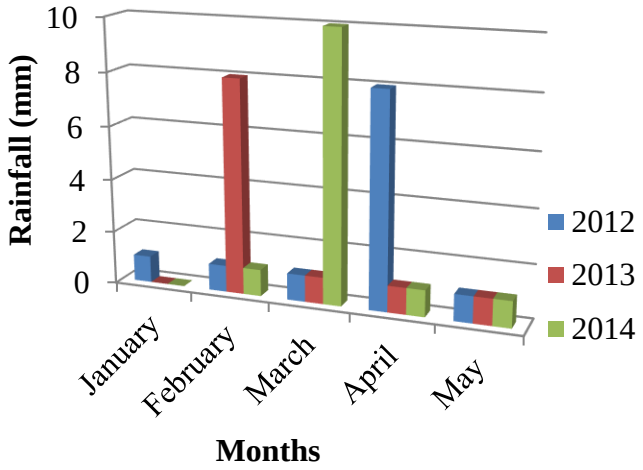

Fig. 3. Rainfall from January-May (2012-2014) in Dhakacity.

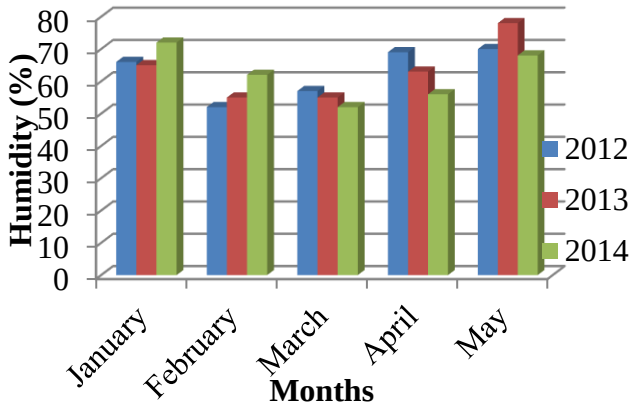

Fig. 4. Humidity from January-May (2012-2014) in Dhaka city

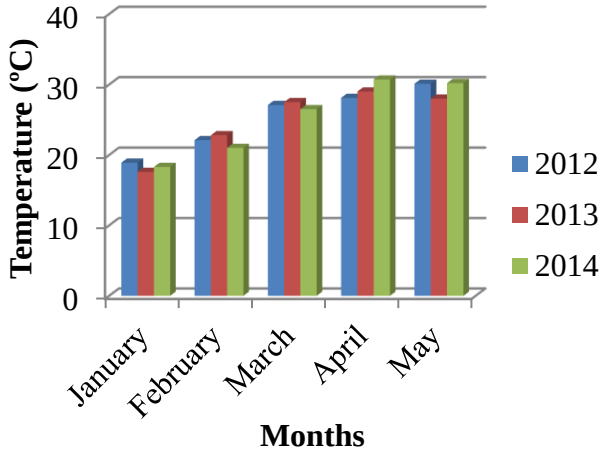

Fig. 5.Temperature from January-May (2012-2014) in Dhaka city.

(28.0 - 40.0%) in May (2012-2014). Figure 3 shows that rainfall was 1 mm in January 2012 and May 2012-2014. 65-72% humidity was recorded in January (2012–2014) and 68-78% humidity was

recorded in May (2012–2014) (Fig. 4). Temperature recorded in the month of January was 17.6-18.9^0 C and it was 28-30.2 ^{0} C in the months of May (2012-2014) (Fig. 5).

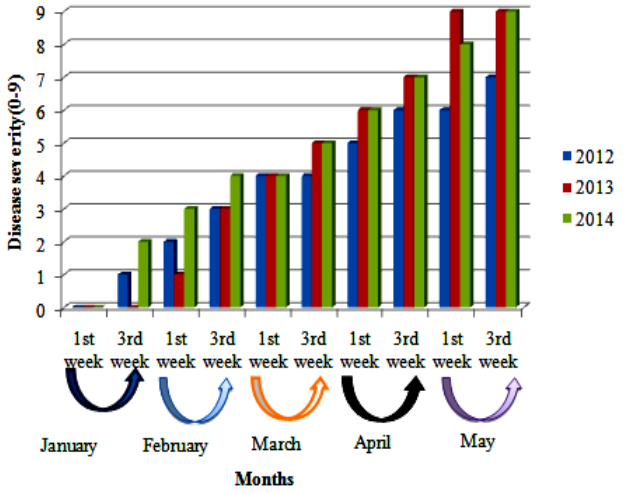

Fig. 6. Disease severity of *Tagetes erecta* in different years.

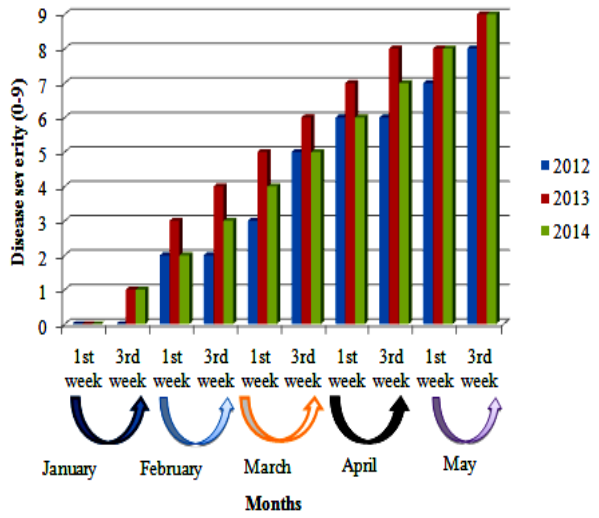

Fig.7. Disease severity of *Tagetes patula* in different years.

Disease severity of *Tagetes* spp. owing to blight was recorded at DS scale 0-9 during all the years studied. Highest disease severity (9) was recorded in the year 2013 and 2014 in the month of May in both the species examined. Lowest DS (1) was recorded in the year 2012 in case of *T. erecta* and 2013-2014 in case of *T. patula* (Figs. 6-8). A total of twenty fungi were isolated from infected plant parts of *T. erecta* and *T. patula*. The isolated fungi were *Alternaria alternata* (Fr.) Keissler, *Aspergillus flavus* Link, *A. fumigatus* Fresenius, *A. niger* van Tieghem, *Bipolaris australiensis* (M.B. Ellis) Tsuda & Ueyama, *Chaetomium globosum* Kunze, *Cladosporium elatum* (Harz) Nannf., *Corynespora cambrensis* M. B. Ellis, *Curvularia brachyspora* Boedijn, *C. fallax* Boedijn , *C. lunata* (Wakker) Boedijn, *C. stapeliae* (du Plessis) Hughes & du Plessis, *Epicoccum purpurascens* Ehrenb. ex Schlecht., *Fusarium semitectum* Berk. & Rav., *Monochaetia ceratoniae* (Sousa da Camera) Sutton, *Nigrospora panici* Zimm., *Penicillium italicum* Wehmer, *Rhizopus stolonifer* (Ehrenb.: Fr.) Vuill, *Trichoderma viride* Pers. and *Trichothecium roseum* Link (Table 1).

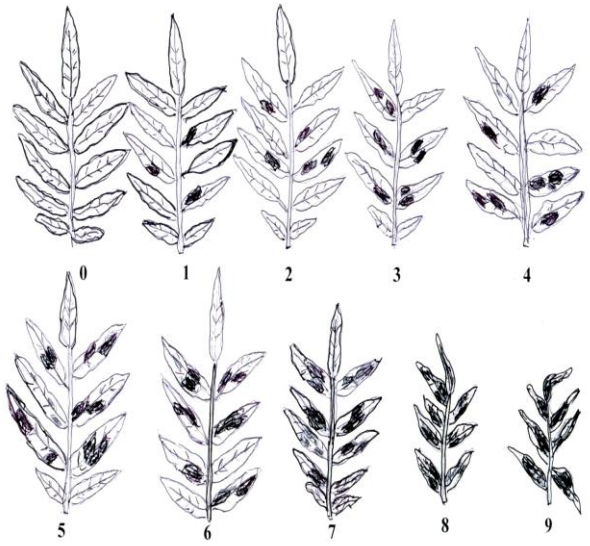

Fig. 8. Diagrammatic presentation of disease severity scale 0-9

Blight symptom was recorded on different parts of *Tagetes erecta* and *T. patula* during the tenure of 2009 to 2014. Disease incidence was started from January and gradually increased up to May. The Lowest disease severity (DS 1) was recorded in the month of January and the highest DS was (DS 9) in the month of May. Rainfall and humidity did not show any effect on disease development but temperature shows noticeable effect on disease development. Among the isolated fungi *Alternaria alternata*, *Aspergillus fumigatus* and *Curvularia lunata* were found to be pathogenic to *Tagetes erecta* and *T. patula* [24-26].

Table 2 shows that frequency percentage of association of *Alternaria alternata* was highest 97.50 in the year 2013 and 8.33 was the lowest in the year 2014. In case of *Aspergillus fumigatus* frequency percentage of association of the fungus was highest 77.50 in the year 2014 and it was lowest 0.83 in the year 2009. In case of *Curvularia lunata* frequency percentage of association of the fungus was 29.16 was highest 29.16 in the year 2010 and was lowest 4.99 in the year 2009.

Present finding will be helpful for designing a proper management of blight disease of *Tagetes* spp.

Table 1. List of fungi associated with infected plants of *Tagetes erecta* and *T. patula* during 2009-2014.

Name of isolates	*Tagetes erecta*	*T. patula*
Alternaria altrenata	+	+
Aspergillus flavus	+	+
A.fumigatus	+	+
A. niger	+	+
Bipolaris australiensis	-	+
Chaetomium globosum	+	+
Cladosporium elatum	+	+
Corynesora cambrensis	+	+
Curvularia brachyspora	+	+
C. fallax	+	+
C. lunata	+	+
C. stapeliae	-	+
Epicoccum purpurascens	-	+
Fusarium semitectum.	+	+
Monochaetia ceratoniae	+	+
Nigrospora panici	+	+
Penicillium italicum	+	+
Rhizopus stolonifer	+	+
Trichoderma viride	+	+
Trichothecium roseum	+	-

Table2. Frequency percentage of association of fungi with *Tagetes erecta* and *T. patula* from 2009 to 2014.

Name of the Fungi	Years											
	2009		2010		2011		2012		2013		2014	
	T. erecta	*T. patula*	*T. erecta*	*T. patula*	*T. erecta*	*T. patula*	*T. erecta*	*T. patula*	*T. erecta*	*T. patula*	*T. erecta*	*T. patula*
Alternaria alternata	42.49	34.99	48.33	45.83	52.49	-	10.00	-	**97.50**	60.83	8.33	37.50
Aspergillus flavus	-	-	-	4.16	3.33	-	27.49	25.83	-	1.66	1.66	30.00
A. fumigatus	20.00	**0.83**	-	50.00	8.33	-	-	-	-	27.50	**77.50**	-
A. niger	8.33	4.99	65.83	20.00	1.66	10.83	10.83	16.66	42.50	13.33	-	-
Bipolaris australiensis	-	7.50	-	-	-	-	-	-	-	-	-	-
Chaetomium globosum	-	-	27.49	12.49	-	-	-	1.66	-	-	-	-
Cladosporium elatum	19.99	1.66	57.49	29.99	-	-	-	1.66	12.50	1.66	-	9.16
Corynespora cambrensis	-	-	16.66	20.83	-	-	-	-	-	-	-	-
Curvularia brachyspora	-	-	**0.83**	4.16	-	25.00	-	4.16	8.33	-	-	-
C. fallax	-	-	-	-	5.00	41.66	8.33	2.50	5.00	-	-	-
C.lunata	20.83	4.99	6.66	**29.16**	-	-	12.50	-	8.33	4.16	16.66	-
C. stapeliae	-	-	-	-	-	-	-	10.83	-	-		- -
Epicoccum purpurascens	-	-	-	4.16	-	-	-	-	-	-	-	-
Fusarium semitectum	18.33	-	24.99	8.33	54.99	20.00	8.33	-	14.99	0.83	-	-
Monochaetia ceratoniae	10.00	-	-	4.16	-	-	-	-	-	-	-	-
Nigrospora panici	-	-	5.83	8.33	13.33	-	-	-	-	-	-	-
Penicillium italicum	5.00	3.33	9.16	2.50	8.33	40.83	15.00	16.66	17.49	0.83	-	-
Rhizopus stolonifer	-	-	-	-	1.66	-	9.99	11.66	-	-	-	-
Trichoderma viride	-	-	16.66	8.33	7.50	6.66	6.66	-	-	-	-	-
Trichothecium roseum	-	-	-	-	1.66	-	-	-	-	-	-	-

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