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Ecology and Chemical Management of *Fusarium oxysporum* Causing Blossom Blight of Marigold

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Abstract: *An extensive survey conducted on the incidence of different fungal diseases of marigold revealed the presence of blossom blight (Fusarium oxysporum), Botrytis blight (Botrytis cinerea), leaf spot (Alternaria tagetica), wilt (Fusarium oxysporum) and powdery mildew (Oidium sp.) in the range of 12.70-52.00%. Blossom blight caused by Fusarium oxysporum was the most serious one, prevalent to the tune of 52% affecting the floral parts. In vitro studies indicated that mean day temperature of 30°C was significantly superior in yielding the highest mean mycelial weight of 455 mg. Further, the performance of the test fungus was found satisfactory in the pH range of 5 to 8. Alternate cycle of 12 hours of light and darkness was found highly favourable for the growth of the fungus among the five photoperiods evaluated. Among the agrochemicals Carbendazim (0.1%), Metalaxyl+Mancozeb (0.2%), Carbendazim+Mancozeb (0.1%) and Tricylazole (0.06%) were found absolutely inhibitory in laboratory condition.*

Key words: *Marigold, Fusarium oxysporum, photoperiod, agrochemical*

INTRODUCTION

Marigold is an important floral crop, highly demanding in Indian and world market. It belongs to Asteraceae family and comprises of 56 species. It is widely cultivated all over the world in view of its versatility to various soil and climatic conditions, longer blooming period and beautiful flowers having long shelf life. In Odisha, the total marigold area is 2625 ha with a production of 2,40,031 MT. Diseases are common problems in marigold production as it deteriorates the yield and quality of the produce by damaging the floral parts of the plant. Among the diseases, blossom blight (*Fusarium oxysporum*), Botrytis blight (*Botrytis cinerea*), leaf spot (*Alternaria tagetica*), wilt (*Fusarium oxysporum*) and powdery mildew (*Oidium sp.*) are pervasive in Odisha condition where blossom blight alone damages upto 52%. In this context, an ecological study on blossom blight *(Fusarium oxysporum)* and *in vitro* experiment was conducted to assess the efficacy of different agrochemicals to manage the disease.

MATERIAL AND METHODS

The light requirement of the pathogen was studied in potato dextrose agar media. Sterile petriplates containing 20 ml PDA were inoculated with 5 mm mycelial discs aseptically and incubated at different photoperiodic conditions, each treatment replicated five times. After 7 days, the dry mycelial weight of each treatment was recorded. The temperature requirement of the fungus was studied in potato dextrose broth. Conical flasks containing 50 ml culture medium each were inoculated with 5 mm mycelial discs aseptically and incubated at different temperature levels, each treatment replicated thrice. After 7 days, the dry mycelial weight of each treatment was recorded. The pH requirement of the fungus was studied in Richard's medium. Conical flasks containing 50 ml medium each, with pH adjusted were inoculated with 5 mm mycelial discs and incubated at room temperature. Each treatment was replicated thrice. The dry weight of the mycelial mat was recorded after 7 days. The bio-efficacy of eight fungicides was evaluated against the fungus *Fusarium oxysporum* at their recommended doses (%) by poisoned food technique (Nene and Thapliyal, 1973). Fungicides were mixed with appropriate amount of molten potato dextrose agar medium to get desired concentrations of the fungicides. 20 ml of

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poisoned medium was poured into each petriplates, each treatment replicated thrice. One set of control was maintained without any poisoning. 5 mm mycelial disc of the culture was transferred to each plate aseptically. Then the plates were incubated at room temperature for 7 days. Observations were recorded when there was maximum radial growth of the colony in the control plate. The per cent inhibition of the radial growth over the control was computed using the formula (Vincent, 1947):

$$I = \frac{C - T}{C} \times 100$$

where, I = Per cent inhibition (%)
C = Radial growth in control (mm)
T = Radial growth in treatment (mm)

RESULTS AND DISCUSSION

Besides temperature and atmospheric humidity, photoperiod also plays a significant role in the build-up of a disease epiphytotic. The data revealed that 12 hours of light along with 12 hours of darkness could facilitate significantly highest mean diameter growth (58.79mm) of the test fungus, indicating the fact 10-12 hours of photoperiod is necessary for optimum growth of majority of the disease causing fungi. However, the variation in the quantum of mycelial growth in between the two extremes of the photoperiod appears to be low (43-58.79mm). The investigation revealed that photoperiod, as a single function, didn't influence much on the radial growth of the test fungus and corroborated the experimental findings of Sharma *et al*.,2005 and Fayzalla *et al*., 2008 (Table 1).

Table 1
Effect of photoperiod on mycelial growth of *Fusarium oxysporum*

Sl. No.	*Photoperiod*	*Radial growth of the fungus(mm) 7 days after inoculation*
T1	Full light	43.00
T2	16 hours light+8 hours dark	44.02
T3	12 hours light+12 hours dark	58.79
T4	8 hours light+16 hours dark	53.18
T5	Full dark	49.90
CD (p=0.05)		2.03

Prevalent temperature of the crop microclimate plays a decisive role in expressing the vegetative growth of fungus and consequently disease development. The investigation revealed that the highest mean dry mycelial weight (455.21mg) was associated with an incubation temperature of 30°C, closely followed by 25°C with the corresponding figure of 400.5mg. Temperature regimes below 25°C (47.66-177.98mg) and above 30°C (155.95-371.02mg) were found unsuitable for the growth of *Fusarium oxysporum*. Therefore, the study indicated that a temperature range of 25-30°C was optimum for the growth of the test fungi in laboratory conditions. This finding was in agreement with the findings of Sharma *et al*, 2005; Fayzalla *et al*. 2008; Singh and Kumar 2011; Khilare and Ahmed 2012 and Somu *et al*. 2014 (Table 2).

Table 2
Effect of temperature on the mycelial growth of *Fusarium oxysporum*

Sl. No.	*Temperature(°C)*	*Mycelial dry weight of fungus(mg) 7 days after inoculation*
T1	10	47.66
T2	15	95.21
T3	20	177.98
T4	25	400.56
T5	30	455.21
T6	35	371.02
T7	40	155.95
T8	45	36.85
CD(p=0.05)		9.03

Hydrogen ion concentration plays a significant role in promoting the vegetative growth as well as sporulation in fungi. The data indicated that pH 7 was significantly superior in yielding the highest mean dry mycelial weight of 379.14mg. Further, it was observed that both highly acidic(pH 3 and 4) and alkaline (pH 9) ranges didn't perform well in promoting the vegetative growth of the test fungus with the dry mean mycelial weight of 16.62,61.60 and 26.66 mg respectively. The fungal pathogen was observed to grow well in the pH range of 5-8 indicating that it could grow well in neutral to alkaline conditions. Naik *et al*.(2004) reported that maximum growth of *Fusarium oxysporum* occurred at pH 5 and 6 *in vitro*. Rathore *et al.* (2015) showed maximum growth of *Fusarium oxysporum f.sp. cumini* at pH 8 followed by pH 9 at 7 days after inoculation in laboratory conditions (Table 3).

The results indicated a positive correlation between the agrochemicals tested and the per cent growth inhibition of test fungus. However, the test chemicals could inhibit the growth of the test fungus to varying extent (68.97-100%). Absolute growth inhibition was observed in case of Carbendazim (0.1%), Metalaxyl+Mancozeb (0.2%), Carbendazim+

Table 3
Effect of pH on the mycelial growth of *Fusarium oxysporum*

Sl. No.	*Treatment (pH)*	*Mycelial dry weight(mg) 7 days after inoculation*
T1	3	16.62
T2	4	61.60
T3	5	268.12
T4	6	289.57
T5	7	379.14
T6	8	241.28
T7	9	26.66
CD (p=0.05)		7.01

Mancozeb (0.1%) and Tricylazole (0.06%). Besides agrochemicals like Chlorothalonil (0.2%), Copper oxychloride (0.3%), Azoxystrobin (0.1%) and Mancozeb (0.25%) could inhibit the test fungus substantially (68.97-99.80%) on the plates containing poisoned media. The overall growth inhibition of the test fungus in the investigation was recorded in the range of 66.97-100%. This finding was in agreement with the findings of Chandel and Kaur, 2003 and Nisa *et al*., 2011 (Table 4).

Table 4
Effect of fungi toxicant on mycelial inhibition of *Fusarium oxysporum*

Sl.No.	*Fungi toxicant*	*Dose(%)*	*Radial growth of the fungus (mm) at 7 days after inoculation*	*Per cent growth inhibition*
T1	Carbendazim	0.1	0.00	100.00
T2	Mancozeb75%WP	0.25	25.03	68.97
T3	Metalaxyl 8%+Mancozeb 64%	0.2	0.00	100.00
T4	Carbendazim12%+Mancozeb63%	0.12	0.00	100.00
T5	Chlorothalonil	0.2	0.10	99.80
T6	Tricyclazole	0.06	0.00	100.00
T7	Copper oxychloride	0.3	1.35	98.32
T8	Azoxystrobin	0.1	15.85	80.35
T9	Control	-	80.67	-
CD (p=0.05)				1.67

References

Chandel SS and Kaur M. (2003), Effect of fungicidal seed treatment on seed variability, seed mycoflora and plant health of marigold, *Journal-of-Hill-Research*, **16**(1): 29-31.

Fayzalla EA, Shabana YM and Mahmoud NS. (2008), Effect of Environmental Conditions on Wilting and Root Rot Fungi Pathogenic to Solanaceous Plants, *Plant Pathology Journal*, 7: 27-33.

Khilare VC and Ahmed R. (2012), Effect of different media, pH and temperature on the growth of *Fusarium* oxysporum *f.sp. ciceri* causing chickpea wilt, *International Journal of Advanced Biological Research,* **2**(1): 99-102.

Nene, YL and Thapliyal, P. N., (1973), Fungicides in Plant Disease Control. (Third Edition) Oxford and IBH publishing Co. Pvt. Ltd., New Delhi. P. 325.

Naik G, Nagaraja , Basavaraja MK and Naik K. (2004), Variability Studies of *Fusarium oxysporum f. Sp. vanillae* Isolates, *International Journal of Science and Nature*, **1**(1): 12-16.

Nisa TU, Wani AH, Bhat MY,Pala SA and Mir RA. (2011), In vitro inhibitory effect of fungicides and botanicals on mycelial growth and spore germination of *Fusarium oxysporum*, *Journal of Bio pesticides*, **4** (1): 53–56.

Sharma RL, Singh BP, Thakur MP and Thapak SK. (2005), Effect of Media, Temperature, pH and Light on the Growth and Sporulation of *Fusarium oxysporum f. sp. Lini*, *Annual Plant Protection Science*, **13** (1) : 172-174.

Singh PK and Kumar V. (2011), Variability among isolates of *Fusarium oxysporum f.sp.chrysanthemi* pathogenic to chrysanthemum,*International Journal of plant pathology*, **2**(3): 136-14.

Somu R , Nidagundi P and Siddartha D. (2014), Effect of Different Media, pH and Temperature on Growth and Sporulation of Gladiolus Wilt caused by *Fusarium oxysporum f.sp. gladioli*, *Trends in Biosciences* , **7**(14): 1737-1739.

Rathore SS, Saxena SN, Shrma YK, Mishra BK and Singh B. (2015), Effect of pH and salt levels on growth of *Fusarium oxysporum f.sp.cumini* isolate from cumin, *International Journal of Seed Spices*, **5**(1): 100-101.

Vincent JM, (1947), Distortion of fungal hyphae in presence of certain inhibitions.*Nature* 150: 850.