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Effect of Temperature and Relative Humidity on the Growth of *Helminthosporium fulvum*

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ABSTRACT: The effects of temperature and relative humidity on the growth of *Helminthosporium fulvum* were investigated. Various temperature regimes of 10°C, 15°C, 20°C, 25°C, 30°C, 35°C and 40ęC were used to determine the temperature effect on the growth of *H. fulvum*. Maximum growth of *H. fulvum* was obtained at 25ęC and 30ęC temperatures. The fungus was also cultured on 100, 92.5, 85, 74 and 32.5% relative humidity regimes. The fungus showed maximum growth at 92.5 and 100% relative humidity. The growth of the fungus was observed to increase with increase in relative humidity and vice versa. There were significant differences (PÒ0.05) in the growth of the fungus at different temperature and relative humidity regimes. The implication of these findings were discussed.
Keywords: Effect, Temperature, Relative Humidity, Growth, *Helminthosporium fulvum*

INTRODUCTION

Helminthosporium fulvum belongs to the family Dematiaceae. It is an ubiquitous fungal pathogen of worldwide distribution, which attack crop plants such as tomato, rice, wheat, tobacco, oats, barley and sugar cane causing severe agricultural losses (Dutta, 1976). Chinoko and Naqvi (1989) reported *H. fulvum* to be among the most pathogenic fungal pathogens associated with spoilage of tomato in Southern Nigeria. Similarly, Ibrahim (2002) found *H. fulvum* and *Monascus ruber* to be responsible for preharvest rot of tomato in Sokoto State, Nigeria.

Several studies were conducted on the effect of environmental factors on the growth of the pathogen (Malik and Singh 2004; Kim and Xiao, 2005). Environmental factors such as relative humidity and temperature were reported to have a profound influence on the infectiveness of a variety of fungi. Growth rate of fungi vary depending on temperature and relative humidity. The optimum growth temperatures for the majority of fungi studied was found to fall between 25ęC to 30ęC and above 40ęC the growth was poor and in some cases mortality may occur (Sharma and Razak, 2003). Malik and Singh (2004) reported maximum growth of *Beaveria bassiana* Fï 263 at 30ęC. The growth of *Fusarium oxysporium* was found to reach its maximum at 30ęC after 7 days of incubation which was drastically reduced below 15ęC and above 35ęC (Farooq *et al*., 2005). Similarly, Sharma and Sharma (2009) showed that *Chrysosporium tropicum* and *Trichophyton mentagrophytes* exhibited maximum growth at a temperature range of 28-30ęC. In a related but independent research Abarca *et al.,* (1990) studied the effect of temperature on growth of 17 strains of *Epidermophyton* and found that 28ęC and 31ęC temperatures were found to be the optimum temperature for growth of most of the test strains.

However, little imformation is available on the influence of environmental factors on the growth of *H. fulvum*. Therefore, the main objective of the study is to investigate the effect of temperature and relative humidity on the growth of *H. fulvum.* This may contribute in reducing heavy losses incured annually by peasant farmers as a result of the devastating effect of this fungus.

MATERIALS AND METHODS

Sample collection and processing: Fifty grams (50g) of rotten tomato (*Lycopersicum esculentum* L.) samples were purchased from Sokoto vegetable and fish market off Abdullahi Fodiyo Road, Sokoto. The samples were placed in clean polythene bags and transported to the Mycology laboratory of the Usmanu Danfodiyo University, Sokoto for the isolation of *H. fulvum.*

Isolation and identification of *H. fulvum:* This was carried out in accordance with the methods of Onions *et al.* (1981). The samples were surface sterilized with 70% alcohol and cut through using a sterile knife. Discs of 5×5mm were cut and plated onto already prepared sterile potato dextrose agar (PDA) plates. The plates were incubated at ambient laboratory temperature (30±2^{o}C) for 168 hours (7 days). Colonies that developed were repeatedly subcultured on PDA plates to obtain pure cultures.

Effect of temperature on growth of *H. fulvum:* The effect of temperature on the growth of *H. fulvum* was carried out in accordance with the methods of Malik and Singh (2004). Four (4)mm agar discs containing 7 days old culture of *H. fulvum* were placed in the centre of sterile Petri dishes containing Czapek-Dox agar medium. The inoculated plates were incubated at 10ęC, 15ęC, 20ęC, 25ęC, 30ęC 35ęC and 40ęC for 4 days. Three replicate plates per temperature treatment were harvested daily. The linear growth of fungus was assessed along several radii from the point of inoculation. The average mean value was taken to be the extent of growth.

Effect of relative humidity on growth of *H. fulvum:* The effects of various regimes of 100% 92.5%, 85% 74% and 32.5% relative humidity on the growth of *H. fulvum* was assessed in accordance with the methods of Kim and Xiao (2005). Agar discs (4mm in diameter) of 7 days-old culture of *H. fulvum* were placed in the centre of sterile Petri dishes containing Czapek-Dox agar medium. The inoculated plates were placed in the upper chambers of the desiccators, to prepare the required relative humidity regimes. Then 250ml each of distilled water, potassium nitrate, sucrose, sodium nitrate and magnesium chloride were placed in the lower chambers of the desiccators and allowed to stand for 4hours to attain the relative humidity regimes of 100% 92.5%, 85% 74% and 32.5% respectively (Winston and Bates, 1960). The linear growth of the fungus was assessed as described above.

RESULTS AND DISCUSSION

The result of the effect of temperature on the growth of *H. fulvum* is presented in Table 1. All the temperature regimes tested supported the growth of the fungus. However, it was observed that at 25ęC and 30ęC the fungus attained maximum growth of 25mm and 35mm after 4 days of incubation. However, the growth of the fungus was drastically reduced below 15ęC and started to decline above 35ęC, as these temperatures did not favour the growth of the fungus. The result of the effect of various regimes of relative humidity on the growth of *H. fulvum* is presented in Table 2. All the relative humidity regimes tested supported the growth of the fungus. However, at 92.5 and 100% relative humidity was 43 cm and 45 cm respectively after 4 days of incubation while the least growth (2 cm) of the fungus was observed at 32.5% relative humidity after 24 hours of incubation. This result showed that the growth of the fungus increased with increased in relative humidity.

Table I: Effect of different temperature regimes on the of *H. fulvum* (cm)

Temperature (^{0}C)	(Incubation period) Days 1	2	3	4
10	2	4	6	9
15	6	9	12	15
20	10	14	17	19
25	12	18	20	26
30	15	25	28	35
35	8	10	14	18
40	5	7	9	12

Table 2: Effect of different relative humidity regimes on the growth of *H. fulvum (*cm)

Rekative humidity (%)	(Incubation period) Days 1	2	3	4
100	15	25	35	45
95.2	10	18	31	43
85	6	16	27	39
74	5	11	19	28
32.5	2	5	8	15

Values represent means of triplicate plates

Temperature plays an important role in influencing the growth of fungi (Cochrare, 1963). Normally, the growth temperature for the majority of fungi is between 25ęC to 30ęC and above 40ęC the growth is poor (Cooney and Emerson, 1964). Similarly, Sharma and Sharma (2009) obtained maximum growth of *Chrysosporium tropicum* and *Trichophyton metagrophytes at* 28ęC to 30ęC temperatures. In this study 25ęC to 30ęC were

observed to support maximum growth of *H. fulvum*. This is similar to the findings of Farooq *et al.* (2005) on the effect of temperature on the growth of *Fusarium oxysporum*. The researchers reported that the fungus showed maximum growth at 30ęC after 7 days incubation which was drastically reduced below 15ęC and above 35ęC temperature. This study also revealed that a temperature of 30ęC and 92.5% to 100% relative humidity were most suitable for the growth of *H. fulvum*. Likewise Sharma and Sharma (2009) reported that temperature of 28ęC to 30ęC and relative humidity of 95% supported maximum growth of *Trichophyton mentagrophytes*. Also knight (1976) investigated the effect of temperature and relative humidity on the growth *Trichophyton mentagrophytes* and found that 24ęC to 36ęC temperature and relative humidity of 97% was the best for the growth of the fungus.

CONCLUSION

It is apparent from the study that low temperature and low relative humidity do not support the growth of *H. fulvum*. Therefore, it is highly recommended that fruits and vegetables should be stored at low temperature and low relative humidity regimes to avoid infections due to *H. fulvum* and this may contribute significantly in controlling the heavy losses our peasant farmers incured due to this fungus.

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