RESEARCH PAPER Asian Journal of Bio Science, Volume **8** | Issue 1 | April, 2013 | 32-35
Received : 13.10.2012; **Revised :** 23.01.2013; **Accepted :** 25.02.2013

Temperature-growth relationship of *Phaeoisariopsis personata*

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Growth of *Phaeoisariopsis personata* was measured in different temperatures of 10, 15, 20, 25, 30 and 35^{0}C on peanut leaf oatmeal agar medium and maximum growth was observed in 25^{0}C. At very high and low temperature conditions like 10, 15 and 35^{0}C growth was very slow. At 20^{0}C growth was slow as compared to 25^{0}C and 30^{0}C where growth fast was observed. In the liquid medium, potato dextrose broth showed significant difference in growth and dry weight accumulation at different temperatures. Highest dry weight was accumulated at 25^{0}C (1025mg) followed by 30^{0}C (969mg) and 20^{0}C (635mg), whereas 15^{0}C accumulated less dry weight (312mg) followed by 35^{0}C (292mg) and 10^{0}C (273mg). The mycelial growth decreased with decreasing and increasing temperatures beyond the optimum temperature range of 25-30^{0}C. So by visual observation at 20 days after inoculation on peanut leaf oatmeal agar and dry weight of mycelial mat was measured in case of liquid media to see the effect of different temperatures on growth of the pathogen.

Key words : Groundnut, Cercospora, *Phaeoisariopsis personata*

How to cite this paper : Nath, B.C., Sarma, B.K., Vaish, S.S., Chand, R. and Pal, Chhattar (2013). Temperature-growth relationship of *Phaeoisariopsis personata*. *Asian J. Bio. Sci.*, **8** (1) : 32-35.

INTRODUCTION

Groundnut is native to South America, originated between Southern Bolivia and Northern Argentina, from where it spread throughout the new world. Groundnut was introduced in India by around 16th century by the Portuguese. The importance of groundnut deserves emphasis as it is the world's second largest source of edible oil. It is extensively used as a cooking medium both as refined oil and hydrogenated oil. Groundnut oil is used in confectionary preparation such as peanut butter, peanut butter milk, margarine, ice cream, bakery goods etc. Groundnut oil is a health friendly, having least cholesterol increasing property in human body for its higher proportion of poly-unsaturated fatty acid components. Apart from high oil content of 47.50 per cent, peanut contains 28.50 per cent protein, 11.20 per cent carbohydrate, 2.90 per cent mineral ash and appreciable amount of vitamin B complex and vitamin K (Freeman *et al.,* 1954). A large number of diseases attack groundnut in India (Mayee, 1987; Mayee and Dater, 1988). The majorities are caused by fungi and several of them are yield reducer in certain regions and seasons. A few viral and two bacterial diseases (Dhal *et al.,* 2002) have also been reported. Late leaf spot (LLS) is a very serious foliar fungal disease of groundnut together with early leaf spot and rust. Yield losses of about 10 per cent kernels have been estimated from the southern USA where fungicide application is normally practiced. Over much of the semi-arid tropics where chemical control of leaf spots is rarely practiced, losses in excess of 50 per cent are common (Jackson and Bell, 1969; Garren and Jackson, 1973). It has been estimated that early and late leaf spot alone cause the loss of about 3 million tones of kernels per year (Bunting *et al.,* 1974). Both early and late leaf spots are disastrous to the plant as it reduce the photosynthetic area by intense lesion formation and by stimulating leaflet abscission (Gerlagh and Bokdam, 1974; McDonald *et al.,* 1985). Butler (1990) reported that infection was very rapid at 23^{0}C when the leaf wetness was provided for five nights. These results confirmed earlier findings of Shew *et al.* (1988) that infection occurred with intermittent periods of surface moisture. He, therefore, concluded that dominant variable affecting infection at a particular temperature was the total number of hours of leaf wetness. Carisse *et al.* (1993) studied the sporulation of *Cercospora carotae* on carrot leaves and reported that sporulation increased with increasing temperature up to the optimum of 28^{0}C, then decreased as temperature increased to 32^{0}C; however, no sporulation was observed at 16 and 32^{0}C when relative humidity was 96 per

cent. Paul and Munkvold (2005) reported that the average temperatures of 27^{0}C and 29^{0}C and the mean relative humidity 95 per cent were the ideal conditions for the development of the gray leaf spot in maize, caused by *Cercospora zeae-maydis*. Kadam *et al.* (2008) reported that high relative humidity, moderate mean temperature and shower of rains are congenial factors for the dispersal of conidia of *Cercospora* species.

RESEARCH METHODOLOGY

Isolation, identification, purification and maintenance of pathogenic isolate:

Groundnut leaves infected with *Phaeoisariopsis personata* were collected from near by villages of Mirzapur district, Uttar Pradesh. The pathogen was isolated from those groundnut leaves. The pathogen, *Phaeoisariopsis personata* was isolated from infected groundnut leaves by tissue segment method (Rangaswami and Mahadevan, 2006). The fresh infected portion along with a portion of healthy tissue was cut and surface sterilized with 0.1per cent $HgCl_2$ solution for 30 seconds followed by thorough washing three times in sterile distilled water. These leaf bits were then inoculated in a Petri plate on potato dextrose agar medium (PDA) using a sterile inoculation needle, incubated at 25 ± 1^{0}C and observed periodically for the growth of the fungus.

The culture was purified by single hyphal tip method and maintained on potato dextrose agar medium by periodical transfer throughout the present investigation for further studies. The fungus isolated from late leaf spot samples of groundnut was identified based on descriptions given by Kolte (1984) and McDonald *et al.* (1985). Temporary aqueous mounts were prepared from the pure cultures of the fungi and observed for different structures under compound microscope. Photomicrograph of the pathogen was taken using stereo binocular and compound microscope for detailed studies.

Effect of different temperature on growth of *Phaeoisariopsis personata*:

Solid medium:

Since the fungus was a slow growing pathogen, growth of the pathogen was taken based on visual observation but not on radial growth. The pathogen was grown on peanut leaf oatmeal agar medium to determine optimum temperature for mycelial growth of *P. personata*. The sterilized medium (20 ml) was poured in sterilized Petri plates (90 mm diameter) and allowed to solidify. Then mycelial bits of 20 days old cultures were placed on the centre of Petri plates. The Petri plates were incubated at temperatures 10, 15, 20, 25, 30, 35^{0}C and growth was seen based on visual observation.

Liquid medium:

The mycelial bit of the pathogen was inoculated to 50 ml of sterilized Potato dextrose broth medium in each 150 ml conical flask. The flasks were then kept in different temperature conditions at 10, 15, 20, 25, 30, 35^0 C. The dry weight of the mycelia from each flask was taken at 25 days after inoculation. Mycelial mats were filtered through whatman filter paper No. 42. Filtered mats with filter paper were dried at 62^{0}C for 24 hrs and were weighed on electronic balance and dry matter of fungus was calculated by reducing the weight of filter paper from total mycelia weight with filter paper.

RESEARCH FINDINGS AND ANALYSIS

Growth of *Phaeoisariopsis personata* was measured in different temperatures of 10, 15, 20, 25, 30 and 35^{0}C on peanut leaf oatmeal agar medium and maximum growth was observed in 25^{0}C. At very high and low temperature conditions like 10, 15 and 35^{0}C growth was very slow. At 20^{0}C growth was slow as compared to 25^{0}C and 30^{0}C where growth fast (Table 1).

In the liquid medium, potato dextrose broth showed significant difference in growth and dry weight accumulation at different temperatures. Highest dry weight was accumulated at 25^{0}C (1025mg) followed by 30^{0}C (969mg) and 20^{0}C (635mg), whereas 15^{0}C accumulated less dry weight (312mg) followed by 35^{0}C (292mg) and 10^{0}C (273mg) Table 2. The mycelial growth decreased with decreasing and increasing temperatures beyond the optimum temperature range of 25-30^{0}C. So by visual observation at 20 days after inoculation on peanut leaf oatmeal agar and dry weight of mycelial mat was measured in case of liquid media to see the effect of different temperatures on growth of the pathogen and found as mentioned above. Present study on growth of *Phaeoisariopsis personata* at different temperature revealed that the mycelial growth was highly affected with temperature. The radial growth was maximum at 25-30^{0}C. There was very slow growth at 10, 15 and 35^{0}C and slow growth of the pathogen was also seen at temperature 20^{0}C. These observations helped to find optimum temperature for the growth of the pathogen. It was observed that minimum and maximum range of temperature for the growth of pathogen may help in epidemiological study of the disease in the future. Effect of temperature on mycelial growth also correlated with disease development. It was evident that when temperature ranged from 25-30^{0}C in last week of August

Table 1: Effect of different temperature on growth of *Phaeoisariopsis personata* on peanut leaf oatmeal agar medium

Temperatures	Growth rate
10^{0}C	Very slow
15^{0}C	Very slow
20^{0}C	Slow
25^{0}C	Fast
30^{0}C	Fast
35^{0}C	Very slow

Table 2: Effect of different temperature on mycelial growth of *Phaeoisariopsis personata* on potato dextrose broth medium

Temperatures	Mycelial dry weight (mg)
10^0C	273
15^0C	312
20^0C	634.66
25^0C	1025
30^0C	969.66
35^0C	292.33
C.D. (P=0.01)	30.23383
S.E. ±	7

infection of leaf was observed. Therefore, temperature plays a very important role in disease development. Some earlier studies are in agreement with the present investigation studied by Carisse *et al.* (1993) where sporulation of *Cercospora carotae* on carrot leaves was found increased with increasing temperature up to the optimum of 28^0C and then decreased as temperature increased to 32^0C; however, no sporulation was observed at 16 and 32^0C when relative humidity was 96 per cent. In an earlier report on effect of different environmental conditions on disease development Ringer and Grybanskas (1995) suggested that environmental conditions during primary infection stages of the disease cycle were more important in determining the rate of disease progress than overall conditions during the growing season. Paul (2003) also reported that the number of hours of day time, air temperature between 20 and 30^0C and night time relative humidity $\geq$ 90 per cent for the period between growth stages V_4 and V_{12} were more highly correlated with gray leaf spot of maize (*C. zeae-maydis*) severity than overall mean temperature and relative humidity during the growing season. According to Paul and Munkvold (2005) the average temperatures 27^0C and 29^0C and the mean relative humidity 95 per cent were ideal conditions for the development of the gray leaf spot in maize, caused by *Cercospora zeae-maydis*. So, it can be reported that temperature plays important role in mycelia growth and disease development and present investigation is in agreement with the previous reports as mentioned above and found 25-30^0C optimum for growth of the pathogen.

The mycelial growth was highly affected with temperature. Among the different temperatures maximum mycelial growth was observed at 25^0C followed by 30^0C. With increase and decrease in temperature, growth of the pathogen was also decreased. Therefore, temperature played a very important role in growth and disease development.

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