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Physiological studies on anthracnose of green gram [Vigna radiata (L.) Wilczek] caused by Colletotrichum truncatum (Schw.) Andrus and Moore

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Abstract

Green gram [*Vigna radiata* (L.) Wilczek] is an important pulse crop. It suffers from many diseases of which anthracnose due to *Colletotrichum truncatum* (Schw.) Andrus and Moore has become one of the most serious diseases in recent years. Temperature has a profound effect on both vegetative and reproductive activity of the fungi. Significantly maximum growth of the fungus (220.25 mg) was recorded at 30^0C, followed by 25^0C (210.86 mg). Relative humidity at 95 per cent (212.55 mg) supported significantly the highest mycelial growth and followed by 85 per cent relative humidity (192.23 mg) was found to be the next. Every organism has minimum, maximum and optimum pH for the growth. Significantly the highest mycelial growth (215.36 mg) was recorded at pH 6.5 Followed by pH 6.0 (187.08 mg) and the least mycelial growth was obtained at pH 4.0 (96.27 mg). Thus it was evident that the pH range of 6.0 to 7.5 was the most optimum for the fungal growth.

Key words: *Colletotrichum truncatum*, Temperature, Relative humidity, Hydrogen ion concentration (pH).

Introduction

Green gram [Vigna radiata (L.) Wilczek] commonly also known as mung bean is an important pulse crop of India. It is also considered as "Golden Bean" because of its nutritional values and suitability for increasing the soil fertility by way of addition of nitrogen (30 kg/ha/annum). Among all pulses grown in India green gram ranks third after chickpea and pigeon pea, with the production of 1.49 MT from 3.53 m ha area (Anon., 2012). It is cultivated mainly as a kharif crop in the major green gram growing states such as Orissa, Maharashtra, Andhra Pradesh, Rajasthan, Karnataka and Gujarat. However the green gram yields are remarkably low due to various factors of biotic and abiotic nature which take a heavy toll on the crop, of which diseases account for estimated yield loss of 20-30 per cent. Among various diseases on green gram anthracnose causes estimated yield losses of 18.2-86.5 per cent (Laxman, 2006). In view of this, in vitro physiological studies of *Colletotrichum truncatum* was undertaken to find out their nature of growth in different physiological condition.

Material and Methods

The present investigation was carried out to evaluate the different plant physiological conditions of *C. truncatum*.

Effect of temperature on the growth of *C. truncatum*

The effect of temperature on the fungal pathogen *C.truncatum* was studied at seven temperature levels *viz*. 10, 15, 20, 25, 30, 35 and 400C using potato dextrose broth medium as a basal medium. Twenty millilitre of basal medium was poured into the 100 ml flasks and sterilized at1.1 kg/cm2 pressure for 20 min. A five mm meter mycelial discs of each of these selected isolates were cut from actively growing cultures was inoculated and incubated at different temperature levels. Each treatment combination was replicated thrice. Mycelial growth was harvested after the incubation period of 14 days and dry mycelial weights (mg) were recorded as described earlier. The results were analyzed statistically and compared.

Effect of relative humidity (RH) on growth of *C. truncatum*

The effect of relative humidity on the fungal pathogen *C.truncatum* was studied at five relative humidity levels *viz*. 65, 75, 85, 95 and 100 percent using potato dextrose broth medium as a basal medium. Twenty milli litre of basal medium was poured into the 100 ml flasks and sterilized at1.1 kg/cm2 pressure for 20 min. A five mm mycelial discs of each of these selected isolates were cut from actively growing cultures was inoculated and incubated at different relative humidity levels maintained in dessicaters. Different levels of relative humidity were created by using different concentration solutions of H2SO4. The dessicaters were kept at 28 ± 1^0c with four replications. Mycelial growth was harvested after the incubation period of 14 days and dry mycelial weights (mg) were recorded as described earlier. The results were analyzed statistically and compared.

Effect of different pH on growth of *C. truncatum*

Using potato dextrose broth solution as basal medium the experimentation on *C. truncatum* with respect to hydrogen ion concentration was studied with different pH levels. The pH of the liquid medium (potato dextrose broth solution) was determined by pH meter and adjustment of pH was done by adding 0.1N alkali (NaOH) or acid (HCl). Reaction of the medium was adjusted to the desired pH by using dihydrogen phosphate citric acid buffer according to the schedule of Vogel (1951). Basal medium pH was adjusted to 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5 and 8.0. Mycelial discs were cut and inoculated in 20 ml basal medium in 100 ml conical flasks and incubated at 28±10C. Each treatment combination was replicated thrice. The dry weight of the mycelium in each treatment was recorded after harvesting the

mycelial growth after the end of incubation period as described earlier. The results were analyzed statistically and compared.

Results and Discussion

Temperature, relative humidity and pH has a profound effect on both vegetative and reproductive activity of the fungi. These physiological factors of the medium and the growth of the fungus are interrelated. Every organism has minimum, maximum and optimum temperature, relative humidity and pH for the growth.

Effect of temperature on the growth *C. truncatum*

Among the different temperatures (Table 1, Fig. 1 and Plate 1) significantly maximum growth (220.2 mg) was recorded at 30^0C, followed by 25^0C (210.8 mg) and on par with each other. Following these, the fungus put up growth of 165.2 mg at 35^0C and was on par with 20^0C (150.1 mg) and were also on par with each other. It was further observed that the fungal growth at 20^0C was on par with 40^0C (130.1 mg) and 15^0C (129.1 mg). Significantly the least mycelial growth recorded at 10^0C (122.2 mg) and it was found to be on par with former two temperatures. It was evident that temperatures between 25-30^0C were the optimum for the growth of pathogen.

The results are in close agreement with Shirshikar (1995) recorded maximum growth of *C. truncatum* (69.55 mm dia) at 30^0C. (Laxman, 2006 and Kulkarni, 2009) found optimum range of temperature for the growth of *C. truncatum* as 25 to 300C and maximum growth of fungus was recorded at 30^0C.

Effect of relative humidity (RH) on the growth of *C. truncatum*

Significantly the highest mycelial growth (Table 2, Fig. 2 and Plate1) was recorded at 95 per cent relative humidity (212.5 mg) and found significantly superior over all other relative humidity levels. Following this 85 per cent relative humidity (192.2 mg) was found to be the next best while significantly least mycelial growth was observed at 65 per cent relative humidity (131.5 mg) and 75 per cent (155.9 mg) relative humidity which were on par with each other. The relative humidity at 100 per cent put up 173.9 mg fungal growth indicating that too much saturation also does not support the fungal growth as well as that of dry or lesser humidity levels.

The results are in close agreement with Laxman, 2006 and Kulkarni, 2009 observed that optimum range of relative humidity for the *C. truncatum* was 85 to 95 per cent. However, maximum growth of fungus was recorded at 95 per cent

Effect of hydrogen ion concentration (pH) on the growth of *C. truncatum*

Of the different pH (Table 3, Fig. 3 and plate 3,) levels; significantly the highest mycelial growth (215.3 mg) was recorded at 6.5 pH and it was found to be significantly superior over all the other pH levels. Following next was pH 6.0 (187.0 mg) that was on par with pH 7.0 (180.3 mg) and pH 7.5 (160.2 mg) were found to be on par with pH 8.0 (158.3 mg) and 5.5 (147.3 mg). Significantly the least mycelial growth was obtained at pH 4.0 (96.2 mg). Thus it was evident that the pH range of 6.0 to 7.5 was most optimum for the fungal growth.

Similar such pH ranges on the growth and sporulation, appressorial formation in different crops have been reported by various researchers (Ekbote, 1994 and Angadi, 1999) in case of *C. capsici* and *C. gloeosporioides.*

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Annexure

Table 1: Effect of different temperatures on mycelial growth of *C. truncatum*

Sl. No.	Temperature (ºC)	Dry mycelial weight (mg)
1	10	122.2
2	15	129.1
3	20	150.1
4	25	210.8
5	30	220.2
6	35	165.2
7	40	130.1
	S.Em. ±	5.91
	CD at 1 %	25.55

Table 2: Effect of relative humidity levels on mycelial growth of *C. truncatum*

Sl. No.	Relative Humidity (%)	Dry mycelial weight (mg)
1	65	131.5
2	75	155.9
3	85	192.2
4	95	212.5
5	100	173.9
	S.Em. ±	3.77
	CD at 1 %	16.28

Table 3: Effect of hydrogen ion concentration (pH) on dry mycelial weight of *C. truncatum*

Sl. No.	pH level	Dry mycelial weight (mg)
1	4.0	96.2
2	4.5	123.3
3	5.0	127.3
4	5.5	147.3
5	6.0	187.0
6	6.5	215.3
7	7.0	180.3
8	7.5	160.2
9	8.0	158.3
	S.Em. ±	5.3
	CD at 1 %	22.1

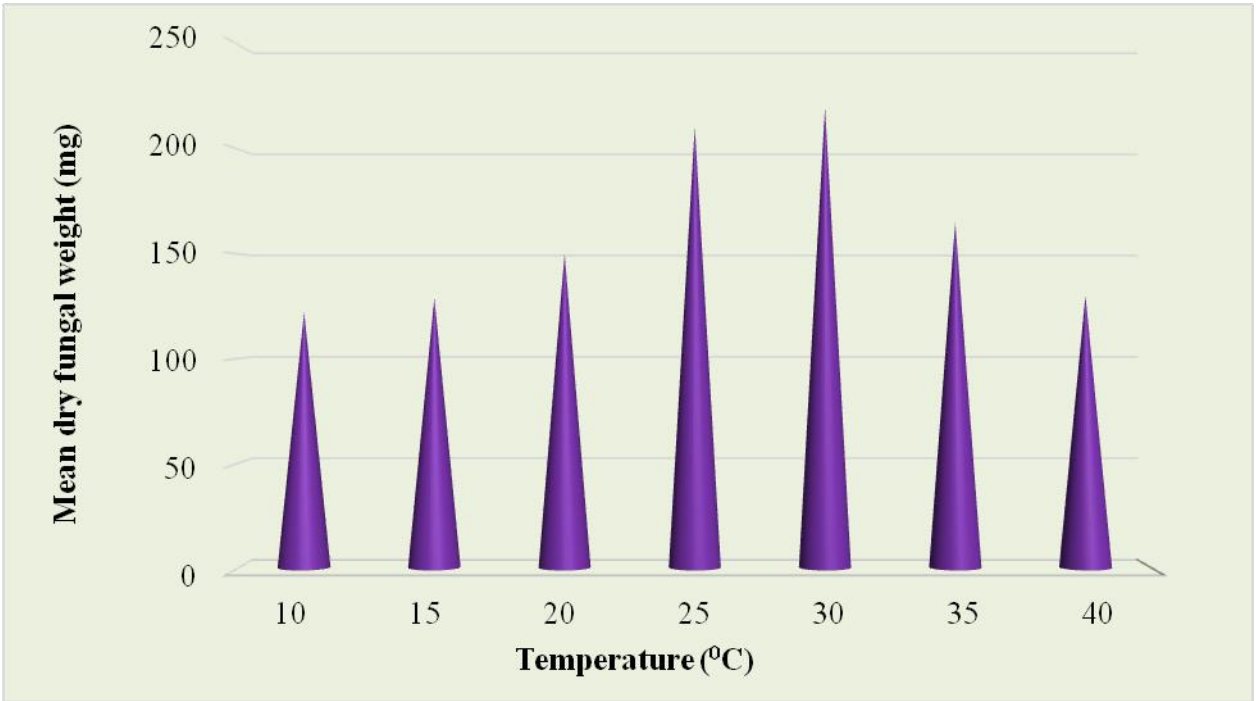

Fig. 1: Effect of different temperatures on mycelial growth of *C. truncatum*

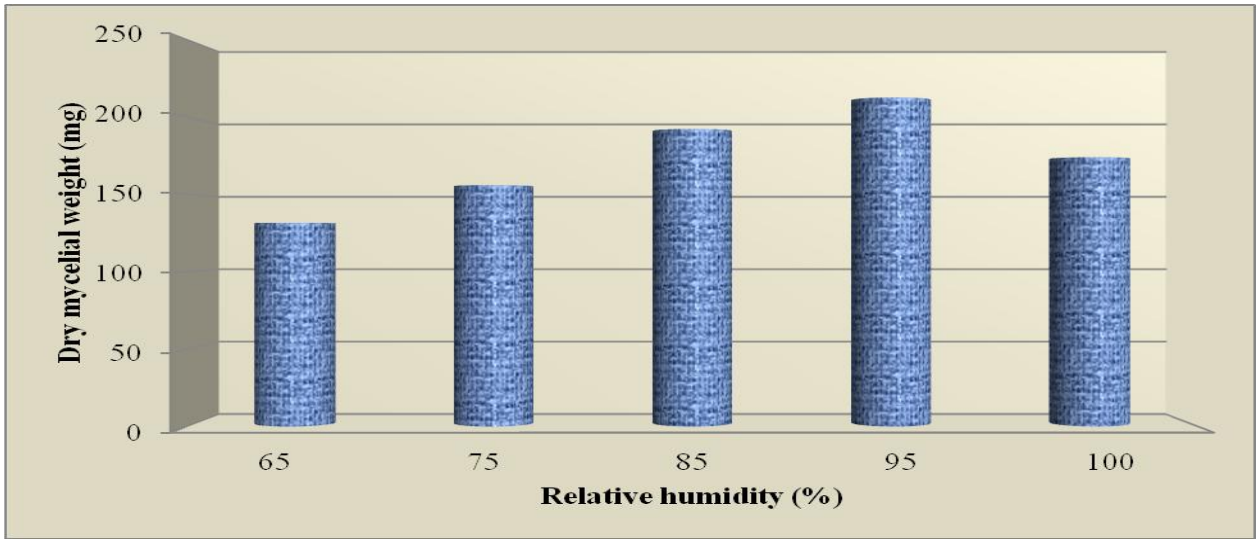

Fig. 2: Effect of relative humidity levels on mycelial growth of *C. truncatum*

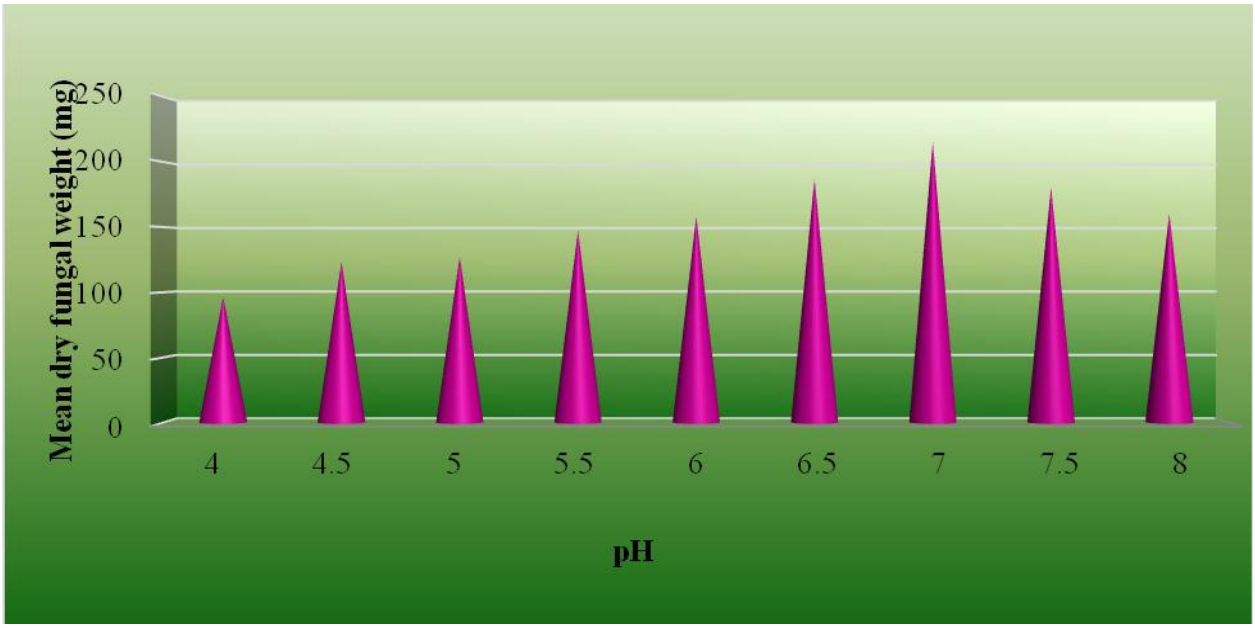

Fig. 3: Effect of hydrogen ion concentration (pH) on dry mycelial weight of *C. truncatum*

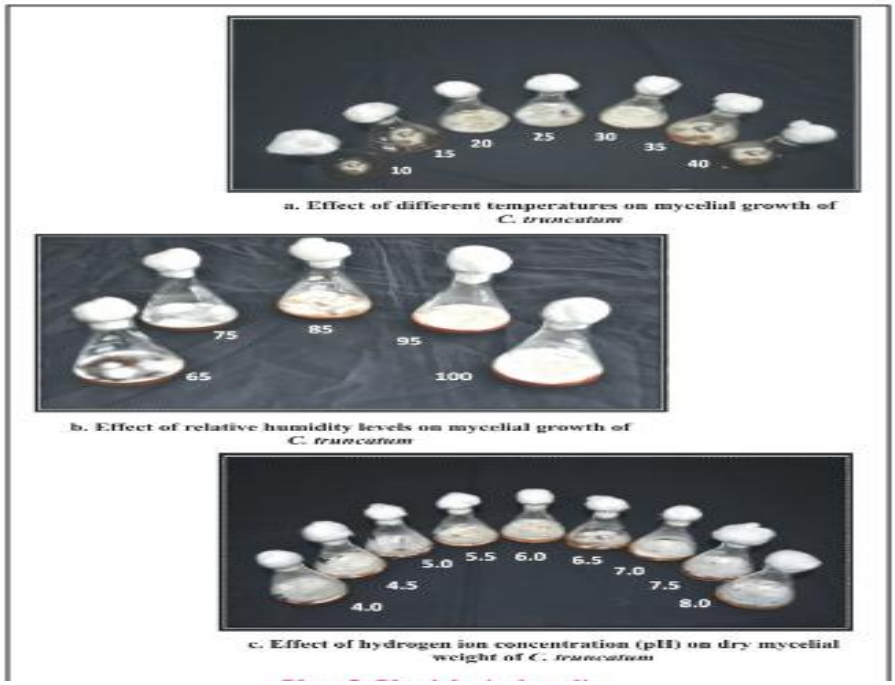

Plate 1: physiological studies