Efficacy of different levels of NPK against Anthracnose of King chilli (*Capsicum chinense*) caused by *Colletotrichum gloeosporioides* (Penz.) and impact on their growth parameters and yield in Manipur.

ABSTRACT

A significant disease in Capsicum that reduces crop output is anthracnose. In the current study, the effectiveness of various NPK dosages (N_1-120 Kg, N_2 -150 Kg, N_3-90 Kg, P_1-60 Kg, P_2-75 Kg, P_3-45 Kg, K_1-60 Kg, K_2-75 Kg, K_3-45 Kg) against *Colletotrichum gloeosporioides* which caused Anthracnose diseases in King chilli and their effects on growth parameters and yield were assessed. The experiment described in Randomized Block Design (RBD) was conducted at KVK Thoubal, Manipur, from October 2021 to April 2022. Results showed that amongst the fertilizers, application of increased doses of P and K exhibited significant management of anthracnose of King chilli with 25.00% and 19.66% disease severity and 'Control' (60.00%) revealed high disease severity and reduced yield. The increased level of P and K also produced maximum yield with 11.17 Kg/plot and 9.30 Kg/plot in fresh weight respectively. Thus application with increased level of P and K has paramount importance in combating anthracnose ~~disease severity of~~ in King chilli which significantly increase in the growth parameters and yield.

Keywords: King chilli, Anthracnose, *Colletotrichum gloeosporioides* , NPK .

Introduction

Chilli (*Capsicum annum* Lin.) belonging to the family S~~s~~olanaceae is a high value cash crop. They are widely used throughout the world as a vegetable, spice, food colourant and also for medicinal purposes. They are used in many pharmaceutical preparations, cosmetics, carminatives, tonic and as stimulants (Pruthi, 1979). The introduction of chilli peppers in Asia is believed to be around 450-500 years old (Berke and Shieh, 2002).

The King chilli (*Capsicum chinense* Jaqc.) is known globally for its spice quality and aroma which is indigenous to the North Eastern states of India. It is also a good source of income for the local farmers. Different local names are given to this chilli such as *Naga chilli* (Nagaland), *Bhut Jolokia* (Assam), and *U-Morok* (Manipur) (Sanatombi *et al*., 2010, Verma *et al*., 2013). It is mainly cultivated in the state of Nagaland, Assam, Manipur and to some level in Mizoram, Arunachal Pradesh and Meghalaya. It is also grown in the North Eastern part of Bangladesh (Bhuyan *et al*., 2015).

The *Naga Raja Mircha* or *Naga Joloakia* is considered as the hottest chilli variety in the world, measuring 855,000 SHU (Mathur *et al.,* 2000). The hotness or hot flavor of chillies are due to the presence of a group of seven closely related compounds called capsaicinoids, but capsaicin and dihydro capsaicin are responsible for their pungency. This is measured in Scoville Heat Units (SHU) or determined by high Performance Liquid Chromatography HPLC.

Anthracnose has been derived from the Greek word which means 'coal'. This is a name for diseases in plants that is determined by dark or dull colour, lesions that are sunken and also containing spores of the pathogen (Issac, 1992). Normally, the symptoms of anthracnose on fruits of chilli show sunken necrosis with concentric rings of acervuli. Blemished fruits have reduced market value (Manandhar *et al.,* 1995).

Anthracnose or fruit rot is a highly destructive pathogen that attacks chilli and causing major crop losses (Saxena *et al.,* 2016). *Colletotrichum* spp. ~~the cause of~~causing anthracnose includes *C. acutatum, C. gloeosporioides* and *C. coccodes* (Park and Kim, 1992). Among all these, the most destructive and widely distributed are *C. gloeosporiodes and C. acutatum* (Babu *et al*., 2011; Voorrips *et al*., 2004).

The King chilli which is grown in Manipur endures huge losses due *to C. gloeosporioides* causing fruit rot disease (Malangmeih *et al.,* 2016). This chilli, like any other Capsicum, suffers from the attack of various pest and diseases, of which anthracnose of fruit rot is considered as the most damaging one. The pathogen *C. gloeospoiriodes* attack leaf, twig and fruit of chilli resulting in die back.

Under the climatic conditions of Manipur with heavy rainfall and humidity, anthracnose or fruit rot disease on King chilli caused by the fungus *Colletotrichum gloeosporioides* has been found to be a limiting factor in optimum crop production (Malangmeih *et al*., 2016). Although management of the pathogen focus on cultural practices, bio-agents, fungicides and genetic resistance, very little is currently known about the influence of plant nutrition and sowing dates on anthracnose of chilli. Hence, the present study was undertaken on management of anthracnose in~~of~~ King chilli by applying different level of NPK and different dates of sowing.

Materials and Methods

The present investigations was carried out at the experimental field of KVK Thoubal, Manipur during 2021-22 entitled "Effect of different levels of NPK and sowing dates against anthracnose of King chilli (*Capsicum Chinese*) caused by *Colletotrichum gloeosporioides* in Manipur.''

~~**Source of seed**~~

~~A susceptible local variety of King chilli (Raja Mircha) was obtained from S. B. Nursery farm, Nepra-company, Thoubal.~~

Comment [KF1]: Same information was written at filed trial (sowing in nursery) part

Isolation and Identification of the pathogen

The pathogen *Colletotrichum gloeosporioides* was isolated from naturally infected King chilli plants showing typical symptoms of the diseases. The infected parts of the samples showing typical symptoms were cut into small pieces. The cut pieces were surface sterilized in 1.0% of s~~S~~odium hypochlorit~~d~~e solution for 30 second and then rinsed three times with sterile distilled water to remove traces of s~~S~~odium hypochlorite, if any which were then dried in sterilized tissue paper and inoculated artificially in potato dextrose agar (PDA) medium in Petriplate. The mycelium growing out of the plant tissue were sub-cultured on PDA medium and incubated at 25±1˚C for 7 to 10 days.

The purified fungal pathogen was observed under the microscope and identification was done based on their morphological characteristics after consultation of relevant literature available.

Comment [KF2]: Koch postulates should be done especially for identifications other than molecular identification.

Maintenance and preservation of culture

The stock cultures were maintained on PDA slants in refrigerator at 5˚C and the pathogen was sub-cultured at regular intervals for maintaining the live culture for further studies.

Field trial

Sowing in nursery

A susceptible local variety of King chilli seeds used in this investigation was obtained from the local farmers of S. B Nursery farm Nepra-company, Thoubal. The Nursery bed was prepared by clearing all the weeds and measuring 3m × 2m size. The soil of the bed was prepared by applying 2 k~~K~~g Vermicompost, 2 k~~K~~g Vermiculite and 1 k~~K~~g Coco peat before 2 days of sowing. Clean seeds were then selected and sown in the nursery plot on 19th October 2021. Seeds were sown in line keeping 5cm gap between each line at a depth of 3-5cm and covered thinly by soil. Irrigation was provided twice a day till transplanting stage of the plant.

Land preparation

Primary tillage for land preparation was done by tractor followed by secondary tillage 2-3 times with harrow to crush the clods and uproot and shred the remaining weeds and stubbles with the help of power tiller. This was done in order to attain the soil to become good tilt condition. The mixture of 3 Kg Vermicompost, 2 kKg Vermiculite, 1 kKg Coco peat, 1 kKg of rice husk, 1 kKg of Charcoal powder were added to each and every plot for enhancing the growth, germination and aeration of the plant after 1 week of deep tillage. Transplanting was done 15 days after the application according to the layout and design of the experiment.

Transplanting

Transplanting was done when the seedlings attained the height of 10-15cm (5-6 weeks after sowing)**.** Before pulling out the seedlings, light irrigation was given to loosen the soil, in order to avoid the root damage during uprooting of the seedlings.

Duration of experiment

The field experiment was conducted under agro-climatic condition of KVK Thoubal, during October, 2021 to May, 2022.

Experiment design

Evaluation of different levels of NPK:

Design of the experiment was RBD, Number of replication = 3, Number of King chilli cultivar = 1(local Raja Mircha), Treatment =10, Chemical nutrients applied were Urea (N 46%), DAP (18 % N and 46 % P_2O_5), MOP (KCl, 66.5% K), Total no. of plot = 30, Plot size = 2 x1.5 m^2, Row to row = 60cm, Plant to plant = 45cm, No. of row in a plot = 2, No. of plant in a row = 4, No. of plant in a plot = 8, Distance between two plot in a block = 0.5 m, Block to block = 1 m, Net area = 90 m^2. There were 10 Treatment including untreated control plotT_0 – $N_0P_0K_0$, T_1 – $N_1P_1K_1$ (RD 120 : 60 : 60 Kg/ha), T_2 – $N_2P_2K_2$ (above RD 150: 75: 75 Kg/ha),T_3 – $N_3P_3K_3$ (below RD 90: 45: 45: Kg/ha), T_4 – $N_2P_1K_1$ (only N is high and rest were given at RD 150: 60: 60 Kg/ha), T_5 – $N_1P_2K_1$ (only P is high and rest were remain unchanged with 120:75: 60 Kg/ha), T_6 – $N_1P_1K_2$ (only K is above the RD and rest were kept at RD with 120:60:75 Kg/ha), T_7 – $N_3P_1K_1$ (Only N is below RD and rest were kept at RD with 90:60:60 Kg /ha) T_8 – $N_1P_3K_1$ (Only P was given below RD and rest were kept at RD) T_9 – $N_1P_1K_3$ (Only K is below RD and rest were given at RD).

Assessment of disease incidence

The number of plants exhibiting symptoms at 60, 90, and 120 DAT was counted in order to determine the disease incidence. Each plot's plants were randomly chosen from among them, and the five most common ones were evaluated and assessed for disease incidence using the formula provided by (Chester, 1959 and Wheeler, 1969).

$$\text{PDI} = \frac{\text{(Sum of each plant disease rating)}}{\text{(Total no. of plant assess} \times \text{maximum disease rating plant)}} \times 100$$

Statistical analysis

ANOVA (analysis of variance) was used to statistically examine the experimental results (Panse and Sukhatme, 1978). By applying the Fisher Schedecor "F" tests of probability at the 5% level of significance, error mean square was used to examine the importance of various causes of variation.

Table1: (0 – 9 scale) for accessing PDI of anthracnose of King chilli given by (Mayee and Datar, 1986).

Rating scale	Description	Degree of Resistance
0	No symptoms on the leaf or branch or fruits	Immune
1	Small, irregular brown spots covering 1% or less area of the leaf or branch or fruits	Resistant
3	Brown, dirty, pin headed spots covering 1-10% area on the leaf or branch or fruits	Moderately
5	Dark brown, dirty black margin covering 1% of the area of the leaf, or branch or fruits	Moderately susceptible
7	Dark brown, circular or irregular spots with blackish covering 26-50% area of leaf or branch or fruits.	Susceptible
9	Dark brown, circular irregular spots with blackish covering 50 % and above area of leaf or branch or fruits.	Highly susceptible

Results and Discussion

Symptoms of the disease

Comment [KF3]: Best described with figures and photo after this details. Pictures need to have measurements

The characteristic symptom of the disease was observed as circular, sunken and elliptical or oblong spots with black margins on chilli fruits. Badly infected fruits lost their normal colour and turned straw colour. In advance stages of the disease, concentric markings with black fructifications representing the fungal acervuli were observed. The spotted fruits drop off prematurely resulting reduction in yield. In severe cases, it also attacked the fruit stalk and spread along the stem causing die-back symptom. The spots on the fruits measured 5-10 mm in diameter and 10-45 mm in length.

In the field studies, the disease symptoms were observed as small, black, circular lesions on the skin of the fruits which spread towards the long axis giving elliptical shape. As the infection advanced, the spots turn either diffused or black and spread along the stem causing die-back symptoms. Similar observations of the symptoms were also reported by many research workers like Butler and Bisby (1931), Chowdhury (1957) and Rangaswami (1994).

Chowdhury, 1957 described the symptoms incited by *Colletotrichum gloeosporioides* on ripe chilli fruit, which appeared as sunken circular or angular lesions. Often multiple lesions coalesce to form severe fruit rot. Generally, the lesions were characterized by the presence of black colored spots in concentric rings at maturity. The dark spots when observed under microscope were the acervuli structure containing setae hairs entrapping the conidia of the pathogen. Further, the pathogen forms micro sclerotia in plant debris or seed, soil, which is the mode of survival under unfavourable conditions.

Isolation and identification of pathogen

The pathogen causing the anthracnose, fruit rot and die-back of King chilli was isolated and identified following the procedure described in materials and methods. The fungal colony appeared as circular and dense, white at first and grey at the later stage conidial masses appeared pink as salmon in colour. Conidia were found to be cylindrical, oblong, acicular, single celled and hyaline measuring 18.23-25.78 × 6.45-9.89 µm. Conidiophores were hyaline faintly brown, cylindrical, septate or aseptate. Setae were dark, brown, rigid, septate and tapering towards the apex, straight and curved measuring 51.56-128.90 x 4.29-6.45µm.

Based on the above characteristic feature confirmed the identity of the fungus as *Colletotrichum gloeosporioides*. (syd.) Butler and Bisby. These observations and finding were similar to the plant pathologist like Butler and Bisby (1931) and Rangaswami (1994).

Field trial

Effect of different levels of NPK on severity of anthracnose of King chilli

Data on the disease incidence as influenced by the treatment of NPK were depicted in Table 2. Observations were recorded on 60 DAT, 90 DAT and 120 DAT. The results of this study revealed that there was minimum disease incidence on $T_6 – N_1P_1K_2$ and disease incidence has been observed at 30 days interval with 15.16% (60 DAT), 16.16% (90 DAT) and 19.66 (120 DAT) % which was followed by $T_5 – N_1P_2K_1$ with 19.64 %, 21.33 % and 25.00 % at 60, 90 and 120 DAT respectively. The maximum disease incidence was observed in untreated control plot (T_0) with 51.27 % (60 DAT), 55.18 % (90 DAT) and 60.00 % (120 DAT) which was followed by T_4-$N_2P_1K_1$ with 45.00%, 52.66 % and 58.00 % at 60, 90 and 120 DAT respectively. ~~So~~So, application of NPK with increased level of P and K has paramount significance in combating anthracnose ~~diseases severity of~~in King chilli.

Nitrogen is an important fertilizer and is essential for cellular components (Huber and Thompson, 2007). However, increased dose of Nitrogen (N_2) increased anthracnose disease (Huber, 1980). Also increased dose of Nitrogen is known to promote succulent growth and also make the cell walls thinner (Atiq *et al,* 2017).

Other studies have shown correlations between Nitrogen concentration and severity of anthracnose, in case of chilli. Choi *et al*. (2000) showed that, as tissue Nitrogen content decreased, Ca and Mn contents, which have a direct role in phenolic metabolism, increased in the chilli.

All the treatments of 'Phosphorous' reduced anthracnose incidence as compared to control but maximum reduction in disease incidence was in case of P_2 because it increased disease resistance by stimulating the defense system of the plant as it plays a vital role in different types of physiological and biochemical process (Khan *et al*., 2007; PPI,1998; Synder and Mascagni, 1998).

Potassium may increase synthesis of host defense products and thereby reduce disease incidence or severity while phosphorous has been shown to inhibit anthracnose (caused by *C. gloeosporioides* or *C. acutatum*) in chilli (Biggs, 1999) and decrease postharvest disease development on chilli.

The results obtained in the present investigation was also found in agreement with the findings of Gaddam and Sobita (2019) who reported that minimum disease intensity was recorded in T_1 (NPK at above the recommended doses - 26.13%) followed by T_5 (P and K above the recommended doses- 26.40%). Maximum disease incidence was recorded in T_4 (NPK at very low recommended doses 37.77%) as compared to control. Chowdhury and Rahim (2007) also reported that combined application of NPK, Gypsum and Zinc sulphate (250 g + 250 g + 350 g + 100 g + 10 g) reduced the anthracnose severity in chilli (23.33%) and the highest (64%) incidence was found in T_{12} (control).

Comment [KF4]: In severity or incidence??

The reduction of disease incidence in the present investigation with increased doses of P and K may be attributed to the increase disease resistance by stimulating the defense system of the plants. It is also known that appliances of P and K reduced plant diseases directly by different ways *viz*., by affecting pathogen metabolism, survival and development; by creating hindrance in food supply to pathogen by affecting internal metabolism of the plants and by disturbing the mode of survival and spread of the pathogen by changing the cell wall ultra-structure and functions of stomata (Perrenoud, 1990; Atiq *et al*., 2017).

Table 2: Effect of different levels of NPK against severity of anthracnose on King chilli.

Comment [KF5]: Best presented in line graph. There is no mean separation or standard deviation indicates at each data for comparison purposes and to see the significant result.

Treatment	Anthracnose disease severity %		
	60 (DAT)	90 (DAT)	120 (DAT)
$T_0 – N_0P_0K_0$	51.28 (45.73)	55.19 (47.96)	60.00 (50.77)
$T_1 – N_1P_1K_1$	35.33 (36.47)	48.14 (43.93)	55.00 (47.87)
$T_2 – N_2P_2K_2$	31.00 (33.83)	36.00 (36.65)	38.67 (38.26)
$T_3 – N_3P_3K_3$	26.74 (31.14)	30.33 (33.42)	35.33 (36.77)
$T_4 – N_2P_1K_1$	45.00 (42.13)	52.67 (46.53)	58.00 (49.51)
$T_5 – N_1P_2K_1$	19.65 (26.31)	21.33 (27.54)	25.00 (30.00)
$T_6 – N_1P_1K_2$	15.17 (22.91)	16.17 (23.71)	19.67 (26.32)
$T_7 – N_3P_1K_1$	22.67 (28.43)	26.00 (30.67)	28.00 (32.00)
$T_8 – N_1P_3K_1$	38.67 (38.44)	41.00 (39.81)	44.50 (41.83)
$T_9 – N_1P_1K_3$	41.81 (40.28)	43.00 (45.50)	46.33 (46.00)
SEm±	0.52	0.32	0.19
CD (P=0.05)	1.56	0.95	0.57

Note: Figures in the table are mean values and those in parentheses are arc sine transformed values.

Effect of different levels of NPK in different growth parameters of King chilli

Plant height

Data on plant height as influenced by the treatment was presented in Table 3. The observations were recorded at 30, 60, and 90 DAT. The maximum plant height was observed in T_2 –

$N_2P_2K_2$ with 35.00 cm, 45.16 cm, and 85.83 cm respectively. This was followed by $T_6 – N_1P_1K_2$ with 16.66 cm, 26.83 cm, and 80.00 cm respectively. The minimum height was recorded at T_0 (untreated plot) with 10.17 cm, -20.50 cm, and 55.33 cm on 30, 60, and 90 DAT respectively.

From the above difference in plant height, it was discovered that treatment $T_2 – N_2P_2K_2$ had the tallest plant height (85.83 cm), followed by treatment $T_6 – N_1P_1K_2$ with (80.00 cm), and treatment $T_9 – N_1P_1K_3$ had the shortest plant height among the treatments with 59.90 cm. This might be as a result of increased NPK availability and uptake, which gradually increased plant height.

The present finding was found in agreement with the earlier report made by Gaddam and Sobita (2019) who reported that the maximum plant height in T_1 (NPK at 150; 50; 50 Kg/ha – 54.66 cm) followed by T_2 (NPK at 250; 100; 100 Kg/ha – 51.10cm). While the untreated control found the shortest plant height (35.54cm). According to Adeola *et al*., 2011, the effect of different levels of NPK was considerably influenced by the plant height of the chilli, which dramatically ranged from 51.00 to 73 cm.

Dubey (2017) measured the maximum plant height at 30, 60, 90, 120, and 150 days after planting in T_7: NPK@ 175:55:45 Kg/ha with (35.76 cm, 50.10 cm, 66.73 cm, 89.10 cm, and 116.70 cm respectively), followed by T_9: NPK @ 175:70:55 Kg/ha with (31.03 cm, 45.37 cm, 61.97 cm, 84.37 cm, and the minimum was recorded in T_1 (control) NPK@ 135:40:35 Kg/ha with (18.46cm, 32.87cm, 49.47cm, 71.77cm and 99.30cm respectively. He observed that plant height rose progressively as NPK levels rose.

Number of fruit per plant:

Data pertaining to number of fruits as influenced by the treatment was presented in Table 4. The observations were recorded at 90 DAT.

The Maximum Number of fruits was recorded in $T_5 – N_1P_2K_1$ with 85 fruits per plant which was followed by $T_6 – N_1P_1K_2$ with 80 fruits per plant and $T_0 – N_0P_0K_0$ plot was observed to give the minimum no. of fruits per plant. Hassan and Kamal Uddin (2019) who revealed that number of hybrid fruits per plant was significant due to the combined fertilizer application of NPK. The number of fruits plant^{-1} was statistically maximum with the application of NPK 100% with 56.64 fruits plant^{-1} as compared to control with 24.26 fruits plant^{-1} (without NPK). The results presented here support those of Johnson and Decoteau (1996), who discovered that fruit count and weight per plant increased linearly with increasing N rate as well as increased disease resistance in chilli crops.

Yield

Data pertaining to fruit yield per plant (fresh weight in gm), per plot (weight in kg) and per hectare (weight in ton) as influenced by the treatment was presented in Table 4. The observations were recorded at 90 DAT.

The maximum yield of fruits per plant, per plot and per hectare was recorded in T_5 – $N_1P_2K_1$ with 853.33 g plant^{-1}, 11.17 Kg plot^{-1} and 37.00 ton hectare^{-1} followed by T_6 – $N_1P_1K_2$ with 800.00 g plant^{-1}, 9.30 Kg^{-1} plot and 31.00 ton hectare^{-1}. Conversely, the minimum yield was obtained at T_0 – $N_0P_0K_0$ with 205.00 gm plant^{-1}, 1.65 Kg plot $^{-1}$ and 5.167 ton hectare^{-1}. The aforementioned conclusion is consistent with that of Ayodele *et al.* (2015). Similar findings were also reported by Hassan and Kamal Uddin~~Hasan~~ (2019), who found that the effect of NPK fertilizer on chilli hybrid plants caused a substantial variation in seed output, ranging from 14.33 to 40.27 Kg ha^{-1}.

The combination of N and P fertilizers and different level of N fertilizers of the plant had found no significant difference. Significant increased of plant fresh weight was registered at P_{60} Kg/ha (72.20g). However, control (P_0 Kg/ha) treatment had relatively lowest plant fresh weight accumulation than other treatments (Johnson and Decoteau ~~*et al.*~~, 1996).

Table 3: Effect of different levels of NPK on plant height of King chilli

Comment [KF6]: Best presented in a line graph. There is no mean separation or standard deviation indicates at each data for comparison purposes and to see the significant result.

Treatment	Plant Height in cm		
	30 DAT	60DAT	90DAT
$T_0 – N_0P_0K_0$	10.17	20.50	55.33
$T_1 – N_1P_1K_1$	20.17	30.00	73.00
$T_2 – N_2P_2K_2$	35.00	45.17	85.83
$T_3 – N_3P_3K_3$	15.17	17.17	66.80
$T_4 – N_2P_1K_1$	25.33	33.17	69.00
$T_5 – N_1P_2K_1$	29.50	40.33	75.47
$T_6 – N_1P_1K_2$	16.67	26.83	80.00
$T_6 – N_1P_1K_2$	12.83	23.00	70.67
$T_8 – N_1P_3K_1$	22.83	43.17	63.23
$T_9 – N_1P_1K_3$	32.17	39.17	59.90
SEm±	0.16	0.08	0.21
CD (P=0.05)	0.68	0.50	0.79

Table 4: Effect of different level s of NPK on no. of fruit and yield of King chilli.

Treatment	No.of fruit /Plant	Yield -Of fresh weight (g) /Plant	Yield per plot (Kg)	Yield (ton)/ hectare
T_0-$N_0P_0K_0$	20.00	205.00	1.65	5.16
T_1-$N_1P_1K_1$	52.00	524.33	5.03	16.41
T_2-$N_2P_2K_2$	75.00	755.00	7.07	23.18
T_3-$N_3P_3K_3$	46.33	458.33	3.72	12.16
T_4-$N_2P_1K_1$	70.00	712.00	4.04	13.00
T_5-$N_1P_2K_1$	85.00	853.33	11.17	37.00
T_6-$N_1P_1K_2$	80.00	800.00	9.30	31.00
T_7-$N_3P_1K_1$	40.16	410.00	6.16	20.16
T_8-$N_1P_3K_1$	36.00	365.00	2.30	7.56
T_9-$N_1P_1K_3$	30.00	301.66	2.43	8.40
SEm±	0.04	31.85	0.47	0.05
CD (P=0.05)	0.35	9.68	0.07	0.38

Comment [KF7]: Effects on height and yield should be presented in a regression analysis to see the relationship between yield, height and anthracnose incidence or at least a statistical factorial analysis. There is no mean separation or standard deviation indicates at each data for comparison purposes and to see the significant result.

Plate 1: Growth of *Colletotrichum gloeosporioides* in PDA

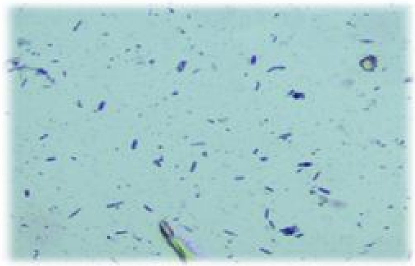

Plate 2: Conidia of *Colletotrichum gloeosporioides* under 40X Compound Microscope
(Cylindrical, hyaline, septate structure)

Comment [KF8]: Need clearer picture .it seems like theres more debris than spores. Cannot see the cylindrical uniformity.

(a)

(b)

(c)

(d)

(e)

(f)

(g) **(h)** **(i)**

(j)

Plate 3: Fig. (a), (b). (c). (d). (e), (f), (g), (h), (I) and (j) are the symptoms -of anthracnose caused by *Colletotrichum gloeosporioides* on leaf, branches, twigs and fruit of King chilli plant

CONCLUSIONS

With the above given findings on the present investigation, it can be concluded that application of 'P' and 'K' at higher or recommended doses were effective in inhibiting anthracnose disease incidence on King chilli. Application of NPK at above the normal recommended doses gave better plant height of King chilli. Furthermore, application of P & K above the normal recommended dosage produced maximum number of fruits per plant and gave better yields that were significantly higher than rest of the treatments. Application of increased level of P and K has therefore paramount importance in combating anthracnose disease severity of King chilli.

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