INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 8 | ISSUE 1 | APRIL, 2015 | 126-129
● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*
IJPP

RESEARCH PAPER
DOI : 10.15740/HAS/IJPP/8.1/126-129

Nutrional studies of *Colletotrichum gloeosporioides* (Penz.) penz. and sacc. causing anthracnose of mango

■ K.N. KOSHALE[1]* AND M.K. MISHRA[2]

[1]Department of Plant Pathology, College of Agriculture, Indira Gandhi Agricultural University, RAIPUR (C.G.) INDIA
[2]Department of Plant Pathology, College of Agriculture, Orissa University of Agriculture and Technology, BHUBANESHWAR (ODISHA) INDIA (Email: mkmpathology@yahoo.co)

ARITCLE INFO

Received : 02.01.2015
Revised : 17.02.2015
Accepted : 05.03.2015

KEY WORDS :
Colletotrichum gloeosporioides, Anthracnose, Nutrition, Mango

***Corresponding author:**
Email: koshalekamalnarayan@gmail.com

ABSTRACT

Anthracnose caused by *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. is one of the most important disease of mango. Effects of different nutritional sources were tested for the growth of pathogen under *in vitro* condition. The result showed that out of ten different carbon sources used, starch recorded highest growth of fungus followed by glycine and maltose. Among the different nitrogen sources tested, glycine found to be the best source of nitrogen followed by sodium nitrate and L-asparagine while zinc sulphate was recorded to be richest source of sulphur followed by magnesium sulphate and ammonium sulphate.

How to view point the article : Koshale, K.N. and Mishra, M.K. (2015). Nutrional studies of *Colletotrichum gloeosporioides* (Penz.) penz. and sacc. causing anthracnose of mango. *Internat. J. Plant Protec.*, **8**(1) : 126-129.

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most popular and major fruit crop of the country (Krishna and Singh, 2007; Moalemiyan *et al.*, 2007 and Prabakar *et al.*, 2008). This tree is indigenous to India and Southern Asia and originated from the Indian/Burmese border region where it has been cultivated for many centuries (Kwee and Chang, 1985). It is the most popular and commonly eaten fruit among millions of people in tropical areas and especially the developed countries (Abd-Alla *et al.*, 2010 and Awa *et al.*, 2012). The global growing demands for the fruit have increased and providing export opportunities for tropical and sub tropical countries and specially developing countries (Silimela, 2003 and Kamle *et al.*, 2013). Anthracnose of mango caused by *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. is considered as one of the most important disease of mango in the global level and is one of the major constraints to mango production (Ploetz and Prakash, 1997, Chowdhury *et al.*, 2008 and Sangeetha and Rawal, 2008). It deteriorates the quality and nutritive value of the fruits and renders them unfit for marketing and consumption, thereby causing severe loss to the growers and traders (Senghor *et al.*, 2007; Pandey *et al.*, 2012 and Adhikary *et al.*, 2013). All the fungi need specific nutritional requirement. Carbon, nitrogen and sulphur are the most important and essential elements, for their infection, growth and development. So an attempt was made to know the best source of carbon, nitrogen and sulphur for better growth and development of *C. gloeosporioides*.

MATERIAL AND METHODS

Infected samples showing prominent symptoms were collected in the month of September, 2013 from nursery of Central Research Farm, Orissa University of Agriculture and Technology, Bhubaneshwar. A small section of infected leaf

or twig was surface sterilized with 0.1 per cent $HgCl_2$ and washed thoroughly with sterile distilled water. It was then inoculated on Potato Dextrose Agar (PDA) medium and incubated at 27±1°C for seven days. The culture was purified with 'single spore' and 'hyphal tip' methods and maintained on Potato Dextrose Agar (PDA) slants under controlled temperature and pathogenicity of the fungus was also confirmed. The causal pathogen was identified as *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. As per available literature Richard's liquid medium was selected as basal medium for all the nutritional study.

Carbon utilization :

Ten different carbon sources *viz.*, L-asparagine, Dextrose, Glucose, Glycine, Maltose, Mannitol, Starch, Sucrose, Xyllose and D-Sorbitol were used. For this study all the components in the basal medium (Richard's liquid medium) were same except carbon source. 21.053 g of carbon per lt. of the medium was incorporated into basal medium through above mentioned carbon sources individually. Treatment without any carbon was also used as control.

Nitrogen utilization :

Ammonium carbonate, L-asparagine, Sodium nitrate, Potassium nitrate, Ammonium oxalate, Glycine, Ammonium sulphate, Ammonium persulphate and Urea were used as different nitrogen source. For this study all the components in the basal medium (Richard's liquid medium) were same except nitrogen source. 1.3855 g of nitrogen per lt. of the medium was incorporated into basal medium through above mentioned nitrogen sources individually. Treatment without nitrogen was also used as control.

Sulphur utilization :

Magnesium sulphate, copper sulphate, ammonium sulphate, zinc sulphate, ferrous sulphate and ammonium persulphate were used as different sulphur source. For this study all the components in the basal medium (Richard's liquid medium) were same except sulphur source. 0.3253 g of sulphur per lt. of the medium was incorporated into basal medium through above mentioned sulphur sources individually. One without sulphur (control) was also used.

Thirty millilitre of each medium was poured into 100 ml flasks, plugged with non-absorbent cotton and autoclaved at 121.6ºC (1.1 kg./cm^2 or 15 psi) pressure for 20 minutes and the flasks were inoculated with five mm discs from an actively growing zone of ten days old culture under aseptic condition and were incubated at 27 ± 1ºC for ten days. Each treatment was replicated three times. After ten days of incubation dry mycelial mat was harvested, dried and weighed. The data were analysed statistically and the best carbon, nitrogen and sulphur source was found out and used for further studies.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads :

Growth pattern in different sources of carbon :

Carbon from various sources was utilized to find out the growth habit of *Colletotrichum gloeosporioides* in the laboratory condition and data was presented in the Table 1. It was revealed from the table that there was significant difference in the mean dry mycelial weight among all the sources of carbon compared with no carbon source. Out of ten sources of carbon, starch recorded highest growth of fungus (603.33 mg) followed by Glycine (470.0 mg) and Maltose (413.33 mg). All the sources of carbon differ significantly among themselves in supporting the growth of *C. gloeosporioides*. The pathogen could not grow properly in the absence of any carbon source with least dry mycelial weight (55 mg). However Dextrose and D-Sorbitol supported similar growth habit (Table 1 and Fig. 1). This was supported by Deshmukh *et al.* (2012) who had got maximum mycelial growth in Starch (88.00 mm) followed by Xylose (86.33 mm) and Glucose (81.00 mm). Dextrose and D-Sorbitol supported similar growth habit of the pathogen. Workers like Chaturvedi (1965), Prusty (1979), Naik (1985), Ekbote (1994) and Sangeetha and Rawal (2008) conducted similar study and found Sucrose, Fructose and Mannitol as the best source of carbon for the pathogen followed by Mannose and Glucose.

Table 1 : Effect of different carbon sources on mycelial growth of *C. gloeosporioides*

Treatments	Carbon sources	Mean dry mycelial weight (mg)
T_1	L-asparagine	260.00
T_2	Dextrose	340.00
T_3	Glucose	263.33
T_4	Glycine	470.00
T_5	Maltose	413.33
T_6	Mannitol	403.33
T_7	Starch	603.33
T_8	Sucrose	390.00
T_9	Xyllose	160.00
T_{10}	D- Sorbitol	353.33
T_{11}	Without C (control)	55.00
	Mean	337.42
	S.E. ±	4.870
	C.D. (P = 0.05)	14.284

Growth pattern in different sources of nitrogen :

A total of nine nitrogen sources were tested for estimating the growth pattern of the pathogen *Colletotrichum gloeosporioides*. The data revealed significant difference

Fig. 1 : Growth of *Colletotrichum gloeosporioides* on different carbon sources

among all the tested nitrogen sources producing fungal mycelial growth of the fungus. Glycine recorded the highest growth of the fungus with 373.33 mg dry mycelial weight followed by sodium nitrate (353.33 mg) and L- Asparagine (350.0 mg). The fungus could produce only 53.33 mg in the absence of nitrogen. Ammonium persulphate was recorded to the least source of nitrogen with only 65.0 mg dry mycelial production. Sodium nitrate and L- Asparagine recorded similar growth habit of pathogen (Table 2 and Fig. 2). Studies conducted by Ekbote (1994), Tasiwal (2008) and Deshmukh *et al.* (2012) showed that potassium nitrate as the best source of nitrogen for the pathogen. In the current study similar growth habit was also observed in sodium nitrate, potassium nitrate and L- Asparagine. Ammonium persulphate was found to be the least source of nitrogen similar to control (without nitrogen) with only 65.00 mg and 55.33 mg dry mycelial weight, respectively.

Table 2 : Effect of different nitrogen sources on mycelial growth of *C. gloeosporioides*

Treatments	Nitrogen sources	Mean dry mycelial weight (mg)
T_1	Ammonium carbonate	126.67
T_2	L-asparagine	350.00
T_3	Sodium nitrate	353.33
T_4	Potassium nitrate	330.00
T_5	Ammonium oxalate	140.00
T_6	Glycine	373.33
T_7	Ammonium sulphate	223.33
T_8	Urea	190.00
T_9	Ammonium persulphate	65.00
T_{10}	Without N (Control)	53.33
	Mean	220.50
	S.E. ±	5.889
	C.D. (P = 0.05)df	17.374

Fig. 2 : Growth of *Colletotrichum gloeosporioides* on different nitrogen sources

Growth pattern in different sources of sulphur :

Different sulphur sources were also used to know the growth habit of *Colletotrichum gloeosporioides*. The growth habit indicated significant difference among all the sources of sulphur in producing dry mycelial weight of the fungus. Zinc sulphate was found to be significantly richest source of Sulphur with 610.0 mg dry mycelial weight followed by Magnesium sulphate (476.67 mg) and Ammonium sulphate (403.33 mg). All the sources of Sulphur differ significantly among themselves in comparison to control. It was observed that copper sulphate, ferrous sulphate and ammonium persulphate when used as source of sulphur were retarding the growth of *C. gloeosporioides* with lower yield of dry mycelium than without any sulphur. Ammonium persulphate recorded lowest yield of dry mycelium (90.0 mg) much below than the growth in control treatment (350.0 mg) (Table 3 and Fig. 3). Ekbote (1994) and

Table 3 : Effect of different sulphur sources on mycelial growth of *C. gloeosporioides*

Treatments	Sulphur sources	Mean dry mycelial weight (mg)
T_1	Magnesium sulphate	476.67
T_2	Copper sulphate	140.00
T_3	Ammonium sulphate	403.33
T_4	Zinc sulphate	610.00
T_5	Ferrous sulphate	280.00
T_6	Ammonium persulphate	90.00
T_7	Without S (Control)	350.00
	Mean	335.71
	S.E. ±	4.627
	C.D. (P = 0.05)df	14.037

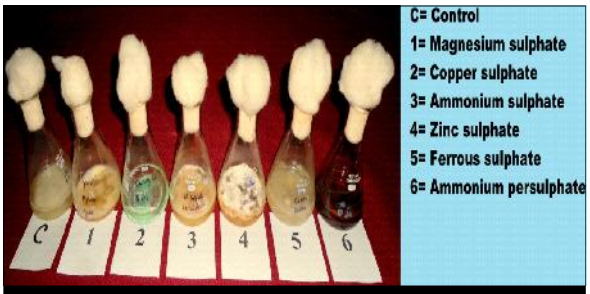

Fig. 3 : Growth of *Colletotrichum gloeosporioides* on different sulphur sources

Tasiwal (2008) recorded maximum growth of *Colletotrichum gloeosporioides* when Magnesium sulphate was used as a sulphur source followed by sodium sulphate and ammonium sulphate. Tasiwal (2008) reported 588.25 mg dry mycelial weight in magnesium sulphate which was significantly superior over five source of sulphur. In the current study copper sulphate, ferrous sulphate and ammonium persulphate retarded the growth of the fungus with ammonium persulphate having lowest yield of dry mycelium (90.00 mg) which was significantly lower than control (no sulphur source). This was supported the studies conducted by Ekbote (1994) and Tasiwal (2008).

Acknowledgement :

I express my modest and profound sense of gratitude to Professor and Head, Department of Plant Pathology, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar (Odisha).

REFERENCES

Abd-Alla, M.A. and Haggag, W.M. (2010). New safe methods for controlling anthracnose disease of mango (*Mangifera indica* L.) fruits caused by *Colletotrichum gloeosporioides* (Penz.). *J. American Sci*., **8**(8) : 361-367.

Adhikary, N.K., Dey, S. and Tarafdar, J. (2013). Studies on morphology of mango anthracnose disease causing fungus *Colletotrichum gleosporioides* (Penz.) Penz. and Sacc. and efficacy of azoxystrobin against the fungus under *in vitro* and *in vivo* condition. *The Bioscan*: *An Internat. Quart. J. Life Sci*., **8**(2) : 493-497.

Awa, O.C., Samuel, O., Oworu, O.O. and Sosanya, O. (2012). First report of fruit anthracnose in mango caused by *Colletotrichum gleosporioides* in south western Nigeria. *Internat. J. Scientific & Tech. Res*., **1**(4) : 30-33.

Chaturvedi, C. (1965). Nutritional studies on *Colletotrichum gloeosporioides* Penz. *Mycopathologia et Mycologia Applicata*., **27**(3-4) : 265-272.

Chowdhury, M.N.A., Rahim, M.A., Khalequzzaman, K.M., Alam, M.J. and Humauan, M.R. (2008). Effect of horticultural practices on incidence of anthracnose on yield and quality of mango. *Int. J. Sustain. Crop Prod*., **3**(2) : 1–9.

Deshmukh, A.J., Mehta, B.P., Sabalpara, A.N. and Patil, V.A. (2012). *In vitro* effect of various nitrogen, carbon sources and pH regimes on the growth and sporulation of *Colletotrichum gloeosporioides* Penz. and Sacc causing anthracnose of Indian bean. *J. Biopest*., **5**: 46-49.

Ekbote, S.D. (1994). Studies on anthracnose of mango (*Mangifera indic*a L.) caused by *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. M.Sc. (Ag.) Thesis, University of Agriculture Science, Dharwad (KARNATAKA) INDIA.

Kamle, M., Kumar, P., Gupta, V.K., Tiwari, A.K., Misra, A.K. and Pandey, B.K. (2013). Identification and phylogenetic correlation among *Colletotrichum gloeosporioides* pathogen of anthracnose for mango. *Biocatalysis & Agric. Biotechnol.*, **2** (3) : 285–287.

Krishna, H. and Singh, S.K. (2007). Biotechnological advances in mango (*Mangifera indica* L.) and their future implication in crop improvement - A review. *Biotechnology Adv.*, **25** (3) : 223–243.

Kwee, L.T. and Chang, K.K. (1985). *Diseases and disorders of mango in Malaysia*. 1-23pp.

Moalemiyan, M., Vikram, A. and Kushalappa, A.C. (2007). Detection and discrimination of two fungal diseases of mango (cv. KEITT) fruits based on volatile metabolite profiles using GC/MS. *Postharvest Biol. & Techno.*, **45** (1) : 117–125.

Naik, M.K. (1985). Studies an anthracnose of betelvine (*Piper betel* Linn.) caused by *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. M.Sc. (Ag.) Thesis, University of Agriculture Science, Bangalore (KARNATAKA) INDIA.

Pandey, A., Yadava, L.P., Manoharan, M., Chauhan, U.K. and Pandey, B.K. (2012a). Effectiveness of cultural parameters on the growth and sporulation of *Colletotrichum gloeosporioides* causing anthracnose disease of mango (*Mangifera indica* L.). *Online J. Biological Sci.*, **12**(4) : 123-133.

Pandey, A., Yadava, L.P., Mishra, R.K., Pandey, B.K., Muthukumar, M. and Chauhan, U.K. (2012b). Studies on the incident and pathogenesis of *Colletotrichum gloeosporioides* Penz. causes anthracnose of mango. *Internat. J. Sci. & Nature*, **3**(2) : 220-232.

Ploetz, R.C. and Prakash, O. (1997). Foliar, floral and soil borne diseases. In: Mango: botany, production and uses. CAB International, Wallingford, United Kingdom. 281-326pp.

Prabakar, K., Raguchander, T., Saravanakumar, D., Muthulakshmi, P., Parthiban, V.K. and Prakasam, V. (2008). Management of post harvest disease of mango anthracnose incited by *Colletotrichum gleosporioides*. *Arch. Phytopathol. & Plant Protec.*, **41**(5) : 333-339.

Prusty, N. (1979). Studies on the anthracnose and gray blight diseases of mango (*Mangifera indica* L.). M.Sc. (Ag.) Thesis, Orissa University of Agriculture and Technology, Bhubaneshwar (ORISSA) INDIA.

Sangeetha, C.G. and Rawal, R.D. (2008). Nutritional studies of *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. the incitant of mango anthracnose. *World J. Agric. Sci.*, **4**(6) : 717-720.

Senghor, A.L., Liang, W.J. and Ho, W.C. (2007). Integrated control of *Colletotrichum gloeosporioides* on mango fruit in Taiwan by the combination of *Bacillus subtilis* and fruit bagging. *Biocontrol Sci. & Techno.*, **17**(8) : 865-870.

Silimela, M. (2003). Evaluation of biocontrol and sunprotectors to control mango fruit diseases and disorders. M. Inst. Agrar (Plant Protection) Thesis, University of Pretoria, Pretoria, South Africa.

Tasiwal, V. (2008). Studies on anthracnose – a postharvest disease of papaya. M.Sc. (Ag.) Thesis, University of Agriculture Science, Dharwad (KARNATAKA) INDIA.