General Impact Factor (GIF): 0.875

e- ISSN: 2394-5532
p- ISSN: 2394-823X

International Journal of Applied And Pure Science and Agriculture

www.ijapsa.com

Pod rot of cowpea and its management using fungicides

Milsha George[1], V.K. Girija[2]

[1,2]*Department of Plant Pathology, College of Agriculture, Vellayani, Kerala*

Abstract

Wet rot disease of cowpea pods were found in the seed production plots of vegetable cowpea (Vigna unguiculata subsp. sesquipedalis (L.) Verdcourt), at College of Agriculture, Vellayani, Kerala during October – November 2014. The mature pods exhibited symptoms like water soaking, wet rotting and shrivelling of pods. The disease was more severe during the hot and high humid conditions. Under high humid conditions, the pods were covered with white cottony mycelial growth of the pathogen with heavy fructifications. The pathogen causing the pod rot of cowpea was isolated from the diseased pods and based on cultural and morphological characters, the pathogen was identified as the Choanephora cucurbitarum (Berk. & Ravenel) Thaxt. Pathogenicity was proven by artificial inoculation of the pathogen on fresh pods and symptoms such as water soaking and wet rotting developed within 24 h. Nine fungicides such as mancozeb, copper hydroxide, copper oxy chloride, azoxystrobin, carbendazim, carboxin, propiconazole, captan + hexaconzole and carbendazim + mancozeb at three concentrations i.e., lower than recommended dose, recommended dose and higher than recommended were tested to evaluate the efficacy to inhibit the growth of C.cucurbitarum under in vitro conditions. Results showed that two contact fungicides mancozeb and copper oxy chloride, two systemic fungicides propiconazole and carboxin at three concentrations gave 100% inhibition of the pathogen, whereas, the two combination fungicides at recommended and higher dose gave complete suppression of the pathogen.

Keywords- Cowpea, pod rot, Choanephora cucurbitarum, fungicides, chemical control.

I. INTRODUCTION

Vegetable cowpea, also known as yard long bean (*Vigna unguiculata* subsp. *sesquipedalis* (L.) Verdcourt) is an important legume crop of the tropics whose centre of origin has been reported from Africa and was introduced to the Indian sub continent approximately 2000 to 3500 years ago. It is an inexpensive source of vegetable protein, which is easily digestible, relatively cheaper and has higher biological values. Due to the favourable agro climatic conditions, the crop has gained much importance in Kerala and has come to occupy a prime position among the vegetable crops raised in the state. The production of cowpea is hindered by an array of fungal diseases such as Fusarium wilt [1], anthracnose [2] collar rot and web blight, Pythium stem rot [3] , Choanephora pod rot [4]and viral diseases *etc.* affecting the crop. Choanephora pod rot is an emerging issue in the major cowpea growing tracts of Kerala, India. The present study was aimed at isolation and identification of the pathogen causing pod rot and in testing the efficacy of various fungicides against the pathogen causing pod rot.

II. MATERIALS AND METHODS

A. Isolation and identification of the casual agent

The pods infected cowpea pods were collected from cowpea fields of College of Agriculture, Vellayani. The diseased pods were washed under running water and pods were cut into bits. The bits were then surface sterilized using 1% sodium hypochlorite 1 min followed by washing in three changes of sterilized water. The bits were then transferred into a sterile filter paper for the absorption of water and was cultured on potato dextrose agar (PDA) medium poured into sterile petri dishes

under aseptic condition. The petri plates were then sealed using parafilm, incubated at room temperature (27- 30°C) for 24- 48 h and observed for fungal growth. The fungal growth of the pathogen was observed on petri dishes were transferred into PDA slants [5] and the fungal isolate obtained were purified by single spore technique. The fungal isolate obtained were then identified based on the cultural and morphological characters described by Kirk (1985) [6].

B. Pathogenicity test

The pathogenicity studies were carried out on excised healthy cowpea pods or yard long bean (*Vigna unguiculata* subsp. *sesquipedalis* (L.) Verdcourt) of the variety Vellayani Jyothika. The pods were then washed under running water followed by surface sterilization using 70% ethanol. Artificial inoculation of the pathogen was carried out prior to which the pods were wounded using sterile needle followed by the deposition of the fungal mycelium at the site of injury. The site of inoculation was covered with wet cotton. After inoculation, the pods were kept in plastic covers in order to maintain humidity and incubated at room temperature for 24- 48 h. till the symptom starts appearing on the inoculated pods. The pods with injury and without the fungal mycelium served as the control.

C. *In vitro* evaluation of chemical fungicide against the pathogen

The *in vitro* suppression of the pathogen by fungicides was done by using poisoned food technique [7]. Nine commercially available fungicides such as mancozeb, copper hydroxide, copper oxy chloride, azoxystrobin, carbendazim, carboxin, propiconazole, captan + hexaconzole and carbendazim + mancozeb at three concentrations *i.e.*, lower than recommended dose, recommended dose and higher than recommended were tested. The desired concentration of the fungicide was weighed out. Three conical flask containing 50 ml of distilled water and another containing 50 ml of double strength PDA were taken and was sterilized by autoclaving at 1.1 kg/ cm^2 for 20 min. The concentration of the fungicide which was weighed out was added into the distilled water and was shaken thoroughly. This was then added into 50 ml of molten PDA to get desired concentration. The amended medium was then poured into sterile petri plates under aseptic conditions and was allowed to solidify. Each plate was inoculated with the 7 mm mycelial disc cut out from three days old of *C.cucurbitarum* in the centre under aseptic condition. The plates were sealed using paraffin film and were incubated at room temperature. The same procedure was repeated for all the fungicides. Unamended PDA medium inoculated with the pathogen at the centre served as the control. The percentage inhibition was calculated using the formula [8].

$$I = C\text{-}T / C \times 100$$

Where,

I – Percentage inhibition

C - Growth of *C.cucurbitarum* in unamended medium

T - Growth of *C.cucurbitarum* in amended medium

D. Statistical Analysis

All data were analyzed using arc transformation in completely randomized design by using computer programme Excel.

III. RESULTS AND DISCUSSION

A. Isolation and identification of the pathogen

The symptoms of Choanephora pod rot of vegetable cowpea caused by *Choanephora cucurbitarum* initiated as water soaked lesion which expanded and caused wet rot (Figure1). The invaded portions became covered with a luxuriant fluffy white growth of the fungus, consisting of mycelium and sporangiophores along with sporangia which appeared as minute black headed pin like structures around the pods, giving lamb's tail like appearance (Figure 2). Similar symptoms have been on grain cowpea reported from Kerala [4], India [9], Sri Lanka [10], South Nigera [11], Korea [12].

Figure 1: Wet rot

Figure 2: Lamb's tail symptom

The fungal colony appeared white in colour on the upper surface (Figure 3a) and pale yellow on the lower side (Figure 3b) on PDA plates. The white coloured mycelium on maturity produced black pin heads indicating onset of sporulation Fig (3c). The cultural characters were in accordance with the descriptions given by Fatma *et al.*,2010[13] . The mycelia was hyaline, unbranched and without any septations. Sporangiophores were non-septate, hyaline and smooth walled.Two types of asexual structures were produced drooping sporangia (Figure 4a) and monosporous sporangiola (Figure 4b). The drooping multisporous sporangia were subglobose in shape and 90.75 - 110 µm in size. The sporangia were non – columellate and dehisce into two half releasing the spores. Sporangiospores were elliptic, fusiform or ovoid in shape, light brown or dark brown in color and sized 16-22 × 8.23 -10 µm (Figure 4c). The sporangiophore (conidiophore) from which the monosporous sporangiola arose was long slender,branched at the apex with primary vesicle from which secondary vesicles were produced on the stalks which bears sporangiospores (conidia). Monosporous sporangiola were elliptic, fusiform or ovoid, striate, and measured 12-20 × 6-14 µm. The mycelial and morphological characters were similar to that described by Kirk (1984) [6].

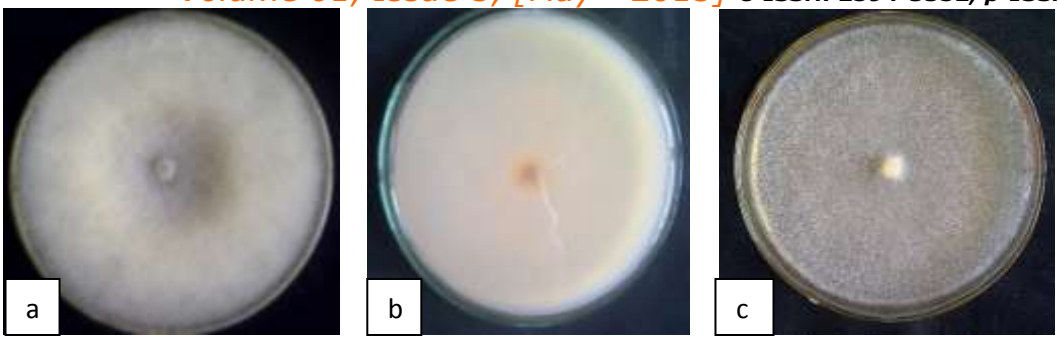

Figure 3: a.Mycelial growth(Upper surface) b. Mycelial growth (Lower surface) c. Sporulation

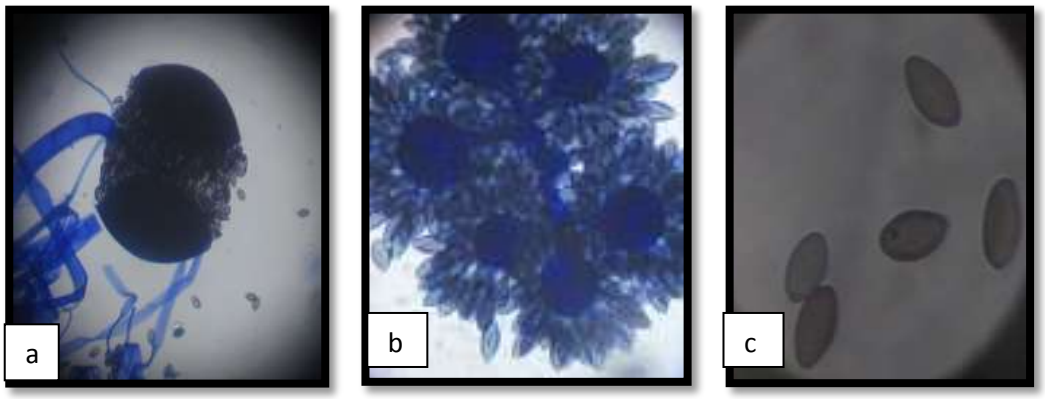

Figure 4: a. Drooping sporangia(45X) b. Monosporous sporangiola(45X) c. Sporangiospores(45X)

B. Pathogenicity test

The cowpea pods showed wet rot within 24 h. of inoculation (Figure 7) and further showed development of white mycelia studded with black sporangial heads within 72h. Re- isolation of the pathogen from the artificially inoculated pods yielded *C.cucurbitarum* identical to the original culture.This agrees with the findings of Lefebvre and Weimer (1989) [14].

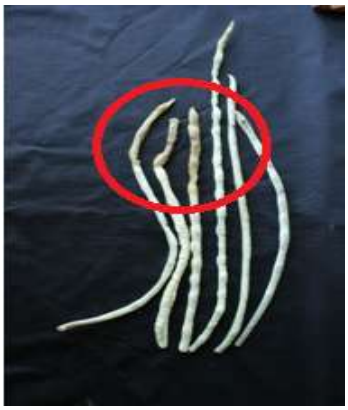

Figure 5: Pathogenicity test

C. *In vitro* evaluation of chemical fungicide against the pathogen

The results (Table 1) of the *in vitro* evaluation of nine fungicides at recommended dose by poisoned food technique revealed that six chemicals *viz*., mancozeb [15], copper oxy chloride, captan + hexaconazole, carboxin, carbendazim + mancozeb and propiconazole gave 100% inhibition to the

growth of the pathogen under *in vitro* conditions (Figure 8) and was significantly different from the effect of other chemicals. However, copper hydroxide also gave 98.30% inhibition of *C.cucurbitarum* and was on par with the above treatments. Azoxystrobin and carbendazim gave 21.01% and 2.10% inhibition of the pathogen and was least effective than other chemicals used for study under *in vitro* conditions.

Table 1: In vitro efficacy of fungicides against C.cucurbitarum

Chemical name (concentrations)**	**Trade name**	**Lower dose***	**Recommended dose***	**Higher dose***
Mancozeb	**Indofil M-45**	**100 (90)^{a}**	**100 (90)^{a}**	**100 (90)^{a}**
Copper oxy chloride	**Fyter**	**100 (90)^{a}**	**100 (90)^{a}**	**100 (90)^{a}**
Copper hydroxide	**Kocide**	**90.86(72.40)^{b}**	**98.30(82.52)^{a}**	**99.61(86.46)^{a}**
Azoxystrobin	**Amistar**	**12.90(21.05)^{d}**	**21.01(27.28)^{c}**	**24(29.34)^{d}**
Carbendazim	**Bavistin**	**0.00(0.00)^{e}**	**2.10(8.34)^{d}**	**59.24(50.33)^{c}**
Carboxin	**Vitavax**	**100 (90)^{a}**	**100 (90)^{a}**	**100 (90)^{a}**
Propiconazole	**Tilt**	**100 (90)^{a}**	**100 (90)^{a}**	**100 (90)^{a}**
Captan+ hexaconazole	**Taqat**	**70.74(57.25)^{c}**	**100 (90)^{a}**	**100 (90)^{a}**
Carbendazim+ mancozeb	**Cosuit**	**92.62(74.25)^{b}**	**100 (90)^{a}**	**100 (90)^{a}**
Control		**0.00(0.00)^{e}**	**0.00(0.00)^{e}**	**0.00(0.00)^{e}**
CD(0.05)		**(2.09)**	**(4.58)**	**(2.93)**

*Mean of three replications
Values in the parenthesis are arc-transformed

****** Concentrations are given in the order of lower dose, recommended dose and higher dose.
Mancozeb (0.1, 0.2, 0.3 g/100ml), Copper oxy chloride(0.1, 0.2, 0.3 g/100ml), Copper hydroxide(0.1, 0.2, 0.3 g/100ml), Azoxystrobin (0.05, 0.1, 0.15 ml/100ml), Carbendazim (0.05, 0.10, 0.15 g/100ml), Carboxin (0.2, 0.25, 0.30 g/100ml), Propiconazole (0.05, 0.1, 0.15 m/100ml), Captan+ hexaconazole (0.15, 0.2, 0.25 g/100ml), Carbendazim+ mancozeb (0.15, 0.2, 0.25 g/100ml).

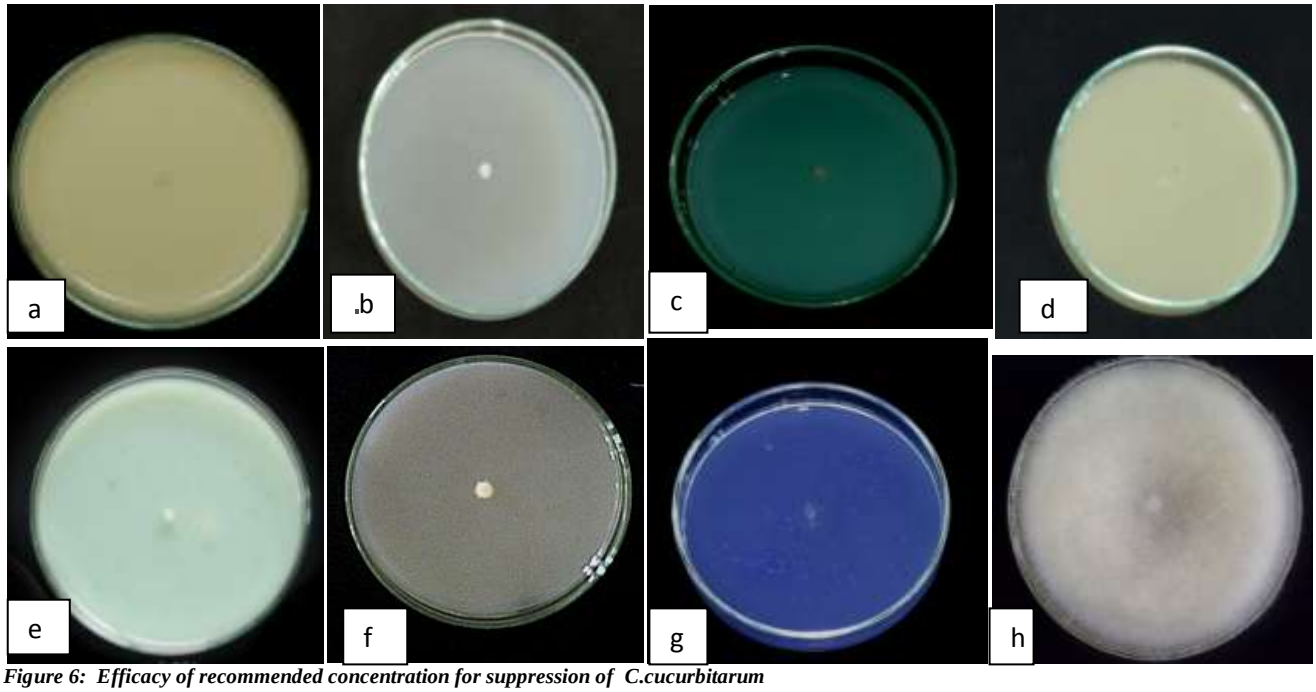

Figure 6: Efficacy of recommended concentration for suppression of C.cucurbitarum a.mancozeb(0.2%), b. Propiconazole(0.1%), c. copper hydroxide (0.1%), d.cosuit(0.25%), e.copper oxychoride(0.2%), f. Taqat(0.1%), g. Carboxin(0.25%), h. control

IV. CONCLUSION

This paper shows the symptoms of wet rot on cowpea pods caused by *Choanephora cucurbitarum* (Berk. & Ravenel) Thaxt.on vegetable cowpea (*Vigna unguiculata subsp. sesquipedalis* (L.) Verdcourt). The pathogen causing wet rot was identified based on cultural and morphological characters. The *in vitro* evaluation of nine fungicides revealed that mancozeb, copper oxychloride, propiconazole, cosuit, taqat and carboxin completely inhibited the mycelial growth of the pathogen.

BIBLIOGRAPHY

[1] Singh, R. S. and Sinha, R.P. 1955. Studies on the wilt disease of Cowpea in Uttar Pradesh- Occurrence and symptoms of the disease and identity of the causal organism. *J. Indian Bot. Soc.*, 34(4): 375 -381.

[2]Williams, R.J. 1974. Plant Pathology in the grain legume improvement program at IITA. In: *Proceedings of the 1st Grain Legume Improvement Workshop*, IITA, Ibadan, Nigeria, pp. 261-268.

[3] Williams, R.J. and Ayanaba, A.1975. Increased incidence of Pythium stem rot in cowpea treated with benomyl and related fungicides. *Phytopathol.*,65:217-218.

[4] Wilson, K.I. and Jose, P.C. 1965. Pod rot of Vigna sinensis (L.) Savi caused by *Choanephora cucurbitarum* (Berk. & Rav.) Thaxter. *Indian Phytopathol.*,21: 130-132.

[5] Aneja, K.R. 2003. *Experiments in microbiology, Plant Pathology and Biotechnology* (4th Ed.). New Age International (P) Ltd. Publishers, New Delhi, 607p.

[6] Kirk, P. M, 1984. A monograph of the Choanephoraceae. *Mycological Papers*,152: 1-61.

[7] Nene, Y.L. and Thapliyal, P.N. 1993. *Fungicides in Plant Disease Control.* 3rd ed. Oxford and IBH Publishing Co. Pv. Ltd, 691 p.

[8] Vincent, J.M. 1927. Distortion of fungal hyphae in the presence of certain inhibitors. *Nature*, 159 :800.

[9] Singh,R.S. and Allen, D.J. 1979. Cowpea pests and diseases. *Inter. Inst. Trop. Agric.Manual Series*, 2:75pp.

[10] Kangatharalingam, N. 1979. Pod rot of cowpea 'Bush Sitao' caused by Choanephora cucurbitarum. *Trop. Grain Legume Bulletin*,16 pp. 7.

[11] Oladiran, A. O. 1980. Choanephora pod rot of cowpea in Southern Nigeria. *Trop. Pest Management*,26 (4) pp. 396-402.

[12]Kown, J.H., Shen, S.S and park,C.S.2001. Pod rot of cowpea (*Vigna sinensis*) caused by *Choanephora cucurbitarum. J.Pl. Pathol.*,17(6):354-356.

[13] Fatma F, Abdel-Motaal, Magdi A. El-Sayed, Soad A. El-Zayat, Mortada S. M. Nassar Shin-ichi Ito. 2010. Choanephora rot of floral tops of *Hyoscyamus muticus* caused by *Choanephora cucurbitarum. J Gen Plant Pathol*., 76:358–361.

[14] Lefebvre, C. and Weimer, L. 1989. *Choanephora cucurbitarum* attacking cowpeas. *J.of Phytopathol.*,29: 898-901.

[15] Chahal, A. S. and Groverrk. 1974. Chemical control of soft fruit rot of chilies caused by *Choanephora cucurbitarum. J. of Hortic. Sci*., 3: 190-194.

