In vitro evaluation of fungicides against Colletotrichum gloeosporioides causing fruit rot of custard apple

SD Shedge, SR Lohate and AA Bhagat

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Abstract

The importance of fruits in human diet has been well recognized. Custard apple is one of major important fruit crop grown in Maharashtra. The indigenous fruits which are locally available in a particular season play a vital role in the nutrition of rural mass. Though, it was considered hardy and resistant to various pests and diseases, the losses caused by fruit rot of custard apple have been increased during recent years. Losses even up to 60-70% have been reported by previous workers. Fungicide use to control disease is a common practice. The present investigation was carried out to evaluate bio efficacy of fungicides, botanicals and bio agents against Colletotrichum gloeosporioides in vitro. Four systemic and two non-systemic fungicides were tested at three different concentrations in vitro against pathogen. Among these fungicides Copper oxychloride at all concentrations, Captan at half and recommended concentration and Fenamidon at recommended concentration inhibited cent per cent mycelial growth of the pathogen.

Keywords: Fungicides, custard apple, fruit rot disease and concentrations

Introduction

Custard apple (Annona squamosa L.) is a native of tropical America and widely distributed throughout the tropical and subtropical regions. It is grown on marginal lands and hillocks with minimum inputs (Rajput, 1985) [5]. Recently area under cultivation of custard apple is increasing due to high economic returns and great export potential. Farmers prefer this crop because it is very hardy and can be successfully grown even on shallow to light soils with low water requirement. It is also considered as devoid of diseases and pest but in recent years crop has found susceptible to various pests and diseases. Among the various diseases, fungal diseases play an important role to severe loss of custard apple production. About 60 - 70 per cent losses have been reported due to the fruit rot disease (Gaikwad, 2002) [1]. The market for fruits and its export potential is totally dependent on quality and appearance of fruits. The fruit rot disease impairs fruit quality and makes them unsuitable for market. This leads to high economic losses. Thus the studies were carried out to evaluate fungicides in in vitro against Colletotrichum gloeosporioides.

Material and Methods

The fungi responsible for causing fruit rot disease in custard apple was isolated from diseased fruits procured from All India Coordinated Research Project on Arid Zone Fruits (Fig and Custard apple), Jadhavwadi, Dist.-Pune. The pure culture was obtained and the experiment was conducted in Completely Randomized Design with seven treatments and three replications in pathology laboratory at College of Agriculture, Pune. The fungicides were evaluated by poison food technique. The required quantity of fungicides was mixed in molten sterilized PDA medium and then sterile Petri plates were filled with about 20 ml poisoned medium. Fungal colony of 0.4 mm diameter was placed in each plate at centre of plate under aseptic condition. The plates were incubated at 28 °C in BOD incubator. The control set was provided by using plates without fungicides. The observations of fungal colony growth inhibition were taken after 10 days of inoculation. Per cent inhibition of mycelial growth of the fungus was calculated by using the formula of Vincent (1947) [10].
In vitro bio-efficacy of fungicides at ¼ concentration against C. gloeosporioides

The data presented in table 3 revealed that there was cent per cent inhibition of mycelial growth of C. gloeosporioides at recommended concentration in three fungicides viz: fenamidion, captan and copper oxychloride while other fungicides viz: Zineb, Propineb and Azoxystrobin inhibited mycelial growth of pathogen (31.36%, 85.61% and 23.25%) respectively.

In vitro bio-efficacy of fungicides at ½ concentration against C. gloeosporioides

At half dose of fungicides in captan and copper oxychloride no mycelial growth of the pathogen was observed where these fungicides inhibited cent per cent growth of the fungus (Table 2). Fenamidion was found next effective treatment with 92.99 per cent inhibition of pathogen. Rest of the fungicides showed inhibition of mycelia growth of pathogen as 23.25 per cent, 39.85 per cent and 22.87 per cent in Zineb, Propineb and Azoxystrobin fungicides, respectively.

Results and Discussion

Six different fungicides were tested at normal, ½ and ¼ concentration of recommended dose in vitro for knowing their effectiveness in inhibiting the mycelia growth of the pathogen. Out of six different fungicides four were systemic and two were non-systemic in nature.

In vitro bio-efficacy of fungicides at ¼ concentration against C. gloeosporioides

Significant results were obtained from these tests as presented in table 1. At lowest (1/4) concentration only Copper oxychloride inhibited cent per cent growth of pathogen. The next effective treatment was Captan in which 89.67 per cent growth inhibition was observed. While rest of the fungicides showed Zineb (9.22%), Propineb (20.66%), Fenamidion (57.93%) and Azoxystrobin (17.71%) growth inhibition of the pathogen.

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| Sr. No. | Fungicides | Conc. (%) | Colony diameter (cm) and growth rate i.e. GR (mm/hr) - hours after inoculation | Growth Degree | Inhibition (%) |
|---------|------------|-----------|--------------------------------------------------------------------------------|---------------|---------------|
| 1       | Zineb      | 0.25      | 1.33 1.31 5.40 6.73 8.20 0.28 0.38 0.47 0.28 0.30 0.34                          | +++++         | 9.22          |
| 2       | Propineb   | 0.25      | 1.27 3.07 4.37 5.33 7.17 0.26 0.38 0.27 0.20 0.38 0.30                          | +++           | 20.66         |
| 3       | Fenamidion | 0.25      | 0.47 1.27 2.47 2.90 3.80 0.09 0.17 0.25 0.09 0.19 0.16                          | ++            | 57.93         |
| 4       | Azoxystrobin| 0.25     | 1.00 3.10 5.20 6.13 7.43 0.21 0.44 0.44 0.20 0.27 0.31                      | +++           | 17.71         |
| 5       | Captan     | 0.5       | 0.43 0.53 0.63 0.93 0.93 0.09 0.02 0.02 0.06 0.00 0.04                          | +             | 89.67         |
| 6       | COC        | 0.5       | 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00                          | -             | 100.00        |
| 7       | Control    | 0.5       | 1.50 3.80 6.67 8.67 9.03 0.31 0.48 0.59 0.42 0.07 0.38                          | +++++         | -             |

Table 1: In vitro bio-efficacy of fungicides at ¼ the concentration against C. gloeosporioides
### Table 2: In vitro bio-efficacy of fungicides at ½ concentration against *C. gloeosporioides*

| Sr. No. | Fungicides     | Conc. (%) | Colony diameter (cm) and growth rate i.e. GR (mm hr\(^{-1}\)) - hours after inoculation | Growth Degree | Inhibition (%) |
|---------|----------------|-----------|--------------------------------------------------------------------------------------|---------------|----------------|
|         |                |           | 48  | 96  | 144 | 192 | 240 | Mean GR |
| 1       | Zineb          | 0.5       | 1.03 | 2.27 | 4.10 | 5.10 | 6.93 | ++ | 23.25 |
| 2       | Propineb       | 0.5       | 0.63 | 1.23 | 2.83 | 3.50 | 5.43 | ++ | 39.85 |
| 3       | Fenamidon      | 0.5       | 0.13 | 0.12 | 0.34 | 0.14 | 0.40 | +  | 92.99 |
| 4       | Azoxystrobin   | 0.5       | 0.25 | 0.40 | 0.46 | 0.18 | 0.17 | ++ | 22.87 |
| 5       | Captain        | 1         | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -  | 100.00 |
| 6       | COC            | 1         | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -  | 100.00 |
| 7       | Control        | S.E. + C.D. (0.05) | 1.50 | 3.80 | 6.67 | 6.67 | 9.03 | +++ | 0.00 |
|         |                |           | 0.31 | 0.48 | 0.59 | 0.42 | 0.07 | 0.38 |
|         |                |           | 0.02 | 0.02 | 0.05 | 0.03 | 0.04 |
|         |                |           | 0.33 | 0.62 | 0.87 | 1.00 | 0.97 |
|         |                |           | 0.07 | 0.07 | 0.15 | 0.08 | 0.11 |
|         |                | CV %      | 27.00 | 22.52 | 17.84 | 16.57 | 13.18 | |
|         |                |           | 26.41 | 21.61 | 32.41 | 34.45 | 41.12 | |

Note: 1. Figures in bold faces indicate growth rate (mm hr\(^{-1}\)) values.
2. Degree of mycelial growth: - NIL, + Poor, ++ Moderate, +++ Good and ++++ Adundant

### Table 3: In vitro bio-efficacy of fungicides at recommended concentration against *C. gloeosporioides*

| Sr. No. | Fungicides     | Conc. (%) | Colony diameter (cm) and growth rate i.e. GR (mm hr\(^{-1}\)) - hours after inoculation | Growth Degree | Inhibition (%) |
|---------|----------------|-----------|--------------------------------------------------------------------------------------|---------------|----------------|
|         |                |           | 48  | 96  | 144 | 192 | 240 | Mean GR |
| 1       | Zineb          | 1         | 1.30 | 2.70 | 4.17 | 5.10 | 6.20 | ++ | 31.36 |
| 2       | Propineb       | 1         | 0.27 | 0.29 | 0.30 | 0.19 | 0.23 | +  | 85.61 |
| 3       | Fenamidon      | 1         | 0.40 | 0.53 | 0.67 | 0.83 | 1.30 | -  | 100.00 |
| 4       | Azoxystrobin   | 1         | 0.08 | 0.03 | 0.03 | 0.03 | 0.10 | -  | 100.00 |
| 5       | Captain        | 2         | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -  | 100.00 |
| 6       | COC            | 2         | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -  | 100.00 |
| 7       | Control        | S.E. + C.D. (0.05) | 1.50 | 3.80 | 6.67 | 8.67 | 9.03 | +++ | 0.00 |
|         |                |           | 0.31 | 0.48 | 0.59 | 0.42 | 0.07 | 0.38 |
|         |                |           | 0.23 | 0.58 | 0.56 | 0.42 | 0.77 |
|         |                |           | 0.05 | 0.09 | 0.03 | 0.07 | 0.08 |
|         |                | CV %      | 21.82 | 22.66 | 13.26 | 7.97 | 12.67 | |
|         |                |           | 21.07 | 28.44 | 8.68 | 31.53 | 44.17 | |

Note: 1. Figures in bold faces indicate growth rate (mm hr\(^{-1}\)) values.
2. Degree of mycelial growth: - NIL, + Poor, ++ Moderate, +++ Good and ++++ Adundant
**Fungicides at different concentrations**

**Fig 1:** *In vitro* bio-efficacy of fungicides at different concentrations against *C. Gloeosporioides*

**Plate 1:** *In vitro* bio-efficacy of fungicides at different concentrations against *C. Gloeosporioides*
References

1. Gaikwad AP. Studies on fruit rot of custard apple (Annona squamosa L.) caused by Colletotrichum gloeosporioides Penz. Ph. D. thesis, MPKV Rahuri, Maharashtra, India 2002.

2. Gawade DB, Suryawanshi AP. In vitro evaluation of fungicides, botanicals and bioagents against Colletotrichum truncatum causing soybean anthracnose. Pl. Dis. Res 2009;24(2):120-123.

3. Kumari Pavitra, Singh R, Punia R. Evaluation of fungicides and botanicals against Mango (Mangifera indica) anthracnose; Curr. J. Appl. Sci. Technol 2017;23(3):1-6. Article no. CJAST.35899

4. Patil CU, Zape AS, Wathore SD. Efficacy of fungicides and bioagents against Colletotrichum gloeosporioides causing blight in Piper longum. Int. J. Plant Prot. 2009;2(1):63-66.

5. Rajput CBS. Custard apple, In: Fruits of India - Tropical and subtropical, Ed. T.K. Bose, Nayaparakash Pub, Calcutta, India 1985, 479-486.

6. Singh A, Verma KS, Mohan C. Evaluation of fungicides against Colletotrichum gloeosporioides causing anthracnose of guava. Plant Dis. Res 2008;23:91-992.

7. Sivakumar D, Bill M, Korsten L, Thompson K. “Integrated application of chitosan coating with different postharvest treatments in the control of postharvest decay and maintenance of overall fruit quality,” Chitosan in the preservation of agricultural commodities, Elsevier Inc, 2016, 127-153.

8. Stanley Kirugo Kimaru, Monda E, Cheruiyot RC, Mbaka J, Alakonya A. Sensitivity of Colletotrichum gloeosporioides Isolates from diseased avocado fruits to selected fungicides in Kenya. Hindawi Advances in Agriculture 2018, Article ID 3567161, 6 pages https://doi.org/10.1155/2018/3567161

9. Tasiwal V, Benagi VI, Hegde YR, Kamanna BC, Naik KR. In vitro evaluation of botanicals, bioagents and fungicides against anthracnose of papaya caused by Colletotrichum gloeosporioides Penz.& Sacc. Karnataka J Agric. Sci 2008;22(4):803-806.

10. Vincent JM. Distribution of fungal hyphae in the presence of certain inhibitors. Nature 1947;159:850.