Original Research Article

***In vitro* Cultural and Conidial Characterization of *Alternaria tenuissima*, the Causal Agent of Leaf Blight in Kodo Millet (*Paspalum scrobiculatum* L.)**

**ABSTRACT**

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| --- |
| The study was conducted from September 2023 to September 2024 at the Department of Plant Pathology, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.). Current investigation was done *in vitro* to study the cultural and conidial characterization (efficacy of different solid media and carbon sources). Kodo millet (*Paspalum scrobiculatum* L.) a historical crop, nowadays have gained significant attention because of its high nutritive values and implications for health. Earlier less disease incidence occurred but now this crop is facing lot of issues. Most widely known disease in this crop is leaf blight of kodo millet known to be caused by *Alternaria tenuissima*. In the experiments mentioned in the paper, effect of different solid media and carbon sources were tested to see the growth, sporulation and its conidial characterization. Among the media tested, potato dextrose agar (89.0 mm) showed the maximum growth followed by oat meal agar (79.4 mm). Sporulation was recorded highest in case of potato dextrose agar followed by oat meal agar. On the other hand, maximum growth was recorded in three treatments, *i.e.*, in sorbitol, sucrose and glucose (85.0 mm) respectively. While highest number of sporulation is observed in maltose. Solid media reveals that how various fungi adapt to various conditions and explore their diet preferences. Fungi come into contact with a wide variety of carbon sources *in vivo*, including as sugars, amino acids and organic acids. Various carbon sources can be used in *in vitro* experiments to recreate comparable conditions and show how fungus adjust to diverse nutritional surroundings while spreading the infections. Hence, these studies can be used to study the nature of the fungus and their preferences resulting in decreasing the disease incidence and its impact. |

*Keywords: Kodo millet, Alternaria tenuissima, leaf blight, carbon sources, media, mycelial growth, conidial characterization.*

1. **INTRODUCTION**

Kodo millet (*Paspalum scrobiculatum* L.) is an ancient millet grain crop, which is native to Africa and domesticated in India about 3000 years ago. It is mostly cultivated by the farmers of low-income group (de Wet et al., 1983). The genus *Paspalum* includes more than 400 species is often used as annual crop. The crop is self-pollinating and has chromosomal no. 2n=4x=40. It is a monocot and the seeds are roughly 1.5 mm wide and 2.00 mm long appearing light brown to dark grey. Plants are slender, up to 90 cm tall, leaf blades are linear, glabrous or pubescent, up to 40 cm long with the basal leaf sheath glabrous or pilose. Inflorescence is composed off more than five racemes that are alternatively arranged on a short to elongated primary axis (Clayton, 1975). Millets are basically drought-resistant cereal crop with short duration of growth that usually stretches from 60 to 100 days (Wang et al., 2018).

Different vernacular names used in different parts of the country are; Harka in Kannada, Varagu in Tamil and Malayalam, Kodra in Punjabi, Marathi, and Gujarati, Arika/Arikelu in Telugu, Kodon in Hindi and Kodua in Oriya. Globally, the crop is cultivated in tropical and subtropical areas. Primarily the crop is grown in India, besides, kodo is also grown in Indonesia, Philippines, Thailand, Vietnam, Bangladesh, Myanmar and western parts of Africa. In India, the crop is largely grown in the states of Madhya Pradesh, Chhattisgarh, Tamil Nadu, Telangana, Maharashtra, Gujarat, Karnataka, Uttar Pradesh and Jharkhand (Hariprasanna, 2023).

Kodo millet, a principal member of “Sri Anna” is a minor millet. Minor millets are also known as "nutri-cereals" due to their low glycaemic index, fatty acid content, micronutrient content, and lack of gluten (Prasad and Sahu, 2025). The grains are medicinally rich, nutritionally superior and potentially utilized in value added food products. The approximate composition of kodo millet per 100 g is as follows: 11.2% moisture, 1.3 g fat, 8.1 g protein, 64.3 g carbohydrate and fibre 8.3 mg. Significant amounts of minerals like calcium (32 mg), phosphorus (169 mg) and iron (0.5 mg) are also present in kodo millet. According to the study, kodo millet provides health benefits for diabetes, coeliac disease, cancer and cardiovascular disease. They are also rich in calcium, potassium, magnesium, zinc, folic acid and vitamins B3 and B6 (Srivastava and Vijayakumar, 2024). It is also popular in rural areas of Deccan plateau, several eastern states, the Himalaya and the northern plains as a valuable healthy food.

Earlier, the crop was known free from diseases. However, plant pathogens were reported in this crop, but losses were negligible. Under the situation of climate change, cropping intensity and introduction of new cultivars, a number of diseases are reappearing and new pathogens are also infecting the crop (Nagaraja et. al., 2016), hence, limiting the sustainable yield of kodo millet. Among fungal pathogens, *Sporisorium paspali thunbergii* (Head smut), *Rhizoctonia solani* (Banded leaf blight), *Puccinia substriata* (Rust), *Ephelis oryzae* (Udbatta), *Alternaria alternata* (leaf blight) and several species of *Helminthosporum* were reported to infect the crop and can cause significant economic loss in grain yield under favourable climatic conditions (Jain and Sharma, 2010). Very few studies were undertaken on characterization of pathogen and needs more studies on different aspects of pathogen as well as disease. Present investigation is mainly focused towards the cultural and its conidial characterization.

1. **MATERIAL AND METHODS**
   1. **Collection of diseased samples**

The study was done at Jawaharlal Nehru Krishi Vishwa Vidyalaya's, Department of Plant Pathology in Jabalpur, Madhya Pradesh, between September 2023 and September 2024. The samples were collected from AICRP on small millets, Rural Agriculture Research Station (RARS) in Madhya Pradesh's Dindori district (latitude: 22.9418º North and longitude: 81.0768º East) and transported to the laboratory, Department of Plant Pathology in Jabalpur (M.P.) for the study. Samples were selected at random by looking to the specific symptoms. The main symptom recognized was blightening of the leaves, which initially started at the apical (tip) region and progressed downwards (older). The charred edges of the leaves, which ranged from straw to pale brown, were evident. This pathogen produces little, scattered lesions on the leaves during the early stages of infection. The scattered lesions combined to form what seemed to be burns as the disease progresses (Gupta et al., 1994).

* 1. **Isolation, purification and maintenance of fungal pathogen**

Fresh infected leaves of kodo millet were collected from the field and was brought to the laboratory. Small pieces of infected parts were cut of 2-3 mm with the help of sterilized scalpel, then it was washed with 0.1% NaOCl (sodium hypochlorite solution) for approximately 20 to 30 seconds. These samples were then washed with distilled water 3 to 4 times. This particular process is repeated thrice. In order to avoid bacterial contamination, streptomycin sulphate powder (100 ppm) was added to potato dextrose agar (PDA). Ten ml of PDA was then poured into 90mm sterilized Petri plate and left for 10 minutes to solidify. Four pieces of small surface sterilized leaf samples were placed on each Petri plate kept evenly spaced. The above-mentioned work was done in an aseptic condition. For 6 days, at appropriate temperature of 27 ± 2ºC the plates were incubated in biological oxygen demand (BOD) incubator and meanwhile the growth and colony development were also monitored. Microscope analysis was used to identify the pathogen and to locate their colonies too. The colony was targeted and then very carefully it was sub cultured using hyphal tip method for purification. The pure culture of the pathogen was maintained on PDA slants and in Petri dishes. The stock cultures were maintained in slants and then these are stored in refrigerator at 4ºC for long term storage.

* 1. **Morphological characters of *Alternaria tenuissima***

Temporary slides were prepared from pure culture of the pathogen. Measurements of the conidia (length and width) were taken binocular microscope of Leica Company. Initially, light microscope was used for looking the presence of conidia. The morphological characters *viz*., growth, septation of the conidia, size (length and width) and shape of the conidia were observed. The measurement of spores from 9 different spots was observed under the 100X magnification microscope. The mean values of these measurements were calculated.

* 1. **Cultural and conidial characterization**
     1. **Effect of different solid media on growth, sporulation and conidial characterization of pathogen**

Seven solid media *viz.*, Czapek dox agar, potato dextrose agar, Richard’s agar, corn meal agar, oat meal agar, leaf decoction agar and water agar were tested for growth and sporulation of the fungus. For the preparation of above these solid media the final volume makes up 1000 ml was done by adding distilled water. 100ml of media was taken in 150ml of conical flask flask tightly packed with non-absorbent cotton plug and sealed with aluminium foil. These media were sterilized by autoclaving at 121ºC and 15 psi for 20 minutes and then 10ml of luke warm medium was poured in sterilized Petri plates (90 mm) under aseptic conditions and allowed to solidify for 10 minutes. 5mm disc of 7-day old culture was inoculated into the Petri plates and sealed with parafilm. Petri plates were then placed inside the BOD incubator at 27 ± 2ºC in an inverted position and perceptions were recorded on radial growth of the pathogen on daily basis after 48 hours at an interval of 24 hours till the plate gets full growth. The treatments were replicated thrice.

* + 1. **Effect of different carbon sources on the growth, sporulation and conidial characteristics of the pathogen**

Richard’s agar medium was used as the basic medium for the nutritional study (carbon source). Sucrose is the carbon constituent present in the Richard’s medium was substituted by different carbon sources like sorbitol, maltose, dextrose, lactose, sucrose, glucose and control (without any carbon source). 100 ml of Richard’s agar medium was poured in 150 ml capacity conical flask tightly packed with non-absorbent cotton plug and sealed with aluminium foil. Then these flasks were sterilized in an autoclave for 20 minutes at 121ºC and 15 psi. The medium was then poured into 90 mm Petri plates @ 10 ml and allowed to solidify for 10 minutes. A disc of 5mm from 7-day old culture was kept in the centre of the plate, sealed with parafilm and kept in an inverted position in BOD incubator. Each treatment was replicated thrice.

* 1. **Counting and Measurements of Conidia**

After the experiments were over, *i.e.,* after 240 hours (different solid media) and 192 hours (different carbon sources) respectively. When growth got full, the spore count was done by making suspension of pathogen by cutting 5mm disc from each treatment with sterilized cork borer and suspending it in the test tube then shaking it properly. A temporary mount was prepared and spores were count from nine different microscopic fields, the conidia microscopic-1 field (100X) were counted; the length and width of the conidia was measured. Number of longitudinal and transverse septa in 25 conidia was recorded. Micrometry was done to ensure proper details regarding length and width of the pathogen in the treatments which showed spore count microscope (Leica Company) and software (Leica Application Suite) at 100X.

* 1. **Statistical Analysis**

The data have been evaluated using OPSTAT online software in completely randomized design (CRD).

1. **RESULTS AND DISCUSSION**
   1. **Isolation, purification and identification of the pathogen**

Kodo millet pathogen was isolated on potato dextrose agar (PDA) medium from the infected leaves collected from Dindori (M.P.) (latitude: 22.9418º North, longitude: 81.0768º East). The isolated pathogen was purified by using hyphal tip method. After culturing of the fungus, it was maintained in the PDA slants for further identification and morphological studies. The test pathogen was identified by making temporary slides from 10 days old culture of isolated pathogens and were observed under compound microscope. Leaf samples collected from Dindori (M.P.) yielded olivaceous dark coloured mycelial growth in the Petri plate. The test fungi showed obclavate, muriform conidia, brownish with olive green ting and attached with conidiophores. Small chains of conidia were also observed. Average size of conidia was recorded 41.40 x 8.56 µm (Plate 1). Based on these morphological features, the fungus was identified as *Alternaria tenuissima*.

 

**Plate 1. Conidia of *Alternaria tenuissima*.**

* 1. **Effect of different solid media on growth, sporulation and conidial characterization of pathogen**

Radial mycelial growth of *A. tenuissima* was studied in seven culture media and data are presented in table 1, figure1 and plate 2. Significant variation in mycelial growth of the fungus was recorded on different media. Starting from 48 hrs to 240 hrs of incubation. Mycelial growth ranging from 14.5 to 69.0 mm, 17.9 to 89.0 mm, 17.0 to 66.7 mm, 7.7 to 56.0 mm, 16.3 to 79.4 mm, 17.5 to 68.9 mm and 8.0 to 20.0 mm was recorded on Czapek’s Dox Agar (CDA), potato dextrose agar (PDA), Richard’s agar (RA), corn meal agar (CMA), oat meal agar (OMA), leaf decoction agar (LDA) and water agar (WA) respectively. The highest significant radial growth was recorded on PDA followed by OMA (79.4 mm) at 240 hrs of incubation. Mycelial growth of the fungus was moderate and significantly at par on CDA (69.0 mm), LDA (68.9 mm) and RA (66.7 mm). Lowest radial growth was noted on water agar (20.0 mm). Excellent sporulation was recorded on PDA and OMA 240 hrs of incubation. Sporulation was good on RA and LDA, whereas sporulation was fair on CDA and poor on CMA and WA.

Conidial characteristics as influenced by different culture media are presented in table 2 and plate 3. Average length of conidia was 25.07 to 30.60 µm. Maximum length of conidia was observed on PDA followed by OMA (29.95 µm) while minimum length was recorded on WA. In rest of the media average conidial length was in between 25.66 to 26.95 µm. Average conidial width varied from 8.09 to 9.86 µm was maximum in WA followed by OMA (9.11 µm), LDA (9.03 µm), CDA (9.00 µm), RA (8.97 µm), CMA (8.91 µm). Lowest conidial width was observed on PDA (8.09 µm). Number of longitudinal septa in each conidia were 3 to 4 on CDA, CMA and LDA, whereas 2 to 4 longitudinal septa were recorded on PDA and RA. Two to three longitudinal septa were noted on OMA. Minimum average longitudinal septa were recorded on WA (1 to 3). Number of transverse septa were 0 to 2 on OMA and WA while 0 to 1 transverse septum were observed on CDA, PDA, RA and CMA.

**Table 1. Effect of different solid media on mycelial growth of *Alternaria tenuissima***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S. No. | Culture media | Radial growth (mm) after (hrs) | | | | | | | | | |
| 48 | 72 | 96 | 120 | 144 | 168 | 192 | 216 | 240 | Sporulation Index |
| 1 | Czapek’s dox agar | 14.5 | 23.0 | 28.5 | 35.2 | 42.5 | 50.3 | 55.5 | 62.4 | 69.0 | ++ |
| 2 | Potato dextrose agar | 17.9 | 27.0 | 34.5 | 44.5 | 54.8 | 65.1 | 73.5 | 82.5 | 89.0 | ++++ |
| 3 | Richard’s agar | 17.0 | 23.9 | 27.7 | 33.4 | 41.5 | 48.8 | 54.9 | 61.0 | 66.7 | +++ |
| 4 | Corn meal agar | 7.7 | 13.5 | 20.9 | 26.6 | 31.8 | 38.1 | 43.4 | 50.8 | 56.0 | + |
| 5 | Oat meal agar | 16.3 | 22.8 | 31.4 | 37.8 | 46.0 | 54.6 | 63.4 | 72.3 | 79.4 | ++++ |
| 6 | Leaf decoction agar | 17.5 | 23.4 | 29.0 | 33.2 | 40.1 | 46.3 | 54.7 | 62.2 | 68.9 | +++ |
| 7 | Water agar | 8.0 | 9.3 | 10.8 | 12.0 | 14.7 | 16.4 | 17.1 | 18.4 | 20.0 | + |
|  | SEm± | 0.877 | 0.981 | 0.945 | 1.164 | 1.320 | 1.378 | 1.338 | 1.118 | 1.058 |  |
|  | CD (5%) | 2.686 | 3.005 | 2.896 | 3.564 | 4.041 | 4.220 | 4.097 | 3.424 | 3.241 |  |

[Scale of sporulation – (++++) = Excellent (>60 conidia per microscopic view) ;(+++) = Good (41-60 conidia per microscopic view) ;(++) = Fair (21-40 conidia per microscopic view) ;(+) = Poor (Less than 20 conidia per microscopic view) ;(-) = No sporulation.]

**Table 2. Conidial Characteristics of *Alternaria tenuissima* as influenced by different solid media**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| S. No. | Culture Media | Length of conidia | | Width of conidia | | Range of longitudinal septa | Range of transverse septa |
| Range | Mean | Range | Mean |  |  |
| 1 | Czapek’s dox agar | 18.17-39.94 | 25.66 | 7.93-9.71 | 9.00 | 3-4 | 0-1 |
| 2 | Potato dextrose agar | 25.74-36.89 | 30.60 | 6.89-8.85 | 8.09 | 2-4 | 0-1 |
| 3 | Richard’s agar | 19.81-34.50 | 26.95 | 7.34-12.46 | 8.97 | 2-4 | 0-1 |
| 4 | Corn meal agar | 18.06-38.92 | 25.89 | 8.20-10.59 | 8.91 | 3-4 | 0-1 |
| 5 | Oat meal agar | 21.35-35.40 | 29.95 | 7.17-11.47 | 9.11 | 2-3 | 0-2 |
| 6 | Leaf decoction agar | 23.72-30.29 | 26.77 | 7.14-11.85 | 9.03 | 3-4 | - |
| 7 | Water agar | 17.44-44.39 | 25.07 | 8.42-11.43 | 9.86 | 1-3 | 0-2 |

**Fig 1. Effect of different solid media on mycelial growth of *Alternaria tenuissima***



**Plate 2. Effect of different media on mycelial growth of *Alternaria tenuissima***



**Plate 3. Conidial Characterization of *Alternaria tenuissima* as influenced by different solid media (10x10 X)**

* 1. **Effect of different carbon sources on the growth, sporulation and conidial characteristics of the pathogen**

Mycelial growth and sporulation of *A. tenuissima* were studied *in vitro* using six carbon sources. Results obtained are presented in table 3, fig 2 and plate 4. All the sources of carbon tested enhanced the better growth of the test fungus. Sorbitol, sucrose and glucose were found most suitable and recorded maximum mycelial growth (85.0 mm) of *A. tenuissima*. Next best carbon source found was maltose (76.0 mm) followed by dextrose (68.5 mm) and lactose (62.1 mm) as compared to 56.3 mm in control. A wide range of sporulation ranging from poor (+) to excellent (++++) was observed in all the six carbon sources. Maltose recorded excellent sporulation, whereas as good sporulation was found in sorbitol and lactose. Sporulation was fair in dextrose and sucrose, while poor sporulation was recorded in glucose and control.

Conidial characteristics of *A. tenuissima* were found to be influenced by carbon sources (table 4 and plate 5). Average length of conidia varied from 26.35 µm to 44.07 µm was recorded in different carbon sources as compared to 22.34 µm in control. Maximum conidial length was recorded in sucrose followed by 31.17 µm in glucose and 30.39 µm in sorbitol. Minimum length of conidia was recorded in lactose (26.35 µm) followed by maltose (27.77 µm). Variation in conidial width was also recorded in different carbon sources. Conidial width varied from 8.40 µm to 11.57 µm was maximum in sucrose followed by 10.97 µm in glucose and 10.13 µm in lactose. Minimum width of conidia was recorded in dextrose. Number of longitudinal and transverse septa varied 1-4 to 3-5 and 0-1 to 0-3, respectively in different carbon sources. Sorbitol and sucrose exhibited maximum number of longitudinal septa, i.e., table 3 and plate 4.

**Table 3. Effect of different carbon sources on mycelial growth of *Alternaria tenuissima***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S. No. | Carbon Source | Radial Growth (in mm) after hours | | | | | | | |
| 48 | 72 | 96 | 120 | 144 | 168 | 192 | Sporulation Index |
| 1 | Sorbitol | 21.2 | 35.0 | 43.3 | 53.6 | 65.0 | 73.8 | 85.0 | +++ |
| 2 | Maltose | 19.4 | 25.7 | 35.2 | 49.7 | 55.8 | 63.7 | 76.0 | ++++ |
| 3 | Dextrose | 17.8 | 26.6 | 34.5 | 42.5 | 50.7 | 59.6 | 68.5 | ++ |
| 4 | Lactose | 19.1 | 27.2 | 35.9 | 43.3 | 49.4 | 55.8 | 62.1 | +++ |
| 5 | Sucrose | 19.0 | 31.4 | 43.3 | 55.3 | 63.4 | 78.9 | 85.0 | ++ |
| 6 | Glucose | 23.2 | 35.3 | 45.0 | 56.8 | 68.1 | 79.1 | 85.0 | + |
| 7 | Control | 14.9 | 20.3 | 29.7 | 38.5 | 45.6 | 50.9 | 56.3 | + |
|  | SEm± | 0.717 | 0.898 | 1.029 | 0.936 | 0.954 | 0.985 | 1.832 |  |
|  | CD (5%) | 2.195 | 2.751 | 3.152 | 2.868 | 2.921 | 3.017 | 5.611 |  |

[Scale of sporulation – (++++) = Excellent (>60 conidia per microscopic view) ;(+++) = Good (41-60 conidia per microscopic view) ;(++) = Fair (21-40 conidia per microscopic view) ;(+) = Poor (Less than 20 conidia per microscopic view) ;(-) = No sporulation.]

**Table 4. Conidial Characteristics of *Alternaria tenuissima* as influenced by different carbon sources**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| S. No. | Carbon Sources | Length of conidia | | Width of conidia | | Range of longitudinal septa | Range of transverse septa |
| Range | Mean | Range | Mean |
| 1 | Sorbitol | 20.66-37.85 | 30.39 | 8.25-10.31 | 9.19 | 3-5 | 0-2 |
| 2 | Maltose | 19.46-40.75 | 27.77 | 8.30-12.90 | 9.91 | 3-4 | 0-3 |
| 3 | Dextrose | 19.61-35.62 | 28.25 | 6.74-9.84 | 8.40 | 1-4 | 0-1 |
| 4 | Lactose | 21.42-35.58 | 26.35 | 8.28-11.56 | 10.13 | 2-3 | 0-1 |
| 5 | Sucrose | 35.15-56.66 | 44.07 | 7.58-10.65 | 9.48 | 3-5 | 0-1 |
| 6 | Glucose | 20.42-43.42 | 31.17 | 8.07-14.26 | 10.97 | 1-5 | 0-2 |
| 7 | Control | 17.45-28.02 | 22.34 | 9.52-13.87 | 11.57 | 2-3 | 1-2 |

**Fig 2. Effect of different carbon sources on mycelial growth of *Alternaria tenuissima***

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**Plate 4. Effect of different carbon sources on mycelial growth of *Alternaria tenuissima***

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**Plate 5. Conidial Characterization of *Alternaria tenuissima* as influenced by different carbon sources (10x10 X)**

Different solid media used revealed, that among 7 different solid media *viz*., Czapek’s dox agar, potato dextrose agar, Richard’s agar, corn meal agar, oat meal agar, leaf decoction agar and water agar. In present study, highest growth of *A. tenuissima* was observed in PDA (89.0 mm) after 240 hours of incubation. Same findings were done by Maheshwari et al. (1999), Singh et al. (2001), TianShu et al. (2009) and Kantwa et al. (2015). Minimum growth was seen in water agar as observed by Hariprasad et al. (2018) and Hubballi et al. (2010). On the other hand, sporulation was observed excellent in potato dextrose agar and oat meal agar in our study. The same findings were proved by Maheshwari et al. (1999), Singh et al. (2001), TianShu et al. (2009) and Kantwa et al. (2015). Leaf decoction agar had good sporulation which was studied to see the effect of growth of *A. tenuissima* on the host plant but it contrastingly proved to be excellent by Naik et al. (2008), Hubballi et al. (2010), Ramjegathesh and Ebenezar (2012) and Hariprasad et al. (2018).

In the present investigation, 6 different carbon sources *viz.*, sorbitol, maltose, dextrose, lactose, sucrose and glucose were tested to know the preferred carbon source by the pathogen. Our findings revealed that maximum growth was seen in sorbitol (85.0 mm), sucrose (85.0 mm) and maltose (85.0 mm) after 192 hours of incubation, these before mentioned served as a carbon source in the experiment separately. The same findings were given by TianShu et al. (2009), Thaware et al. (2010) and Ramjegathesh and Ebenezar (2012). Highest sporulation count was made by us in the carbon source containing maltose, a disaccharide which can readily be broken down into glucose by enzymes like maltase hence producing more and more conidia, which coincided by the findings of TianShu et al. (2009), Thaware et al. (2010), Hariprasad et al. (2018).

1. **CONCLUSION**

Among different solid media used maximum mycelial growth was observed on PDA (89.0 mm) followed by OMA (79.4 mm) after 240 hours of incubation, whereas lowest mycelial growth was observed on water agar (20.0 mm). Sporulation was observed in the same order as above, *i.e.*, PDA followed by OMA and least in WA. On other hand, maximum mycelial growth as observed in different carbon sources were at par in sorbitol (85.0 mm), sucrose (85.0 mm) and maltose (85.0 mm) after 192 hours of incubation. Data regarding highest sporulation count was found in maltose.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declares that no generative AI technologies such as large language models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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**ABBREVIATIONS**

Czapek’s Dox Agar = CDA

Potato dextrose agar = PDA

Richard’s agar = RA

Corn meal agar = CMA

Oat meal agar = OMA

Leaf decoction agar = LDA and

Water agar = WA.