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Conidial morphology of different isolates of *Leveillula taurica* (Lev.) Arn

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Abstract

The conidial morphology of the different isolates of *Leveillula taurica* (Lev.) Arn. collected during survey showed the presence of pyriform conidiospores, cylindrical conidiospores and pyriform + cylindrical conidiospores. The size of pyriform conidiospores was found to be 50.70-80.20 × 12.6-25.10 μm, and that of cylindrical conidiospores was 42.60-62.10 × 9.80-18.60 μm. The conidiophores were hyaline, septate, both branched and unbranched were observed with an average size of 155.4-220.10 × 5.80-8.40 μm.

Keywords: *Leveillula taurica* (Lev.) Arn., conidial morphology, chilli powdery mildew

Introduction

Chilli (*Capsicum annum* L.) is a well-known commercial crop in the centre of the world. Chilli crop is susceptible to various diseases caused by fungus, bacteria, viruses, and nematodes, which lower yields. *Leveillula taurica* (Lev.) Arn. causing powdery mildew of chilli is one of the most dangerous chilli diseases, causing 14 to 30 per cent production losses due to severe defoliation and reduction in photosynthesis, size, and quantity of fruits per plant (Gohokar and Peshney, 1981)^[9]. Powdery mildew of chilli is an endemic disease that has become a severe limitation to chilli output in India (Saroj and Satish, 1985)^[10]. Powdery mildew is difficult to manage after it has affected chilli leaves, and if left untreated, it might completely ruin the crop (Abdel Kader *et al.*, 2012)^[11]. Endoparasitic fungi live in plant leaves, entering through stomata and forming haustoria through which they feed (Clerk and Ayasu-Offei, 1967)^[5]. *L. taurica* conidial germination occurs at temperatures ranging from 10 to 37°C (optimal 20°C) and RH levels of 75 to 85 per cent. The fungus colonized the leaves best around 15 to 25°C (Elad *et al.*, 2007)^[8].

Material and Methods

Disease sample

Chilli leaves showing the typical symptoms of powdery mildew infection were collected from the farmer's fields and brought to the laboratory for further investigations.

Equipment and materials

As per the requirement of the studies standard laboratory equipment *viz.*, petri plates, glass slide, coverslips, needle, staple, polyethene bags, inoculation chamber, autoclave, distilled water, camel hair brush, forceps, gloves, dissection blade, compound microscope etc. were used.

General laboratory procedure

Glassware cleaning and sterilization procedures were carried out as per the standard protocols.

Morphological characterization

For morphological analysis of the anamorph using a compound microscope, powdery mildew infected leaf samples were collected in plastic boxes to not disturb the colonies. The material was observed under a stereo-binocular microscope, and the fungal species associated with powdery mildew infection were identified based on the characteristics of the conidiophores and conidia. Morphological studies of different isolates of *Leveillula taurica* (Lev.) Arn, collected during survey 2020-2021, was done in the laboratory of the Plant Pathology Department, College of Agriculture, Shivamogga.

At first, transparent plastic covers were taken and made some holes for aeration. The infected leaves from the farmer fields were taken into these perforated transparent covers during the survey. Equipment like petri plates, distilled water, cavity slides, camel hair brush, forceps, gloves, and dissection blade were sterilised in the laboratory.

After sterilizing the equipment, the collected samples were taken out, and the white powdery mass with conidial development under the surface of leaves was dislodged gently using camel hairbrush into the petri plates with distilled water under sterile conditions, thus made the conidial solution. Two to three drops from this conidial solution were taken onto the cavity slides and covered with coverslips. These cavity slides containing conidia were observed under a compound microscope with the help of computer software (ImageJ software for Windows) to measure the size, colour, and shape of conidia.

Similarly, the infected leaf tissue samples collected from farmer's fields were dissected using a dissection blade under sterile conditions. The dissected leaf bits were placed on glass slides and then covered with coverslips. Later, these glass slides were observed under the compound microscope with the help of computer software (ImageJ software for Windows) for measuring the length, breadth, septation, branching or unbranching of conidiophores. Microphotographs of the conidia, conidiophores were taken.

Results and Discussion

Mycelium of *Leveillula taurica* (Lev.) Arn. was endophytic, producing dimorphic conidia (pyriform and cylindrical) on long, branched and unbranched conidiophores that emerged via., stomata. Conidia were single-celled at hyaline mycelium of *Leveillula taurica* (Lev.) Arn. that were borne individually (pyriform) or in short chains (cylindrical). The range of the size of pyriform conidiospores was recorded up to 50.70-80.20 ×

12.6-25.10 µm, whereas for cylindrical conidiospores, it was found to be 42.60-62.10 × 9.80-18.60 µm and all the conidiophores were septate.

The isolates collected from different taluks like Bhadravati, Chikmagalur, Honnali, Soraba and Tarikere showed the cylindrical conidiospores. The isolate collected from the Nyamathi taluk showed the pyriform shape of conidia. But the isolates that were collected from Arkalagodu, Belur and Savalanga showed both the pyriform and cylindrical shaped conidiospores as shown in Fig 1.

Among the pyriform conidia observed, the isolate collected from the Nyamathi showed the largest size with 80.20 µm × 25.10 µm. The smallest size of pyriform conidia was observed in the Savalanga isolate with 50.70 µm × 12.60 µm. Similarly, among the different cylindrical

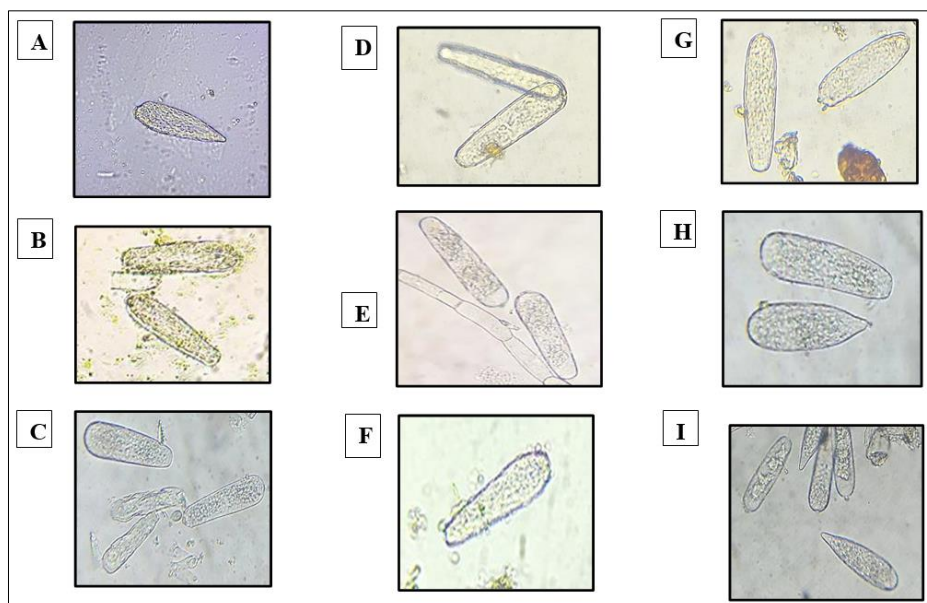
conidiospore isolates observed, the conidia of Honnali isolate showed largest with 62.10 µm × 17.90 µm. and the smallest size was observed in Arakalagodu isolate with 42.60 µm × 12.40 µm.

Similarly, the conidiophores were both branched and unbranched with pyriform as well as cylindrical conidia. The conidiophores were erect, septate and long. The size of the conidiophores observed was 155.4-220.10 µm × 5.80-8.4 µm. Isolates brought from the Nyamathi, Savalanga, Tarikere and Chikmagalur showed branching conidiophores as shown in Fig 2.

Whereas the isolates brought from the Honnali, Soraba, Bhadravati, Belur and Arkalagodu showed an unbranching pattern of the conidiophores. The size of the conidiophores from the Tarikere isolates showed the largest with 220.10 µm × 8.40 µm. followed by Chikmagalur isolate with the size of 211.40 µm × 7.90 µm. At the same time, the smallest size of the conidiophores among the isolates observed was from Arkalagodu with 155.40 µm × 5.80 µm.

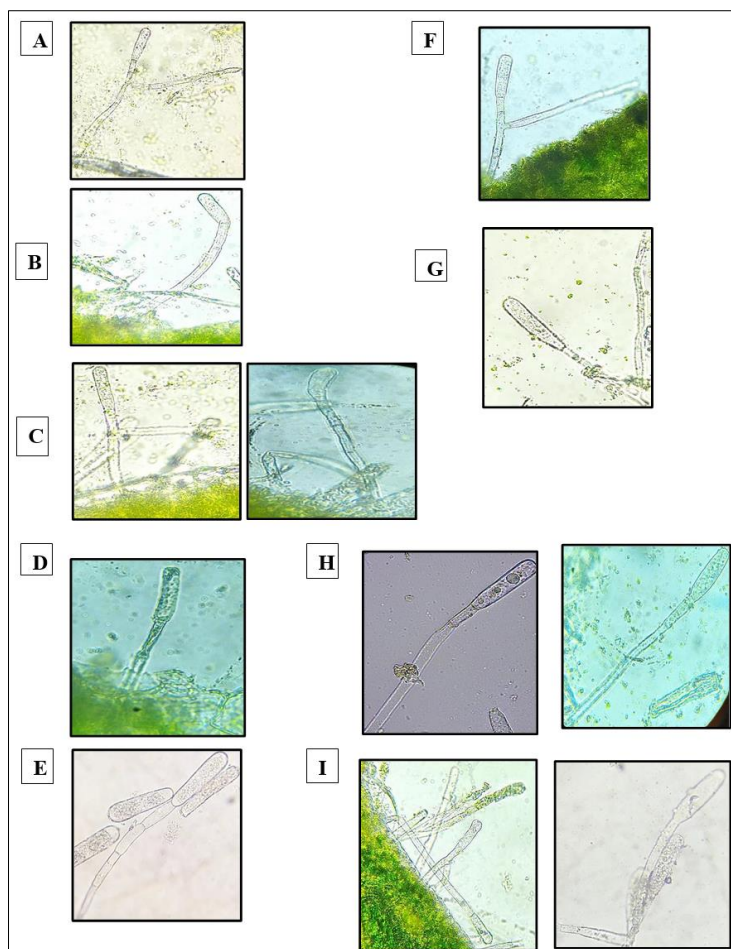
Table 1: Conidial morphology of *Leveillula taurica* (Lev.) Arn. isolates

Sl. No.	Isolate collected from	Conidial morphology		Conidiophore morphology	
		Shape of conidia	Size of conidia (l×b) µm	Branching	Size of conidiophore (l×b) µm
1	Nyamathi	Pyriform	80.20×25.10	Branched	160.40×6.40
2	Honnali	Cylindrical	62.1×17.90	Unbranched	181.20×7.10
3	Savalanga	Pyriform + Cylindrical	(50.70×12.60) + (47.40×15.40)	Branched	173.50×6.80
4	Soraba	Cylindrical	54.50×10.10	Unbranched	201.10×7.60
5	Bhadravati	Cylindrical	49.70×18.60	Unbranched	198.60×6.90
6	Tarikere	Cylindrical	52.30×11.80	Branched	220.10×8.40
7	Chikmagalur	Cylindrical	59.40×16.70	Branched	211.40×7.90
8	Belur	Pyriform + Cylindrical	(75.80×20.10) + (51.40×9.80)	Unbranched	204.40×7.80
9	Arkalagodu	Pyriform + Cylindrical	(69.90×15.20) + (42.60×12.40)	Unbranched	155.40×5.80



A = Nyamathi (Pyriform)
 B = Honnali (Cylindrical)
 C = Savalanga (Pyriform + Cylindrical)
 D = Soraba (Cylindrical)
 E = Bhadravati (Cylindrical)
 F = Tarikere (Cylindrical)
 G = Chikmagalur (Cylindrical)
 H = Belur (Pyriform + Cylindrical)
 I = Arkalagudu (Pyriform + Cylindrical)

Fig 1: Conidial morphology of *Leveillula taurica* (Lev.) Arn. isolates



A = Nyamathi (Branched)
 B = Honnali (Unbranched)
 C = Savalanga (Branched)
 D = Soraba (Unbranched)
 E = Bhadravati (Unbranched)
 F = Tarikere (Branched)
 G = Chikmagalur (Branched)
 H = Belur (Unbranched)
 I = Arkalagudu (Unbranched)

Fig 2: Conidiophore morphology of *Leveillula taurica* (Lev.) Arn. isolates

Conclusion

In the present investigations, microscopic examination of diseased samples collected from different localities in the Southern Transition Zone of Karnataka were found to contain only anamorphs of the pathogen, which have been successfully used for establishing the identity of the causal agent of powdery mildews on chilli.

In the present studies, anamorphic characters such as Mycelium, conidiophore, and conidia of the fungus were found to be extremely similar to *Leveillula taurica* (Lev.) Arn., which was reported by Correll *et al.* (1987)^[6], Cerkauskas *et al.* (1999)^[4], and Damicone (1999)^[7].

As a result, *Leveillula taurica* (Lev.) Arn. was identified as the causative fungus. Conidial dimensions were found to be 50.70-80.20 × 12.6-25.1 µm for pyriform conidiospores, whereas for cylindrical conidiospores it was found to be 42.60-62.10 × 9.80-18.60 µm. as compared to 31.57-66.10 × 15.20-20.96 µm reported by various workers (Boesewinkel, 1980; Bharat, 2013)^[3, 2]. The size of the conidiophores observed was 155.4-220.10 µm × 5.80-8.40 µm. Differences in conidial and conidiophore dimensions as observed in the present studies show the significance and suggest a different race of the pathogen in this area.

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