

Variability in different isolates of *Penicillium italicum* causing blue mould rot in orange (*Citrus reticulata*)

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ABSTRACT

Seven isolates of blue mould fungi (*Penicillium italicum*), causing blue mould rot on orange (*Citrus reticulata* Blanco) isolated from Jobner region exhibited variable growth on artificial culture media (PDA). The PI-1 appeared as dark green centre with white periphery. The other isolates had different colony characters with green to light blue centre surrounded by cottony to profuse colony peripheries. The disease intensities of blue mould isolates were also variable. The PI-1, PI-2 and PI-3 were at par, while maximum intensity (57.76 %) was recorded in PI-1 and minimum (21.12 %) in PI-7.

Key words: Morphological, Pathological, Isolates, Blue mould rot, Cultural variability

Orange (*Citrus reticulata* Blanco) is most common citrus fruit grown in India. In Rajasthan, area under orange is 23,188 ha with a total production on 3,17,679 tonnes and productivity of 13.70 tonnes/ha (2017-18). The major constraint is post-harvest spoilage, caused by green and blue moulds. The *Penicillium digitatum* and *P. italicum* causes 80 per cent losses in mediterranean conditions (Embaby *et al.*, 2013). Primarily consumed as fresh fruits and also processed mainly to prepare squash, juice, marmalade and pickles (Tripathi *et al.*, 2018). An experiment conducted to improve quality and yield of Nagpur mandarin by using foliar application of GA3 with urea to delay the senescence of tissues and maintain their firmness (Kalapatti *et al.*, 2022).

Materials and Methods

Seven locations in Rajasthan, viz. Jaipur, Chaumu, Sikar, Ajmer, Alwar, Jhalawar and Jaipur were surveyed for the fungus. The diseased sample were collected, from markets, the pathogen was isolated, brought to pure cultures and cultural, morphological and pathogenic differences were studied. Small bits of infected rind of orange fruits adjoining with some healthy area were surface sterilized in 1 per cent NaOCl, followed by three washings with sterilized water and transferred

to petridishes at 25+10C in BOD incubator for seven days. The culture was purified by preparing a spore suspension in distilled water with a dilution of 25-30 spores under 10x magnification and transferred to plain agar medium (2.0%).

After 24 hours, germinating spores were located, cut by a dummy objective, transferred to PDA slants and incubated at 25+10C for 6-7 days. Pathogenicity tests were carried out through standard technique. To investigate the cultural and morphological variability, single spore culture of seven isolates (PI-1 to PI-7) were established and maintained on PDA and radial growth of fungal mycelium, colony characters and sporulation. Each treatment was quadruplicated. In order to test the pathogenic variability among isolates, orange fruits were inoculated with seven days old culture of fungus. Severity of fruit rot was recorded with each treatment replicated 4 times, having three orange fruits in each replication.

Results and Discussion

The cultural and morphological characteristics such as colour and appearance of mycelial growth of different isolates of *Penicillium italicum* were recorded by growing them on artificial culture medium. The results clearly reveal that there were marked variations in colony characters and growth rates among seven isolates of fungus measured at seven-day-old inoculation (Table 1) The colony growth rate of these isolates arranged in descending order showed maximum growth in PI-1 (65.60 mm) followed by PI-3 (63.80 mm), PI-4

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(62.60 mm), PI-2 (61.50 mm), PI-5 (59.70 mm), PI-6 (56.50 mm) and PI-7 (55.75 mm). Based on the colony appearance PI-1 characterized as green centre with white periphery whereas PI-2, PI-5 and PI-6 were of green colour without dominant green centre and had white periphery. The PI-3 colony had light green colour, surrounded by a white cottony growth, whereas PI-4 was of green centre with profuse cottony growth and

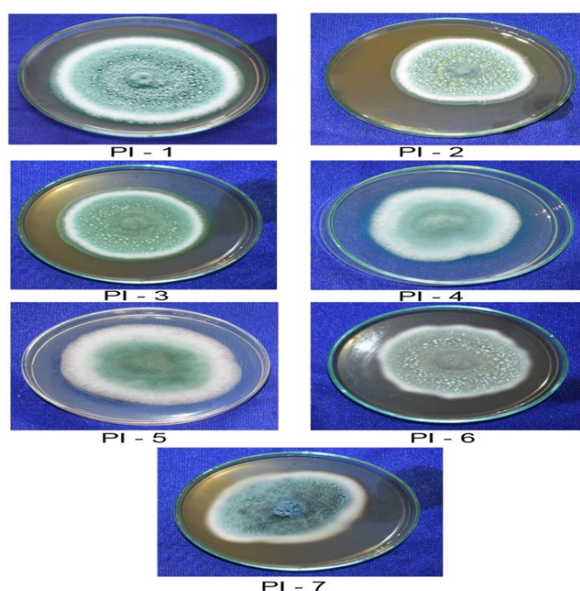


Fig. 1: Cultural and morphological variability in different isolates of *Penicillium italicum*

Table 1: Cultural and morphological variability in different isolates of *Penicillium italicum* at 7th day of incubation

Isolate	Colony characters	Colony diameter (mm)*
PI-1	Green centre with whitish periphery	65.60
PI-2	Medium green and cottony periphery	61.50
PI-3	Light green surrounded by cottony growth	63.80
PI-4	Green centre with profuse cottony growth	62.60
PI-5	Greenish growth with white periphery	59.70
PI-6	Light green with dark centre surrounded by white periphery	56.10
PI-7	Light bluish with cottony periphery	56.75

*Average of four replications

PI-7 was of light bluish colour with cottony periphery (Fig. 1).

Morphological characteristics of *Penicillium italicum* and *P. digitalum* have been described by Subramanian (1971) and Kumari (2005). Our findings of present investigation are in close confirmation of Zhao *et al.* (2016) and Yin *et al.* (2016).

The morphological behavior of different isolates of *Penicillium italicum* has also been reflected in their pathogenic variability on orange fruit. All the seven isolates were tested under favourable conditions of the pathogen. The results showed maximum disease intensity (57.76%) with PI-1 isolate, followed by PI-3 (54.11%), whereas lowest disease intensity (21.12%) was recorded with PI-7. The remaining isolates were intermediate in disease intensity percentage. The PI-1, PI-2 and PI-3 were statistically at par with each other and PI-4 and PI-7 were also statistically similar (Table 1). Different levels of disease incidence have been reported by earlier workers. Disease incidence was reported between 17.6 to 48.6 per cent on wholesale and retail markets of Madhya Pradesh, caused by *Penicillium* of orange fruits, whereas average disease severity 49.63 per cent was recorded under ambient conditions (Alam *et al.* 2016).

Table 2: Pathogenic variability in different isolates of *Penicillium italicum* at 7th day of incubation

Isolate	Intensity
PI-1	57.76 (49.46)
PI-2	44.62 (41.91)
PI-3	54.11 (47.36)
PI-4	53.21 (46.84)
PI-5	43.23 (41.11)
PI-6	37.80 (37.94)
PI-7	21.12 (27.36)
SEm±	1.55
CD (p=0.05)	4.77

Figures in parentheses are angular transformed values

References

- Alam M W, Rehman A, Ali S, Fiaz M, Riaz K. 2016. Assessment of different food additives for postharvest disease control of kinnow mandarin fruit. *Transylvanian Review* **24**(10):1934-51.
- Embaby E S M, Hazaa M, Hagag L F, Ibrahim T E S, Abd el-Azem F S. 2013. Decay of some citrus fruit quality caused by fungi and their control: III- control blue and green mould decay by using some alternative fungicides. *Journal of Applied Sciences Re-search* **9** (8): 5086-96.
- Kaltippi AS, Pandey SK, Huchche AD, Debashish H. 2022. Tree storage of Nagpur Mandarin (*Citrus reticulata*) fruits by managing of incidence of creasing disorder in central India. *Current Horticulture* **10**(2) 27-29.
- Kumari L. 2005. 'Epidemiology and managements of leaf blight of periwinkle (*Catharanthus roseus* L) caused by *Alternaria alternata*' MSc Thesis, Rajasthan Agricultural University, Bikaner.
- MA and FW, New Delhi. 2017-18. Ministry of Agriculture and Farmers Welfare, Government of India.
- Subramanian C V. 1971. Hyphomycetes, an account of Indian species except *Cercospora*. Indian Council of Agricultural Research, New Delhi, pp 930.
- Tripathi P C, Yogeasha H S, Kanupriya, Rajashankar. 2018. Management of genetic resources of perennial horticultural crops: a review. *Current horticulture* **6**(1) 3-14.
- Yin G, Zhang Y, Pennerman K K, Hua S S T, Huang Q, Gua A, Liu Z, Bennett J W 2016. Genome sequencing and analysis of filamentous fungus *Penicillium sclerotiorum* 113, isolated after hurricane Sandy. *Genome Announc.* 4: e01153-16.
- Zhao G, Yin G, Inamda AA, Luo J, Zhang N, Yang I, Buckley, B, Bennet J W. 2016. Volatile organic compounds emitted by filamentous fungi isolated from flooded homes after hurricane Sandy show toxicity in a *Drosophila* bioassay. *Indoor Air*.