

Production of Secondary Metabolites from Two *Penicillium* Strains Adapted to Different Temperature Conditions: A Study on Differential Response of Fungal Strains to Temperature Stress

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Abstract

In the present investigation, temperature dependent production of secondary metabolites of two *Penicillium* strains i.e., cold tolerant *Penicillium oxalicum* originally isolated from a low temperature environment of Leh (Ladakh), India and the other one is mesophilic *Penicillium citrinum* (KR150257) isolated from Lucknow (Uttar Pradesh), India. The psychrotolerant *P. oxalicum* can grow at low temperature (4°C) and shows optimum growth at 15°C, while the mesophilic *P. citrinum* exhibits optimum growth temperature at 35°C. The study of secondary metabolites produced by both *Penicillium* strains, studied by UV-Visible Spectroscopy, GC-MS, confirmed the presence of alkaloids, mycotoxins, antibiotics, hydrocarbons and fatty acids. The maximum production of alkaloids by cold tolerant *Penicillium oxalicum* is detected under temperature stress (35°C). On the other hand, mesophilic *Penicillium citrinum* produced maximum alkaloids with different absorption characteristics at 35°C. The GC-MS analysis of secondary metabolites revealed the presence of number of unique biochemical compounds in both the *P. oxalicum* and *P. citrinum* strains grown under temperature stress conditions (35°C and 4°C, respectively). The common biochemical in the secondary metabolites produced by both the *Penicillium* strains grown under temperature stress condition are 3-dodecene, 2-dodecanol and 1-hexadecanol, eicosane, dibutyl, phthalate, 9-hexacosene, propanoic acid, 2-(aminoxy). The three-unique biochemical produced by *P. oxalicum* grown at low temperature (4°C) are 4(1H) Quinazolinone, 1,4,8-Metheno-1H-cyclopent [f] azulene, 3a, 4, 4a, 7, 7a, 8, 9, 9a-octahydro and 6-Quinazolinol. The five-unique biochemical produced by *P. oxalicum* at high temperature (35°C) are 2-Methyl-2-propylmethylphospho nofuoridate, Pyridine, 2[(1,1dimethylethyl) thio], 4(1H) Pyrimidinone,6-amino-2-methyl-5-nitroso, 4(3H) Quinolinone and Phthalic acid, di(2-propylpentyl). The seven unique biochemical produced by *P. citrinum* at low temperature (4°C) are Cyclohexanone, 4-ethyl-4-methyl-3-(1-methylethyl)-,trans-, 3-Methyl-1,4diazabicyclo[4.3.0]nonan-2,5-dione, N-acetyl, Glycyl-L-proline, Pyrrolo [1,2-a]pyrazine-1,4-dione,hexahydro-3-(2-methylpropyl)-, 2,2-Dimethyl-propyl 2,2-dimethyl-propanesulfonyl sulfone, 11,14-Eicosadienoic acid, methyl ester. The unique derivative of -lactam antibiotic produced by the *P. citrinum* at 35°C is 2,4-Azetidinedione,3,3-diethyl-1-methyl.

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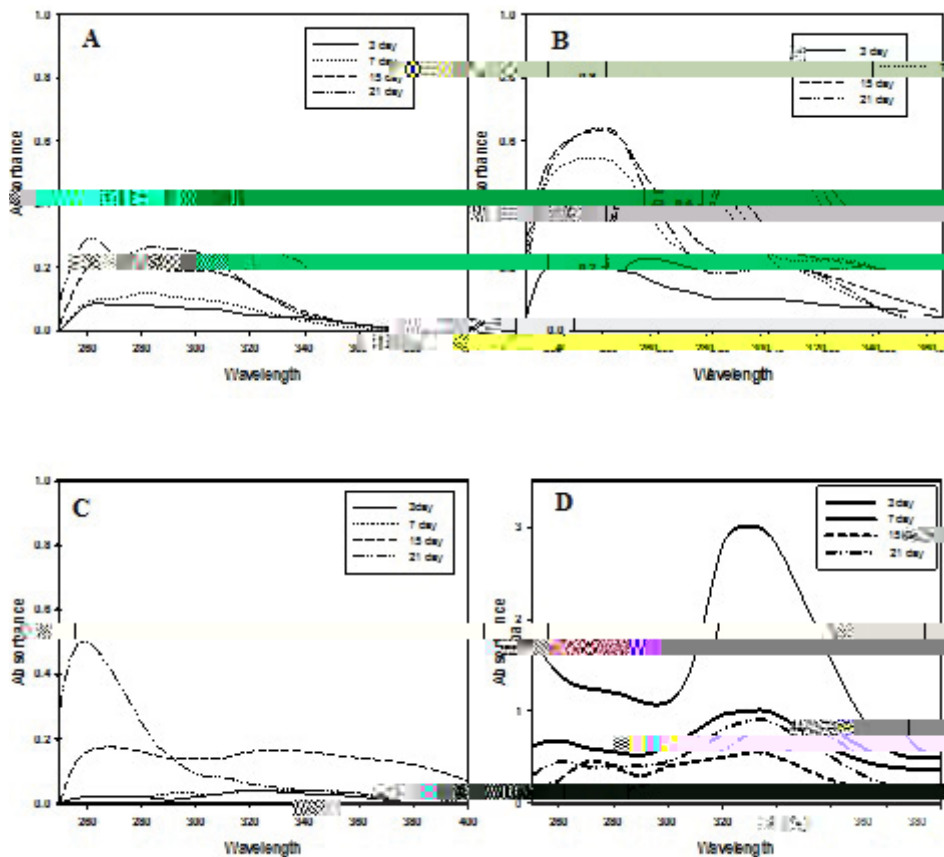


Figure 2: A and B: Absorbance spectra (250-400 nm) of ethyl acetate extract of secondary metabolites produced by *P. oxalicum* grown at temperatures 4°C and 35°C; C and D: Absorbance spectra (250-400 nm) of ethyl acetate extract of secondary metabolites produced by *P. citrinum* grown at temperatures 4°C and 35°C.

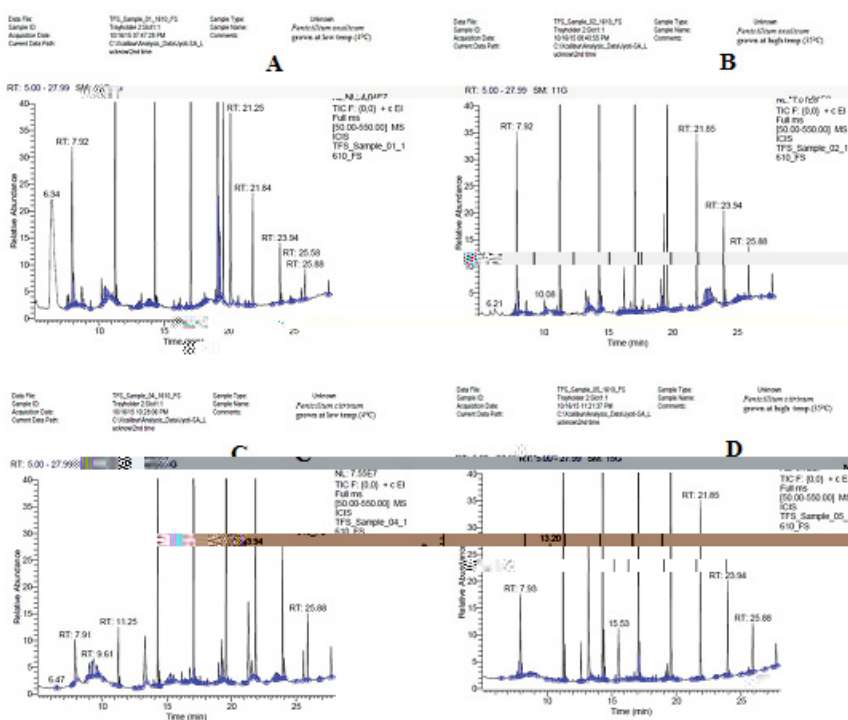


Figure 3: A-D: Chromatogram of GC-MS/MS analysis of ethyl acetate extract of secondary metabolites produced by *P. oxalicum* and *P. citrinum* grown at temperatures 4°C and 35°C respectively.

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