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OXIDATIVE STRESS AND ANTIOXIDANT RESPONSES OF BLOOM-FORMING CYANOBACTERIAL GENUS *Pseudanabaena* IN PRESENCE OF CYANOLYTIC BACTERIUM *Pseudomonas fluorescens* BG-E

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In antagonistic interactions, cyanolytic bacteria may alter the physiology of cyanobacteria leading to cell death. The characterization of physiological alterations in cyanobacteria by the action of cyanolytic bacteria is important in the determination of cyanolytic mechanisms. Therefore, this study aimed to determine the oxidative stress and antioxidant responses generated in *Pseudanabaena* species against the cyanolytic bacteria *Pseudomonas fluorescens* BG-E (NCBI Acc. No. MZ007859) during the cyanolytic process as biomarkers. Based on the results of the preliminary screening study, 15% (v/v) of the total volume of bacterial suspension (6×10^7 cells ml^{-1}) and cell-free supernatant of bacteria were inoculated into axenic cultures of *Pseudanabaena* sp. and *P. lonchoides* grown in BG11 medium at a cell density of 0.020 (OD730) respectively, in triplicates. The H_2O_2 content, peroxidase (POD) activity, and catalase (CAT) activity were analyzed on the date of incubation and following 2, 5, 8, and 10 days of experimental time. Initially, the H_2O_2 contents increased with time and reached the maximum values of 0.1622 and 0.1448 µM g^{-1} f wt in *Pseudanabaena* sp. and *P. lonchoides*, respectively, at the end of the fifth day and decreased thereafter. The CAT and POD activities of both species showed a similar trend as H_2O_2 contents. On the fifth day, the CAT activities of both species were recorded at a similar value, 0.0029 U g^{-1} f wt. Thereafter, in *P. lonchoides*, the CAT activity started to decrease and was even lower than the control on the tenth day. In *Pseudanabaena* sp., it was equal to the control (0.0011 U g^{-1} f wt). The POD activity was highest in *Pseudanabaena* species (0.0081 U g^{-1} f wt) compared with *P. lonchoides* (0.0069 U g^{-1} f wt) on the fifth day. The elevated levels of H_2O_2 contents and CAT and POD activities infer that the cell suspension and cell-free supernatant of *P. fluorescens* BG-E have induced oxidative stress in *Pseudanabaena* sp. and *P. lonchoides*, respectively, and the antioxidant defence mechanisms in the cyanobacterial cells might have been activated to prevent damages as a response. The significant differences ($p < 0.05$) in the antioxidant levels of the two *Pseudanabaena* species could be due to their structural and morphological differences. The overall results infer the applicability of oxidative stress and antioxidant responses in cyanobateria as physiological biomarkers in the determination of cyanolytic mechanisms.

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Keywords: Cyanolytic bacteria, Catalase activity, H_2O_2 content, Peroxidase activity