

Abstract

Duckweed is an aquatic plant with significant potential for use in sustainable agricultural systems as a phytoremediation agent and a source of high-protein biomass for animal feed. Optimizing duckweed growth is therefore essential to improve its utilization efficiency. One promising approach is the application of Plant Growth-Promoting Bacteria (PGPB) naturally present in paddy soils. This study aimed to evaluate the effects of paddy soil bacterial inoculation on the growth performance of three duckweed species, including *Lemna perpusilla*, *Spirodela polyrhiza*, and *Spirodela punctata*. Paddy soil samples were collected from Imogiri, Bantul, Yogyakarta, Indonesia, followed by incubation and bacterial isolation using the pour plate method on soil extract agar medium. The obtained bacterial isolates were characterized through a pathogenicity test on tobacco plants, and non-pathogenic isolates were directly inoculated onto duckweed cultures. The experiment was conducted for 14 days at 25°C under a light intensity of 5,000 lux with a photoperiod of 16 h light and 8 h dark. Growth parameters, including daily frond number, root length, and dry weight, were measured and analysed using one-way ANOVA with RStudio software. In addition, bacterial isolates were evaluated for plant growth-promoting traits and identified molecularly to determine their phylogenetic affiliation. The results revealed that two non-pathogenic isolates, A4 (*Priestia megaterium*) and A5 (*Bacillus altitudinis*), exhibited nitrogen-fixing capability and *indole-3-acetic acid* (IAA) production. Inoculation with these isolates significantly increased frond number, root length, and dry weight of duckweed compared to the control. The highest Effect on Plant Growth (EPG) values reached 74.4% and 196.8% for isolate A4 and 64.1% and 196.9% for isolate A5. Overall, these findings demonstrate that paddy soil bacteria possess strong potential as effective biological agents to enhance duckweed growth in sustainable agricultural applications.

Keywords: Duckweed, paddy soil bacteria, plant growth promoting bacteria (PGPB).

Duckweed merupakan tanaman air yang berpotensi dimanfaatkan dalam sistem pertanian berkelanjutan sebagai agen fitoremediasi, sekaligus menjadi sumber pakan ternak berprotein tinggi. Optimalisasi pertumbuhan *duckweed* menjadi aspek penting untuk meningkatkan efisiensi pemanfaatannya. Salah satu strategi yang dapat diterapkan adalah pemanfaatan *Plant Growth Promoting Bacteria* (PGPB) yang secara alami terdapat pada tanah sawah. Penelitian ini bertujuan untuk mengetahui pengaruh inokulasi bakteri tanah sawah terhadap pertumbuhan 3 spesies *duckweed* yaitu (*Lemna perpusilla*, *Spirodela polyrhiza*, dan *Spirodela punctata*). Sampel tanah sawah diambil dari Imogiri, Bantul, Yogyakarta, kemudian isolasi bakteri dengan metode *pour plating* pada media *soil extract agar*. Isolat bakteri yang diperoleh diseleksi melalui uji patogenitas pada tanaman tembakau dan isolat non-patogen diinokulasikan pada *duckweed*. Inkubasi dilakukan selama 14 hari pada suhu 25°C dengan intensitas cahaya 5.000 lux serta fotoperiode 16 jam terang dan 8 jam gelap. Parameter pertumbuhan meliputi jumlah *frond* harian, panjang akar, dan berat kering, kemudian dianalisis menggunakan uji ANOVA dengan perangkat lunak RStudio. Selain itu, isolat bakteri dikarakterisasi berdasarkan kemampuan pemacu pertumbuhan dan diidentifikasi spesiesnya secara molekuler. Hasil penelitian menunjukkan bahwa 2 isolat non-patogen, yaitu A4 (*Priestia megaterium*) dan A5 (*Bacillus altitudinis*) memiliki kemampuan fiksasi nitrogen dan produksi hormon *indole acetic acid*. Kedua isolat tersebut secara signifikan meningkatkan jumlah *frond*, panjang akar, dan berat kering *duckweed* dibandingkan dengan kontrol. Nilai *Effect on Plant Growth* (EPG) tertinggi masing-masing mencapai 74,4% dan 196,8% untuk isolat A4 serta 64,1% dan 196,9% untuk isolat A5. Dengan demikian, kedua isolat bakteri tanah sawah tersebut berpotensi sebagai agen hayati yang menstimulasi pertumbuhan *duckweed* yang efektif.

Kata kunci: Bakteri tanah sawah, *duckweed*, *plant growth promoting bacteria* (PGPB).