

RINGKASAN

PGPR (*Plant Growth Promoting Rhizobacteria*) merupakan bakteri tanah pada daerah perakaran tanaman (rizosfer) yang menyediakan unsur hara untuk pertumbuhan, perkembangan, dan perlindungan tanaman. Beberapa kemampuan PGPR, yaitu melarutkan fosfat, mengikat nitrogen atmosfer, menghasilkan enzim protease, serta menghasilkan hormon *Indole-3aceticAcid* (IAA). Jumlah dan jenis mikroorganisme dalam tanah dapat menunjukkan kesuburan tanah, yang dipengaruhi oleh ketersediaan bahan organik, suhu, ketersediaan air, dan kondisi ekologi yang mendukung. Namun, mikroorganisme tanah sangat sensitif terhadap perubahan akibat pemanfaatan lahan untuk pertanian, seperti penggunaan pupuk, pestisida, dan pengolahan tanah. Penelitian ini bertujuan untuk 1) Mengetahui perbedaan populasi PGPR tanaman kopi budidaya organik dan konvensional, 2) Mengetahui keanekaragaman bakteri rizosfer pada lahan sistem budidaya organik dan konvensional, 3) Mengetahui potensi PGPR isolat bakteri pada lahan tanaman kopi budidaya organik dan konvensional.

Penelitian ini dilakukan di Unit Mikrobiologi Laboratorium Agroekologi, Fakultas Pertanian, Universitas Jenderal Soedirman, Purwokerto. Sampel tanah diambil dari perakaran kopi pada dua Lokasi yaitu lahan pertanian organik Desa Pesangkalan, Kecamatan Pagedongan, Kabupaten Banjarnegara dan lahan pertanian konvensional Desa Pengadegan, Kecamatan Wangon, Kabupaten Banyumas. Penelitian ini dilaksanakan pada bulan Juni-Oktober 2024, Pengambilan sampel tanah dilakukan secara komposit dengan teknik pengambilan secara diagonal. Sampel tanah yang diperoleh kemudian dilakukan isolasi bakteri. Isolat yang telah diperoleh selanjutnya dilakukan karakterisasi morfologi dan uji potensi PGPR.

Hasil penelitian menunjukkan bahwa populasi bakteri rizosfer yang berasal dari lahan pertanian organik lebih tinggi, yaitu $6,8 \times 10^9$ cfu/gram, sedangkan lahan konvensional $4,35 \times 10^9$ cfu/gram. Terdapat 18 koloni bakteri dengan karakter morfologi berbeda, 11 koloni dari sistem budidaya lahan organik dan 7 koloni dari sistem budidaya lahan konvensional. Setiap koloni bakteri memiliki morfologi yang berbeda baik bentuk, ukuran, elevasi, tepi, dan warna. Masing-masing lokasi memiliki 8 bakteri Gram positif dan 2 Gram negatif dengan bentuk sel basil dan kokus. Hasil uji potensi PGPR pada 5 isolat dominan dari masing-masing sampel menunjukkan bahwa beberapa isolat memiliki kemampuan menambat nitrogen di atmosfer, pelarut fosfat, menghasilkan hormon IAA, dan menghasilkan enzim protease. Pada penelitian ini, bakteri yang ditemukan pada tanaman kopi di lahan organik dan konvensional menunjukkan keberagaman serta memiliki potensi sebagai agen pemacu pertumbuhan tanaman (PGPR).

SUMMARY

PGPR (Plant Growth Promoting Rhizobacteria) are soil bacteria found in the rhizosphere (root zone) that provide nutrients to support plant growth, development, and protection. Some of the abilities of PGPR include dissolving phosphate, fixing atmospheric nitrogen, producing protease enzymes, and synthesizing the hormone Indole-3acetic Acid (IAA). The number and types of microorganisms in the soil can indicate soil fertility, which is influenced by the availability of organic matter, temperature, water availability, and supportive ecological conditions. However, soil microorganisms are highly sensitive to changes caused by agricultural activities, such as the use of fertilizers, pesticides, and soil tillage. This study aims to: 1) Identify differences in PGPR populations in coffee plants cultivated under organic and conventional systems. 2) Determine the diversity of rhizosphere bacteria in organic and conventional farming systems. 3) Assess the PGPR potential of bacterial isolates from organic and conventional coffee cultivation systems.

The study was conducted in the Microbiology Unit of the Agroecology Laboratory, Faculty of Agriculture, Universitas Jenderal Soedirman, Purwokerto. Soil samples were collected from coffee plant rhizospheres at two locations: organic farming fields in Pesangkalan Village, Pagedongan Subdistrict, Banjarnegara District, and conventional farming fields in Pengadegan Village, Wangon Subdistrict, Banyumas District. The study took place from June to October 2024. Soil sampling was conducted using a composite sampling method with a diagonal technique. The collected soil samples were used for bacterial isolation. The obtained isolates were then subjected to morphological characterization and PGPR potential testing.

The results showed that the rhizosphere bacterial population in organic farming fields was higher, at $4,35 \times 10^9$ cfu/g, compared to conventional fields with $6,8 \times 10^9$ cfu/g. A total of 18 bacterial colonies with distinct morphological characteristics were identified: 11 colonies from organic fields and 7 colonies from conventional fields. Each bacterial colony exhibited different morphological traits, including shape, size, elevation, edge, and color. Both locations contained 8 gram-positive and 2 gram-negative bacteria with bacillus and coccus cell shapes. PGPR potential tests on 5 dominant isolates from each sample revealed that some isolates were capable of nitrogen fixation, phosphate solubilization, IAA production, and protease enzyme production. The conclusion of this study is that the bacteria found in coffee plants from organic and conventional fields exhibit diversity and have potential as plant growth-promoting rhizobacteria (PGPR).