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Histokimia dan Potensi Minyak Atsiri Daun Beluntas (Pluchea indica (L.) Less) dari Lingkungan Berbeda sebagai Aantibakteri Ralstonia solanacearum
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HISTOKIMIA DAN POTENSI MINYAK ATSIRI DAUN BELUNTAS (*Pluchea indica* (L.) Less) DARI LINGKUNGAN BERBEDA SEBAGAI ANTIBAKTERI *Ralstonia solanacearum*

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INTISARI

Minyak atsiri merupakan metabolit sekunder tumbuhan yang tersusun atas senyawa volatil dan diketahui memiliki berbagai aktivitas biologis, termasuk sebagai antibakteri. Aktivitas tersebut berkaitan dengan kandungan senyawa terpenoid yang umumnya disintesis dan disimpan pada struktur sekretori, terutama trikoma glandular. Daun beluntas (*Pluchea indica* (L.) Less.) merupakan salah satu sumber minyak atsiri, namun pengaruh perbedaan lingkungan tumbuh terhadap karakteristik minyak atsiri masih belum banyak dilaporkan. Penelitian ini bertujuan mengkaji distribusi terpenoid, komposisi senyawa minyak atsiri, dan aktivitas antibakteri minyak atsiri daun *Pluchea indica* yang tumbuh pada tanah berpasir di Ngaglik dan tanah berkapur di Gunungkidul. Distribusi terpenoid diamati menggunakan metode histokimia, karakteristik tanah dianalisis secara fisik dan kimia, minyak atsiri diperoleh melalui distilasi uap, komposisi senyawa minyak atsiri dianalisis menggunakan *Gas Chromatography–Mass Spectrometry* (GC–MS), sedangkan aktivitas antibakteri terhadap *Ralstonia solanacearum* diuji menggunakan metode difusi cakram, *Minimum Inhibitory Concentration* (MIC), dan *Minimum Bactericidal Concentration* (MBC). Hasil penelitian menunjukkan bahwa tanah Ngaglik memiliki pH lebih rendah dan fosfor tersedia lebih tinggi, sedangkan tanah Gunungkidul memiliki pH dan nitrogen total lebih tinggi. Rendemen minyak atsiri sebesar 0,0597%. Terpenoid terakumulasi pada epidermis atas dan bawah, kolenkim, floem, serta trikoma glandular. Minyak atsiri didominasi *β-caryophyllene*, *caryophyllene oxide*, dan *δ-cadinene* dengan proporsi yang berbeda antar lokasi. Sampel Gunungkidul menunjukkan aktivitas antibakteri lebih tinggi dengan zona hambat 14,50 ± 0,50 mm, MIC 0,313%, dan MBC 2,5%, sedangkan Ngaglik menghasilkan zona hambat 10,83 ± 0,29 mm, MIC 0,625%, dan MBC 5%. Perbedaan karakteristik tanah menghasilkan perbedaan komposisi minyak atsiri dan aktivitas antibakteri daun *Pluchea indica* terhadap *Ralstonia solanacearum*.

Kata kunci: GC-MS, histokimia, minyak atsiri, *Pluchea indica*, *Ralstonia solanacearum*,

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Histochemistry and Antibacterial Potential of Beluntas (*Pluchea indica* (L.) Less) Essential Oils from Different Environments Against *Ralstonia solanacearum*

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ABSTRACT

Essential oils are plant secondary metabolites composed of volatile compounds and are known to possess various biological activities, including antibacterial properties. These activities are associated with terpenoid compounds, which are generally synthesized and stored in secretory structures, particularly glandular trichomes. Beluntas (*Pluchea indica* (L.) Less.) leaves are one of the sources of essential oils; however, the influence of different growing environments on the characteristics of their essential oils has been scarcely reported. This study aimed to investigate the distribution of terpenoids, the chemical composition of essential oils, and the antibacterial activity of essential oils extracted from *Pluchea indica* leaves growing on sandy soil in Ngaglik and calcareous soil in Gunungkidul. Terpenoid distribution was examined using histochemical analysis, soil characteristics were analyzed based on their physical and chemical properties, essential oils were extracted by steam distillation, and their chemical composition was determined using Gas Chromatography–Mass Spectrometry (GC–MS). Antibacterial activity against *Ralstonia solanacearum* was evaluated using the disk diffusion method, Minimum Inhibitory Concentration (MIC), and Minimum Bactericidal Concentration (MBC) assays. The results showed that the Ngaglik soil had a lower pH and higher available phosphorus content, whereas the Gunungkidul soil had a higher pH and total nitrogen content. The essential oil yield was 0.0597%. Terpenoids accumulated in the upper and lower epidermis, collenchyma, phloem, and glandular trichomes. The essential oils were dominated by β-caryophyllene, caryophyllene oxide, and δ-cadinene, although their proportions differed between the two locations. The Gunungkidul sample exhibited higher antibacterial activity, with an inhibition zone of 14.50 ± 0.50 mm, an MIC of 0.313%, and an MBC of 2.5%, whereas the Ngaglik sample showed an inhibition zone of 10.83 ± 0.29 mm, an MIC of 0.625%, and an MBC of 5%. Differences in soil characteristics resulted in differences in the essential oil composition and antibacterial activity of *Pluchea indica* leaves against *Ralstonia solanacearum*.

Keywords: histochemistry, GC–MS, minyak atsiri, *Ralstonia solanacearum*, *Pluchea indica*