Karakter Morfologis, Anatomis, dan Kandungan Metabolit Sekunder Tapak Dara (Catharanthus roseus (L.)
G. Don) dengan Perlakuan Media Tanam Pasir Pantai
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KARAKTER MORFOLOGIS, ANATOMIS, DAN KANDUNGAN METABOLIT SEKUNDER TAPAK DARA (*Catharanthus roseus* (L.) G. Don) DENGAN PERLAKUAN MEDIA TANAM PASIR PANTAI

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INTISARI

Tanaman tapak dara (*Catharanthus roseus* (L.) G. Don) mengandung metabolit sekunder bioaktif berupa alkaloid indol monoterpen, seperti vinkristin dan vinblastin, yang telah banyak dimanfaatkan sebagai agen kemoterapi dalam pengobatan kanker. Selain pemanfaatannya di bidang kesehatan, tanaman ini juga berpotensi dikembangkan di bidang pertanian karena berbagai aktivitas biologis metabolit sekundernya. Pemanfaatan tapak dara telah dikembangkan melalui berbagai penelitian, salah satunya menghasilkan formulasi serbuk tapak dara yang telah memperoleh paten (IDP00038766). Komersialisasi produk tersebut saat ini masih menghadapi kendala berupa ketidakstabilan kandungan senyawa bioaktif pada bahan baku tanaman. Biosintesis dan akumulasi metabolit sekunder dipengaruhi oleh berbagai faktor lingkungan, seperti salinitas, intensitas cahaya, suhu, dan ketersediaan air. Kondisi tersebut dapat memicu respons adaptasi morfologis, anatomis, dan metabolik tanaman. Penelitian ini bertujuan mengembangkan sistem budidaya tapak dara skala pilot serta mengkarakterisasi morfologis, anatomis, dan metabolit sekunder tanaman sebagai bahan baku Bio-Catharantin. Penanaman dilakukan di *greenhouse* menggunakan lima komposisi media tanam dengan dan tanpa pasir pantai, yaitu M1 (pasir pantai 100%), M2 (tanah sawah 100%), M3 (pasir pantai 70% : tanah sawah 30%), M4 (pasir pantai 50% : tanah sawah 50%), dan M5 (pasir pantai 30% : tanah sawah 70%). Analisis morfologi dilakukan secara makroskopis dan kuantitatif, anatomi secara kuantitatif dan deskriptif kualitatif, sedangkan distribusi metabolit sekunder dianalisis melalui uji histokimia dan kandungan metabolit sekunder dianalisis secara *profiling*. Hasil penelitian menunjukkan bahwa media M1 menghasilkan pertumbuhan tapak dara ciri terbaik, serta meningkatkan perkembangan jaringan pengangkut pada akar dan batang serta ketebalan kutikula daun. Uji histokimia menunjukkan bahwa M3 meningkatkan akumulasi alkaloid, sedangkan M5 meningkatkan akumulasi terpenoid. Analisis *profiling* kandungan metabolit sekunder menunjukkan bahwa M1 meningkatkan kelimpahan vindolin, vinkristin, dan vinblastin, sementara M3 meningkatkan kelimpahan ajmalisin.

Kata Kunci: anatomis, metabolit sekunder, morfologis, pasir pantai, tapak dara

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MORPHOLOGICAL, ANATOMICAL, AND SECONDARY METABOLITE CHARACTERISTICS OF *Catharanthus roseus* (L.) G. DON UNDER COASTAL SAND GROWING MEDIA TREATMENT

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ABSTRACT

Catharanthus roseus (L.) G. Don contains bioactive secondary metabolites, including the monoterpene indole alkaloids vincristine and vinblastine, which are widely used in cancer chemotherapy. In addition to its pharmaceutical applications, *C. roseus* has attracted considerable interest for its potential use in agriculture owing to the biological activities of its secondary metabolites. The utilization of this species has also led to the development of various products, including a powdered formulation of *C. roseus*, which has been patented by the Directorate General of Intellectual Property, Ministry of Law and Human Rights of the Republic of Indonesia (Patent No. IDP00038766). The commercialization of this product remains challenging because the concentration of bioactive compounds in the plant raw material is often variable. The biosynthesis and accumulation of secondary metabolites are strongly influenced by environmental factors, such as salinity, light intensity, temperature, and water availability. These conditions can trigger morphological, anatomical, and metabolic adaptive responses in the plant. This study aimed to develop a pilot-scale cultivation system for tapak dara and to characterize the growth, morphology, anatomy, and secondary metabolite of the plant as a raw material for Bio-Catharantine. Planting was conducted in a greenhouse using five growing media compositions with and without coastal sand: M1 (100% coastal sand), M2 (100% paddy soil), M3 (70% coastal sand : 30% paddy soil), M4 (50% coastal sand : 50% paddy soil), and M5 (30% coastal sand : 70% paddy soil). Morphological analysis was performed macroscopically and quantitatively, anatomical analysis was conducted quantitative and qualitative descriptive, the distribution of secondary metabolites was analyzed through histochemical testing, and the secondary metabolite content was analyzed by metabolite profiling. The results showed that the medium M1 produced the best growth of tapak dara, as well as enhancing the development of vascular tissue in the roots and stems and the thickness of the leaf cuticle. Histochemical tests indicated that M3 increased alkaloid accumulation, while M5 increased terpenoid accumulation. Analysis of secondary metabolite profiling showed that M1 increased the abundance of vindoline, vincristine, and vinblastine, while M3 increased the abundance of ajmalicine.

Keywords: anatomy, *C. roseus*. coastal sand, morphology, secondary metabolites