

## ABSTRAK

### **SINTESIS KOMPOSIT ZnO–EKSTRAK DAUN BINTARO (*Cerbera odollam*) DAN UJI ANTIMAKAN TERHADAP ULAT GRAYAK (*Spodoptera frugiperda*)**

Daun bintaro (*Cerbera odollam*) mengandung berbagai metabolit sekunder seperti alkaloid, flavonoid, saponin, tanin, dan steroid/terpenoid yang diketahui memiliki aktivitas sebagai agen antimakan dan toksik terhadap hama. Namun, efektivitas senyawa tersebut dapat menurun akibat paparan lingkungan terbuka seperti sinar UV dan suhu tinggi. Penelitian ini bertujuan untuk mengidentifikasi kandungan metabolit sekunder dalam ekstrak daun bintaro menggunakan pelarut n-heksana (EH), etil asetat (EEA), dan metanol (EM); menganalisis morfologi serta ukuran partikel komposit ZnO–ekstrak daun bintaro; serta mengevaluasi aktivitas antimakan terhadap ulat grayak (*Spodoptera frugiperda*). Ekstraksi dilakukan dengan metode maserasi bertingkat, dan sintesis komposit ZnO menggunakan metode sonikasi-dispersif berbasis pelarut dengan ZnO pro analisis. Pengujian aktivitas antimakan dilakukan menggunakan metode residu pada daun pakcoy selama tujuh hari, disertai evaluasi toksisitas melalui pengukuran mortalitas dan nilai  $LT_{50}/LT_{95}$ . Uji fitokimia menunjukkan bahwa EH mengandung alkaloid dan steroid/terpenoid; EEA mengandung alkaloid, flavonoid, tanin, dan steroid/terpenoid; serta EM mengandung alkaloid, flavonoid, saponin, dan tanin. Karakterisasi SEM menunjukkan bahwa morfologi partikel bervariasi tergantung pelarut: Z–EH tidak beraturan ( $0,23\ \mu\text{m}$ ), Z–EEA kasar ( $X_c\ 0,077\ \mu\text{m}$ ), dan Z–EM halus-homogen ( $X_c\ 0,078\ \mu\text{m}$ ). Persentase penghambatan makan sebesar 86,152% (EH), 91,145% (EEA), 83,570% (EM), 79,680% (Z–EH), 97,246% (Z–EEA), dan 88,637% (Z–EM); dengan mortalitas berturut-turut 86,7%, 96,7%, 86,7%, 90,0%, 96,7%, dan 93,3%. Nilai  $LT_{50}$  dan  $LT_{95}$  masing-masing: 0,797 dan 19,089 hari (EH), 2,813 dan 9,826 hari (EEA), 2,945 dan 9,317 hari (EM), 3,897 dan 10,033 hari (Z–EH), 3,702 dan 7,469 hari (Z–EEA), serta 4,081 dan 7,195 hari (Z–EM). Komposit ZnO–etil asetat (Z–EEA) merupakan formulasi paling efektif untuk menurunkan aktivitas makan, serta menunjukkan toksisitas tinggi terhadap ulat grayak.

Kata-kata kunci: daun bintaro; komposit ZnO; metabolit sekunder; penurunan aktivitas makan; ulat grayak.

## ABSTRACT

### **SYNTHESIS OF ZNO–BINTARO LEAF (*Cerbera odollam*) EXTRACT COMPOSITE AND ANTIFEEDANT ASSAY AGAINST FALL ARMYWORM (*Spodoptera frugiperda*)**

Bintaro leaves (*Cerbera odollam*) contain various secondary metabolites such as alkaloids, flavonoids, saponins, tannins, and steroids/terpenoids, which are known to possess antifeedant and toxic activities against pests. However, the effectiveness of these compounds may decline due to exposure to environmental factors such as UV radiation and high temperatures. This study aimed to identify the secondary metabolite contents in bintaro leaf extracts using n-hexane (EH), ethyl acetate (EEA), and methanol (EM) as solvents; to analyze the morphology and particle size of ZnO–bintaro leaf extract composites; and to evaluate their antifeedant activity against fall armyworm (*Spodoptera frugiperda*). Extraction was performed using a successive maceration method, while the ZnO composites were synthesized through a solvent-based sonication-dispersive technique using analytical-grade ZnO. Antifeedant activity was assessed via leaf residue method on pakcoy leaves for seven days, along with toxicity evaluation through mortality rates and  $LT_{50}/LT_{95}$  values. Phytochemical screening revealed that EH contained alkaloids and steroids/terpenoids; EEA contained alkaloids, flavonoids, tannins, and steroids/terpenoids; and EM contained alkaloids, flavonoids, saponins, and tannins. SEM characterization showed that particle morphology varied by solvent: Z–EH was irregular (0.23  $\mu\text{m}$ ), Z–EEA was coarse (Xc 0.077  $\mu\text{m}$ ), and Z–EM was smooth-homogeneous (Xc 0.078  $\mu\text{m}$ ). Feeding inhibition percentages were 86.152% (EH), 91.145% (EEA), 83.570% (EM), 79.680% (Z–EH), 97.246% (Z–EEA), and 88.637% (Z–EM), with respective mortality rates of 86.7%, 96.7%, 86.7%, 90.0%, 96.7%, and 93.3%. The  $LT_{50}$  and  $LT_{95}$  values were 0.797 and 19.089 days (EH), 2.813 and 9.826 days (EEA), 2.945 and 9.317 days (EM), 3.897 and 10.033 days (Z–EH), 3.702 and 7.469 days (Z–EEA), and 4.081 and 7.195 days (Z–EM), respectively. The ZnO–ethyl acetate composite (Z–EEA) was the most effective formulation in reducing feeding activity and exhibited high toxicity against *S. frugiperda* larvae.

**Keywords:** *Cerbera odollam*; ZnO composite; secondary metabolites; feeding inhibition; fall armyworm.