

INTISARI

Asam galat pada kosmos kuning (*Cosmos sulphureus* Cav.) berpotensi sebagai sumber bioherbisida. Upaya peningkatan kandungan asam galat kosmos kuning telah dilakukan dengan penyisipan gen *SoSPS1* (Sucrose Phosphate Synthase dari cDNA tebu) secara *floral dip* menggunakan kuncup bunga ukuran 5-7 mm yang dicelupkan pada larutan berisi *Agrobacterium tumefaciens* strain GV3101 membawa plasmid pRI101AN *SoSPS1* dan gen penanda seleksi *nptII*. Penelitian ini bertujuan untuk: (1) mengevaluasi konsistensi perubahan karakter morfologi, biokimia, fisiologi, dan molekuler pada tanaman kosmos kuning transforman generasi T0 dan T1; (2) menentukan peningkatan kandungan asam galat akibat penyisipan gen *SoSPS1*; (3) menentukan pola pewarisan gen *SoSPS1* generasi T1; serta (4) mendapatkan tingkat toksisitas ekstrak bunga kosmos kuning transforman terhadap pertumbuhan gulma teki (*Cyperus rotundus*). Karakterisasi dilakukan pada generasi T0 hingga T1 melalui analisis morfologi, biokimia, fisiologi, dan molekuler. Deteksi keberadaan gen *SoSPS1* dan *nptII* dilakukan menggunakan PCR dengan primer spesifik, yaitu CaMV-35S (*Forward*) dan SPS P9 (*Reverse*) untuk *SoSPS1* dan *nptII-F* dan *nptII-R* untuk *nptII*. Pola pewarisan berdasarkan deteksi keberadaan sisipan gen dievaluasi menggunakan uji *chi-square*. Uji toksisitas dilakukan dengan aplikasi ekstrak bunga kosmos kuning transforman konsentrasi 10%, 20%, dan 40% (w/v) serta larutan kontrol berupa akuades dan asam galat sintesis 100 ppm pada umbi gulma teki. Hasil menunjukkan bahwa perubahan karakter morfologi, biokimia, dan fisiologi tanaman kosmos kuning sebagai akibat penyisipan gen *SoSPS1* bersifat konsisten pada generasi T0 hingga T1. Akumulasi asam galat pada bunga kosmos kuning transforman meningkat sebesar 65,07% (T0) hingga 81,28% (T1) dibandingkan tanaman tipe liar. Pola segregasi menunjukkan kesesuaian rasio 1:3 untuk gen *SoSPS1* dan 1:1 untuk gen *nptII*. Uji toksisitas menunjukkan bahwa ekstrak bunga kosmos kuning transforman konsentrasi 10% (w/v) telah efektif menghambat pertumbuhan gulma teki setara dengan efek ekstrak bunga kosmos kuning tipe liar pada konsentrasi 40% (w/v).

Kata kunci: *Cosmos sulphureus*; overekspresi; *SoSPS1*; pola pewarisan; asam galat; bioherbisida.

Abstract

Gallic acid in yellow cosmos (*Cosmos sulphureus* Cav.) is a promising candidate for development as a natural bioherbicide. To enhance its gallic acid content, the *SoSPS1* gene (Sucrose Phosphate Synthase from sugarcane cDNA) was introduced using the floral dip method, in which 5–7 mm flower buds were immersed in a solution containing *Agrobacterium tumefaciens* strain GV3101 carrying the pRI101AN-*SoSPS1* plasmid and the *nptII* selection marker. This study aimed to: (1) evaluate the consistency of morphological, biochemical, physiological, and molecular changes across T0 and T1 transformant generations; (2) quantify the increase in gallic acid content resulting from *SoSPS1* insertion; (3) determine the inheritance pattern of the *SoSPS1* gene in the T1 generation; and (4) assess the toxicity of transformant flower extracts on the growth of nutsedge (*Cyperus rotundus*). Characterization of T0 and T1 plants included morphological observations, biochemical and physiological measurements, and molecular analyses. The presence of *SoSPS1* and *nptII* was confirmed by PCR using specific primer pairs: CaMV-35S (Forward) and SPS P9 (Reverse) for *SoSPS1*, and *nptII*-F/R for *nptII*. Gene inheritance patterns were evaluated using chi-square analysis. Toxicity assays were performed by applying 10%, 20%, and 40% (w/v) flower extract concentrations from transformant plants to nutsedge rhizomes, with distilled water and 100 ppm synthetic gallic acid as controls. The results showed that the morphological, biochemical, and physiological changes associated with *SoSPS1* insertion were stable across both generations. Gallic acid levels in transformant flowers increased by 65.07% in T0 and 81.28% in T1 compared with wild-type plants. Segregation analysis indicated a 1:3 ratio for *SoSPS1* and a 1:1 ratio for *nptII*. Toxicity tests revealed that a 10% (w/v) concentration of transformant flower extract effectively inhibited nutsedge growth, producing an inhibitory effect comparable to that of a 40% (w/v) extract from wild-type plants.

Keywords: *Cosmos sulphureus*; overexpression; *SoSPS1*; inheritance pattern; gallic acid; bioherbicide.