

## Analisis Genetik dan Fenotipik hasil penyisipan acak pada populasi T3 Kosmos Kuning (*Cosmos sulphureus* Cav.)

### Abstrak

Stabilitas genetik memainkan peran penting dalam keberhasilan transformasi genetik pada tanaman. Transgen umumnya akan diwariskan sesuai dengan hukum Mendel. *nptII* adalah gen penanda selektabel dan umumnya tidak mempengaruhi fenotipe tanaman. Penelitian ini bertujuan untuk mengetahui pengaruh penyisipan acak terhadap fenotipe tanaman kosmos kuning transgenik pada generasi ketiga. Penelitian ini dilakukan dari Agustus 2023 hingga April 2024 di laboratorium pemuliaan dan genetika tanaman serta rumah kaca, Fakultas Pertanian, Universitas Gadjah Mada. Penelitian dilakukan pada tanaman kosmos kuning T3, dengan bahan tanaman berasal dari benih kosmos kuning T2 yang positif gen *nptII*. Bunga kosmos T2 diperlakukan dengan penyerbukan terbuka untuk menghasilkan benih T3. Semua sampel DNA tanaman diekstraksi dari daun dan kemudian dianalisis secara molekuler menggunakan metode deteksi PCR gen *nptII* dengan ukuran produk 500 bp untuk konfirmasi keberadaan gen *nptII*. Analisis segregasi *nptII* didasarkan pada hasil PCR. Fenotipisasi tanaman transgenik dilakukan menggunakan penanda morfologi pada karakter pertumbuhan, daun, dan bunga yang bersifat kualitatif dan kuantitatif. Hasil menunjukkan bahwa gen *nptII* diwariskan mengikuti rasio 3:1 bukan aturan fenotipik 5:3 pada T3 kosmos kuning berdasarkan pita DNA berukuran 500 bp. Sampel DNA tanaman kemudian dianalisis secara molekuler menggunakan 6 set primer untuk 6 ekson gen *HaYABBY*. Fenotipe kualitatif tanaman transgen mengalami perubahan dibandingkan dengan tipe liar dalam hal tipe pertumbuhan, bentuk ujung daun, tipe pita bunga, dan susunan pita bunga. Fenotipe kuantitatif tanaman kosmos kuning T3 berbeda secara signifikan dari tipe liar untuk beberapa karakter dan tidak signifikan untuk beberapa karakter lainnya. Studi korelasi lanjutan dari sifat morfologi tanaman mengungkapkan asosiasi dan korelasi yang signifikan di antara sifat-sifat tersebut. Matriks nilai *p* memvalidasi hubungan-hubungan ini, menawarkan panduan penting untuk program pemuliaan yang bertujuan mengoptimalkan sifat-sifat tanaman secara efisien.

**Kata Kunci:** Kosmos Kuning, *nptII*, *HaYABBY*, Transgenik, T3

## Genetic and Phenotypic Analysis of random insertion on T3 population of Yellow Cosmos (*Cosmos sulphureus* Cav.)

### Abstract

Genetic stability plays an important role in the success of genetic transformation in plants. Transgenes will generally be inherited according to Mendelian laws. *nptII* is a selectable marker gene and generally does not affect plant phenotypes. This study aims to determine the effect of random insertion on the phenotype of the transformant yellow cosmos plants in the third generation. This research was carried out from August 2023 to April 2024 at the plant breeding and genetics laboratory as well as the green house, Faculty of Agriculture, Gadjah Mada University. The study was carried out on T3 yellow cosmos plants, with plant material derived from T2 yellow cosmos seeds that were positive for the *nptII* gene. Cosmos T2 flowers were treated with open pollination flowers to produce T3 seeds. All plant DNA samples were extracted from the leaves and then first analyzed molecularly using the *nptII* gene detection PCR method with a product size of 500 bp for confirmation of the *nptII* gene presence. The *nptII* segregation analysis was based on PCR results. Phenotyping of transgenic plants was carried out using morphological markers on the qualitative and quantitative growth, leaf and flower characters. The results showed the *nptII* gene is inherited following the 3:1 ratio instead of 5:3 phenotypic rule in the T3 of yellow Cosmos based on DNA bands measuring 500 bp. The plant DNA samples were then analyzed molecularly using 6 set of primers for the 6 exons of HaYABBY gene. The qualitative phenotypes of the transformant plants underwent changes compared to the wild type in terms of growth type, leaf tip shape, flower band type, and flower band arrangement. The quantitative phenotype of the T3 yellow cosmos plant was significantly different from the wild type for some character and not significant for some characters. Further correlation study of plant morphological trait revealed significant associations and correlation in between the traits. The p-value matrix validates these relationships, offering crucial guidance for breeding programs aiming to optimize plant traits efficiently.

**Keywords:** Yellow Cosmos, *nptII*, HaYABBY, Transgenic, T3