

Pengaruh pemberian perlakuan logam berat kadmium terhadap pertumbuhan dan profil metabolit sekunder Rimpang *Zingiber officinale* var. *Rubrum* = The effect of heavy metal cadmium stress on growth and secondary metabolite profile of Rhizome *Zingiber officinale* var. *Rubrum*

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Abstrak

Logam berat kadmium bersifat non-esensial bagi tumbuhan, namun dapat terakumulasi di dalam organ tumbuhan. Keberadaan kadmium dalam media tanam dapat menyebabkan efek toksik, salah satunya bagi tanaman obat *Zingiber officinale* var. *Rubrum* (jahe merah). Penelitian bertujuan untuk mengetahui pengaruh pemberian perlakuan kadmium terhadap pertumbuhan dan profil metabolit sekunder pada rimpang jahe merah. Penelitian ini bersifat eksperimental, dengan Rancangan Acak Lengkap (RAL), menggunakan empat perlakuan dalam bentuk larutan $CdCl_2$ dengan konsentrasi 0 ppm (kontrol), 50 ppm, 100 ppm, dan 150 ppm, dengan 6 ulangan pada setiap perlakuan. Parameter yang diteliti berupa laju pertumbuhan tinggi tanaman dan berat rimpang yang diolah menggunakan uji ANOVA serta dilanjutkan uji Duncan, gejala toksisitas di daun, dan profil metabolit sekunder yang terdeteksi diolah menggunakan Principal Component Analysis (PCA) dan Hierarchical Cluster Analysis (HCA). Hasil penelitian menunjukkan semakin besar konsentrasi kadmium yang diberikan maka laju pertumbuhan tinggi tanaman dan berat rimpang semakin menurun. Gejala toksisitas mulai muncul pada pekan ke-2 seperti klorosis dan nekrosis di ujung dan tepi daun. Profil metabolit sekunder rimpang yang terdeteksi membentuk tiga pengelompokan, kelompok I memiliki kemiripan antara sampel perlakuan kadmium 100 ppm dan 150 ppm, sedangkan yang menunjukkan perbedaan terdapat di antara sampel kelompok perlakuan kontrol dan kadmium 50 ppm.

.....Heavy metal cadmium is non-essential for plants, but it can accumulate in plants. The presence of cadmium in the growing media can cause toxic effects for the medicinal plants, one of which is the red ginger (*Zingiber officinale* var. *Rubrum*). The purpose of this study was to determine the effect of cadmium treatment on the growth and profile of secondary metabolites in the red ginger rhizome. This study was experimental, with a completely randomized design, using four treatments in the form of a $CdCl_2$ solution with a concentration of 0 ppm (control), 50 ppm, 100 ppm, and 150 ppm, the samples used are 6 replications for each treatment. The studied parameters were the rate of increase in plant height and rhizome weight which were processed using ANOVA test and continued with Duncan's test, symptoms of toxicity in the leaves, and the profile of the detected secondary metabolites were processed using Principal Component Analysis (PCA) and Hierarchical Cluster Analysis (HCA). The results showed that the increase the concentration of cadmium given, the growth rate of plant height and rhizome weight decreases. Toxicity symptoms begin to appear in the second week, such as chlorosis and necrosis at the tips and edges of the leaves. The secondary metabolite profiles detected formed three groupings, Group 1 had similarities between the 100 ppm and 150 ppm cadmium treatment samples, while those showing differences were between the control and 50 ppm cadmium treatment samples.