INTISARI

Penelitian ini bermaksud untuk memperoleh strategi perakitan kutivar cabai tahan busuk batang Phytophthora melalui introgresi dari sumber ketahanan CM334. Penelitian terdiri atas dua tahap. Tahap pertama bertujuan untuk menentukan model pewarisan ketahanan ini. Populasi uji terdiri atas tetua rentan GF001 (P_1) dan tetua tahan CM334 (P_2), serta generasi F_1, F_2, $BC_{1.1}$ dan $BC_{1.2}$ hasil persilangan kedua tetua tersebut. Penapisan ketahanan dilakukan melalui inokulasi populasi uji dengan zoospora *P. capsici* isolat Torong menggunakan dosis 1×10^4 zoospora per bibit. Data AUDPC dan RAUDPC diperoleh melalui pengukuran panjang busuk batang bibit cabai pada interval 0-14 hari setelah inokulasi. Penghitungan jumlah individu tahan maupun rentan dilakukan untuk memperoleh nisbah individu tahan-rentan. Uji normalitas Shapiro-Wilk dilakukan untuk menentukan metode pendugaan jumlah gen pengendali ketahanan. Apabila sebaran data dari RAUDPC populasi generasi F_2 tidak normal, maka data yang digunakan adalah nisbah individu tahan-rentan. Selanjutnya, pendugaan jumlah gen pengendali dilakukan lewat analisis segregasi dari model satu, dua dan tiga lokus. Uji kesesuaian menunjukkan bahwa ketahanan tanaman cabai terhadap *P. capsici* dikendalikan oleh tiga gen, yaitu gen ketahanan *R*, inhibitor ketahanan *Ipcr* dan anti-inhibitor *Aipcr* yang berinteraksi secara epistasis dominan-resesif. Gen *Ipcr* berasosiasi secara epistasis dominan terhadap gen tahan *R*. Jika satu alel gen inhibitor *Ipcr* hadir dalam bentuk dominan, maka ekspresi gen tahan *R* akan tertutupi dan fenotipenya akan rentan. Gen *Aipcr* berasosiasi secara epistasis resesif terhadap gen *Ipcr*. Apabila gen *Aipcr* berbentuk resesif homozigot, maka ekspresi gen *Ipcr* akan tertutupi dan tidak mampu menghambat ekspresi gen *R*, sehingga fenotipenya tahan. Tahap kedua bertujuan untuk menentukan jenis gen peroksidase tertentu yang ekspresinya bisa digunakan sebagai penanda ketahanan cabai terhadap penyakit busuk batang Phytophthora. GF001 dan CM334 digunakan dalam analisis aktivitas peroksidase total dan analisis ekspresi gen kelompok enzim peroksidase. Nilai aktivitas peroksidase total diperoleh lewat pengukuran perubahan kepadatan optis campuran reagen pirogalol dan H_2O_2 1% yang lalu dititrasi dengan ekstrak daun cabai yang akan diuji. Analisis ekspresi gen menggunakan *Real-Time qPCR* dilakukan pada gen *CaPO1*, *CaPO2* serta *CaPOA1*, dengan *GAPDH* sebagai gen pembaku, pada interval 0, 24, 48 dan 72 jam setelah inokulasi. Analisis aktivitas peroksidase total menunjukkan bahwa tetua tahan mengalami peningkatan aktivitas pada 24, 48 dan 72 jam setelah inokulasi. Tetua rentan hanya mengalami sedikit peningkatan aktivitas pada 24 dan 48 jam setelah inokulasi dan justru mengalami penurunan aktivitas pada 72 jam setelah inokulasi. *G*en *CaPO1* pada tetua tahan terekspresi hampir 18 kali lipat lebih tinggi dari tetua rentan, pada 0 jam setelah inokulasi. Ekspresi gen *CaPO2* dari tetua tahan hampir 759 kali lipat lebih tinggi dari tetua rentan, pada 0 jam setelah inokulasi. Ekspresi gen *CaPOA1* cenderung tidak memperlihatkan perbedaan tingkat ekspresi berarti antara tetua tahan dan rentan. Gen *CaPO2* memiliki potensi terbaik untuk digunakan sebagai penanda ketahanan cabai terhadap busuk batang Phytophthora.

Kata kunci: ketahanan, cabai, *Phytophthora capsici*, pewarisan, penanda

ABSTRACT

This research was aimed to obtain a strategy to construct pepper cultivars which are resistant to Phytophthora stem rot through introgression with CM334 as a resistance source. This research was conducted within two steps. The first step was aimed to ensure the proper inheritance model for this resistance character. Tested population con ist of a susceptible parent (GF001), a resistant parent (CM334), and F_1, F_2, $BC_{1.1}$ and $BC_{1.2}$ generation which obtained from cross between those two parents. Resistance screening was conducted through inoculation using P. capsici zoospore which counted approximately 1×10^4 zoospore for each seedling. AUDPC and RAUDPC values were obtained through measurement of pepper seedlings stem lesion during 0-14 days post inoculation. Number of resistant and susceptible plants were counted to get resistant-susceptible ratio. Shapiro-Wilk normality test was applied to determine the proper method for estimating number of gene which controlling resistance. If RAUDPC values distribution of F_2 generation is abnormal, then we should used susceptible-resistant ratio. Number of controlling genes were estimated using segregation analysis, for one, two and three loci model. Goodness of fit test showing that pepper resistance to P. capsici controlled by three genes, i.e. resistance gene (R), resistance inhibitor gene (Ipcr) and resistance anti-inhibitor gene (Aipcr), which is interact as dominant-recessive epistasis. Ipcr gene associate with R gene in dominant epistasis manner. If one of Ipcr allel present in dominant form, then R gene expression will be supressed and its phenotype will become susceptible. Aipcr gene associate with Ipcr gene in recessive epistasis manner. If Aipcr gene present in homozygot recessive form, Ipcr gene expression will be supressed and cannot supress R gene expression, so its phenotype will become resistant. The second step was aimed to identify a kind of peroxidase gene which its expression can used as pepper resistance marker toward Phytophthora stem rot disease. GF001 and CM334 were used in analysis of total peroxidase activity and analysis of several peroxidase isoenzyme gene expression. Total peroxidase activity values were obtained through optical density change measurement of pyrogallol and H2O2 1% mixture which titrated with tested pepper leaves extracts. Analysis of gene expressions were conducted using Real-Time qPCR towards CaPO1, CaPO2 and CaPOA1 genes, with GAPDH as a standardized gene, within 0, 24, 48 and 72 hour(s) post inoculation. Total peroxidase activity analysis displayed that resistant parent activity was highly increased during 24, 48 and 72 hours post inoculation. While susceptible parent only showed a little activity increasing during 24 and 48 hours post inoculation, but then decreased after 72 hours post inoculation. CaPO1 gene of resistant parent was expressed almost 18 folds higher than in susceptible parent, without inoculation. While CaPO2 gene expression of resistant parent was almost 759 folds higher than susceptible parent, without inoculation. Meanwhile, CaPOA1 expression tend to show insignificant level between resistant and susceptible parent. CaPO2 gene has best potential to be a Phytophthora stem rot pepper resistance marker.

Keywords: *resistance, pepper, Phytophthora capsici, inheritance, marker*