Studi Resistensi Padi Cempo Ireng terhadap *Xanthomonas oryzae* pv. *oryzae*: Interaksi Ekspresi Gen *R* dan *WRKY45* dengan Jalur Pensinyalan Asam Salisilat

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INTISARI

Pengembangan budidaya padi hitam masih terkendala oleh patogen *Xanthomonas oryzae* pv. *oryzae* (*Xoo*), penyebab penyakit hawar daun bakteri(*Bacterial leave blight*). *Xoo* dapat menginfeksi tanaman padi pada tahap anakan hingga masa reproduktif tanaman. Pengendalian penyakit hawar daun bakteri menggunakan bakterisida dan antibiotik dalam jangka panjang menimbulkan resistensi terhadap *Xoo* dan pencemaran lingkungan. Cempo Ireng merupakan padi hitam kultivar lokal Yogyakarta diketahui memiliki ketahanan yang tinggi terhadap *Xoo*. Gen resisten (*R*) gene pada padi cempo ireng seperti *Xa21 dan xa5* berperan dalam pensinyalan yang memediasi resistensi terhadap *Xoo.* Perlakuan hormon asam salisilat eksogen menginduksi ekspresi sejumlah gen yang berhubungan dalam sistem imunitas tanaman, seperti factor transkripsi *WRKY45.* Tujuan penelitian ini adalah mempelajari intensitas infeksi *Xanthomonas oryzae* pv. *oryzae* pada padi Cempo Ireng dalam pensinyalan asam salisilat, mengetahui pengaruh asam salisilat eksogen terhadap ekspresi gen *R* dan *WRKY45*, dan sistem resistensi padi Cempo Ireng. Pada penelitian ini digunakan kultivar Java14 dan IR64 sebagai pembanding kultivar tahan dan rentan. Penelitian ini dilakukan dengan tahapan sebagai berikut: penanaman padi Cempo Ireng, perbanyakan atau kultur *Xoo*, aplikasi hormon dan inokulasi *Xoo*, uji fenotipik, isolasi RNA, sintesis cDNA dan analisis ekspresi gen. Hasil penelitian pengamatan fenotip selama dua minggu kultivar Cempo Ireng dan Java14 dikategorikan sebagai tanaman tahan dengan skor masing-masing 3,389% dan 6,081%, padi IR64 sebagai tanaman rentan dengan skor 21,44%. Hasil analisis ekspresi gen menunjukkan ekspresi gen *WRKY45, Xa21* dan *xa5* pola dan nilai yang fluktuatif pada jam ke-0, 24, 72, dan 96 pasca infeksi pada ketiga kultivar Java14, Cempo Ireng, dan IR64. Secara keseluruhan ekspresi gen *WRKY45* dan *Xa21* secara berurut tertinggi pada kultivar IR64 sebagai tanaman rentan, Cempo Ireng dan Java14 sebagai tanaman tahan. Secara keseluruhan nilai *fold change* ekspresi gen *xa5* secara berurut lebih tinggi pada Java14, Cempo ireng, dan IR64.

Kata Kunci: Cempo Ireng, *Xoo*, Hawar daun, Asam salisilat, *gen R*, *Xa21*, *xa5*, *WRKY45*

Study Of Resistance Cempo Ireng Rice Against *Xanthomonas oryzae* pv. *oryzae*: Interaction of *R* And *WRKY45* Gene Expression With Salicylic Acid Signaling

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ABSTRACT

Black rice cultivation is still constrained by the pathogen *Xanthomonas oryzae* pv. *oryzae* (*Xoo*), the cause of leaf blight. *Xoo* can infect rice plants in the seedling stage until the plant's reproductive period. Control of bacterial leaf blight using bactericides and antibiotics in the long term causes resistance to *Xoo* and environmental pollution. Cempo Ireng is a black rice cultivar local Yogyakarta known to have high resistance to *Xoo*. Resistance (*R*) genes in cempo ireng rice such as *Xa21*and *xa5* play a role in signaling mediating resistance to *Xoo.* Treatment with exogenous salicylic acid hormone induced the expression of a number of genes related to the plant immune system, such as the transcription factor *WRKY45*. The purpose of this research were to study the intensity of *Xanthomonas oryzae* pv. *oryzae* infection in Cempo Ireng rice in salicylic acid signaling, to determine the effect of exogenous salicylic acid on *R* and *WRKY45* gene expression, and the Cempo Ireng rice resistance system. In this study, Java14 and IR64 cultivars were used as a comparison of resistant and susceptible cultivars. This research was conducted with the following stages: Ireng Cempo rice cultivation, propagation or *Xoo* culture, hormone application and inoculation *Xoo*, phenotypic testing, RNA isolation, cDNA synthesis and gene expression analysis. The results of the phenotypic observation for two weeks of Cempo Ireng and Java14 cultivars were categorized as resistant plants with a score of 3.389% and 6.081%, respectively, rice IR64 as a susceptible plant with a score of 21.44%. The results of gene expression analysis showed that the expression of *WRKY45*, *Xa21* and *xa5* genes fluctuated at 0, 24, 72, and 96 hours after infection in the three cultivars Java14, Cempo Ireng, and IR64. Overall, the *WRKY45* and *Xa21* gene expression was sequentially highest in cultivars IR64 as susceptible plants, Cempo Ireng and Java14 as resistant plants. the fold change value of *xa5* gene expression was sequentially higher in Java14, Cempo Ireng, and IR64.

Key Words: Cempo Ireng, *Xoo*, leave blight, salicylic acid, *R gene*, *Xa21*, *xa5*, *WRKY4*