

Respons Anatomis Lima Kultivar Padi (*Oryza sativa* L.) terhadap Kekeringan

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INTISARI

Padi (*Oryza sativa* L.) merupakan salah satu tanaman pangan komersial di Indonesia. Umumnya, padi ditanam di tanah sawah yang menggantungkan ketersediaan air di dalam tanah untuk kehidupannya. Tetapi, ketersediaan air di dalam tanah tidak selalu tersedia bagi tanaman padi dan dapat mempengaruhi keberlangsungan hidup tanaman padi. Penelitian ini bertujuan untuk mengamati respons anatomis akar dan daun, serta fisiologis lima kultivar tanaman padi terhadap kekeringan. Penelitian ini menggunakan rancangan acak lengkap faktorial dengan dua aras yaitu tingkat kekeringan (FTSW' *Fraction Transpirable Soil Water* 1 dan 0,2) dan kultivar padi ('Aek Sibundong' (tahan), 'Inpari 24' (sensitif), (Merah Pari Eja' (tahan), 'Patan Gunungkidul' (moderat), dan 'Siam Anjir' (sensitif). Satu tanaman padi umur 21 hari dipindahkan ke *cup plastic* yang berisi campuran media tanam yaitu tanah sawah: pupuk kandang" kerikil kecil (2:1:1). Tanaman padi diberi perlakuan kekeringan selama tujuh hari dengan mempertahankan nilai BTP (berat pot selama perlakuan) sesuai level kekeringan dan kultivar padi. Daun ketiga tanaman padi dari lima kultivar digunakan untuk pembuatan preparat semi permanen daun, semi permanen untuk pengamatan stomata, penentuan kadar relatif air di daun, dan indeks permeabilitas membran. Sampel akar tanaman padi dari lima kultivar untuk pembuatan preparat anatomi akar dengan metode penyelubungan parafin. Data dianalisis tingkat signifikansi secara statistik *One way ANOVA* dan *Duncan's multiple range test* pada tingkat kepercayaan 95% (IBM-SPSS ver 22, US) dan korelasi antar variabel pada karakter anatomis akar dan daun, serta fisiologis dengan korelasi *Pearson* pada tingkat signifikansi 99% dan 95%. Respons anatomis akar menunjukkan pengelupasan sel epidermis, variasi jumlah metaxilem, perubahan bentuk epidermis, penurunan ukuran diameter dan luas akar, tebal sel epidermis, tebal korteks, tebal endodermis, dan luas stele. Respons anatomis daun di lamina daun menunjukkan perubahan signifikan dibandingkan costa daun (penurunan lebar mesofil, luas metaxilem, luas *air space*, luas area floem, tebal sklerenkim, dan luas berkas pangangkut. Respons costa di daun yang signifikan adalah panjang, lebar dan keliling costa. Respons stomata di anatomis daun menunjukkan penurunan ukuran panjang dan lebar stomata, panjang dan lebar sel penjaga, maksimum pembukaan area porus di abaksial daun. Respons fisiologis menunjukkan penurunan berat basah akar, berat basah tajuk, tinggi tanaman. Hasil korelasi positif *Pearson* karakter anatomis dan fisiologis lima kultivar padi dengan FTSW 0,2 antara lain diameter akar, luas akar, tebal sel epidermis, tebal korteks, luas stele, maksimum area pembukaan porus, panjang dan lebar stomata, lebar sel tetangga, panjang dan lebar porus, jarak antar stomata di abaksial daun, tinggi tanaman, berat basah akar dan tajuk, berat kering akar dan tajuk.

Kata Kunci: Kekeringan, stomata, xilem.

Anatomical Response of Five Rice Cultivars (*Oryza sativa* L.) to Drought

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ABSTRACT

Rice (*Oryza sativa* L.) is one of the commercial food in Indonesia. Commonly, rice plants grown on the paddy soil are dependent on water storage for its life. However, the water availability is not always ready for rice growth and development. It can affect its life cycle. Aims of this research were to determine anatomical and physiological responses of root and leaves, of five rice cultivars (*O. sativa* L.) to drought stress. This research was conducted with complete randomized design with two factors: level drought stress (FTSW/ Fraction Transpirable Soil Water 1 and 0,2) and rice cultivars 'Aek Sibundong' (tolerant), 'Inpari 24' (sensitive), 'Merah Pari Eja' (tolerant), 'Patan Gunungkidul' (moderat), and 'Siam Anjir' (sensitive). After 21 days, one rice seedling was planted in a mixture of planting medium consisted of paddy field soil: manure:small gravel (2:1:1). The rice plant was treated drought stress for seven days with maintenance pot weight (BTP) along treatment based on each cultivar and level stress. The third rice leaves were collected for anatomical slides preparation (including semi permanent leaf cross sections, leaf clearing for stomata analysis), relative water content, and permeability membrane index. Rice roots were transversally using paraffin embedding method. The data were analyzed for the level significance statistically by One-Way ANOVA and Duncan's multiple range test at 95% confidence level (IBM-SPSS ver 22,00 US). Correlation between variables for root and leaf anatomy, as well as physiological variables of five rice cultivar to drought was done with Pearson correlation at 99% and 95% confidence level. The anatomical responses of the roots showed exfoliation of epidermal cells, variations in the number of metaxylem, changes in the shape of the epidermis, a decrease in root diameter and area, epidermal cell thickness, cortex thickness, endodermis thickness, and stele area. The anatomical responses of the leaves in the leaf lamina showed significant changes compared to the leaf midvein (decreased mesophyll width, metaxylem area, air space area, phloem area, sclerenchyma thickness, and bundle area). Significant midvein responses in leaves were the length, width and perimeter of the midvein. The stomata response in leaf anatomy showed a decrease in the length and width of the stomata, the length and width of guard cells, the maximum opening of the porous area in the abaxial leaf. Physiological responses showed a decrease in root and shoot fresh weight, plant height. Pearson's positive correlation results of anatomical and physiological characters of five rice cultivars with FTSW 0.2 included root diameter, root area, epidermal cell thickness, cortex thickness, stele area, maximum pore opening area, stomata length and width, neighboring cell width, pore length and width, abaxial distance between stomata leaves, plant height, root and shoot fresh weight, root and shoot dry weight.

Keywords: drought stress, stomata, xylem.