ABSTRACT

Activation of the unfolded protein response (UPR) in mammalian cells leads to cell cycle arrest at the G1 phase (Thomas et al., J Biol Chem 288:7606–7617, 2013). However, how UPR signaling affects cell cycle arrest remains largely unknown in plants. Here, we examined UPR and endoreduplication in Col-0, *wee1*, and ER stress sensing-deficient *ire1a&b* plants during DNA replication and ER stress conditions. We found that WEE1, an essential negative regulator of the cell cycle, is involved in the maintenance of ER homeostasis during genotoxic stress and the ER stress hypersensitivity of *ire1a&b* is alleviated by loss-of-function mutation in *WEE1*. WEE1-mediated cell cycle arrest was required for IRE1–bZIP60 pathway activation during ER stress. In contrast, loss-of-function mutation in *WEE1* caused increased expression of UPR-related genes during DNA replication stress. WEE1 and IRE1 were required for endoreduplication during DNA replication stress and ER stress, respectively. Taken together, these findings suggest that cell cycle regulation is associated with UPR activation in different manners during ER stress and DNA replication stress in Arabidopsis.