SUMMARY

Potential Use of Ethylene Receptor Mutants as Breeding Material

to Extend Fruit Shelf Life of Tomato

（トマトのエチレン受容体変異体の果実の貯蔵性を向上するための育種素材としての評価）

Doctoral Program in Biosphere Resource Science and Technology

SYARIFUL MUBAROK（シャリフルムバラク）学籍番号：201330282

Ethylene is plant hormone regulated several biological and chemical processes during plant growth and development. One of the main effects of ethylene response is fruit ripening. The presence of ethylene during postharvest handling of horticultural crops can be a main problem in maintaining postharvest quality especially for shelf life of fresh product. One of the famous horticultural crops is tomato. The postharvest shelf life of tomato fruit is mainly affected by ethylene since tomato belongs to climacteric fruit. The effect of ethylene in reducing postharvest life of tomato fruit by enhancing the ripening process causes several quality changes in fruit such as colour, firmness, nutrition, flavour and disease susceptibility. Several researcher have been studied the methods for improving postharvest life of tomato fruit by controlling ethylene response such as by mutation. New ethylene receptor mutants have been identified as ethylene insensitive phenotypes, *Sletr1-1* and *Sletr1-2*, from Tomato 'Micro-Tom' background. In this study, I have generated F1 hybrid lines from those mutants to elucidate the mutation effect on postharvest quality in the F1 hybrid lines.

In Chapter 2, I generated four F1 hybrid lines of *Sletr1-1* and *Sletr1-2* that was crossed with different background of pure-line of tomato cultivar ('Aichi First', ' Ailsa Craig',

'Moneymaker', and 'M82'). From those F1 hybrid line, I characterized the seedling, plant, fruit phenotype and fruit shelf life analysis. The result showed that *Sletr1-1* and *Sletr1-2* mutation had a dominant effect in those F1 hybrid lines that exhibited in ethylene response of F1 hybrid lines was more insensitive that WT-MT F1 hybrid line. *Sletr1-1* did not potential use as breeding material because *Sletr1-1* F1 hybrid lines represented a high responsiveness to stress response such as wounding stress and disease. Whereas, *Sletr1-2* F1 hybrid lines showed a similar plant growth, plant phenotype and fruit phenotype compared with WT-MT F1 hybrid lines. *Sletr1-2* mutation significantly extended fruit shelf life in the *Sletr1-2* F1 hybrid lines 4 to 5 days longer than WT-MT F1 hybrid line. The *Sletr1-2* F1 hybrids did not show many undesirable characteristics, such as highly reduced the lycopene content and red fruit color, moreover it provided similar levels of β-carotene and TSS, and a higher level of TA and fruit firmness. Based on this study, I conclude that the *Sletr1-2* mutant has potential as a breeding material for the development of new tomato cultivars with improved fruit shelf-life.

In Chapter 3, I identified the change of metabolic compound related taste quality during postharvest storage in *Sletr1-2* F1 hybrid lines as an impact of *Sletr1-2* mutation. Three major metabolic related taste compounds; sugar, organic acid, and amino acid have been measured at different postharvest storage time. The result showed that *Sletr1-2* mutation did not give a significant effect on the change of total sugar and individual sugar (sucrose, glucose and fructose) of *Sletr1-2* F1 hybrid lines. The level of total sugar and individual sugar were comparable with WT-MT F1 hybrid lines. On the other hand, *Sletr1-2* mutation significantly affected in increasing total amino acid and citric acid during 30 days of postharvest storage. Based on this result indicated that sugar is ethylene independent process and organic acids is ethylene dependent process. The function of amino acid in fruit taste is a

taste enhancer. Until 30 days of postharvest storage, *Sletr1-2* mutation did not affect in the change of total amino acid despite at the beginning of storage it was lower in *Sletr1-2* F1 hybrid from 'M82' parental background. Although the total amino acid was comparable with control, however the impact of *Sletr1-2* mutation in the change of individual amino acid was dependent on parental background. I conclude that the *Sletr1-2* mutation results in a favourable impact on the postharvest fruit quality changes in *Sletr1-2* F1 hybrid lines.