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**Ethephon, Ethylene and Abscission Physiology of *Camellia*.**

**A thesis presented in partial fulfilment of  
the requirements for the degree of  
Doctor of Philosophy  
in  
Horticultural Science  
at  
Massey University, Palmerston North,  
New Zealand.**

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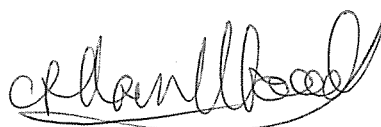
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## ABSTRACT

Ethylene application to leaves and floral buds of *Camellia* resulted in abscission with a lag period, the duration of which was dependent on ethylene concentration and cultivar. During this period, cellulase activity doubled in leaf abscission zones, and when abscission commenced, activity increased more rapidly. However, no increase in cellulase activity was observed in floral bud abscission zones. Propylene application revealed that autocatalytic ethylene production increased in leaf abscission zones prior to and decreased after abscission. However, in the leaf blade, no change in endogenous ethylene production was measured, nor were any signs of leaf senescence observed. Application of (STS) <sup>silver thiosulphate</sup> completely inhibited leaf abscission and delayed and reduced floral bud abscission in response to applied ethylene. This pointed to a similar role for ethylene in both organs, but that the abscission process of floral buds occurred at a faster rate than that of leaves. Application of ethylene for differing durations to floral buds and leaves demonstrated that regardless of ethylene treatment duration, abscission ceased less than 24 hr after ethylene removal indicating that continuous ethylene exposure is required to promote abscission of *Camellia* organs.

Measurement of abscission rate (time to 50% abscission) in response to a range of ethylene concentrations determined that floral buds were more sensitive (that is; responded more rapidly to lower ethylene concentrations) than leaves. Ethylene-sensitivity was influenced by organ maturity. As floral buds matured from initiation to flower opening, the rate of ethylene-promoted abscission increased, indicating greater sensitivity. Leaves were most sensitive to ethylene directly after bud break and sensitivity decreased until 12 weeks after cessation of stem extension; after this time, sensitivity did not change significantly over the next 3 years.

Low temperatures reduced the ethylene-promoted abscission rate of both leaves and floral buds with an exponential relationship. Low temperatures increased the ethylene concentration required to saturate the abscission response. Endogenous ethylene production of *Camellia* leaves increased with higher temperatures and peaked at 20° to 25°C.

Since ethylene release from ethephon may be described in terms of concentration and duration of ethylene exposure, the effect of time, temperature, cultivar, organ type and organ maturity on organ abscission response to ethephon application could be explained in terms of the ethylene-promoted response.

The level of ethylene- and ethephon-promoted abscission were explained in terms of the interaction of ethylene concentration and duration of exposure with organ type, organ maturity and temperature which determined the level of abscission response. Three mechanisms were important in determining the response to ethylene; ethylene-sensitivity, and rate of reaction and reversibility of the abscission process. The rate of the abscission process was determined by ethylene concentration, temperature, organ type and maturity. Since abscission was reversible in *Camellia*, the duration of exposure interacted with the abscission rate to determine the extent of abscission in response to ethylene or ethephon application.

In conclusion, the greatly expanded understanding of the ethylene-promoted abscission process carried out in this study facilitates control (promotion or inhibition) of abscission in *Camellia*. This enhances the possibility for culture and transportation of high quality *Camellia* plants from New Zealand.

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