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Temporal non-synchronization between water uptake and loss causes stomatal oscillations in young orange trees [*Citrus sinensis* (L) Osbeck] under natural climatic conditions

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Sustained cyclic oscillations in stomatal conductance, leaf water potential and sap flow measured at stem and branch level were observed in young orange trees with navel scions [*Citrus sinensis* (L) Osbeck] on troyer citrange rootstocks [*Citrus sinensis* x *Poncirus trifoliate*] growing under natural conditions. The oscillations, which were synchronized throughout the tree, had periods ranging from 70 – 80 min. This period of the oscillations was significantly larger than the commonly reported 10 – 50 min for most plant species. Oscillations in branch sap flow had a constant time lag of approximately 20 min behind the stomatal conductance while stem sap flow lagged behind branch sap flow by approximately 10 – 15 min. This non-synchronization between water uptake by the tree and demand by the atmosphere led to oscillations in stem diameter, which were also measured. In addition, this unbalanced water uptake and demand had a significant effect on the course of leaf water potential and, hence, on stomatal conductance. Low leaf water potentials (more negative) coincided with periods when transpirational water loss exceeded stem sap flow while high leaf water potentials (less negative) were associated with stem sap flow exceeding transpiration. Stomates started opening when leaf water potential was low and started closing when leaf water potential was high. Minimum leaf water potential and maximum leaf conductance were out of phase by 10 to 25 min. Intriguingly, the measured stomatal conductance of the model trees after sunset was higher than the dips reached during the daytime oscillations. This suggested that this rootstock-scion combination had a

strong control of water losses during periods of high atmospheric evaporative demand.

1 Key words

Orange tree, *Citrus sinensis* (L) Osbeck, rootstock - scion combination, stomatal oscillations, transpiration, sap flow, time lag, leaf water potential, stem diameter changes.