"Effective Pollination Period and Implications for Successful Pollination in Apple"

Stefan Roeder, Ph.D. candidate, WSU-Horticulture, TFREC WENATCHEE

Abstract

Pollination and fertilization are two key processes that have been shown to impact fruit set and quality in apples (Malus domestica). Despite decades of research on pollination and fruit set, specific information regarding the effective pollination period (EPP) and the parentage effects on pollen tube growth are limited. The research objectives of this project were (1) to determine the effective pollination period of four apple cultivars under natural open field conditions and (2) to determine potential parentage effects on pollen tube growth under semi-controlled greenhouse conditions. The effective pollination periods of 'Golden Delicious', 'Olsentwo Gala', 'Rubinstar', and 'WA 38' were calculated by determining the stigmatic receptivity, pollen tube growth, and ovule longevity using fluorescence microscopy. EPPs for all cultivars, except for 'WA 38', were evaluated in two consecutive years (2019-2020). In 2020, six maternal apple cultivars were cross-pollinated using pollen from six crabapple cultivars to determine potential parentage effects. Pollen tube length inside the styles were evaluated 24 and 48 hours after pollination. Overall, effective pollination periods ranged from 1.4 to 5.6 days, depending on the cultivar and year. The stigmatic receptivity was not considered a limiting factor because it always exceeded the EPP duration. The greenhouse study results indicate that both maternal and paternal factors significantly impact pollen tube growth. However, because of the significant interaction between both factors, pollinizers have to be evaluated for each cultivar separately to draw meaningful
inferences. In conclusion, apple cultivars with a short EPP require special attention, especially when prone to low fruit sets. Several horticultural management techniques are available, including the use of ethylene biosynthesis inhibitors, optimizing pollinator density and hive strength, or the use of supplementary pollination to improve fruit set. Some selected key factors will be discussed specifically for apples.