

Biology/Phenology

How Fruit Maturity Affects Codling Moth Larvae Survival

R.A. Van Steenwyk, C.F. Fouche and M.R. Gaither
University of California Department of Environmental Science, Policy and Management,
Berkeley, CA

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During the course of our postharvest codling moth (CM) control studies, it was observed that CM larvae that infest ripe pears do not complete their larval development. A study was conducted to determine fruit maturity as it affects larval survival.

Methods and Materials

The effect of 'Bartlett' fruit maturity on CM survival was determined by infesting a minimum of 25 pears per color from a standardized peach maturity color chart. A standardized peach maturity color chart was provided by the California Tree Fruit Agreement. The color chart, with modification, was used because it was a nondestructive measure of maturity and allowed us to determine maturity without removing the fruit from the tree. We assigned color A = 1, B = 2, C = 3, D = 4, G = 5, H = 6, I = 7 and J = 8. Color A was the most immature (green) and color J was the most mature (yellow). Colors E and F were not used because in pears color E could not be readily distinguished from D, and color F could not be readily distinguished from G. In addition to color as a measure of maturity, fruit pressure was determined on a "twin" fruit. The "twin" fruit was the same color, shape and size as the infested fruit. The "twin" fruit was removed from the tree at the same time as the other fruit was infested and three pressure readings (kg/cm²) were taken from both the stem and base of each pear.

Fruit was infested from July 28 through August 4 by placing two recently hatched CM larvae on the calyx end of each fruit. A small plastic cup was placed over the larvae and sealed to the fruit to prevent predation or larvae falling off the fruit. The fruit was removed from the trees two weeks after infestation and placed individually in a large plastic container. The plastic container had a layer of single-sided corrugated cardboard above and below the infested fruit to serve as a site for pupation or diapause. The containers were inspected weekly for six weeks to determine if a larva had infested the fruit and had successfully completed development.

Results and Discussion

CM infestation decreased with increasing fruit color. Fruit in color classifications A and B were about 90 to 95% infested whereas fruit in color classification J were about 10% infested. These data would indicate that CM females do not prefer to lay eggs on or near ripening fruit or that young larvae have more difficulty in infesting ripening fruit.

The number of CM larvae that completed development decreased with increasing fruit color. CM larvae successfully completed development in about 80% of the fruit in color classifications A and B whereas no larvae successfully completed development in fruit of color classifications I and J. There was a rapid decrease in the number of fruit producing a larva in

color classifications B through D. The decrease slowed in color classifications G and H. No larvae were produced in color classifications I and J. The data indicates that even though a larva may infest the pear, the larva has difficulty in completing its development as the fruit ripens.

Mean stem and base pressure decreased uniformly with increasing pear maturity (color) with stem pressure consistently above base pressure. Both stem and base pressure was about 17 kg/cm² in color classification A and decreased to about 1 kg/cm² in color classification J. A linear regression with fruit color as the independent variable and mean stem and base pressures as the dependent variables produced r^2 values of 0.96 for base pressure and 0.93 for stem pressure. Since base pressure had a slightly greater r^2 value and since growers use base pressure in determining fruit maturity at harvest, we used base pressure in determining fruit maturity in relationship to CM infestation and larval survival.

CM infestation increased with increasing fruit pressure. Fruit with pressure of 0 to 1.9 kg/cm² had 0% infestation whereas fruit pressure of 18.0 to 19.9 kg/cm² had 100% infestation. These pressure data show the same pattern of fruit infestation as the fruit color data and would indicate that CM females do not prefer to lay eggs on or near ripening fruit or that young larvae have more difficulty in infesting ripening fruit.

The number of CM larvae that completed development increased with increasing pressure. Fruit with pressure of 2.0 to 3.9 kg/cm² had no larvae completing development whereas fruit pressure of 18.0 to 19.9 kg/cm² had 100% of the larvae completing development. However, only one larva completed development in fruit pressure less than 6 kg/cm². These data would indicate that a CM cannot complete larval development if the base fruit pressure is less than 6 kg/cm². A base pressure of 6 kg/cm² corresponds to a color classification between H and I which is in agreement with the color data.

This study indicates that fruit maturity has a great influence of larval infestation and survival. Fruit maturity can be rapidly evaluated based on fruit color since fruit color and fruit pressure are closely correlated. If postharvest fruit maturity can be advanced by the application of a plant growth regulator such as ethephon to a pressure of 6 kg/cm² or less, or a color of H or greater, then CM will not be able to successfully complete larval development.