Population Phenology Model of the Peach Fruit Moth, *Carposina sasakii* (Lepidoptera: Carposinidae)

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The population phenology model of the peach fruit moth (PFM), *Carposina sasakii* Matsumura, was constructed to understand its seasonal occurrence pattern and population behavior through a series of studies: (1) postdiapause larval development and spring emergence of adults, (2) adult reproduction, (3) temperature-dependent development of egg, larva, and pupa, (4) larval survivorship in growing host fruits, and (5) insecticide effects.

The emergence of overwintering larvae in the laboratory and field showed a bimodal form in which the first major peak occurred in late June and the second smaller peak occurred in late July. This bimodal pattern was described by combination of two sigmoidal equations. Daily egg production of PFM was estimated by a reproduction model consisted of age-specific oviposition rate, temperature-dependent total egg production, and age-specific adult survival rate function. The chronological age of an adult was transformed to the physiological age based on the summation of longevity completion rate. The relationships between development rates of egg, larva and pupa, and temperature showed a typical temperature-dependent form with high temperature inhibition. It was well described by a nonlinear development rate model. The probability distribution of development time of each stage was estimated by Weibull function based on the physiological age of each stage. The number of individuals shifted from a stage to the next stage was calculated by multiplying the initial number of individuals in a stage by the probabilities produced by the development distribution model of each stage. The survivorship of PFM larvae within fruits were different according to the type of PFM host plants and season. Thus, the survivalships were incorporated into population model.

The PFM population phenology model was constructed using equations and parameters described above. In comparison with an assumption of no insecticide effects, average deviation between model outputs and actual records in predicting of the 1st and 2nd adult peak date was 2.8 and 3.9d, respectively. The prediction of the 3rd peak date showed larger deviation of 6.1d. Also, the sizes of the 2nd and 3rd peak were overestimated in the model outputs compared to the actual field pheromone trap records. The deviation of adult peak date decreased by incorporating insecticide effects into the model, but severe pesticide use in the early season eliminated the last adult peak which was visible in fields. Further, sensitivity analysis and suggestions of some possible application were described.