#38: Population dynamics of tortrix moths in Pennsylvania fruit orchards

Damie Pak, Ottar Bjornstad, David J. Biddinger

The cyclic fluctuations of insect species can provide critical insights on how life-history traits can affect population dynamics and community structure. Interannual and generational cycles can scale up and lead to interesting patterns of interspecific synchrony with important consequences for co-existence in specious arthropod guilds. We explored how the varying voltinism, feeding behaviors, and spring emergence of five economically important moth pests in Pennsylvania fruit orchards shape their community dynamics. Additionally, we analyzed the synchrony between the moth species to better understand how it relates to continued co-existence of species sharing similar resources.

For this study, we analyzed the abundance data of moths collected and identified at the Fruit Research and Extension Center (Bigglerville, Pennsylvania) from 2000 to 2013. Species abundance was averaged across sites and continuous wavelet transformation was used to analyze the periodicity of population fluctuations. For analyzing interspecific dynamics, we utilize cross-wavelet analysis to locate periods of high correlation and phase relationships among the moth species.

Wavelet analysis of the moth species showed significant periodicity at both the generational and annual scale. Certain species such as the obliquebanded leafroller (*Choristoneura rosaceana*) had significant intra-year periodicities for only certain years (2000-2008). Other species like the tufted apple bud moth (*Platynota idaeusalis*) showed a consistent and significant periodicity for all years. For all species however, there are changes in the amplitude of fluctuations which we hypothesize may be due to variation in yearly temperature.

The cross-wavelet analysis between different species indicated complex phase-relationship at different scales. We found that the three bivoltine species are generally in-phase at the generational scale but at the annual scale, our analysis suggested that phase-relationship can vary. It is possible that changes in the phase-relationship can be attributed to changes in spring emergence of moths after diapause.

Our results show that population fluctuations of the moth species can vary over time and at different scales which can lead to significant changes on community dynamics.