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Long term patterns of herbivore abundance in cereal grain agrosystems of the Pacific Northwestern USA

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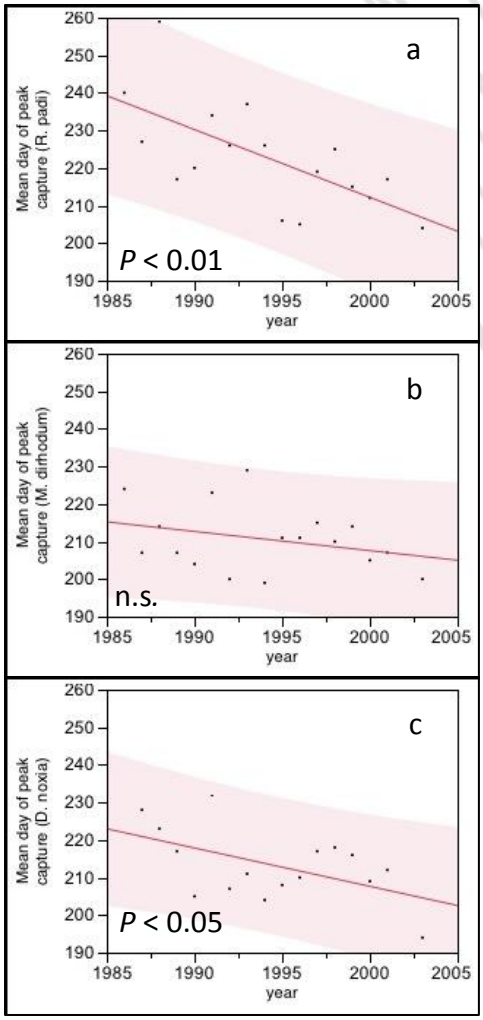

Graphs indicate the mean day of peak flight for the aphid species (A) *R. padi*; (B) *M. dirhodum*; and (C) *D. noxia*, over a seventeen-year period. Shaded regions indicate the 95% CI of each fit.

We compiled a seventeen year record of cereal aphid abundance from a landscape-scale suction trap network located in the northwestern USA, and coupled abundance data with retrospective climatic projections using down scaled climate models. We asked four questions about the biogeography and phenology of cereal aphids:(1) Are aphid populations biogeographically structured by interannual variation in abundance?; (2) Is there evidence that peak flight periods changed over the trapping period?; (3) Which climatic and biotic factors are correlated with aphid abundances?; and (4) Does thermal sum or cumulative precipitation predict aphid phenology? Single-linkage clustering algorithms generated geographically supported groupings based on interannual abundance and trap catch phenology. We determined that by the end of the trapping period, peak flight periods occurred earlier on average for two of the three species, which correlated with an overall rise in temperature projections. Estimations of mean temperature, thermals sums, and interspecific aphid abundances were moderately correlated with aphid captures for each species and across all clusters. Thermal sums were a good predictor of cumulative aphid captures when variance due to site and year effects were omitted from analysis, and a random-draw simulation experiment demonstrated a strong linear effect of thermal sum on simulated mean aphid captures. This information will provide growers with accurate information regarding the timing and magnitude of cereal aphid flights, and the models we develop can be used to forecast aphid abundances using temperature estimates. Future challenges will include developing, refining, and comparing predictive models of aphid abundance across the region, and further investigating the influence of geographic features on these trends. There are significant possibilities to integrate this work within the broader framework of ecological and climate modeling, population ecology, and geospatial analysis.

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