**ReadMe for “DDE population dynamics.py”**

The following ReadMe gives a brief overview of how to use “DDE population dynamics.py”. ***Please note that running this script is not strictly necessary for the populations in the manuscript as all population dynamics data already exist in the “Time series data” and “Time series data DI” folders.***

**Input:** User-defined species name and location for a population (or *all* = True)

**Output:** Updated CSV files containing population dynamics data (if *save* = True)

**To run:**

1. Update variable *species* (line 36) and *location* (line 37) with a species name and location from “Temperature response parameters.csv”. Set *all* = True in line 38 if the script is to be run for all populations or set *all* = False if the script is to be run just for the specified population.
2. Set *recent* = True for the recent time period or *recent* = False for the future time period in line 41.
3. To save population dynamics (over existing files), change *save* from False to True in line 48.
4. To include competition in the model, set *competition* to True in line 51. (Note that if *competition* = False, the script will model density-independent population dynamics, which will then be saved in the “Time series data DI” folder (if *save* = True).
5. To run models for validation with field census data, set *census* to True in line 54 (note that field census data was found only for *Clavigralla shadabi* and *Apolygus lucorum*).
6. Set or confirm the paths to “Temperature response parameters.csv” and “Habitat temperature parameters.csv” in lines 58 and 59.
7. Run the script by pressing the green ‘play’ button.

**Potential issues:**

* Several error messages and potential solutions are listed in lines 4-13
* The variable *species* (line 36) and *location* (line 37) must exist within “Temperature response parameters.csv” and match the “Population” and “Location” columns exactly
* The script downloads the ‘jitcdde’ package from GitHub (<https://github.com/neurophysik/jitcdde>) if it is not installed. It may, however, be necessary to download and install the package directly.
* The script only works if the working directory (line 32) is in the main folder of the GitHub repo

**Script details:**

Lines 1-13 Potential error messages and potential solutions

Lines 16-32 Download (if necessary) and import necessary packages and set working directory

Lines 35-54 Have user enter required information

Lines 57-58 Input temperature response parameters and habitat temperature parameters

Lines 62-88 Define model parameters and select population

Lines 91-145 Start loop (for multiple populations), set minimum tolerance to avoid integration errors (must be higher for *Myzus persicae* in Canada Chatham and *Aulacorthum solani* in US Ithaca) and assign temperature response parameters and habitat temperature parameters

Lines 148-178 Define habitat temperature and temperature response functions

Lines 181-206 Define the delay differential equations (DDE) model and run the DDE solver

Lines 209-249 Save population dynamics data (if desired), plot population dynamics, and exit loop when the model has been run for specified population or for all populations