**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 34) and *location* (line 35) with a species name and location from “Temperature response parameters.csv”. Set *all* = True in line 36 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 39.
3. To save population dynamics (over existing files), change *save* from False to True in line 46.
4. To include competition in the model, set *competition* to True in line 49. (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 52 (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 56 and 57.
7. Run the script by pressing the green ‘play’ button.

**Potential issues:**

* Several error messages and potential solutions are listed in lines 4-11
* The variable *species* (line 34) and *location* (line 35) 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 30) is in the main folder of the GitHub repo

**Script details:**

Lines 1-11 Potential error messages and potential solutions

Lines 14-30 Download (if necessary) and import necessary packages and set working directory

Lines 33-52 Have user enter required information

Lines 55-57 Input temperature response parameters and habitat temperature parameters

Lines 60-86 Define model parameters and select population

Lines 89-143 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 146-175 Define habitat temperature and temperature response functions

Lines 178-203 Define the delay differential equations (DDE) model and run the DDE solver

Lines 206-246 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