Extract from the user's guide `PBSddesolve-UG.pdf` *found in the directory* `.../library/PBSddesolve/doc`. *For further information, please see the complete guide.*

4.2 Blowflies – (DDE Example)

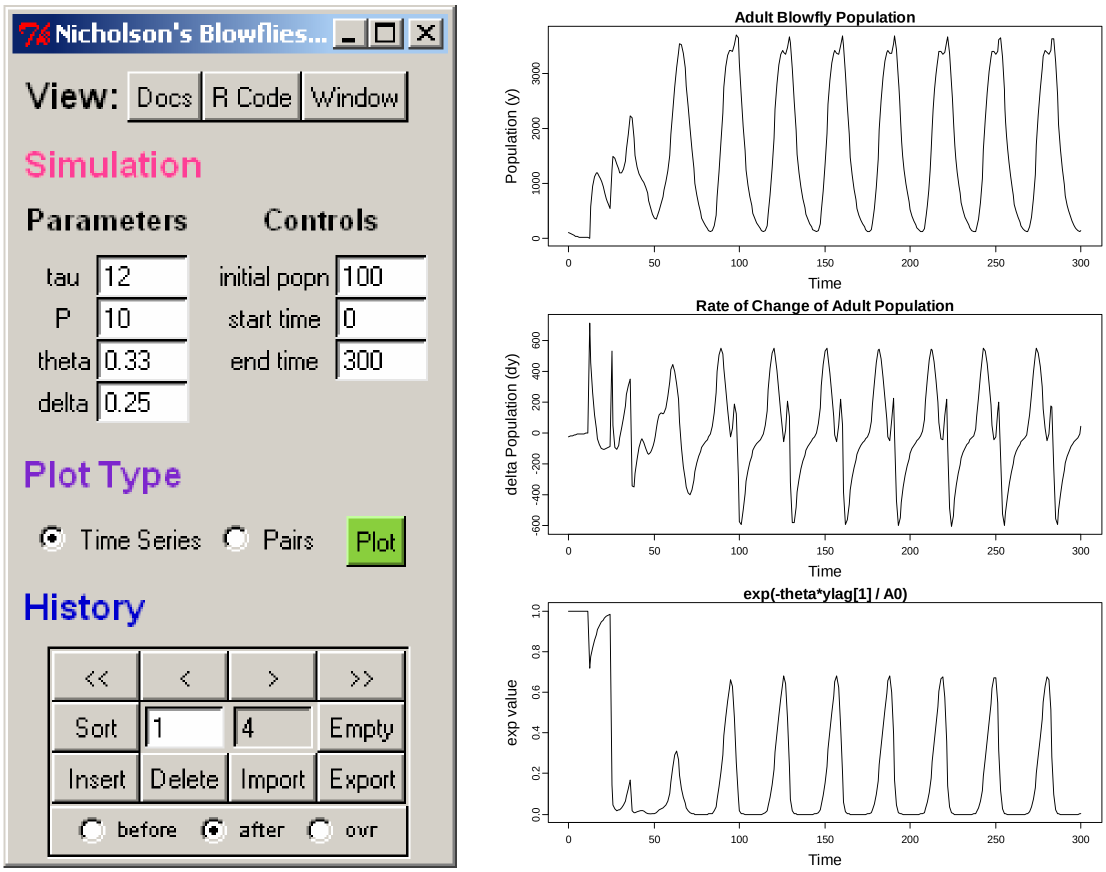

Figure 2. Nicholson's blowflies model demonstration (included in Simon Wood's Solv95 User Manual as an example of solving a DDE).

As an example with a delay, Wood (1999) suggested a blowfly population model for adults $A(t)$ at time *t*:

$$\frac{dA}{dt} = \begin{cases} -\delta A(t), & t < t_0 + \tau; \\ PA(t-\tau)\,e^{-\theta A(t-\tau)/A_0} - \delta A(t), & t \geq t_0 + \tau; \end{cases}$$

$$A(t_0) = A_0 .$$

Here τ is the development time from egg to adult, *P* is the net production rate determined by adult fecundity and egg survival to adulthood, θ is a parameter determining how quickly fecundity declines with an increasing adult population, δ is the adult death rate, and t_0 is the initial time when $A(t)$ starts with the value A_0. We assume that $A(t) = 0$ for $t < t_0$. In our formulation, the differential equation also includes the parameter A_0, so that θ becomes dimensionless. Essentially, A_0 sets the scale for $A(t)$.

The GUI in Figure 2 allows the four parameters $(\tau, P, \theta, \delta)$ to be adjusted, along with the initial conditions (t_0, A_0) and the final time t_1. The graph at the left shows three panels: $A(t)$, $dA(t)/dt$, and $e^{-\theta A(t-\tau)/A_0}$. In this case, a key portion of the R code is:

```
myGrad <- function(t, y) {
  if (t-t0 >= tau) ylag <- pastvalue(t-tau)
  else ylag <- 0
  yexp <- exp(-theta*ylag[1]/A0)-delta*y[1]
  yp <- P*ylag[1]*yexp
  return( list(yp, c(dy=yp, exp=yexp)) ) }
```

where values of `tau`, `P`, `theta`, `delta`, `t0`, and `A0` come from the GUI.