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# A NOTE ON PERMANENCE FOR A NICHOLSON'S BLOWFLIES MODEL WITH DELAY

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**Abstract.** In this work, we will establish conditions to guarantee the permanence of the solution of the Nicholson's blowflies model with delay

$$\begin{cases} x'(t) = -\delta(t)x(t) + R(t)x(t-\tau(t))\exp[-a(t)x(t-\tau(t))], \ t > 0, \\ x(t) = \varphi(t), \ t \in [-r, 0], \end{cases}$$

where $R, \tau : \mathbb{R} \longrightarrow [0, \infty)$ are bounded continuous functions, $r = \sup_{t\in\mathbb{R}} \tau(t)$, $\varphi : [-r, 0] \longrightarrow [0, \infty)$ is a continuous function with $\varphi(0) > 0$, and $\delta, a : \mathbb{R} \longrightarrow (0, \infty)$ are bounded continuous functions. More specifically, we will be interested in obtaining positive constants $k$ and $K$ such that, if $x : [-r, \infty) \to \mathbb{R}$ is the solution of the described system, then $k \le \lim_{t\to\infty} \inf x(t) \le \lim_{t\to\infty} \sup x(t) \le K$.

Some numerical examples are provided to illustrate our results.

**Keywords.** Nicholson's blowflies model; Delay; Permanence; Boundedness of solution; Population study.

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# 1 Notations

The following symbols will be used in the sequel.

1. $\mathbb{R} = (-\infty, \infty)$.
2. $|\mu|$ denotes the absolute value of the real number $\mu$.
3. $C(A, B)$ is the vector space of the continuous functions $f : A \longrightarrow B$.
4. $f^l = \inf_{t\in\mathbb{R}} f(t)$.
5. $f^m = \sup_{t\in\mathbb{R}} f(t)$.