**Abstract**: A deterministic differential equation model for the dynamics of terrestrial forms of mosquito populations is studied. The model assesses the impact of multiple probing attempts by mosquitoes that quest for blood within human populations by including a waiting class for mosquitoes that failed a blood feeding attempt. The equations are derived based on the idea that the reproductive cycle of the mosquito can be viewed as a set of alternating egg laying and blood feeding outcomes realized on a directed path called the gonotrophic cycle pathway. There exists a threshold parameter, the basic offspring number for mosquitoes, whose nature is affected by the way we interpret the transitions involving the different classes on the gonotrophic cycle path. The trivial steady state for the system, which always exists, can be globally asymptomatically stable whenever the threshold parameter is less than unity. The non-trivial steady state, when it exists, is stable for a range of values of the threshold parameter but can also be driven to instability via a Hopf bifurcation. The model's output reveals that the waiting class mosquitoes do contribute positively to sustain mosquito populations as well as increase their interactions with humans via increased frequency and initial amplitude of oscillations. A nonlinear analysis, based on the center manifold theory, is used to derive expressions for the amplitude and phase of the oscillating solutions. We conclude that to understand human-mosquito interactions, it is informative to consider multiple probing attempts; known to occur when mosquitoes quest for blood meals within human populations.