Wenzhang Huang* (huangw@uah.edu), Department of Mathematical Sciences, University of Alabama in Huntsville, Huntsville, AL 35899, and Zhilan Feng. Global Dynamics of a Plant-Herbivore Model with Toxin-Determined Functional Response. Preliminary report.

We study the dynamics of plant-herbivore interactions with toxin-determined functional response. Unlike the traditional Holling Type 2 functional response, the selected toxin-determined functional response looses its monotonicity at high levels of plant-toxicity levels. Systems with non-monotone functional responses are capable of supporting multiple interior equilibria and bistable attractors. Therefore, identifying conditions that guarantee global stability is not only mathematically challenging but important to scientists. We are able to find necessary and sufficient condition on the non-existence of a closed orbit via the transformation of the model to a new equivalent system. The Poincare-Bendixson theorem is used to show that the existence of a unique interior equilibrium point guarantees its global asymptotical stability whenever it is locally asymptotically stable. When there are multiple interior equilibria, it is shown that the local stability of the “first interior equilibrium” implies model bistability and that the phase space is separated by two sub-regions: the basins of attraction of two stable equilibria - the interior and the boundary equilibria. (Received February 11, 2012)