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Epidemic models with multiple delays: impact of diapause

We consider the dynamic vector-host-pathogen interaction motivated by such tick borne diseases as tick-borne encephalitis and Lyme disease. We stratify the vector population in terms of the stage before and after the contact with the host when co-feeding transmission may take place, and we consider the case where vector development may involve two time lags due to diapause. We derive and calculate the critical rate for the model to exhibit nonlinear oscillations. Our objective here is to use our simple mechanistic dynamic model to show that this structured epidemic model involving diapause and motivated by co-feeding transmission may generate periodic and irregular oscillations even when seasonal variations of the environmental conditions are ignored. This oscillation is not necessarily in synchrony with the seasonality of vector development and hence one should expect complicated oscillatory patterns of vector-borne disease dynamics in the filed observation and surveillance. This is based on a joint work with X. Wu and X. Zhang.