Overwintering habitats of the Colorado potato beetle in Wisconsin’s Central Sands Production Area

Anders S. Huseth\(^1\) and Russell L. Groves\(^2\)

\(^1\)Graduate Research Assistant, Department of Entomology, University of Wisconsin-Madison

\(^2\) Assistant Professor and Entomology Extension Specialist, Department of Entomology, University of Wisconsin-Madison

**Cooperator(s)**
Scott A. Chapman, Associate Researcher, University of Wisconsin-Madison
Paul Esker, Assistant Professor and Plant Pathology Extension Specialist, University of Wisconsin-Madison

**Project History.** The determination of Colorado potato beetle’s (CPB), *Leptinotarsa decemlineata* (Say), relationship to previous potato crops has provided significant new information aiding in area wide pest management and accurate recommendations on cultural practices including crop rotation. Yet, only limited anecdotal evidence exists relating the identity of preferred overwintering sites in the Central Sands. Identification of preferred overwintering sites, or ‘population sinks’ for CPB, will provide research-based information needed to more feasibly and economically apply various established cultural control methods.

**Background and Rationale.** In recent years, researchers have generated significant information regarding infield population dynamics, dispersal, and movement patterns of the CPB. Accurate characterization of dispersal tendencies and site selection would certainly benefit Wisconsin’s commercial growing region. In temperate potato production regions, preferred CPB overwintering, or diapause, sites, are thought to be outside production fields and along field margins (Weber & Ferro 1994). Late season movement of CPB towards prominent dark, vertical landscape features, such as windbreaks and adjacent forested edges, is hypothesized to occur in many systems (Follett et al. 1996). Field studies by Weber and Ferro supporting this observation were conducted at several sites throughout Massachusetts. Apply their observations to our growing region may be a viable approach based on similarities in climatic, biotic, and abiotic characteristics. Selections of test sites were based upon fields in production where at least five previous years of potato rotation had occurred.

Density dependent emigration was proposed by Weber and Ferro (1994) as the single greatest factor influencing edge habitat dispersal. These findings have been met with some disagreement regarding the relative importance of dispersal mechanisms to field edges. Specifically, Sandeson et al. (2002) described the emigration patterns of CPB to be density-independent, influenced more so by short day length and forage quality than by population size or aggregations of populations. Regardless of the predominant dispersal mechanism that triggers movement, Weber and Ferro (1994) have shown overwintering beetles proceeding to non-crop areas exhibit consistent behavioral tendencies. Long range flight, versus walking that occurs in the spring, seems to be the primary method for late season CPB migration from cropping systems. Observation of long range flights to field edges indicated that beetles moving to diapause sites fly approximately five meters or less from the ground. Striking vegetation induces the beetles to drop to the earth and burrow into the soil matrix (Weber and Ferro 1994). This behavioral response to vegetation results in spatial aggregation of diapausing adults along field edges. Investigation of this phenomenon seems extremely important as there has been little work to quantify or spatially define the influence of specific, non-crop habitat types. Knowing the behavioral tendencies of
adult CPB dispersion from the field will make management practices such as large scale, focused trap crops, trenches, and specific applications of adulticides more efficient and effective. To address these questions, this project will document and quantify differing bordering landscape elements, as identified by the Natural Resource Initiatives, Managed Ecosystems Project, serving as primary overwintering habitats and will also attempt to document the movement and dispersal patterns of overwintered, adult CPB from these areas.

**Experimental Site:** Potato growing region(s) of southern Portage County.

**Project Objective:** Characterization of non-crop habitats that are most frequently associated with early-season, CPB colonization patterns. Enhanced knowledge of overwintering biology and dispersion patterns will refine semi-annual cultural control tactics.

**Spatial Analysis:** We are currently underway with data analyses to relate early-season CPB population aggregates with adjacent or neighboring habitat classifications. The experimental site(s) used for these analyses are delineated south of Plover, Wisconsin. The study region is bounded to the east by Interstate 39 and the Wisconsin River to the west. Initial characterization of habitat classes and association to count information is our first objective. Established high resolution land-use classification regimes will accurately quantify specific habitat types which may influence CPB population dynamics. We will combine this information with previously acquired, geo-referenced, pest scouting data into a GIS database (ArcGIS 9.1, ESRI) (Fig. 1). Next, we will perform spatial analysis of CPB count data (points) and associated landscape features using a stepwise, multivariate regression model (SAS Version 8.0). These analyses will document the infestation progress of post-diapause, emerging CPB and their relationship to specified habitat types or perhaps previous potato production.

**Field Experiments.** By completion of our first objective, we propose to effectively apply selected cultural control practices on a commercial scale to test our hypothesis. Our first application of cultural controls will be spring trenches that will be positioned parallel to habitats coinciding with high edge populations of CPB. Trench specifications will adhere to established research design suggestions (Moyer 1993). These will functionally be placed along field margins and replicated across bordering habitats. Untrenched sampling locations will also be included to serve as a control. Additionally we will attempt to establish spring trap crops. Spring trap crops will be planted approximately five to ten days prior to

![Figure 1. Early-season, CPB population aggregates in selected fields (2002) relative to different landscape classifications.](image)
adjacent to trenches and controls. Sequential sampling will occur over regular intervals (weekly) throughout the early-season, field colonization interval which may extend over 3-5 weeks. Conclusion of the experiment will occur prior to pupation of the first large larvae.

To test the hypothesis that pre-diapause, adult CPB retreat to preferred overwintering habitat types (e.g. dark, vertical landscape features), fall trap crops will be deployed. In addition to providing empirical data on the overwintering dispersal biology of adult CPB, fall trap crops have been successfully demonstrated in a variety of potato growing systems. Unfortunately, application of this cultural practice to commercial scale, production systems is more difficult due to extent of acreage involved. Demonstration of strategically placed traps in conjunction with significant overwintering ‘sinks’ may provide a more feasible, late season population reduction. Establishment of long season or late planted potatoes spatially associated with identified, preferred overwintering habitats will induce late season colonization. Traps will be then treated with selected insecticidal chemistries of differing modes of action from that of the previous season. Fall trap crop design will be consistent with commercial application equipment as to adhere to established production and disease management practices. Application of differing modes of action reduces insensitivity to classes utilized both in the current growing season and following seasons. A subset of fall traps will also be established in areas adjacent to non-preferred sites and the colonizing populations compared with those present on traps adjacent to preferred overwintering sites. Populations of adult CPB will again be sequentially sampled over regular intervals throughout the fall period which may also extend over several weeks.

Expected Results: The primary goal of this research will be to improve our understanding of the environmental factors that influence pre- and post-diapause CPB behavior and dispersal. A realization of what, if any, non-crop community is preferentially selected by CPB in the Central Sands would be advantageous for several reasons. Native plant communities of particular interest have been identified in the potato growing region through the efforts by the USDA’s Natural Resource Initiatives program. The potential utilization of these spatially explicit communities as discrete and readily identifiable habitats for increased overwintering survivorship by Colorado potato beetles will aid in deployment of more sustainable management efforts to lower problematic populations of these insects.

Detection of preferential diapause locations would greatly increase the accurate deployment of cultural control methods for emerging adults in the spring. Large scale focused trap crops, trenches, and specific applications of adulticides may result with an improved understanding of CPB behavioral tendencies. Focused and well-timed deployment of selected cultural practices may benefit the potato growing industry by providing another set of sustainable management practices to limit an insect with a tremendous potential for resistance development. With the potential for increases in insensitivity to industry control standards such as the neonicotinyl class of insecticides, adequate control may be achieved through a combination of practices. Successful implementation of cultural control tactics would directly assist in CPB management. The perpetuation of this valuable chemical family would clearly be advantageous due to their minimal effects on non-target organisms, their cost advantages associated with new generics, and their flexibility in use through in-furrow, lay-by, and seed treatment applications. Continued use of these important chemistries, however, can only occur with responsible stewardship in managing the CPB which should embrace alternate control methods where possible. Thus there are significant intrinsic merits to researching and discovering the over wintering habitat preferences of Colorado potato beetles.

References


