# Distribution and Seasonal Phenology of Cereal Leaf Beetle (Coleoptera: Chrysomelidae) on Wheat in Tennessee[1]

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**ABSTRACT** A three-year study was conducted to assess the distribution and seasonal incidence of cereal leaf beetle, *Oulema melanopus* (L.), on wheat, *Triticum aestivum* L., in Tennessee. Cereal leaf beetle was distributed across the state with populations most frequently encountered in eastern and middle Tennessee. Cereal leaf beetle adults were active in wheat fields during late March to early April; eggs were found from late March to early May; and larvae were found from early April to early June, peaking during mid May. In our experimental plots, larval densities exceeded the suggested economic threshold during each year. $F_1$ adults emerged from late May to late June and fed approximately 2 wks on corn and other available Graminae plants. Adult activity then ceased; adults, eggs, and larvae were not encountered again until the following March and April.

**KEY WORDS** Small grains, wheat, cereal leaf beetle, *Oulema melanopus*.

The cereal leaf beetle (CLB), *Oulema melanopus* (L.), is an important pest of small grains, e.g., wheat, *Triticum aestivum* L., and oats, *Avena sativa* L., in several regions of the United States, primarily in the northcentral and eastern states (Haynes and Gage 1981). Although the adult and larva may feed on leaf tissue, the larva is the most destructive stage because it skeletonizes the leaf surface and reduces the photosynthetic ability of the plant (Haynes and Gage 1981). This reduction in photosynthesis may affect yield quantity and quality. For example, significant losses in grain yield among several CLB - susceptible winter wheat cultivars in Michigan have been documented (Webster et al. 1982, Webster and Smith 1983).

CLB was first confirmed in the United States in 1962 in southern Michigan, and has spread north to southern Canada, east to North Carolina, and west to Missouri (Battenfield et al. 1982). CLB was present in low numbers in Tennessee as early as 1972 (Haynes and Gage 1981); however, reports of damaging populations of CLB on wheat in Tennessee have increased during the last few years (Patrick, unpubl. data). Factors responsible for the spread and distribution of CLB are not clearly defined. The rapid movement eastward from its origin was partially due to the availability of food sources, sufficient environmental conditions, and appropriate weather patterns (Haynes and Gage 1981).

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The general biology of CLB in the United States has been reported by various researchers during the past few decades (Battenfield et al. 1982, Hatchett et al. 1987, Haynes and Gage 1981, Hunt and Baker 1982, Ruppel et al. 1970). CLB has one generation annually, undergoes four larval instars, usually pupates within an earthen cell 2 to 5 cm beneath the soil surface, and overwinters an an adult. Little information, however, is available on CLB in Tennessee. Therefore, a three-year study was initiated to assess the distribution of this pest species in Tennessee and to monitor its seasonal incidence on wheat.

## Materials and Methods

**Distribution.** To assess the distribution of CLB in Tennessee, wheat fields located in selected counties across the state were randomly surveyed during the spring (mid March to early June) of 1987, 1988, and 1989 for CLB populations (adults and/or larvae). Data (relative to presence or absence of CLB) obtained from this survey, combined with documented occurrences of CLB as reported by the Tennessee Department of Agriculture and University of Tennessee Agricultural Extension personnel, were evaluated to assess the statewide distribution of CLB.

**Seasonal Incidence.** To monitor seasonal phenology and density of CLB populations, soft red winter wheat (var. Coker 916) fields (one in 1987, two in 1988, and one in 1989) were sampled at the Highland Rim Experiment Station, Springfield, TN, located in the middle area of the state. Sizes and planting dates of each field were: approximately 2-ha field planted on 12 November 1986, approximately 1 and 2-ha fields planted on 24 October and 7 November 1987, respectively, and approximately 2-ha field planted on 26 October 1988. Management and cultural practices used were those recommended by the University of Tennessee Agricultural Extension Service for wheat production. No insecticide or fungicide treatments were applied.

Each field was sampled weekly beginning in early March and ending in early to mid June (at harvest). On each sampling date, 50 to 100 tillers were randomly selected in each field, and the number of CLB larvae on each tiller was counted and recorded. In addition, 50 leaves were randomly selected, and CLB eggs were counted and recorded on each leaf. To provide information relative to adult CLB, 50 sweep-samples were randomly taken with a standard sweep-net (37.5-cm diam) at weekly intervals in each field until larvae were collected. Sweep-net sampling was terminated once larvae were found. CLB larvae encased themselves in moist globules of fecal material which became attached to the sides of the sweep net and hindered accurate assessments of adult densities.

## Results and Discussion

**Distribution.** Known distribution of CLB has been limited, until the last decade, to several counties in eastern and middle Tennessee (Patrick, unpubl. data). During this study, CLB populations were found in 81 (of 95) counties

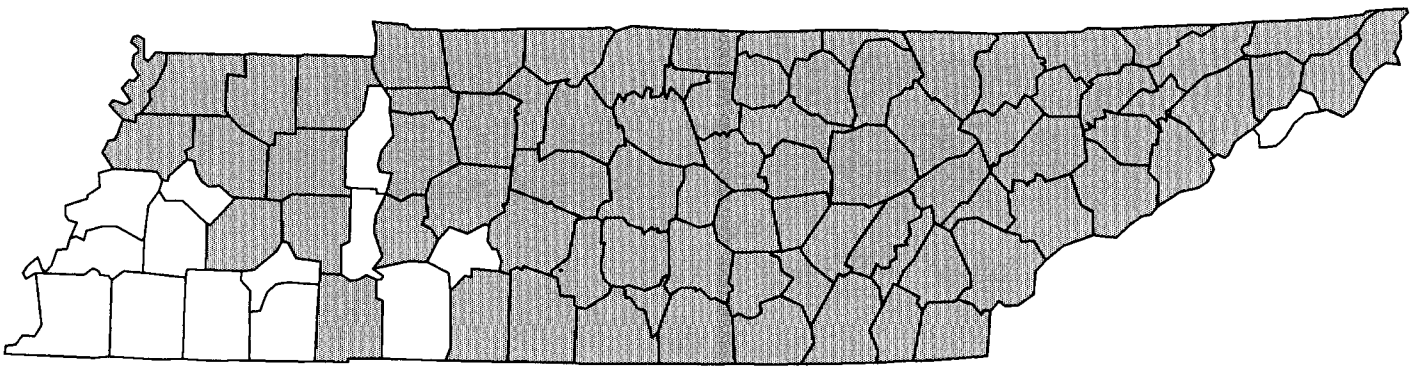

Fig. 1. Distribution of cereal leaf beetle on wheat in Tennessee, 1990 (shaded areas indicate counties where cereal leaf beetle larvae or adults were found).

(Figure 1). Although low levels of CLB were found in many of these counties, populations may continue to increase and reach damaging levels.

The spread of CLB from its original location in Michigan to the western and northwestern U.S. has been relatively slow (Haynes and Gage 1981). Environmental conditions, e.g., weather patterns, agricultural practices, adequate overwintering sites, as well as other factors, may have contributed to its reduced movement into some areas, especially western Tennessee. Casagrande et al. (1977) reported that adult CLB survived the winter in highest densities at the edge of woodlots and in sparse woods. These conditions are widespread in eastern and middle Tennessee, where most reports of CLB in the state were recorded.

**Seasonal Incidence.** Adults were first found in wheat fields during mid to late March. For example, adults were first collected on 23 March 1988. Eggs were first detected during late March to early April (Figure 2a,b,d) and larvae were first found on 23 April, 30 March, and 5 April during 1987, 1988, and 1989, respectively (Figure 2a,c,d). Larvae were present in the field until mid to late May, and larval densities peaked in mid May during each year.

The suggested economic threshold for CLB in Tennessee is one larva or adult per flag leaf or one per leaf prior to flag leaf emergence (Patrick et al. 1988). In our experimental plots, population densities of CLB exceeded this economic threshold during each year of this study. Maximum densities of CLB larvae were approximately 1.2/tiller, 2.3/tiller, and 2.1/tiller (approximately 2 leaves/tiller) on 14 May 1987, 11 May 1988, and 11 May 1989, respectively.

During 1988, more adults were found early in the season in the early-planted field than in the later-planted field (77/50 and 2/50 sweeps, respectively, on 23 March, and 112/50 and 8/50 sweeps, respectively, on 30 March). Large numbers of adults, however, did not remain and oviposit in the early-planted wheat. Adult absence was later reflected by CLB egg densities which were much greater on later-planted wheat (Field 2) than on the early-planted wheat (Field 1) (Figure 2b). CLB adults have been reported to be attracted to fields with thin stands (Herbert 1990). The later-planted field contained a thinner stand (ca. 20% less tillers) than the early-planted field, a condition that may have accounted for the higher oviposition (eggs/tiller) in the late-planted wheat. In Michigan, early-planted winter grains and late-planted spring grains generally maintained lower populations of CLB than normal plantings of each (Casagrande et al. 1977).

$F_1$ adults emerged during mid May to early June and fed on seedling corn and other available grasses (e.g., fescue) for ca. 2 to 4 weeks. Adults then ceased feeding, moved from the plants, and were not encountered until the following March and April.

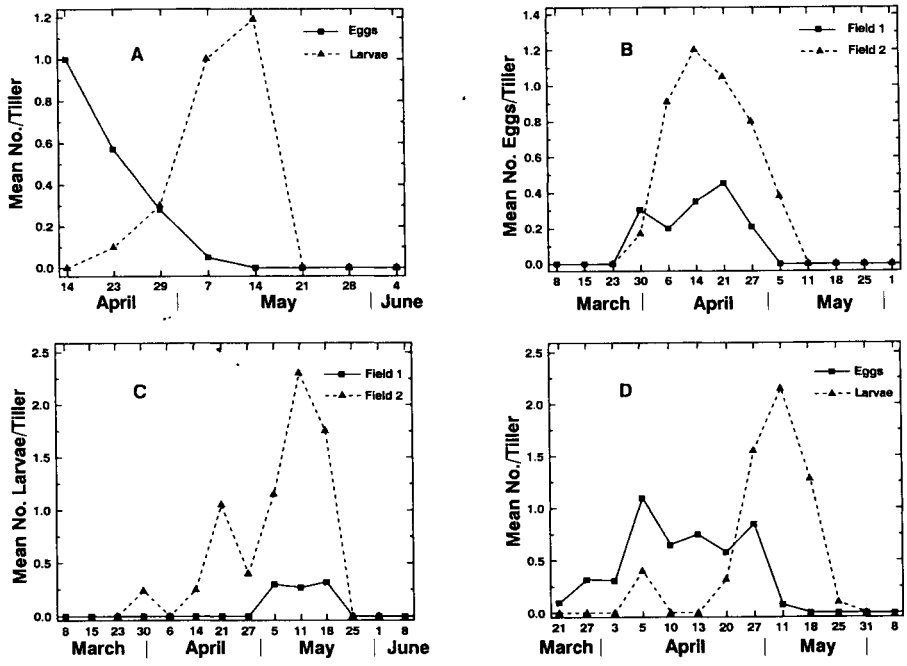


Fig. 2. Seasonal incidence of cereal leaf beetle on wheat (Springfield, Tennessee) – A) 1987 - eggs and larvae, B) 1988 - eggs, C) 1988 - larvae, and D) 1989 - eggs and larvae.

## Conclusions

Grower concern about CLB has increased in recent years (Patrick, unpubl. data). This concern combined with the spread of CLB in Tennessee necessitate the refinement of wheat management practices to incorporate decision-making guidelines and provide appropriate pest management strategies for CLB. These data provide basic biological information important to our understanding of possible pest-plant interactions. Because CLB also feeds on other small grains, especially oats (Ruppel et al. 1970), it is also important to understand its other host associations and population dynamics in Tennessee.

Although chemical insecticides are effective against CLB, the current value of wheat and cost of material may encourage the use of other control tactics. For example, pubescent wheat has been shown to be resistant to CLB, and several wheat lines with resistance to CLB have been released (Gallun et al. 1966, Ringlund and Everson 1968, Smith et al. 1978, Smith et al. 1980). In addition, researchers in other states have established several imported parasitoids for suppression of this pest (Maltby et al. 1971, Dysart et al. 1973, and others). These tactics may also be important to successfully regulate CLB in Tennessee;

however, further research is necessary to better understand their influence on population dynamics of CLB in the southeastern United States.

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