What Happened to the Alfalfa Blotch Leafminer?

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Introduction

Alfalfa blotch leafminer (ABL) recently invaded and attained pest status in Wisconsin. This insect was probably brought into Wisconsin in infested hay purchased from Thunder Bay, Ontario. It was first detected in 1996, and in the next two years ABL populations reached outbreak levels in northwestern Wisconsin. In 1998 the ABL epidemic appeared ready to expand to all alfalfa growing regions of the state. ABL has several generations a year. The adult female emerges from the soil and feeds by making pinholes in the alfalfa leaflets. She inserts her eggs between the upper and lower epidermis of the leaf. Larvae hatch from the eggs and eat the mesophyll of the leaf creating a mine. Larvae emerge from the leaf, as prepupae, and drop to the soil to pupate. Mining can result in losses of dry matter and protein (MacCollom et al. 1982, Andaloro et al. 1983). This study was undertaken to document the spread and severity of ABL within Wisconsin.

Materials and Methods

A survey was conducted to determine infestation levels of ABL throughout the state. Alfalfa fields were sampled during first, second and third cuttings. The fields chosen had at least 12 inches of growth to allow sufficient time for ABL adult emergence and oviposition. The sampler walked each field for a maximum of 5 minutes searching for pinhole (adult) feeding or mines. Upon detection of pinhole feeding or mines, 30 stems were collected randomly from the field. Stem samples were examined in the lab by counting numbers of leaflets per stem and recording the presence of pinholes and mines (only data on mines will be presented here).

Life table studies were performed in 1998 and 1999. In 1998, ABL populations were studied at Ashland Agricultural Research Station. In 1999 the Ashland populations crashed to almost undetectable levels, therefore the life table study was shifted to a commercial alfalfa field in Pierce County. Intensive sampling for ABL was conducted in each study field to determine the numbers entering each ABL life stage and the associated mortality factors. Egg and larval densities were estimated from stem samples (Harcourt and Binns 1980a), pupal densities were estimated from soil samples (Harcourt and Binns 1980b), and adult densities were estimated with emergence traps (Harcourt 1982).

Impacts of mortality factors were estimated several ways. ABL larvae and pupae were reared for parasitoid emergence. ABL larvae killed by predatory bugs could be identified in their mines, whereas egg and prepupal predation was approximated from

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disappearance. To corroborate the role of invertebrate predators in egg, larval and prepupal mortality, a series of no-choice cage studies was performed. These involved four potential predator species or morphospecies: damsel bugs (Hemiptera: Nabidae) and minute pirate bugs (Hemiptera: Anthocoridae) on ABL eggs and larvae, and ground beetles (Coleoptera: Carabidae) and rove beetles (Coleoptera: Staphylinidae) on ABL prepupae. Individual predators were caged for 5 or 7 days with known numbers of ABL in the appropriate life stage(s). A cage without a predator was included as a control.

Results and Discussion

ABL populations in Wisconsin grew to epidemic proportions and then declined to non-damaging levels. So what happened to alfalfa blotch leafminer? The ABL population survey that was conducted in 1998 and 1999 depicted a pattern of the insect as it invaded the state. The invasion of Alfalfa blotch leafminer resembled a wave with a population buildup followed by a distinct crash. In 1998 ABL populations were largest in northwestern Wisconsin and exceeded economically damaging levels of 10 mines/stem **(Fig. 1)**. However, in 1999 ABL population levels declined sharply in the northwest and the geographic distribution of the population shifted southward. **(Fig.2)**.

These observations suggest that ABL invades an area and proceeds to build up in numbers. In response, natural enemies reduce the ABL population. Life table studies conducted in Ashland in 1998 and Pierce County in 1999 indicated that the mortality factors that contributed most to the population decline of ABL were larval predation, prepupal predation plus pupation failure, and parasitism by *Chrysocharis liriomyzae* (a parasitoid wasp) **(Tables 1 and 2)**. *C. liriomyzae* is a small wasp that lays its eggs in ABL larvae. After the ABL maggot has pupated the wasp egg hatches and consumes the host. *C. liriomyzae* provided the highest apparent mortality of ABL. Large numbers of predators (damsel bugs, minute pirate bugs, ground beetles and rove beetles) were observed in the life table study fields. Cage studies provided supporting evidence of who the predators were. Damsel bugs ate an average of 38.5 % of ABL larvae that were presented to them. Minute pirate bugs fed heavily on ABL larvae, eating an average of 84.6% of the larvae presented to them. Ground beetles ate an average of 12% of ABL prepupae and rove beetles ate all prepupae that were encountered.

The reduction and apparent control of alfalfa blotch leafminer, an invading exotic pest, was realized by the combination of a suite of generalist predators along with a parasitic wasp (*C. liriomyzae)*. In the following years it appears that ABL population may continue to move south but at reduced population levels. Areas behind the front of the wave should also have reduced population levels. If this prediction is accurate ABL will be of minor concern to producers.

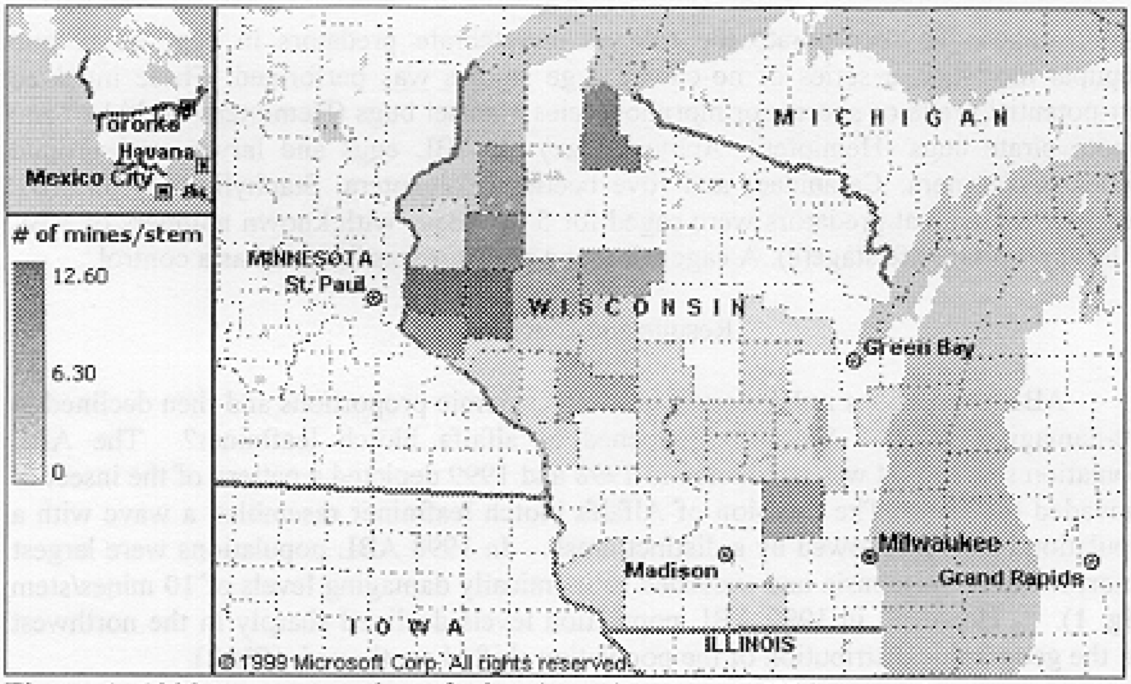

Figure 1: 1998 average number of mines/stem by county. White counties were not sampled.

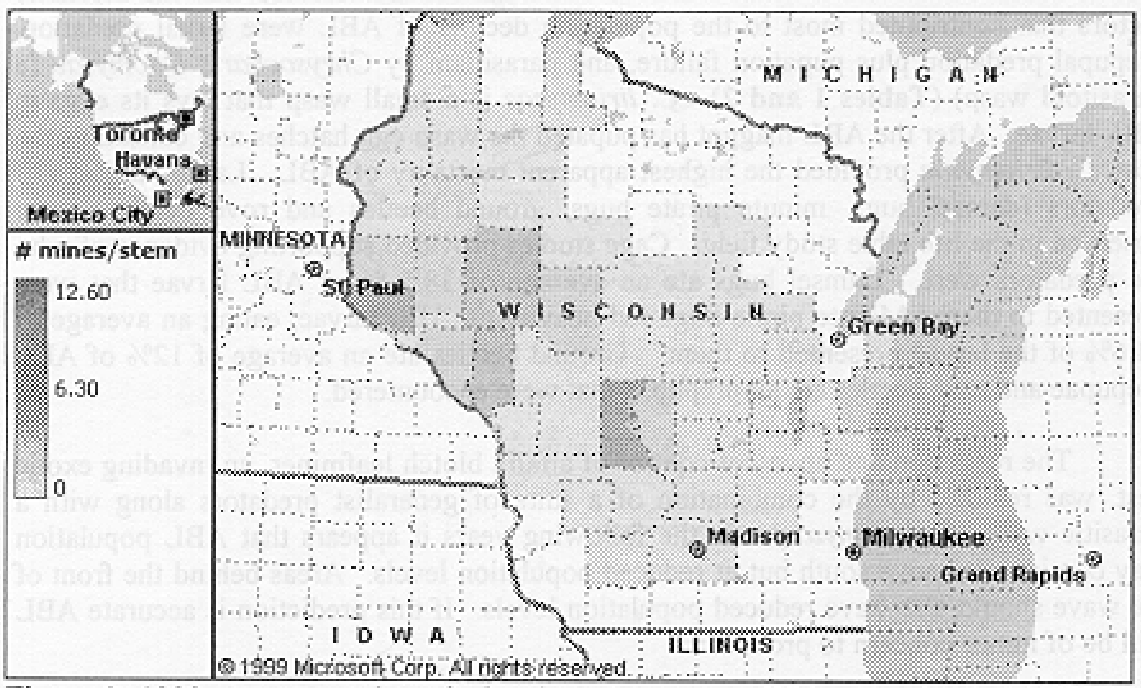

Figure 2: 1999 average number of mines/stem by county. White counties were not sampled

Table 1: 1998 Alfalfa Blotch Leafminer life table, UW Ashland Agricultural Research Station field 7(planted 5/96). Densities are insects per 0.0625 m^2.

insect stage	# entering each stage	mortality factors	# dying from each mortality factor	percent dying from each mortality factor
1st generation				
eggs	2563	predation and hatching failure	159	6.21
1st	2404	predation	518	21.52
		competition	116	4.85
		Diglyphus spp.	6	0.26
2nd	1764	predation	438	24.83
		Diglyphus spp.	59	3.30
		competition	35	2.00
3rd	1232	predation	173	14.06
		Diglyphus spp.	46	3.77
		harvest	16	1.31
		competition	2	0.14
prepupae	995	predation and pupation failure	624	62.68
pupae	371	*Chrysocharis liriomyzae*	362	97.61
adult				
female	7			
male	2			
2nd generation				
eggs	1699	predation and hatching failure	354	20.87
1st	1345	predation	499	37.08
		competition	7	0.56
2nd	839	predation	91	10.79
		competition	11	1.41
		Diglyphus spp.	1	0.05
3rd	736	predation	244	33.11
		Diglyphus spp.	5	0.72
prepupae	487	predation and pupation failure	276	56.68
pupae	211	*Chrysocharis liriomyzae*	211	100
adult				
female	0			
male	0			

Table 2: 1999 Alfalfa Blotch Leafminer life table, Pierce County field. Densities are insects per 0.0625 m^2.

insect stage	# entering each stage	mortality factors	# dying from each mortality factor	percent dying from each mortality factor
eggs	1474	predation and hatching failure	154	10.45
1st	1320	**predation**	395	**29.94**
		competition	15	1.14
		Diglyphus spp.	2	0.13
2nd	908	**predation**	154	**16.94**
		competition	12	1.31
		Diglyphus spp.	4	0.47
3rd	738	**predation**	155	**21.05**
		Diglyphus spp.	13	1.78
prepupae	570	**predation and pupation failure**	531	**93.16**
pupae	39	***Chrysocharis liriomyzae***	39	**100.00**
adult				
female	0			
male	0			

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