Plant Bugs (Lygus spp.), an Emerging Problem in Canola

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Introduction

Plant bugs belonging to the genus Lygus are increasingly important pests of canola in western Canada. Of the 3 1 species that occur in North America, only a few are significant crop pests (Schwartz and Foottit 1997). However, Lygus are insidious pests in a wide variety of crops (Schuster 1987, Scott 1987, Soroka 1997) and the Tarnished Plant Bug (*L. lineolaris* (Palisot de Beauvois)) has been reported feeding on 391 plant species (Young 1986). In western Canada Lygus is well known as a pest in seed alfalfa (Beime 1972). This paper summarizes what is known about the Lygus problem in canola and attempts to define where more work needs to be done.

Life Cycle and Damage

Studies in canola by Gerber and Wise (1995) and in alfalfa by Craig and Loan (1987) determined that adult Lygus over-winter in refuge habitats such as shelter belts which provide maximum protection from harsh winter conditions. In spring and early summer (May to July) the overwintering adults become active and move from their refuge sites to the first plants that are flowering, generally weeds and volunteer canola, where the females lay eggs. The first generation develops on these plant hosts, the adults dispersing in July and August to the next group of flowering plants (planted canola is vulnerable) . Craig and Loan (1987) determined that at latitudes below 50ºN (a line through Winnipeg and Medicine Hat) 70% of the first generation adults will reproduce. As the latitude increases the percent of the population reproducing decreases until above 53º30' N only a single generation is produced.

Lygus feed on plants by piercing the plant tissues, secreting digestive enzymes and pumping out the liquefied plant material (Tingey and Pillemer 1977). In canola, feeding injury consists of lesions on the surfaces of stems, buds, flowers and pods and causes buds and flowers to abscise and seeds to collapse, reducing the weight of healthy seeds (Butts and Lamb 1990, 199 1b). Butts and Lamb (199 1b) determined that feeding activity of Lygus bugs reduced seed yields up to 20% and highest yield losses were associated with a Lygus density of 52 per 10 sweeps.

Infestation of canola by Lygus plant bugs has increased to the point where insecticide application is necessary. One insecticide, trichlorfon, is currently registered for use in canola. In 1996 and 1997 more than 10,000 ha and 200,000 ha, respectively, were sprayed at podding in the Vulcan area of southern Alberta (Figure 1). Also in 1997, spraying took place at the start of

bloom in the Meadow Lake area of Saskatchewan and agai
9,000 ha. In the Olds, Alberta area an estimated 40% of canola seed loss was attributed to damage by ***Lygus*** in 1997 (Phil Thomas, Alberta Agriculture Food and Rural Development, pers. comm. 1997).

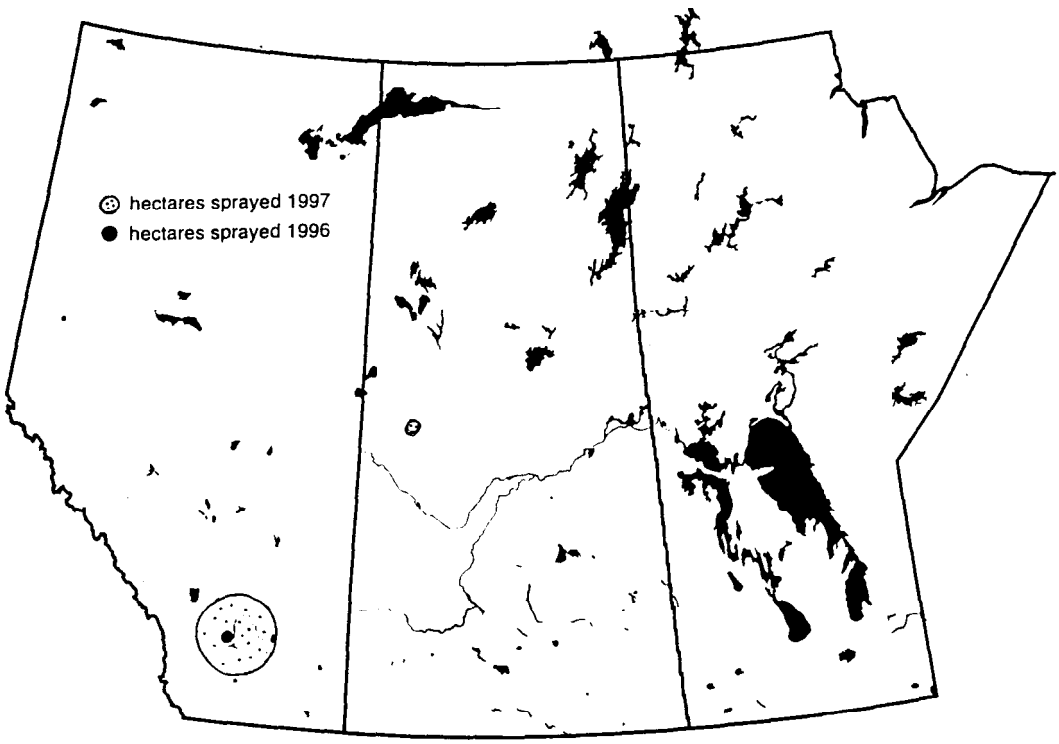

Fig. 1. Locations of Lygus outbreaks 1996 - 1997.

Population Composition, Sampling and Economic Threshold

Studies by Gerber & Wise (1994) and Schwartz and Foottit (1992a) concluded that Lygus ***borealis*** and ***L. elisus are*** most abundant in Alberta and Saskatchewan while ***L. lineolaris*** is most prevalent in Manitoba. However other studies indicate that the dominant species varies from year to year, region to region, crop to crop, and field to field (Loan and Craig 1976, Craig 1983, Butts and Lamb 1991a, Schwartz and Foottit 1992b, Timlick et al. 1993, unpublished data).

Population estimates of ***Lygus are*** made by taking series of sweeps with a sweep net and counting the numbers of adult and nymphs. Gerber and Wise (1994) found that in Manitoba ***Lygus*** bug populations are highest after flowering when nymphs are present and pods are developing. These researchers recommended sampling soon after the end of flowering to best determine the need to control damaging infestations in canola. Wise and Lamb (1997) determined that in Manitoba the economic threshold (ET) for plant bugs in canola at the end of flowering or when upper pods form is 15 plant bugs per 10 sweeps. When pods are fully formed the recommended threshold is 20 plant bugs per 10 sweeps.

In 1997 surveys by provincial agrologists in Alberta and Saskatchewan yielded samples containing up to 200 Lygus nymphs/l 0 sweeps at the budding and early flowering stages. Although damage may be extensive, chemical spraying is not recommended at the budding and early flowering stages because of the significant negative impact of insecticides on beneficial species, particularly insect pollinators essential for facilitating maximum canola yields (Gerber and Wise 1994).

Natural Enemies and Biological Control

There is very little known about the impact of natural enemies on Lygus populations in canola. However, natural enemies are important mortality factors in other crop systems and integrated management programs should be developed around the natural enemy complex. All stages of Lygus are attacked by a number of generalist predators (Table 1). Parasitoids attacking the egg, nymph, and adult stages of Lygus species (Table 2) have a much narrower range of food

Table 1. Predators known to attack and consume Lygus spp. in North America.

Predator		Reference
Hemiptera		
Lygaeidae		
	Geocoris bullatus (Say)	Tamaki et al. 1978
	Geocoris pallens (Stahl)	Leigh and Gonzalez 1976
Nabidae	*Nabis alternatus* (Parshley)	Perkins & Watson 1972, Tamaki et al. 1978
	Nabis aminicoferus Carayon	Leigh and Gonzalez 1976
	Nabicula leoptrata Kirby	Amoldi et al. 199 l
Pentatomidae		
	Podisus maculiventris Say	Amoldi et al. 199 l
Phymatidae		
	Phymatapennsylcanica Hanlisch	Amoldi et al. 199 1
Reduviidae	Zelus *renardii* Kolenati	Haglen et al. 1992
	Zelus socius Stahl	Amoldi et al. 1991
Araneida		
Philodromidae		
	Philodromus praelustris Keyserling	Amoldi et al. 1991
Thomisidae		
	Xysticus punctatus Keyserling	Amoldi et al. 199 1

species than predators, and the use of parasitoids as biological control agents is an important strategy in integrated management programs. The parasitic wasps that attack the immature stages of Lygus species have the greatest potential as biological control agents.

Several species of parasitic wasps belonging to the genus *Peristenus* attack and kill Lygus nymphs in North America and Europe. In western Canada *P. pallipes* is the only species found in Lygus populations in alfalfa (Craig and Loan 1987). In Europe there are three species, *P. digoneutis, P. stygicus* and *P. rubricollis* that attack *Lygus rugulipennis* Poppius, the most

important pest species (Craig and Loan 1984). Of these species *P. digoneutis* has been successfully established in the eastern U.S. for control of L. *lineolaris* in alfalfa (Day et al 1990). Introduction and establishment of *P. digoneutis* in western Canada would augment the levels of control by the existing *P. pallipes.*

Table 2. Parasitoids known to attack and kill Lygus spp. in North America.

Parasitoid	Reference
Egg Parasitoids	
Hymenoptera	
Anaphes iole Girault	Graham et al. 1986, Sohati et al. 1992, Jackson & Graham 1983
Erythmelus miridiphagus Dozier	Sohati et al. 1992
Polynema pratensiphagum Walley	Sohati et al. 1992
Telenomus sp.	Sohati et al. 1992
Nymphal Parasitoids	
Hymenoptera	
Euphoriana lygivora Loan (eastern)	Loan 1969
Leiophron uniformis (Gahan) (eastern)	Clancy & Pierce 1966, Graham et al. 1986, Amoldi et al. 1991
Peristenus pallipes (Curtis)	Clancey & Pierce 1966, Loan & Craig 1976
Peristenus pseudopallipes Loan (eastern)	Loan 1969
Adult Parasitoids	
Diptera	
Phasia aeneoventris (Williston)	Amaud 1978
Phasia fumosa (Coquillett)	Amaud 1978
Phasia opaca (Coquillett)	Amaud 1978
Phasia pulverea (Coquillett)	Amaud 1978

Tolerant Crop Varieties

Development of crop varieties tolerant to attack by insect pests is an important alternative to use of insecticides and there is evidence that some canola varieties are not preferred by Lygus species. Gerber (1997) found that Lygus *lineolaris* has different oviposition preferences on various lines of B. *napus* and that *B. juncea* is not a preferred host plant (Table 3). Schwartz and

Table 3. Oviposition preferences of *L. lineoluris* (adapted from Gerber 1997, $P<0.05$)

Host species	Nymphs/plant	Eggs laid
Brassica carinata A. Braun	32.7 + 8.4a	2nd week
Brussica juncea (L.)	*9.8* ± 5.7b	2nd week
Brassica napus L.	*40.3* ± 10.0a	2nd week
Brassica rapa L.	12.8 ± 4.9ab	2nd week
Sinapis alba L. (high glucosinolate)	40.5 ± 15.la	1 st week
Sinapis alba L. (low glucosinolate)	20.3 ± 6.lab	1 st week
Sinapis arvensis L.	*6.6* ± 2.5b	1st week

Foottit (1992) concluded that there is a wide range of geographic variation within Lygus populations that may reflect adaptation to changing natural and agricultural environments. Thus, identification of Lygus populations more prone to feed on canola than other populations will provide the technology to facilitate more precise targeting of tolerant crop variety development.

Research Needs

Successful integration of a variety of management approaches will facilitate canola production while minimizing costs to control Lygus pest species. The following areas of research are important to meeting that goal:

1) Document pest biology in canola and the sequence of host plants attacked (i.e. wild crucifers, volunteer canola, early seeded canola, late seeded canola) by Lygus species in areas where one and two generations occur in Alberta and Saskatchewan, including host plants during each stage. This information will provide the framework from which integrated management will be developed.

2) Determine how natural enemies impact on Lygus in canola and develop strategies for enhancing native species and for classical biological control using non-native species.

3) Continue study of the sources and types of resistance to attack by Lygus in canola and related plant species.

4) Develop a cohort developmental profile using temperature data to determine the application window for optimum control with insecticides.

5) Determine the genetic diversity of the pest Lygus species for developing regional management programs.

6) Develop monitoring and forecast systems for Lygus in canola to explain where and why they are occurring. For example, a study by Varis (1995) suggests that a warm summer and dry fall and spring lead to increased populations the following summer and that the number of Lygus nymphs in summer depends on the mean temperature in June.

7) Develop an intergrated pest management strategy for Lygus in canola.

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