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Surveys of *Lygus* spp. and their Movement on Cultivated Crops and Non-cultivated Habitats throughout Growing Season in Colorado

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Abstract: A three-year survey was conducted to evaluate population density and movement of *Lygus* species on cultivated crops and non-cultivated habitats throughout the growing season in Colorado. Three *Lygus* species, *L. elisus*, *L. hesperus*, *L. lineolaris*, were commonly found in cultivated crops and non-cultivated habitats based on concurrent adult collections in Colorado. *Lygus* species were found from early April to late in August, having multiple generations in each year in Colorado. *Lygus* species had wide host range in Colorado. Alfalfa was a significant host plant for *Lygus* species. However, after cutting alfalfa, *Lygus* species moved to adjacent crops, i.e. canola and caused significant injury during early flower and pod stages. The wild mustards, flixweed, *D. sophia* L. and tansy mustard, *D. pinnata* (Walt.), were significantly important host plants in non-cultivated areas and within cultivated crops. Removing wild mustard in sampling area resulted in the movement of *Lygus* species to canola crop. In conclusion, it might be important to know population density of *Lygus* species and their movement on cultivated crops and non-cultivated habitats to predict their injury to canola plants to develop control strategies.

Key words: *Lygus* spp. (Hemiptera: Miridae), population density, movement, cultivated crops and non-cultivated habitats, canola

INTRODUCTION

The genus *Lygus* Hahn (Hemiptera: Miridae) contains plant bugs including several economically important species in the United States (Schuh and Slater, 1995; Wheeler, 2000; 2001). Worldwide there are 43 known species of *Lygus* (Kelton, 1975) with 34 presents in the United States (Kelton, 1975). Most *Lygus* species are multivoltine (Henry and Lattin, 1987; Kelton, 1975; Layton, 2000) and all *Lygus* species overwinter as adults (Kelton, 1975; Layton, 2000; Wheeler, 2000). Most *Lygus* species are oligophagous (Henry and Lattin, 1987; Kelton, 1975; Schuh and Slater, 1995; Wheeler, 2000). They are highly mobile and annually migrate to crop areas (Kelton, 1975). Three *Lygus* species were important in cultivated crops and non-cultivated habitats in Colorado: *L. elisus* Van Duzee, the pale legume bug; *L. hesperus* Knight, the western tarnished plant bug; *L. lineolaris* (Palisot de Beauvois), the tarnished plant bug (Demirel *et al.*, 2005; Kelton, 1975). However, little known about their biology outside the croplands which might be

critical for development of their population density and their movement (Demirel *et al.*, 2005). The purposes of this study were to evaluate their population density and their movement on cultivated crops and non-cultivated habitats throughout the growing season in Colorado.

MATERIALS AND METHODS

A total of twenty-two different Colorado sites were sampled during 2000, 2001 and 2002 in Larimer (LC), Western Weld (WWC) countries. Thirteen sites (6 LC, 7 WWC) in 2000, ten sites (5 LC, 5 WWC) in 2001, and thirteen sites (10 LC, 3 WWC) in 2002 were sampled (Table 1). Field sampling involved using a standard 15-in diameter sweep-net, taking 20 sweep net samples per site for each sampling. Samples were taken from 18 April to 2 August in 2000, 18 April to 14 August in 2001 and 18 April to 13 August in 2002.

Samples were taken from varieties of vegetation types including croplands primarily monocultures of alfalfa (*Medicago sativa* L.), which sometimes infested

Table 1: Sites used in surveys of *Lygus* spp. on various habitats at LC and WWC in Colorado in 2000-2001- 2002

Site	Location	Predominant vegetation ¹
Ardec A	Ardec	Flixweed
Ardec B	Ardec	Flixweed
Ardec C	West of Ardec A	Alfalfa with some flixweed
Ardec D	Southwest of Ardec	Alfalfa with little flixweed
Ardec E	Ardec	Alfalfa with little flixweed
Ardec F	Ardec	Alfalfa with some flixweed
BayFarm A	CSU Bay Farm	Alfalfa field
BayFarm B	CSU Bay Farm	Alfalfa field
CSFS Nursery	CSFS Nursery	Alfalfa field
CR15 A	Weld County Rd 15	Roadside weeds, predominantly grasses
CR15 B	Weld County Rd 15	Roadside weeds, predominantly flixweed
CR15 C	Weld County Rd 15	Alfalfa with some flixweed
EI25	1.5 Miles East I25	Alfalfa with some flixweed
HortFarm	Colorado State Horticulture Research Farm	Alfalfa with little flixweed
H257 A	Southeast corner, Hwy 257	Alfalfa with some flixweed
H257 B	Weld County, Hwy 257	Flixweed
H257 C	Weld County Hwy, 257	Alfalfa with little flixweed
North Budweiser	LC Rd 54, North of Budweiser	Alfalfa with little flixweed
Mountain Vista	Mountain Vista Rd	Alfalfa with little flixweed
Severance A	NW of Downtown Severance center	Garden with flixweed
Severance B	Adjacent to above Severance site	Alfalfa with some flixweed
<i>W. cargill</i>	Cargill Oilseed Research Center, Ft. Collins	Alfalfa with some flixweed

¹ Flixweed at H257 B was predominantly the native species, *Descurainia pinnata* (Walt.) Britt. Flixweed at all other sites was predominantly the introduced European species, *Descurainia sophia* (L.) Webb. ex Prantl

with flixweed (*Descurainia sophia* (L.) Webb ex Prantl, and roadsides containing tansy mustard (*Descurainia pinnata* (Walt.)). Having flixweed common throughout the field, alfalfa fields were described as “some flixweed”. Fields where flixweed present but uncommon, were described as “little flixweed”. All samples were taken between 10 AM to 4 PM to allow warming on the surface of plants. Samples were taken by the same person, usually on a straight line transect across the sampling site. Samples were immediately placed into plastic bags and returned to the lab for counting of *Lygus* spp. nymphs and adults.

RESULTS AND DISCUSSION

Based on concurrent adult collections, three *Lygus* species, *L. elisus*, *L. hesperus*, *L. lineolaris*, were commonly found in cultivated crops and non-cultivated habitats in Colorado. The great majority of *Lygus* spp. present were *L. elisus*, *L. hesperus*, a small percentage of the adult insects were *L. lineolaris* in samples sites. Moreover, the most recent *Lygus* survey in 2002 resulted in three species present within different percent in Colorado (Demirel *et al.*, 2005). *Lygus elisus* was recovered with the highest frequency at 58.4 % of all. *Lygus hesperus* was the second most abundant species (29.3 %) followed by *L. lineolaris* (12.3%) (Demirel *et al.*, 2005).

The greatest numbers of *Lygus* species were recovered in 2000 with 2 times and 2.9 times greater total capture than those of 2001 and 2002, respectively (Table 2-4). The population density of *Lygus* species had

a couple of peaks during sampling period; 7 June 2000, 7 June and 21 July in 2001 and 18 May and 22 July in 2002, respectively. The first *Lygus* species were reported in each year in the middle of April. This support previous report by Kelton (1975) indicating the movement of *Lygus* species from winter shelter by early spring. In addition, *Lygus* species were also found more consistently throughout the season. The most recent survey also indicated that activity of *Lygus* species was continued into October (Demirel *et al.*, 2005). Furthermore, different *Lygus* species had different activity periods. For example, in 2002, 1745 *Lygus* adults were collected in total and the highest population of *L. elisus* occurred during the early season which comprised 98.0 and 89.2% of all *Lygus* collected in May and June samplings, respectively (Demirel *et al.*, 2005). *Lygus hesperus* tended to occur in higher ratio later in the season becoming the predominant *Lygus* species during October and September. Moreover, the greatest recoveries of *L. lineolaris* were in July and October, with none collected in August (Demirel *et al.*, 2005).

The current survey indicated that alfalfa was a favored food source of three *Lygus* species in Colorado as mentioned previous studies (Sevacherian and Stern, 1974; 1975). For example, *Lygus* species had the highest population density in alfalfa fields at CR15 C in 9 May, Ardec D in 16 May, H257 A in 17 May, Severance B, EI25, Hortfarm, and *W. cargill* in 7 June in 2000, Ardec E, F, EI25, CR15 C and *W. cargill* in 29 May, Hortfarm, H257 C in 7 June in 2001, Ardec C, CR15 C, EI25, *W. cargill* in 18 May, Hortfarm in 18 June in 2002 (Table 2-4). However, after cutting alfalfa, the population

Table 2: Weekly samples of *Lygus* spp. on varies habitats at LC and WWC in Colorado in 2000

Site	18-Apr	25-Apr	2-May	9-May	16-May	23-May	30-May	7-June	14-June	21-June	29-June	5-Jul	11-Jul	18-Jul	28-Jul	2-Aug
Ardec A	20	28	77	62	51	110	25	380	83	32	19	9	0	0	0	0
Ardec B	25	32	34	55	69	143	36	388	87	61	11	5	0	0	0	0
Ardec D	17	17	51	16	42	0	1	2	3	25	16	17	0	0	0	0
Hortfarm	29	18	58	26	47	72	52	133	24	0	0	3	88	31	15	15
CR15 A	9	20	2	0	6	0	4	0	0	0	0	0	0	0	0	0
CR15B	25	33	49	61	110	65	120	295	268	23	5	3	0	0	0	0
CR15C	66	55	81	61	1	0	0	33	12	1	1	1	4	0	64	16
H257A	45	20	25	25	17	0	0	0	1	8	5	13	76	0	0	0
H257 B	71	15	16	42	27	182	51	499	10	3	0	0	0	0	0	0
Severance A	0	10	11	7	60	45	13	493	285	197	11	1	1	31	31	19
Severance B	49	0	0	12	17	54	20	175	42	20	31	1	0	0	0	0
EI25	0	7	7	19	60	267	6	629	0	11	0	37	38	11	54	24
<i>W. cargill</i>	96	35	9	8	11	150	4	805	271	457	14	66	10	0	10	16
Total	452	290	420	394	518	1088	332	3832	1078	838	113	156	217	73	174	90

Table 3: Weekly samples of *Lygus* spp. on varies habitats at LC and WWC in Colorado in 2001

Site	18-Apr	25-Apr	3-May	8-May	23-May	29-May	7-June	12-June	19-June	27-June	3-Jul	12-Jul	21-Jul	25-Jul	7-Aug	14-Aug
Ardec E	0	4	15	14	16	21	5	24	7	15	37	36	55	79	6	9
Ardec F	0	6	15	4	7	26	9	35	0	14	26	18	73	53	18	27
Hortfarm	2	8	3	19	20	6	71	2	0	6	14	23	64	24	0	0
CR15 C	0	10	5	13	2	65	5	15	21	1	6	65	45	64	20	4
<i>W. cargill</i>	5	13	63	8	3	25	12	3	154	26	74	18	61	7	6	27
H257 B	91	71	14	31	58	228	18	33	0	8	16	15	0	0	0	0
H257 C	10	5	11	14	6	8	404	160	42	3	0	10	36	37	17	19
Severance A	51	14	17	12	24	91	65	64	36	24	28	66	108	64	3	19
Severance B	133	64	58	32	44	32	15	36	10	13	89	45	10	14	0	12
EI25	30	39	2	4	10	64	4	43	25	26	35	66	68	7	18	21
Total	322	234	203	151	190	566	608	415	295	136	325	362	520	349	88	138

Table 4: Weekly samples of *Lygus* spp. on varies habitats at LC and WWC in Colorado in 2002

Site	18-Apr	25-Apr	2-May	8-May	18-May	27-May	4-June	12-June	18-June	28-June	5-Jul	12-Jul	22-Jul	5-Aug	13-Aug
Ardec C	1	2	39	19	101	0	11	3	4	12	4	4	209	19	12
Ardec D	4	3	14	11	2	5	10	12	8	18	4	3	69	36	19
Hortfarm	2	0	5	7	10	65	16	25	108	6	22	12	39	14	9
N.Bud	4	4	4	17	13	14	8	21	18	29	25	28	51	76	4
Mon.Vista	1	1	5	0	2	0	5	18	4	16	8	8	0	0	0
CR15 C	1	3	2	8	305	23	61	10	24	4	11	0	57	25	9
H257 C	2	3	12	26	13	12	0	4	18	29	16	25	167	17	2
Severance A	0	0	0	7	8	0	16	16	10	2	15	15	16	32	9
EI25	3	1	15	28	18	4	7	125	28	10	2	2	10	43	22
<i>W. cargill</i>	3	0	29	23	25	8	8	25	8	22	9	9	59	5	8
Bayfarm A	6	4	3	5	11	14	38	35	3	10	7	7	21	16	2
Bayfarm B	4	4	8	15	9	2	22	12	8	6	13	21	54	0	1
CSFS Nursery	0	0	12	11	10	12	15	10	4	18	6	6	010	3	3
Total	31	25	148	177	527	159	217	316	245	182	142	140	752	293	100

density of *Lygus* species had a sharp decline in sampling sites. For example, the population density of *Lygus* species declined after cutting alfalfa at those sampling places; CR 15 C in 16 May, Ardec D, H257 A in 23 May, Severance B in 7 June, EI25, *W. cargill* in 14 June, Hortfarm in 21 June in 2000, Ardec E, EI25 in 7 June, Hortfarm, H257 C in 12 June in 2001, Ardec C, CR15 C, EI25, and *W. cargill* in 27 May in 2002 (Table 2-4). This suggests that alfalfa harvest contributes to *Lygus* migration. Moreover, previous report by (Demirel, N., 2003, Ph. D Thesis, Colorado State University) indicated that after cutting alfalfa, the *Lygus* species moved to canola crops and caused significant injury, especially during early flower and pod stages. However, previous report indicated that manipulations of alfalfa through strip

harvest can prevent migration of *Lygus* to adjacent crops (Stern *et al.*, 1964; Stewart and Layton, 2000).

Lygus species were commonly found on flaxweed in early season. For example, the sampling sites, Ardec A, Ardec B, CR15 B, H257 B, Severance A sites in 7 June in 2000 and H257 B, Severance A sites in 29 May in 2001 with flaxweed alone, had higher *Lygus* populations (Table 2 and 3). In addition, the previous survey also indicated that the *Lygus* species might be found at different percentages in different vegetations sampled (Demirel *et al.*, 2005). *Lygus elisus* was found mainly on flaxweed and in alfalfa/flaxweed mixtures. *Lygus hesperus* was the species most commonly recovered from lambsquarters, *Chenopodium album* L., kochia, *Kochia scoparia* (L.) Schrad. and pigweed, *Amaranthus*

retroflexus L. in Colorado (Demirel *et al.*, 2005). However, after removing flixweed in sampling areas the population density of *Lygus* species decreased, i.e., Ardec A and B, H257 B, and Severance A in 14 June, CR 15 B in 21 June in 2000, H257 B 7 June in 2001 (Table 2 and 3).

In conclusion, three *Lygus* species, *L. elisus*, *L. hesperus*, *L. lineolaris*, were important pests in cultivated crops and commonly found in non-cultivated habitats in Colorado. *Lygus* species having multiple generations per year were found from early in April to late in August in Colorado. *Lygus* species have a wide host range. Alfalfa was significant host plant for *Lygus* species and yet after cutting alfalfa, *Lygus* species moved to adjacent canola and caused significant injury during early flower and pod stages. The wild mustard, flixweed, *D. sophia* L., and tansy mustard, *D. pinnata* (Walt.), were important host plants in the non-cultivated and within cultivated crops in Colorado. Removing of wild mustard in sampling areas also caused the movement of *Lygus* species to canola crop in Colorado. Strip cutting, where strips of alfalfa is cut alternately to prevent the movement of *Lygus* spp. from alfalfa to canola, managing cutting times of alfalfa before or after the flower and pod stages of canola, but more importantly not to plant alfalfa and canola to adjacent fields might be useful tactics to decrease the *Lygus* injury on canola crops. In addition, wild mustards around the field can be destroyed to prevent the population build up of *Lygus* spp.

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