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**Surveys of False Chinch Bug, *Nysius raphanus* (Howard)
(Hemiptera: Lygaeidae) 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 of False Chinch Bug (FCB), *Nysius raphanus* (Howard) (Hemiptera: Lygaeidae) and their movement on cultivated crops and non-cultivated habitats throughout the growing season in Colorado (USA). The first population of the FCB appeared winter mustard such as flixweed, *Descurainia* spp., in Larimer and western weld County in Colorado. Within a wide host range, they moved from alfalfa after cutting to adjacent crops, i.e. canola and caused significant injury during early flower and pod stages. They also moved to canola from wild mustards, flixweed, *D. sophia* L. and tansy mustard, *D. pinnata* (Walt.), which were present in both non-cultivated areas and cultivated crops. Furthermore, the dry weather condition might be increased the activity and outbreak of FCB on the cultivated crops and non-cultivated habitats, whereas the heavy rain was decreased the population density of FCB. Knowing the population density of FCB and their movement on cultivated crops and non-cultivated habitats is important to predict their injury to canola plants and for developing new control strategies.

Key words: False Chinch Bug (FCB), *Nysius raphanus* (Howard), (Hemiptera: Lygaeidae), population density, movement cultivated crops, non-cultivated habitats

Introduction

The False Chinch Bug (FCB), *Nysius raphanus* (Howard) (Hemiptera: Lygaeidae), is the most serious pest among North America species of *Nysius* (Ashlock, 1977; Sweet, 2000). False chinch bug is multivoltine (Burgess and Weegar, 1986) and overwintering as adult stage under protective debris or rubbish (Burgess and Weegar, 1986; Barnes, 1970; Byers, 1973; Sweet, 2000). FCB has a broad host range (Knowlton, 1934; Knowlton and Wood, 1943; Barnes, 1970; Tappan, 1970; Sweet, 2000; Capinera, 2002; Demirel, 2003) and a general feeder with preference for plants in the Chenopodiaceae and Brassicaceae (Howard, 1872; Knowlton, 1934; Smith, 1942; Knowlton and Wood, 1943; Wene, 1953, 1958; Leigh, 1961; Tappan, 1970; Sweet, 2000; Capinera, 2002; Demirel, 2003). The false chinch bug is highly mobile, annually migrates from cultivated crops and non-cultivated habitats to canola and congregate upon them causing significant injury during early

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flower and pod stages (Demirel, 2003; Demirel and Cranshaw, 2005, 2006). However, there is little information on the biology of these species in Colorado outside croplands. Such non-cultivated habitats can be critical to population development of false chinch bug, prior to migration into canola. The purpose of this study was surveying of population density of FCB outside of canola crops that were thought useful in understanding factors contributing to damaging outbreaks and developing new control tactics to prevent their injury on canola crops 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) counties. 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 in 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 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”.

Table 1: Sites used in surveys of *Nysius raphanus* on different habitats at LC and WWC in Colorado in 2000-2001-2002

Site	Location	Predominant vegetation ¹
ARDEC A	Colorado State Agricultural Development and Education Center	Flixweed
ARDEC B	ARDEC	Flixweed
ARDEC C	Immediately west of ARDEC A	Alfalfa with some flixweed
ARDEC D	Southwest of ARDEC along CR 56	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, 1. 5 miles to East 14	Roadside weeds, predominantly grasses
CR15 B	Weld County Rd 15, 2 miles to East 14	Roadside weeds, predominantly flixweed
CR15 C	Weld County Rd 15, intersection of Hwy 86	Alfalfa with some flixweed
EI25	One half mile east of I25, on right of Strauss Cabin Rd	Alfalfa with some flixweed
HortFarm	Colorado State Horticulture Research Farm	Alfalfa with little flixweed
H257 A	Southeast corner, Hwy 257 and 14-intersection	Alfalfa with some flixweed
H257 B	Weld County Hwy 257, 2 miles south of Hwy 14	Flixweed
H257 C	Weld County Hwy 257 intersection at CR 80	Alfalfa with little flixweed
North Budweiser	Larimer County Rd 54, north of Budweiser Plant	Alfalfa with little flixweed
Mountain Vista	Corner of Mountain Vista Rd and Timberline Rd	Alfalfa with little flixweed
Severance A	Two blocks NW of downtown Severance center	Garden with flixweed
Severance B	Adjacent to above Severance site	Alfalfa with some flixweed
W.Cargill	Cargill Oilseed Research Center, Ft. Collins	Alfalfa with some flixweed

¹Flixweed 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

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 false chinch bug nymphs and adults.

Results and Discussion

A significant high FCB numbers were collected on 18 April in 2000 comparing with in the subsequent two years (Table 2-4). The peak of FCB numbers occurred over a two-week range; 23 May, 6 Jun, 27 May in 2000-2002, respectively (Table 2-4). A dramatic declines in FCB captures occurred shortly following peak capture in 2001 and 2002, but were more gradual in 2000. This decrease can largely be attributable to first cutting of alfalfa. The first cutting of alfalfa occurred on 23 May 2000 at Ardec C; the remaining alfalfa fields were the first cut in June; 7 June at H257 A; 14 June at Hortfarm, Severance B, EI25, W. Cargill and 21 June at CR15 C (Table 2). In addition, the first cutting of alfalfa occurred between the first week and third week of June in 2001 (Table 3). Moreover, the first alfalfa cutting occurred the second week on June 2002 (Table 4).

Table 2: Weekly samples of false chinch bugs, *Nysius raphanus*, on different crops 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
Ardec A	7	7	46	51	108	275	791	1253
Ardec B	10	14	21	15	34	803	326	12071
Ardec D	6	8	8	10	10	0	4	1
Hortfarm	3	89	41	30	58	152	462	180
CR15 A	0	54	3	2	4	0	1	0
CR15 B	1	25	32	36	62	380	708	1416
CR15 C	0	169	44	285	84	5990	4002	7613
H257 A	38	80	115	641	888	3441	1368	5
H257 B	15	45	25	515	321	1189	770	248
SeveranceA	0	850	580	750	390	980	103	425
SeveranceB	4	0	0	190	180	835	96	188
EI25	0	201	240	466	475	2609	895	323
W. Cargill	635	225	440	454	474	2437	460	178
	719	1797	1595	3445	3088	29077	9986	23901

Table 2: Continue

Site	14-June	21-June	29-June	5-July	11-July	18-July	28-July	2-Aug
Ardec A	97	185	1502	881	0	0	0	0
Ardec B	19	163	1598	388	0	0	0	0
Ardec D	0	18	1	8	0	0	0	0
Hortfarm	27	0	0	0	0	0	0	0
CR15 A	0	0	0	0	0	0	0	0
CR15 B	22	9469	666	549	0	0	0	0
CR15 C	1722	22	23	18	55	14	44	0
H257 A	1	15	14	4	1	0	0	0
H257 B	11	0	2	0	0	0	0	0
SeveranceA	13845	11562	3416	82	6	6	9	0
SeveranceB	25	150	235	87	0	0	0	0
EI25	0	3	9	80	0	1	0	4
W. Cargill	47	1125	176	10785	19	1	2	2
	15816	22712	7642	12810	81	21	65	6

Table 3: Weekly samples of false chinch bugs, *Nysius raphanus*, on different crops 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
Ardec E	0	0	2	7	0	3	0	4
Ardec F	0	0	2	0	0	0	0	0
Hortfarm	0	0	0	0	0	0	5	0
CR15 C	0	0	0	0	0	1	2	0
H257 B	0	8	4	0	2	71	2	6
H257 C	0	3	0	0	0	2	169	30
Severance A	0	3	4	3	2	1	3	0
Severance B	0	8	13	4	5	3	4	10
E125	0	2	1	0	0	0	0	5
W. Cargill	0	1	0	1	0	2	0	3
	0	25	26	15	9	83	185	58

Table 3: Continue

Site	19-June	27-June	3-Jul	12-Jul	21-Jul	25-Jul	7-Aug	14-Aug
Ardec E	5	7	24	5	0	16	4	3
Ardec F	1	0	0	2	1	5	6	5
Hortfarm	0	0	0	3	2	0	0	0
CR15 C	0	1	4	16	58	4	0	0
H257 B	0	0	2	2	0	0	0	0
H257 C	28	36	25	16	46	13	1	0
Severance A	1	5	3	0	0	0	0	0
Severance B	0	2	25	10	2	0	0	0
E125	0	1	0	16	1	0	0	0
W. Cargill	0	1	3	4	2	0	0	0
	35	53	86	74	112	38	11	8

Furthermore, Alfalfa cutting apparently induces migration from fields earlier than would occur in its absence. For example, in 2000 high FCB numbers were sustained through late June in the predominantly flixweed sites of ARDEC A, ARDEC B, CR15 B and Severance A (Table 2). Subsequent reductions in FCB numbers in early July reflect drying of these weeds.

Although alfalfa fields do appear to serve as a major source of FCB early in the season, this does appear due largely to winter annual mustards associated with the crop. During 2000 samplings, alfalfa fields with little flixweed (ARDEC C, Hortfarm) produced far fewer FCB numbers in weekly captures than did alfalfa fields where this weed was more abundant (Table 2). In addition, FCB numbers captured in alfalfa fields declined sharply after late June, when flixweed had largely matured and was no longer a suitable host. Leigh (1961) similarly reported that FCB populations built up on several spring mustards; *Sisymbrium irio* L., *Capsella bursa-pastoris* (L.) Medik., *Lepidium nitidum* Nutt. prior to migration into cotton fields. In addition, the importance of *S. irio* was also noted by Barnes (1970) as the major source of FCB prior to migration into vineyards.

The new founding with in this current study in northern Colorado, *Descurainia sophia* and to lesser extent, *D. pinnata* appear to be very important in early season populations of *N. raphanus* in the alfalfa crops and non-cultivated habitats. In addition, the first population of the FCB appeared winter mustard such as Flixweed, *Descurainia* spp., in Larimer and western weld County in Colorado. This suggests that movement from overwintering sites and active feeding on hosts may begin over a nearly month-long period in mid-spring, depending on season. Large numbers of nymphs, as well as adults, were captured during these surveys. This also indicates that the sampled sites

Table 4: Weekly samples of false chinch bugs, *Nysius raphanus*, on different crops at LC and WWC in Colorado in 2002

Site	18-Apr	25-Apr	2-May	8-May	18-May	27-May	4-June
Ardec C	0	0	0	0	0	3951	3210
Ardec D	0	0	0	249	7819	3	10
Hortfarm	0	0	0	0	0	7169	7101
N. Bud	0	0	0	0	3	4	3
Mon.Vista	0	0	0	0	0	0	0
CR15 C	0	0	0	21	435	2111	2010
H257 C	0	0	0	0	2	0	6
Severance A	0	0	0	2	0	5	2
EI25	0	0	0	0	0	0	0
W.Cargill	1	0	1	4	0	2	0
Bayfarm A	0	0	0	1	2	210	2
Bayfarm B	0	0	0	0	2	2	1
CSFS Nursery	0	0	0	0	1	2	24
	1	0	1	277	8264	13459	12369

Table 4: Continue

Site	12-June	18-June	28-June	5-Jul	12-Jul	22-Jul	5-Aug	13-Aug
Ardec C	0	0	0	6	0	0	0	0
Ardec D	0	0	0	0	0	0	0	0
Hortfarm	2	48	0	0	0	0	0	0
N. Bud	0	0	0	4	0	0	0	0
Mon.Vista	0	0	4	4	0	0	0	3
CR15 C	2	0	0	0	0	0	0	1
H257 C	1	4	2	6	0	0	0	0
Severance A	0	0	0	0	0	0	0	0
EI25	0	4	0	0	0	0	0	6
W.Cargill	10	7	0	0	0	0	0	0
Bayfarm A	0	0	0	0	0	0	0	0
Bayfarm B	0	3	0	3	0	0	2	0
CSFS Nursery	0	2	2	7	0	0	0	3
	15	68	8	30	0	0	2	13

(e.g., alfalfa, flixweed) reflect areas of early season FCB population development. In addition, a total numbers of FCB caught during 2000 in sweep net samples were 162 times and 42 times higher than in 2001 and 2002, respectively (Table 2- 4). In part, higher FCB captures during 2000 may be related to the excellent growing conditions for winter annual mustards, notably flixweed. Moreover, the more sites where this weed was present were sampled during 2000. However, there are some weekly changes in FCB capture that are more difficult to explain. For example, between 18 May and 27 May captured at ARDEC C and Hortfarm, then went from 0 to very high number in one week, whereas Ardec D went from very high number to 0 the same week (Table 4). This may be due in part to sampling biases inherent in use of the sweep net (Southwood 1978). It also could be related to the highly aggregated distribution of FCB within sample sites, which was repeatedly observed in with individual plants or small patches hosting thousands of individuals. Capinera (2002) commented that the highly aggregated distribution of FCB requires systematic inspection when doing field survey. Furthermore, an extreme FCB aggregation was observed in these samplings, particularly in fields that were predominantly flixweed (e.g., ARDEC A, B in 2000).

The other reason for sharply decreasing of FCB numbers might be the weather conditions that can also be a factor in FCB population changes, at least as assessed by sweep net sampling. For example, FCB can be hard to find following heavy rainfall (Howard, 1872), which was also observed in these studies. However, heavy rainfall did not have persistent effect on FCB

capture. During sampling, heavy rainfall events at the ARDEC site occurred on 17-May (0.91) in 2000, on 5-May and 17-May (0.94 and 0.33 in) in 2001 and on 23-May (1.01) in 2002. There was no consistent trend of lower FCB capture in sample sites around the ARDEC area following these rainfall events. As a result, the dry weather condition might be increased the activity and outbreak of FCB on the cultivated crops and non-cultivated habitats, while the heavy rain resulted in decreasing the population density of FCB.

In conclusion, evaluation of three year survey indicated that the first population of the FCB appeared winter mustard such as Flixweed, *Descurainia* spp., in Colorado. Within a wide host range, FCB moved from alfalfa after cutting to adjacent crops, i.e. canola and caused significant injury during early flower and pod stages. FCB also moved to canola from wild mustards, flixweed, *D. sophia* L. and tansy mustard, *D. pinnata* (Walt.), which were present in both non-cultivated areas and cultivated crops. Furthermore, the dry weather condition might be increased the activity and outbreak of FCB on the cultivated crops, whereas the heavy rain was decreased the population density of FCB. Knowing the population density of FCB and their movement on cultivated crops and non-cultivated habitats is important to predict their injury to canola plants and for developing new control strategies. In addition, the controlling of wild mustard in cultivated crops and non-cultivated habitat is significantly important to take under control FCB injury on canola crops in Colorado.

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