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Evaluation of Spring Canolas and Mustards of Varying Age for Relative Preference by False Chinch Bugs, *Nysius raphanus* (Howard)

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Abstract: The False Chinch Bug (FCB), *Nysius raphanus* (Howard), is one of the most important pests on the Brassicaceae plants. Eleven different Brassica cultivars were tested at two different seedling stages for relative feeding preferences by FCB in the greenhouse conditions. False chinch bug showed strong feeding preference for older plants, particularly among the cultivars ZEM1, Debut and CO1. The cultivars preferred less due to age were Helios, Alto and W1-23. In addition, the spring mustard W1-23 was consistently least preferred by false chinch bug.

Key words: False Chinch Bug (FCB), *Nysius raphanus* (Howard) (Hemiptera: Lygaeidae), host preferences, *Brassica* cultivars, canola, mustard

INTRODUCTION

The False Chinch Bug (FCB), *Nysius raphanus* (Howard) (Hemiptera: Lygaeidae), originally described from Kansas by Howard[1], is one of the most serious pests among North America species of *Nysius*[2,3]. False chinch bug is multivoltine[4] and overwintering as the adult stage under protective debris or rubbish[5-7]. Eggs are about 1.5 mm long and 0.4 mm wide and translucent pinkish white color[8]. It is laid in many sites including loose soil, among clods or rubbish, among petals of a composite flower. There are five nymphal stages[1] and the nymphs have grayish with reddish-brown abdomens[9].

The false chinch bug is a general feeder with preference for plants in the Chenopodiaceae and Brassicaceae[1,7,9-15]. Injury by FCB is caused from removal of sap, which is sucked from plants while feeding. Individual insects cause little damage but large aggregations frequently occur on single plants or in small areas of the field. Heavily infested plants can show symptoms of severe wilting and sometimes are killed[1,6,8,11,12,16,17].

False chinch bugs are a key pest of canola grown in Colorado[18,19]. They cause significant injury at all growth stages of canola but is the most damaging at seedling stages[13,14] and particularly, following flowering and during seed-pod development[19]. During outbreaks large aggregations can occur on plants causing wilting and sometimes death of plants[11,19]. Host plant preference is a potential management tactic in development of IPM systems[20]. Evaluation of FCB susceptibility among oilseed brassicas has not previously been reported. The purpose of this study was to make preliminary evaluation of resistance present in commercially available oilseed canola and mustard.

MATERIALS AND METHODS

Trials were conducted during 2000 at Colorado State University, Ft. Collins, CO. Included were mixtures of 11 different *Brassica* cultivars including seven spring canolas, *Brassica napus* cvs. Alto, Sterling, Helios, Westar, CO1, IMC01 and Springfield, a winter canola, *Brassica napus* cv. Casino, a winter mustard, *Brassica juncea* cv. Debut and two spring mustards, *Brassica juncea* cvs. ZEM 1 and W1-23.

A separate variable was age of the plants. Seedling stages were evaluated beginning at 15 Days After Seeding (DAS). Older plants were first evaluated at 45 days following seeding. Replications consisted of randomly placing a single equal-aged plant of each cultivar within a 61 cm high x 61 cm long x 37 cm wide cage and subsequently introducing 100 field collected false chinch bug adults. Each of the cages contained plants of two different growth stages (15 days after seeding; 45 days after seeding). Experimental design was Randomized Complete Block with five replications.

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There were three separate runs of the trial and each conducted under identical conditions. The first trial took place from 16 to 22 August; the second trial from 25 to 31 August; the final trial from 7 to 11 September. In each trial count of the numbers of false chinch bugs per plant were made at 24 h intervals. Data were analyzed by analysis of variance (ANOVA) with using the SAS software and means were separated using the Student-Newman-Keuls (SNK) Multiple Comparison Test[21].

RESULTS AND DISCUSSION

Average number of FCB showed significant feeding preference for older plants (45 DAS) (df =10,319, F= 19.780, p=0.0001; df =10,264, F=38.596, p=0.0001; df=10,209, F=29.414, p=0.0001, respectively) (Table 1-3). There was not any significant difference feeding preference among young plant (15 DAS) in first and second trial (df =10,319, F=1.820, p=0.056; df=10,264, F=2.133, p=0.022, respectively) (Table 1 and 2) and yet third trial indicated significant feeding of preference by FCB among young plants (df=10,209, F=3.390, p=0.0001) (Table 3).

The cultivars that had the greatest difference in numbers between 15 and 45 DAS were ZEM1, Debut and CO1 (Table 1 and 2). The cultivars showing least differences due to age in the three trials were Helios, Alto and W1-23 (Table 1-3). Few differences in susceptibility were evident in seedling age plants. In the third trial the cultivar CO1 hosted significantly higher FCB numbers/plant (df=10,209, F=3.390, p=0.0001). However, such differences were neither consistent nor repeated.

Significant differences were observed among older (45 day) plants. The spring mustard cultivar ZEM-1 consistently supported highest numbers of FCB/plant (df =10,319, F= 19.780, p=0.0001; df =10,264, F=38.596, p=0.0001; df =10,209, F=29.414, p=0.0001, respectively). Other cultivars showing high FCB preference included the winter mustard Debut (df=10,264, F=38.596, p=0.0001) (Table 2) and spring canola CO1 (df=10,319, F= 19.780, p=0.0001; df=10,264, F=38.596, p=0.0001, respectively) (Table 1 and 2). Some older cultivars were spring mustard cultivar (W1-23) and spring canola cultivar Helios less infested by FCB than were the spring mustard (ZEM-1) and spring canola (CO1) cultivars.

Damage by false chinch bugs can occur at all growth stages of canola but is the most damaging at seedling stages[13,14]. However, the false chinch bugs did not show feeding preference for younger plants as much as the older plants. The feeding preference of pests might have differed depending on pest species and host plants. For example, the relative feeding preferences by Western Black Flea Beetle (WBFB), *Phyllotreta pusilla* Horn (Coleoptera:Chrysomelidae), to seedling stages of 11 canola and oilseed mustard cultivars were differed from feeding preference of FCB. The western black flea beetle preferred to feed seeding stages of young plant[18,19]. Each of the cultivar used in these trials indicated different response to WBFB feeding. The two spring mustards included, supported the greatest number of WBFB, (ZEM 1) and the lowest (W1-23)[19]. The winter mustard (Debut) supported the greatest number of WBFB on plants and had the greatest associated plant injury. Plant damage was generally correlated with number of adult

Table 1: Average number of false chinch bugs on canolas and mustards of two different ages. First run of a laboratory choice experiment

			FCB/Plant[3]						
Cultivar	Type[1]	DAS[2]	1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	6 DAT	Average (1-6 DAT)
W1-23	SM	15	1.4±0.5a	3.4±1.2a	6.4±3.4a	5.2±2.5a	5.2±1.9a	1.4±1.0a	3.8±0.8a
ZEM 1	SM	15	2.0±1.1a	0.4±0.4a	3.2±1.3a	3.8±1.2a	2.6±1.2a	0.8±0.5a	2.1±0.4a
Debut	WM	15	1.8±1.1a	1.2±0.5a	3.2±1.2a	2.4±0.5a	3.4±1.3a	1.0±0.4a	2.2±0.4a
Casino	WC	15	2.2±1.6a	2.0±0.9a	5.4±2.8a	4.4±1.9a	5.0±0.2a	1.2±0.7a	3.4±0.7a
CO1	SC	15	0.4±0.4a	0.4±0.2a	3.0±0.6a	3.0±1.3a	2.2±0.5a	0.8±0.5a	1.6±0.3a
IMCO1	SC	15	1.2±0.6a	1.2±0.4a	1.8±0.7a	1.8±0.6a	3.6±1.7a	0.6±0.4a	1.7±0.4a
Alto	SC	15	1.0±0.6a	3.6±1.2a	2.8±1.4a	8.2±1.6a	5.2±1.7a	2.8±1.0a	3.9±0.6a
Helios	SC	15	0.6±0.6a	1.4±0.7a	4.0±1.2a	2.2±0.6a	5.8±1.2a	1.2±0.7a	2.5±0.5a
Sterling	SC	15	1.8±1.8a	3.0±1.6a	4.0±2.3a	3.2±1.6a	4.2±0.9a	3.4±1.5a	3.3±0.6a
Westar	SC	15	0.2±0.2a	1.2±1.0a	2.4±1.5a	6.8±4.6a	2.8±1.0a	0.2±0.2a	2.3±0.9a
Springfield	SC	15	0.2±0.2a	1.2±0.4a	3.6±1.8a	4.2±2.0a	4.4±1.2a	5.6±2.9a	3.2±0.7a
W1-23	SM	45	1.6±0.8c	3.4±2.4b	6.2±2.1bcd	5.2±1.3bcd	5.0±1.2b	0.6±0.6c	3.7±0.7cd
ZEM 1	SM	45	13.2±2.6a	10.4±1.4a	14.2±2.1a	11.0±1.7abc	10.6±1.7ab	8.6±2.1a	11.3±0.8a
Debut	WM	45	0.6±0.6c	5.8±1.1ab	12.6±2.8ab	12.6±2.9ab	17.0±3.2a	2.4±1.2bc	8.5±1.4b
Casino	WC	45	1.0±0.6c	2.0±1.5b	3.0±1.0d	4.8±1.8bcd	5.0±1.3b	4.6±1.6abc	3.4±0.6cd
CO1	SC	45	6.4±1.8b	8.8±2.2a	11.6±2.2abc	15.4±3.8a	15.8±1.8a	7.2±1.3ab	10.9±1.1a
IMCO1	SC	45	1.6±0.9c	1.4±1.0b	9.2±1.4abcd	3.8±1.1cd	13.0±2.9a	2.6±1.6bc	5.3±1.0c
Alto	SC	45	1.2±0.6c	1.0±0.6b	1.4±0.6d	2.6±0.9cd	3.6±0.5b	0.6±0.6c	1.7±0.3d
Helios	SC	45	0.4±0.2c	0.6±0.2b	4.8±2.1cd	2.2±0.6d	3.4±1.4b	0.8±0.2c	2.0±0.5cd
Sterling	SC	45	0.6±0.4c	1.0±0.8b	3.6±2.0d	7.4±1.4bcd	5.8±1.4b	2.8±1.7bc	3.5±0.7cd
Westar	SC	45	0.8±0.6c	2.6±1.9b	6.2±2.0bcd	5.2±2.1bcd	4.8±2.1b	0.2±0.2c	3.3±0.7cd
Springfield	SC	45	0.4±0.4c	1.2±1.2b	2.2±1.0d	1.8±0.4d	2.6±0.6b	2.0±0.5bc	1.7±0.3d

[1]WM = Winter mustard; SM = Spring mustard; WC = Winter canola; SC = Spring canola

[2]DAS-Days after seeding. Age of the plant at the initiation of the evaluation. DAT - Days after treatment. Evaluation made subsequent to infestation with false chinch bug.

[3]Numbers within a column of the same seeding date that are followed by the same letter(s) are not significantly different ($p<0.05$) by SNK

Table 2: Average number of false chinch bugs on canolas and mustards of two different ages. Second run of a laboratory choice experiment

			FCB/Plant[3]					
Cultivar	Type[1]	DAS[2]	1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	Average (1-5 DAT)
W1-23	SM	15	1.0±0.8a	0.8±0.6a	0.6±0.6a	0.6±0.2a	1.4±0.8a	0.9±0.3a
ZEM1	SM	15	0.8±0.6a	0.8±0.5a	0.8±0.4a	0.8±0.6a	0.6±0.4a	0.8±0.2a
Debut	WM	15	1.4±0.8a	2.6±1.0a	2.0±0.9a	4.2±2.6a	3.0±1.9a	2.6±0.7a
Casino	WC	15	2.2±1.2a	3.0±1.5a	2.0±1.5a	1.4±0.8a	1.0±0.8a	1.9±0.5a
CO1	SC	15	1.2±1.0a	2.2±0.8a	1.2±1.0a	1.4±1.4a	1.2±0.8a	1.4±0.4a
IMCO1	SC	15	0.8±0.4a	1.6±0.2a	2.8±1.2a	2.6±2.1a	2.8±0.4a	2.1±0.5a
Alto	SC	15	2.6±1.7a	4.4±2.1a	1.4±0.8a	2.2±0.7a	1.0±0.8a	2.3±0.6a
Helios	SC	15	2.2±1.5a	2.2±1.1a	2.6±1.2a	3.0±1.2a	2.0±1.1a	2.4±0.5a
Sterling	SC	15	1.2±0.7a	1.6±0.5a	0.6±0.6a	1.4±0.5a	1.0±0.3a	1.2±0.2a
Westar	SC	15	0.4±0.2a	2.8±1.6a	2.6±1.5a	2.8±1.5a	0.6±0.2a	1.8±0.5a
Springfield	SC	15	0.6±0.4a	1.4±0.7a	1.0±0.8a	0.0±0.0a	1.2±1.2a	0.8±0.3a
W1-23	SM	45	0.8±0.2b	1.8±0.6c	2.2±0.9c	2.2±1.3b	7.8±1.4b	3.0±0.6c
ZEM1	SM	45	14.8±4.9a	15.6±2.3ab	27.0±2.3a	10.0±2.3b	12.4±2.4b	16.0±1.4a
Debut	WM	45	8.8±2.0ab	17.6±4.6a	17.0±2.3ab	21.2±2.8a	24.8±2.5a	17.8±1.4a
Casino	WC	45	1.0±0.0b	1.8±0.7c	1.2±0.2c	2.6±1.4b	9.8±2.0b	3.3±0.7c
CO1	SC	45	15.6±4.8a	15.0±3.9ab	18.2±2.2ab	15.0±3.4ab	13.8±2.8b	15.5±1.5a
IMCO1	SC	45	1.0±0.4b	1.8±0.5c	1.4±0.7c	3.4±1.6b	3.0±1.6b	2.1±0.5c
Alto	SC	45	1.2±0.6b	3.2±2.7c	3.4±2.7c	3.6±2.3b	3.0±1.6b	2.9±0.9c
Helios	SC	45	0.6±0.6b	3.8±1.0c	3.4±1.9c	1.6±0.5b	3.4±1.3b	2.6±0.5c
Sterling	SC	45	0.8±0.4b	10.2±1.9abc	5.8±1.8c	2.0±0.7b	2.2±0.8b	4.2±0.9c
Westar	SC	45	2.0±1.1b	4.8±0.6bc	4.8±0.8c	3.4±2.2b	4.2±1.0b	3.8±0.6c
Springfield	SC	45	13.6±2.6a	9.4±1.2abc	12.6±1.2bc	10.4±2.0b	13.4±0.7b	11.8±1.0b

[1]WM = Winter mustard; SM = Spring mustard; WC = Winter canola; SC = Spring canola

[2]DAS - Days after seeding. Age of the plant at the initiation of the evaluation. DAT - Days after treatment. Evaluation made subsequent to infestation with false chinch bug.

[3]Numbers within a column of the same seeding date that are followed by the same letter(s) are not significantly different ($p<0.05$) by SNK

Table 3: Average number of false chinch bugs on canolas and mustards of two different ages. Third run of a laboratory choice experiment

			FCB/Plant[3]				
Cultivar	Type[1]	DAS[2]	1 DAT	2 DAT	3 DAT	4 DAT	Average (1-4 DAT)
W1-23	SM	15	0.4±0.4a	0.4±0.4a	0.8±0.5a	1.8±0.2ab	0.9±0.2b
ZEM1	SM	15	1.0±0.0a	1.2±0.2a	1.0±0.0a	2.2±0.5ab	1.4±0.2ab
Debut	WM	15	0.0±0.0a	0.2±0.2a	1.2±0.7a	2.0±0.3ab	0.9±0.3b
Casino	WC	15	1.6±0.9a	1.6±0.4a	2.2±1.7a	1.0±0.5ab	1.6±0.5ab
CO1	SC	15	1.4±0.5a	1.6±0.7a	3.6±1.4a	3.4±1.0a	2.5±0.5a
IMCO1	SC	15	0.4±0.4a	0.0±0.0a	0.2±0.2a	1.6±0.5ab	0.6±0.2b
Alto	SC	15	0.8±0.5a	0.4±0.4a	0.8±0.5a	1.8±0.5ab	1.0±0.3b
Helios	SC	15	0.4±0.2a	0.8±0.6a	1.4±0.4a	2.4±0.9ab	1.3±0.3b
Sterling	SC	15	1.0±0.6a	0.8±0.8a	0.6±0.4a	1.4±0.5ab	1.0±0.3b
Westar	SC	15	1.0±0.6a	1.0±0.8a	0.8±0.4a	1.0±0.6ab	1.0±0.3b
Springfield	SC	15	0.4±0.2a	0.6±0.4a	0.4±0.2a	0.6±0.2b	0.5±0.1b
W1-23	SM	45	0.6±0.4b	4.0±1.1bc	1.6±0.8bc	2.6±0.4c	2.2±0.4d
ZEM1	SM	45	29.0±8.4a	23.0±5.4a	22.8±5.6a	19.8±3.7a	23.7±2.9a
Debut	WM	45	1.0±0.6b	7.4±1.7bc	11.6±2.1b	3.8±0.7c	6.0±1.1c
Casino	WC	45	1.2±0.8b	1.2±0.6c	0.6±0.4c	1.8±0.4c	1.2±0.3d
CO1	SC	45	6.6±2.1b	10.4±1.0b	9.4±1.2bc	8.6±1.4bc	8.8±0.8b
IMCO1	SC	45	8.4±2.0b	12.6±2.7b	10.4±2.9bc	10.0±2.1bc	10.4±1.2b
Alto	SC	45	7.8±2.2b	12.4±2.5b	9.4±2.8bc	11.0±3.4bc	10.2±1.3b
Helios	SC	45	1.2±1.0b	1.4±0.2c	1.2±0.2bc	3.0±0.6c	1.7±0.3d
Sterling	SC	45	1.0±0.8b	0.6±0.2c	1.8±0.9bc	2.2±0.2c	1.4±0.3d
Westar	SC	45	3.8±1.0b	7.0±1.3bc	5.4±1.0bc	3.6±1.9c	5.0±0.7c
Springfield	SC	45	8.9±2.2b	11.8±3.6b	10.8±1.9bc	13.2±4.0b	11.1±1.5b

[1]WM = Winter mustard; SM = Spring mustard; WC = Winter canola; SC = Spring canola

[2]DAS - Days after seeding. Age of the plant at the initiation of the evaluation. DAT - Days after treatment. Evaluation made subsequent to infestation with false chinch bug.

[3]Numbers within a column of the same seeding date that are followed by the same letter(s) are not significantly different ($p<0.05$) by SNK

beetles present on plants. The greatest injury occurred to spring mustard ZEM 1, the winter mustard Debut and the spring canola CO1. The least plant injury was observed on the spring canolas Helios, Sterling and Alto and with the spring mustard W1-23[19].

Injury level by False Chinch Bugs (FCB) might differ depending on amount of FCB and plant cultivars[3,16,17,19,22] and also depending on plant stages, i.e., early flowering stages, pod stages of canola plants[3,19,22]. The growth stage of canola can affect FCB

damage potential, with plants at pod fill less susceptible than those during early flowering. The different canola cultivars also resulted in different yield reductions infested with FCB at early flowering stages or early pod stages[19,22].

In summary, false chinch bug showed strong feeding preference for older plants, particularly among the cultivars ZEM1, Debut and CO1. The cultivars showing the least differences due to age were Helios, Alto and W1-23. In addition, the spring mustard W1-23 was consistently least infested by false chinch bug.

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