POTENTIAL USE OF CHARD AS A PLANT TRAP FOR THE TORTOISE BEETLE *CASSIDA VITTATA* VILL. IN SUGAR BEET PLANTATIONS

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Abstract

Chard (*Beta vulgaris* var. *cicla*) was used as plant barrier of sugar beet field in order to eliminate the population denisty of different stages of the tortoise beetle *Cassida vittata* Vill. (Coleoptera: Chrysomelidae) and lowering sugar beet infestation. Results of field trials indicated significant decrease in insect numbers and increase of sucrose in sugar beet with chard barrier compared with sole sugar beet. Egg, larva and adult populations decreased by 69.2, 81.5, and 53.1%, respectively. At the same time, rate of insect infestation decreased by 18.2% and sucrose content of sugar beet with chard averaged 19.2% compared with 13.1% in sole sugar beet.

INTRODUCTION

The concept of integrated pest mangaement is to employ all available tools in the environment to suppress pest population below the economic injury level. These tools may be cultural practices, biological agents and even chemicals or pesticides (El-Sebae *et al.*, 1987, Roberts *et al.*, 1988, Lambert *et al.*, 1992, Feuerhak & Schmutter, 1992, Ali *et al.*, 1993, Murry *et al.*, 1993, Palaniswamy & Wise, 1994). Recently, many efforts are devoting to minimize pesticides consumption in pest control programs in order to avoid their hazards and keep environment free of pollution.

Secondary plant hosts of insect may play a definite role in this respect. Radian & Drummund (1994) used squash as a trap to control *Acalymma vitta* (F.) and found that, plots contained squash were more attractive to *A. vittata* at least 70% of beetles found in plots on squash plants. Similarly, potato trap rows were more effective in reducing beetle numbers of *Leptinotarsa decemlineata* (Say) on the tomatoes and producing crop yields of 61.87% higher than plots without trap rows (Hunt & whitefield, 1996).

In Egypt, Willcocks (1992) reported for the first time the occurrence of *Cassida vittata* adults on leaves of sugar-beet and chard (Salq) in the field. Chard (*Beta vulgaris* var. *cicla*) was considered a secondary host plant of *C. vittata* (El-Kholy, 1992). Therefore, in the present study field trials were carried out to evaluate the role of chard as barrier of sugar beet plantations in reducing the tortiose beetle popultion and reducing insect infestation as a component of integrated pest control program.

MATERIALS AND METHODS

The role of chard (*Beta vulgaris* var. *cicla*) as plant trap reducing population level of the tortiose beetle *Cassida vittata* Vill. (Coleoptera: Chrysomelidae) in sugar beet field was evaluated by cultivating chard as a barrier surrounding sugar beet plantations at time prior to planting sugar beet. The philosophy of such technique is to gather and attract the reactivated beetles that resume activity and leave their aestivo-hibernating sites to chard which will be suitable age and condition favorable for insect establishment and feeding, consequantly saving sugar beet plants against insect attack.

To carry out this field trial, an area of about half feddan was chosen at El-Hamoul locality (Kafir El-Shiekh governorate) and prepared for sugar beet cultivation. In mid-September, a barrier of the field (about 2m width) was seeded with chard seeds in four lines surrounding sugar beet area. One month later, the remained area was seeded with sugar beet seeds (Top variety). Chard and sugar beet plantations received the normal cultural practices without chemical pesticides application.

Field was carefully inspected at weekly intervals, and after the first adult appearance of *C. vittata*. Samples either from chard or sugar beet were taken regularly every week. Fourty chard plants were chosen randomly from the four barrier directions, (10 plants), while in the case of sugar beet area, this number amounted 50 plants representing north, south, east, west and field center sites. Plants were inspected carefully while standing in the field and the number of *C. vittata* different stages (egg, larva, adult) were counted and recorded. Sampling took place from February to the end of May. At harvesting time of sugar beet (mid-May), samples of sugar beet roots (20 roots) representing the different field sites were pulled out and were transported to the laboratory where weighed and sugar contents were determined by using saccharometer according to Carucarruthers & Oldfield (1960) and Darweish (1990) techniques.

All the experiments were conducted at the randomized completely design and analysis of variance (ANOVA) was accomplished by SAS (1994).

RESULTS AND DISCUSSION

Chard barrier played an important role in reducing the tortoise beetle *Cassida vittata* population in sugar beet plantations, consequently infestation was significantly reduced.

1. Effect on egg population:

The number of deposited eggs on sole sugar beet plants (769.6 eggs) was significantly ($p > 0.01$) higher than on either sole chard (422.5 eggs) or sugar beet with chard (237.2 eggs). These results were expected since sugar beet is the main host of *C. vittata* (Willcocks, 1925), however at least 54.9% of the total number of eggs laid (45.9-61.2%) was found on chard plants throughout sampling period (Table 1). Total and highest number of eggs were recorded on plants locating in the northern field site while western site showed the least one irrespective of the host plant. Sugar beet plots with chard barrier harbored significantly chard barrier could be reduced egg population by 74.9% overall sugar beet season.

2. Effect on larval population:

Results in table (2) indicated that number of estimated larvae of *C. vittata* on sole sugar beet plants ranged between 493.9 and 520 larvae per 10 plants being the highest in northern field site. In sugar beet plots with chard, larval population was significantly ($p > 0.01$) lowered to 66.5 larvae in northern site of the sugar beet field. In other words, application of chard barrier as trap crop could successfully reduce lrval poulation on sugar beet plants by 71.1% (western site) and 93.4% in southern site, respectively. Overall reduction of larval population on sugar beet averaged 83.4%.

Table 1. Comparative counts of *C. vittata* eggs on sugar beet and sugar beet-chard barrier

Field direction	Total Number of eggs/10 plants			
	Sole sugar beet	Sugar beet with chard barrier	Sole chard	% Egg reduction
East	183.6 a (3.5-42.0)	47.2 a (0.2-12.0)	112.4 a (1.1-28.4)	74.3
North	218.1 a (1.2-43.0)	51.0 a (0.4-13.3)	100.0 a (1.0-22.7)	76.6
South	185.7 a (3.0-43.2)	48.4 a (0.3-11.6)	108.5 a (2.1-28.2)	73.9
West	182.2 a (1.9-42.9)	45.6 a (0.2-10.8)	101.6 a (105-24.6)	74.9
Total	**769.6**	**23702**	**422.5**	**74.9**

@ Average of 10 inspection throughout the season of 1997.
Numbers between brackets are insect count range.

Table 2. Comparative counts of *C. vittata* larvae on sugar beet and sugar beet-chard barrier

Field direction	Total Number of eggs/10 plants			
	Sole sugar beet	Sugar beet with chard barrier	Sole chard	% Egg reduction
East	497.2 a (1.0-116.8)	83.6 ab (0.7-25.4)	192.3 a (1.0-60.2)	82.9
North	520.0 a (0.5-106.8)	66.5 bc (0.5-21.4)	152.3 b (1.8-51.5)	87.21
South	512.5 b (0.6-107.6)	78.0 b (0.2-22.1)	184.0 a (1.0-60.8)	84.9
West	493.4 a (0.6-113.0)	94.0 a (0.3-26.8)	149.1 bc (2.1-47.4)	71.1
Total	**2023.1**	**322.1**	**677.7**	**81.53**

@ Average of 10 inspection throughout the season of 1997.
Numbers between brackets are insect count range.

3. Effect on adult population:

Number of beetles on sugar beet with chard barrier was significantly ($p > 0.05$) lower than on monocrop sugar beet or sole chard (Table 3). Adult population on sole sugar beet ranged between 96.4 beetles and 120.7 beetles, being the highest in eastern site of the field. These values dropped to 56.6 and 62.4 beetles in northern and southern sites sugar beet with chard, respectively. On the other hand, 93.5-97.4% of total adults poulation was trapped on chard barrier surrounding sugar beet by trapping 45.5% of adults attacking sugar beet.

4. Effect on total population:

Total population (egg, larva, adult) of *C.vittata* amounted 3270.5, 1543.5 and 760.6 on sole sugar beet, sole chard and sugar bett with chard barrier, respectively. These results demonstrate the significance of using chard as trap crop since it could reduce insect population on sugar beet by approximately 76.7%. maximum insect population (852 individuals) was reduced on sugar beet locating in southern field site, while the lowest population (786.1 individuals) was found in eastern site. Sugar beet plants surrounded by chard harbored the lowest number of insect population, total insect population average 185.1 individuals (northern site) and 201.6 individuals in western site (Table 4).

5. Effect on rate of infestation:

Chard barrier used as trap crop for the tortoise beetle *C. vittata* had considerable on sugar beet infestation. This phenomenon was obviously occurred at different sites of sugar beet field. For sole sugar beet cultivation, infestation rate ranged between 80.3% and 85.4% and being the highest at southern site of the field (Table 5). Sugar beet with chard barrier showed significantly ($p > 0.01$) lower infestation at different field sites compared with sole sugar beet. Infestation rate averaged 81.09% in sole sugar beet plots while this value significantly dropped to 62.85% in sugar beet with chard and infestation percentage was reduced by 16.66-21.40% (av. 18.24%).

6. Effect on sucrose content:

Sucrose content of sugar beet plants with chard significantly ($p > 0.05$) surpassed that of sole sugar beet plants in spite of the location of plants at different field sites. Maximum sucrose content of sole sugar beet plants. (15.31%, av. 13.11%) was recorded for plants located in northern site, while plants situated in the center of the field with chard barrier showed 20.86% sucrose with an average of 19.16% (Table 6). These results indicate that use of chard as trap crop resulted in significant increase of sucrose content of sugar beet by 21.7-34.3% according to field site which could be attributed to eliminating insect attack of sugar beet plants.

The aforementioned results proved the suitability of chard as trap crop against *C. vittata*, which agree with El-Khouly (1992) who reported the suitability and supporting growth of chard as secondary host plant for *C. vittata*. The successful use of chard as trap crop which reflected by reducing insect population and increasing sucrose content in plants with chard compared with plants without chard greatly confirm with potential use of secondary host plants as trap crop for *Acalymma vittata* (Radin & Drummund, 1994) and *Leptinotarsa decemlineata* (Hunt & whitefield, 1996). Reviewing the obtained results, it could be proved that the potential use of chard as trap crop as a component of integrated pest control of *C. vittata* in sugar beet plantations.

Table 3. Comparative counts of *C. vittata* adults on sugar beet and sugar beet-chard barrier

Field direction	Total Number of adults/10 plants			
	Sole sugar beet	Sugar beet with chard barrier	Sole chard	% Adult reduction
East	120.7 a (1.7-35.2)	57.1 a (0.2-57.6)	112.8 a (0.7-28.3)	52.7
North	110.7 a (0.7-36.2)	56.6 a (0.3-33.6)	105.3 a (1.4-26.8)	48.9
South	96.4 b (0.8-29.0)	62.4 a (0.2-32.0)	93.9 a (1.3-27.9)	33.5
West	117.2 a (1.6-36.1)	62.1 a (0.2-33.8)	112.0 a (1.1-27.9)	47.0
Total	**442.5**	**238.1**	**424.4**	**45.5**

@ Average of 10 inspection throughout the season of 1997.
Numbers between brackets are insect count range.

Table 4. Infestation rates by *C. vittata* in sole sugar beet and sugar beet with chard barrier trap

Field site	% Infestation sugar beet plants		Reduction of infestation rate
	Sole sugar beet	Sugar beet with chard barrier	
East	80.33	63.67	16.66
North	80.85	63.00	17.85
South	85.40	64.00	21.40
West	82.50	62.00	20.50
Overall field	81.09	62.85	18.24

Table 5. Comparative counts of *C. vittata* total population on sugar beet and sugar beet-chard barrier

Field direction	Total Population of different stages/10 plants			
	Sole sugar beet	Sugar beet with chard barrier	Sole chard	% total populaion reduction
East	786.1 (4.3-146.3)	188.4 (0.3-70.0)	417.5 (0.7-101.4)	76.1
North	839.4 (2.2-131.4)	185.1 (0.4-66.0)	356.2 (1.4-91.6)	77.9
South	852.0 (4.4-140.7)	186.4 (0.7-65.9)	397.6 (3.4-103.4)	78.2
West	793.1 (3.3-155.4)	201.6 (0.4-69.5)	372.2 (2.2-88.7)	74.6
Total	**3270.5**	**760.6**	**1543.5**	**76.7**

@ Average of 10 inspection throughout the season of 1997.
Numbers between brackets are insect count range.

Table 6. % Sucrose content of sole sugar beet plants and sugar beet plants with chard trap (% Sucrose)

Field site	Sucrose contents of plant root (%)		% Sucrose increase
	Sugar beet with chard barrier	Sole sugar beet	
E	18.82±0.41 b	12.37±0.18 a	34.3
N	19.67±0.24 ab	15.31±0.14 b	22.2
S	18.93±0.39 bc	11.82±0.32 a	21.7
W	17.68±0.38 a	12.21±0.26 a	30.9
C	20.86±0.35 a	12.84±0.57 ab	33.7
Average	**19.16±0.72 abc**	**13.11±0.42 ab**	**31.6**

Means followed by the same letter in a rows are not significantly different [P= 0.05, Duncan's (1955) multiple range test]
No. of replicates 4, No. of samples 40

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إمكانية استخدام نباتات السلق كمصيدة نباتية لحماية بنجر السكر من الإصابة بخنفساء السلحفائية ***Cassida vittata*** **vill**

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وجد أن استخدام نبات السلق كمصيدة نباتية لحشرة خنفساء البنجر السلحفائية على محصول بنجر السكر كداير قد أدى إلى خفض الإصابة بالحشرة بكل أعمارها من بيض ويرقات وحشرات كاملة.

وقد أوضحت الدراسة أن عدد بيض الحشرة قد انخفض إلى ٦٩,٢% وانخفض عدد اليرقات إلى ٨١,٥% والحشرات الكاملة إلى ٥٣,١% وفى نفس الوقت انخفضت الإصابة بوجه عام بنسبة ١٨,٢% وبالتالى فقد سجلت زيادة فى محتوى السكر لنبات بنجر السكر المحاط بالمصيدة النباتية إلى ١٩,٢% مقارنة بـــ ١٣,١% فى زراعات بنجر السكر المنفرد بدون داير السلق.