Research Journal of Agriculture and Biological Sciences, 5(1): 24-28, 2009

Use of Some Relatively Safe Compounds For Controlling of the Tortoise Beetle, *Cassida vittata* (Vill) in Sugar Beet Crop

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Abstract: The efficiency of five compounds representing different classes of insecticides was evaluated against adult stage of the tortoise beetle, *Cassida vittata* under laboratory and field conditions. The toxicity of tested compound to *C. vittata* revealed that Marshal (carbamate insecticide) as standard insecticide was the most effective against *C. vittata* compared with the other four compounds where, LC_{50} value was 0.001% followed by Bancol (LC_{50}= 0.0613%) while Alkanze (Jojoba oil) was the least toxic (LC_{50}= 0.7401 %). Concerning the antifeeding tests, the data indicated strong antifeeding properties of Achook (Azadirachtin) which gave 75.9% antifeeding activity followed by Pymetrozine (a new type of insecticides) (68.23%) . Field evaluation showed that the all chemical treatments were able to suppress the adult population at different degrees in comparison to the untreated control. The suppression varied according to the nature of the tested compound, the rate of use and the time elapsed after spraying. Marshal caused 82.3% decrease in the adult population followed by Achook (68.5%). Generally the efficiency of the tested compounds can be arranged as follows: Marshal > Achook > Bancol > Pymetozine > AlKanz.

Key words: sugar beet, *Cassida vittata*, antifeedant activity, insecticides.

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) Provides about 40% of world sugar production and represents the second source for sugar production in Egypt[23]. Sugar beet plants attract numerous insect pests during the growing season and causes losses in yield sugar production due to their infestation[19,5,6,12,14,8].

The tortoise beetle, *Cassida vettata* Vill. (Coleoptera: Chrysomelidoe) is one of the most destructive pest of sugar beet plant[14,9,15]. *C. vittata* are leaf feeders. Crop loss comes from leaf feeding and reduction in sugar content of infested plant[4,]. Abou Aina[3] mentioned that *C. vittata* reduced both crop quantity and quality. Some conventional insecticides have been recommended for its control such as Methomyl, Profenofos, Pirimiphos-methyl, Carbosulfan, Monocrotophos, Chlorfenopyr, and Fentrothion[14,12,22,]. Therefore, the present study aimed to use some relatively safe compounds to control *C. vittata* throughout the following studies:

1- Evaluation the toxicity of five compounds to *C. vittata* under laboratory condition. 2- Study the effect of low concentration of these compounds on pest feeding activity. 3- Field evaluation of these compounds against this pest.

MATERIALS AND METHODS

Tested Compound: Five compounds representing different classes of insecticides were used:

- Pymetrozine 25%WP: (chess) a new type of insecticide having pyridine azomethine group.
- Achook 0.15% EC: botanical insecticide contains Azadirachtin (a.i).
- Alkanz 70% EC; natural compound containing oil, jojoba leave extracts and also natural oils.
- Bensultap 50% WP: (Bancol) Based on toxins from annelid shipworm.
- Carbosulfan 25% WP: (Marshal) carbamate insecticide as (standard insecticide).

Toxicity Tests: The adult stage of tortoise beetle, *Cassida vittata* was collected from the field and fed in the laboratory with fresh sugar beat leaves for 24 hours before bioassay. The bioassay tests were carried out by preparing serial concentrations of each insecticide. The leaf dipping technique was used. Fresh clean sugar beet leaves were dipped in diluted solution for ten seconds and left to dry under laboratory conditions. Ten adults were exposed to the treated leaf in Petri dishes using 3 replicates for concentration. Untreated insects were exposed to water treated leaves. Mortalities were recorded after 48 hours of treatment. The percent

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mortalities was calculated and corrected for natural mortality using Abbott's formula[1]. The toxicity data were subjected to probit analysis[17] where LC_{50}, LC_{90} and slope values were determined.

Antifeeding Activity: To investigate the antifeedant effect of these compounds, LC_{40} concentration from each compound was prepared. The leaf dipping technique was used as previously mentioned. Five adults were exposed to the disc of the treated leaf after their starvation for 4 hours. Untreated adults were exposed to the disc leaf water treated. The total disc area before exposure and the area consumed after 48 hours feeding was recorded. The antifeedant activity of the tested compounds was calculated using the formula of[22]. as follows:

$$\text{Antifeedant activity} = 1 - \frac{A}{B} \times 100$$

Where as:
A = % of treated disc eaten.
B = % of non-treated disc eaten

Field Experiment: Field study was conducted at El-Abasiea village, Kafr El-Shiekh Governorate. The experimental area was divided plots, each plot, was $21m^2$ in complete randomized block design with 3 replicates including untreated control. Each chemical was applied at two rates; the first was recommended by the Ministry of Agriculture or by the manufacturer while the second lower rate amounted to 2/3 the recommended rate.

Knapsack sprayer 20L capacitiy was used in applying of the tested compounds as foliar treatment.

Samples for pre treatment counts were taken immediately in the field before spraying and those for post treatment counts were taken after 1, 4, 7 days from application. Adult stages were counted directly in the field on 5 plants / plot. The percentage reduction of adult populations of *C. vittata* was calculated using [17]. formula. The data were analyzed by the analysis of variance[22].

RESULTS AND DISCUSSION

I- Toxicity of the Tested Compounds to *C. vittata:* Data in Table (1) shows the toxicity of five the compounds from different classes to adult stage of *C. vittata*. Results indicated that the sensitivity of *C. vittata* to the various toxicants, revealed great variations in effectiveness. Marshal (Carbamate pesticide) was highly toxic against the pest where the LC_{50} and LC_{90} values were 0.001% and 0.0038%, respectively compared with the other four compounds (nontraditional compounds).

Also a great variation was observed between the other four nontraditional compounds. Bancol (Based on toxins from annelid shipworm) was the most toxic (LC_{50}= 0.0631%) followed by Pymetrozine and Achook where the LC_{50} values were 0.1451% and 0.3618%, respectively while AlKanz (Jojoba oil) was the least toxic (LC_{50}=0.7401%).

II. Antifeedant Activity: Some nontraditional compounds exhibit antifeeding effect against treated insects when used with low concentration. The results in Table (2) showed that various degrees of the antifeeding activity of tested compounds against *C. vittata* when used with low concentration (LC_{40}) . All tested compounds exhibited different degrees of antifeeding activity against *C. vittata* compared with the control (untreated). Achook (botanical insecticide) had strong antifeedant properties on the adult stage (75.90%). Adults consumed 70.7 mm^2 from leaf area as compared with the control adults consumed 275 mm^2 from leaf disc area followed by Pymetrozine and Alkanz where antifeeding activity were 68.23% and 66.76%, respectively. Marshal had moderate antiffeeding properties (52.80%) while Bancol was the least antifeeding activity (39.24%).

The antifeeding effect of Achook compound could be due to the presence of Azadirachtin**.** . Azadirachtin, a tetranortriterpenoid, is noted for its potent antifeedant characteristics[23]. Misra and Singh[20] evaluated feeding deterrent activity of *Azadirachta indica* based formulations against *Epilachna vigintioctopunctata*. They found that all formulations have potential to deter feeding activity of the experimental insect. As well as, Pymetrozine may affected on the pest feeding behaviour through the nervous control of salivary gland[10]. Harrewijn and Kayser[18] concluded that pymetrozine does not have a general toxic effect on aphids but selectively interferes with the nervous regulation of feeding behaviour which consequently results in death due to starvation after a few days.

It worth mentioning that the ability of decreasing or feeding inhibition considers one of the advantages of the modern compounds, where some of their concentrations can act on leaves protection against pest attack.

III. Field Evaluation of Tested Compound against *C. vittata*: The average number of adults and percent reduction in adult population of *C. vittata* are presented in Table (3). Results showed that the average number of adults/5 plants before any insecticidal treatments was ranged from 14.3 to 22.3.

The chemical treatments were able to suppress the adult population to different degrees in comparison to that of untreated control. The suppression varied according to the nature of the tested compound, the rate of application and the time elapsed after spraying.

Table 1: The toxicity of tested compounds to adult stage of *Cassida vittata* collected from the field.

Treatment	LC_{50} (% a.i)	Confidence limits	LC_{50} (% a.i)	Confidence limits	Slope
Marshal	0.0010	0.0011 - 0.0009	0.0038	0.0047 - 0.0031	2.7
Bancol	0.0631	0.0683 - 0.0583	0.1864	0.2347 - 0.1482	3.4
Pymetrozine	0.1451	0.1605 - 0.1311	0.5877	0.8010 - 0.4314	2.7
Achook	0.3618	0.3933 - 0.3329	1.035	1.2507 - 0.8582	3.6
Alkanz	0.7401	0.8089 - 0.6772	2.756	3.533 - 2.151	2.8

Table 2: Antifeeding activity of the tested compounds against *C. vittata*.

Treatment	LC_{40} (%)	Avg. Leaf disc (mm^2)	Avg. Leaf disc consumed (mm^2)	% Leaf disc consumed	% Antifeeding activity
Marshal	0.0007	898.3	130.0	14.47	52.80
Bancol	0.0545	859.0	160.0	18.63	39.24
Pymetrozine	0.1300	896.7	87.3	9.74	68.23
Achook	0.3000	955.7	70.7	7.39	75.90
Alkanz	0.6000	866.7	88.3	10.19	66.76
Control	-	897.0	275.0	30.66	-
$LSD_{0.05=}$		115	50.9	5.08	

Table 3: Direct and residual effects of the tested compounds against population of *C. vittata* in sugar beet field.

Treatment	Rat of use /fad.	Avg. No. of adults (pre spray)	Avg. no of adults / 5 plants and percent reduction in population as indicated days after spray						Avg. % Reduction
			1		4		7		
			Avg. No. of adults	% Reduction	Avg. No. of adults	% Reduction	Avg. No. of adults	% Reduction	
Marshal	800	22.3	3.7	80.0	0.0	100.0	12.7	65.4	81.5
	534	15.3	6.0	52.5	4.7	74.3	19.7	22.9	49.9
Bancal	600	17.0	3.7	73.7	4.0	80.3	17.0	40.1	64.7
	400	15.7	5.0	61.5	5.3	71.7	22.3	14.9	49.4
Pymetrozine	600	20.0	6.7	59.5	9.0	62.3	28.3	15.2	45.7
	400	14.3	7.7	34.8	13.7	19.8	23.0	3.7	19.4
Achook	750	15.7	2.3	82.3	5.7	69.6	12.3	53.1	68.5
	500	18.7	7.7	50.2	16.7	25.3	23.7	24.1	33.2
Alkanz	1000	17.3	7.3	52.8	9.3	55.0	21.7	24.9	44.2
	667	15.3	8.3	34.4	15.7	14.1	26.3	0.0	16.2
Control (untreated)	-	19.0	15.7	-	22.7	-	31.7	-	-
$LSD_{0.05=}$		9.6	5.4		8.5		8.1		

The first day after treatment, Achook (botanical insecticide) and Marshal (standard insecticide) caused highly decrease in the adult population where the percent reduction were 82.3% and 80%, respectively at recommended rate followed by Bancol and Pymetrozin were 73.7% and 59.5% respectively, while Alkanz was the least effective (52.8%) at recommended rate. After four days from application, it was clear that Marshal had superior effect with percent reduction in adult population (100% and 74.3%) respectively at recommended and 2/3 recommended rates. After seven days, the number of adults increased gradually in both treatments and control. Therefore, efficiency of the compound decreased gradually with time elapsed since the percent reduction in adult populations were not exceed to 40% except Marshal (Table3).

As an average percentage reduction throughout the experimental period (1 week), the recommended rates were more efficient than 2/3 recommended rates in all treatments. The Bancol treatments gave 64.7% and

49.4% average percen reduction in adult population in recommended and 2/3 recommended rates also, Achook recorded 68.5 %and 33.2%, respectively.

Generally, efficiency of the tested compounds could be arranged as follows Marshal >Achook > Bancol > Pymetrozine > Alkanz (Table 3).

These results are in agreement with data obtained by[7]. who found that Marshal and Selecron were the best compounds in reducing the adults of *C. vittata*. El-Khouly found that Neemazal and Selecron were most effective insecticides against the immature stages of *C.vittata*. Also successful reduction in adult population by spraying infested sugar beet plants with Selecron and Marshal was ascertained by[3,4,11]. reported that the Profenofos was the most efficient compound against all stages of *C. vittata* under field conditions but was very harmful against its associated natural enemies. Tefubenzuron and Azadirachtin exhibited sufficient effectiveness as biorational compounds in controlling *C. vittata*.

Therefore it can be concluded that Marshal the most effective to control the adults of *C. vittata* but it may be harmful against its associated natural enemies. Achook(botanical insecticide) had moderate efficient against this pest .Thus, it may be suitable for Integrated Pest Management to control *C. vittat*a in sugar beet.

ACKNOWLEDGMENT

The author wishes to express her deep thanks to the late soul of Prof. Dr. E. Fawaz Abdalla for his help and great support during conducting this work.

REFERENCES

1. Abbott, W.S., 1925. A method of computing the effectiveness of a insecticide J. Econ. Entomal. 18: 265-267.
2. Abdel-Raheem, M.A.A., 2005. Studies on the possibility of using the entomopathogenic fungi *Beauveria bassiana* and *Metarhizium anisoliapliae* for controlling the sugar-beet insects *Cassida vittata*(vill) and *scrobipalpa ocellatello* (Paoh.) in Egypt. Ph. D. Thesis. Fac. of Agric. Cairo Univ., Egypt.
3. Abo-Aiane, R.A., 1991. Studies on pests of sugar-beat. Ph. D. Thesis, Fac. of Agric. Tanta Univ., Kafr El-Sheikh, Egypt.
4. Aly, F.A., M.M.A. Mahgoub, S.I. El-Deib and M.A. El-Hamaky, 1993. Ecological studies on tortoise beetle, *Cassida vittata* Vill and the efficacy of certain chemical in controlling this insect in sugar beet plants J. Agric. Sci. Mansoura Univ., Egypt, 18(16): 1813-1824.
5. Arifa G.S., 1999. Sugar beet fly, pegomya mixta Vill.: Behavior of egg laying and phemology. Alex. J. Agric. Res., 44(3): 311-327.
6. Arifa G.S., 2001. Effect of proceeding summer crops and nitrogen fertilization on rates of infestation by Tortoise beetle, *Cassida vittata* (Vill.) and beet fly, *pegomya mixta* on sugar beet in the new reclaimed areas. Annals of Agric. Sci. Moshtohor 39(4): 2455-246.
7. Bassyony, A.M. and S.B. Bleih, 1996. Sowing dates, seasonal fluctuations and chemical control against the main insects attacking sugar beet .Alex Sci. Exch. 17(30): 283-296.
8. Bassyouny, A.M., 1987. Studies on the insects attacking sugar beet in Kafr El-Sheikh Governorate. Ph. D. Thesis, Fac. of Agric., Tanta Univ., Egypt.
9. Bassyouny, A.M., 1998. Economic injury level of the main defoliator insects on sugar beet plants J. Agric. Sci. Mansaura Univ., 23(1): 405-418.
10. Bextine, B.R., D. Harshman, M.C. Johnson and T.A. Miller, 2004. Impact of pymetrozine on glassy winged sharpshooter feeding behavior and rate of *Xylella fastidiosa* transmission. J. Insect Sci., 34(4): 1-6.
11 El-Kouly, M.I., 1998.Ecological studies and control of the tortoise beetle Cassida vittata Villers in sugar beet ecosystem .Ph.D. Thesis, Fac. Agri., Al-Azhar Uni.
12. El-Khouly, M.I., 2002a. Biological activity of certain insecticides against the tortoise beetle, *Cassida vittata* (Vill) and associate Natural enemies in sugar beet fields. Egpt. J. Agric. Res., 80(2): 647-663.
13. El-Khouly, M.I., 2006. Population fluctuations of beet fly, *pegomyia mixta and tortoise beetle, Cassida vittat* in relation to certain association natural enemies in sugar beat fields at Kafr El-Sheikh Governorate, Egypt: Egyptian J. of Biol. Pest Control, 16(1-2): 25-28.
14. El-Khouly, M.I. and B.A. Omar, 2002b. The efficiency of some insecticides on tortoise beltle. *Cassida vittata* Vill. Inhabiting sugar beat fields. Egypt. J. Agric. Res., 80(2): 697-708.
15. El-Zoghbey, A.A., F.A. Atalla and A.H. Mesban, 2003. Effect of two biocides in controlling *Cassida vittata* (vill.) and *Spodoptera littarais* (Biosd) infesting sugar beet plants. Ann. Agric. Sci. Moshthor, 41(1): 339-346.
16. Fathy, A.A., M.A. Assem and F.E. El-Aal, 1986. Studies on the population density of the insects attacking sugar beet, 1st, Hart. Sci. Conf. Tanta Univ., 321-334.
17. Harrewjin, P. and H. Kayser, 1999. Pymetrozine, a fast-acting and selective inhibitor of aphid feeding. In-situ studies with electronic monitoring of feeding behavior. Pestic. Sci., 49: 130-140.

18 Finney, D.J., 1971. Probit analysis .Cambridge University Press, 3ed Edition.
19. Henderson, C.F. and E.W. Tilton, 1955. Test with a caricides against the brown wheat mites J. Econ. Entomol., 84: 157-161.
20. Misra, B.R. and G.C. Singh, 2008. Feeding deterrent activity of Azadirachta indica based formulations against hadda beetle, *Epilachna vigintioctopunctata (Fabr.).* J. Ecophysiol. Occup. Hlth. 8: 111-114.
21. Sabbour, M.M. and A. Abdel-Rahman, 2007. Evaluation of some trepans and entomopathogenic fungi on three sugar beet insect pests. Egyptian. J. of Bial-pest control; 17(1-2): 125-130.
22. Saleh, A.Y., 1994. Insecticides tests to control of tortoise beetle, *Cassida vittata* (vill.) in sugar beet crop Assiut J. Agric. Sci., 25(4): 197-202.
23. Schoonhoven, L.M., 1981. Perception of azadirachtin by some lepidopterous larvae. 105-108. In: Schmutterer, H., Ascher, K.R.S. & H. Rembold (eds), Natural Pesticides from the Neem Tree (*Azadirachta indica* A. Juss). Proc. 1st. Int. Conf. (Rottach-Egern, 1980), GTZ, W. Germany: 297.
24. Snedecor, G.W., 1970. Statistical methods applied to experiment in agriculture and biology. (Iowa State press, U.S.A. 534.
25. Youssef, Asmhan, E. and F.A. Abou-Attia, 2001. Effect of insect infestations an some characteristic features of sugar beet crop and the predatory efficiency of *Chrysoperla carnea* (steph.) on the main insects. J. Agric. Sci. Mansoura Unvi., 26(10): 6427-6436.