



**EFFICACY OF CERTAIN CHEMICAL AND SAFE ALTERNATIVE
COMPOUNDS ON THE CABBAGE APHID BREVICORYNE BRASSICAE
(LINNAEUS) AND ITS ASSOCIATED PARASITOID DIAERETIELLA
RAPAE (MCLNTOCH) INHABITING CABBAGE PLANTATIONS**

Farouk A. Abdel-Galil *, Safaa, M.A. Amro**, Abd El-Raheem A. Abd El -Raheem**
and Dalya Y.A. Darwish*

*Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut, Egypt.

** Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.

Corresponding Author, Email address: faagalil@hotmail.com

ABSTRACT:

The study was conducted to evaluate the efficacy of two newly introduced European safe alternative compounds (Evure® and Karate® Zeon) versus two biocide compounds (Biosad 22% SC and Abamectin 1.8%EC), and the chemical compound (Melody 24%SC) against the cabbage aphid *Brevicoryne brassicae* (Linnaeus) inhabiting cabbage plantations during 2017/18 and 2018/19 cabbage growing seasons in Assiut, northern upper Egypt. Impact of the tested compounds on the infestation levels and the yield income was evaluated. Also, their side effect against the emergence of the aphid parasitoid *Diaeretiella rapae* (McIntoch) was taken in consideration. Data revealed that the newly introduced compound (Karate® Zeon) was the most effective compound on the population density of *B. brassicae* during the entire period of study with 98.98% reduction in the pest numbers. The other newly introduced compound (Evure®) reduced the pest numbers by less reduction percentage (94.20%), and ranked the second. The chemical compound (Melody 24%SC) reduced the pest populations by 93.40% (less than both of the two newly introduced safe alternative compounds). The biocide compounds (Abamectin 1.8% EC and Biosad 22% SC) presented 78.99 and 59.08% reduction in the pest populations and appeared as the least effective compounds. Efficacy on the infestation levels and damaged (unmarketable) plants showed slight variation between the tested compounds (ranged between 47.46 -55.34 and 46.78-49.10%, respectively). So, use of these compounds led to an increase in the marketable cabbage plants (yield income) by more than 50%. Unfortunately the highest effective compound (Karate® Zeon) against cabbage aphid reduced the emerged parasitoid *D. rapae* by 91.64%, and consequently could be has cautions as aphids control agent. According to their acceptable effectiveness against *B. brassicae* populations, infestation levels , unmarketable plants and low effectiveness against *D. rapae*, it can be recommended to use the biocide compounds (Abamectin 1.8% EC and Biosad 22% SC) to manage the population density of cabbage aphids in the field by more than one application throughout one season.

Key words: *Cabbage aphid, parasitoids, chemical control, safe alternative compounds.*

INTRODUCTION

The cabbage aphid *Brevicoryne brassicae* (Linnaeus) causes serious losses of yield in Brassica crops and reduces its marketable value (Liu et al., 1994; Costello and Altieri, 1995). This insect pest is one of the most common pests of cabbage crop in Egypt (El-Fakharany and Hendawy, 2010). Aphid's associated parasitoids are very important control agents in a variety of agricultural and horticultural crops. The hymenopterous parasitoid *Diaeretiella rapae* (McIntosh) is a highly polyphagous parasitic wasp parasitizing exclusively aphids throughout the world infesting hundreds of plant species, both cultivated and wild (Singh and Singh, 2015). Several decades ago, *D. rapae* was reported as the most effective natural enemy against the cabbage aphid, *B. brassicae* (George, 1957) and it has been observed to cause as high as 72% parasitism in the Netherlands (Hafez, 1961) and 76% parasitism in Kenya (Bahana and Karuhize, 1986). Continuous usage of broad-spectrum insecticides for aphid control was an occasion to its resurgence, secondary pest outbreaks, and increasing levels of resistance to insecticides. So, predominant pest control strategy has led to intensification of research on alternative control techniques and to the use of selective insecticides. Among the products that are recommended for aphid control, Pymetrozine has reported highest selectivity, systematic insecticide that harmless to natural enemies and can be used in integrated pest management (IPM) programs (Rimaz and Valizadegan, 2013). Spinosyns compounds being of biological origin, and are considered to have a low

environmental impact and they are not much aggressive against non-target species. Also, these compounds had broad range of action against many insect pests belonging to different orders, noxious to a wide variety of agricultural crops. For all these reasons, these compounds are considered one of the most interesting products to be used in fighting against agricultural pests (Bacci et al., 2016). Bio-pesticides such as abamectin has been reported as broad-spectrum pesticides with high biological activity with dosage as low as 1-3 g active ingredient per hectare. With such a low rate, such pesticides not only provide protection to the environment but also are safe to human beings (UNIDO, 2008). Therefore, this work has been conducted to evaluate the efficacy of certain chemical and safe alternative compounds such as Bio-pesticides in reducing the cabbage aphid, *B. brassicae* populations in the field. Also, their potency to reduce the infestation levels and yield loss (unmarketable plants) has been evaluated. The side effect of these compounds on the aphid parasitoid *D. rapae* was also taken in consideration.

MATERIALS AND METHODS

The present investigations were conducted at the Experimental Farm of Assiut University during 2017-2018 and 2018-2019 cabbage growing seasons by using Ganzory cabbage cultivar at (Ca.1/4 fed.) and divided into plots (1/400 fed. / plot). Plants were transplanted in 50 cm intervals at 3rd October during both seasons. Insecticides application was initiated as aphid populations reached to moderate density (two months post transplantation). To evaluate the reduction

percentage of *B. brassicae* (all forms), 4 cabbage leaves were randomly picked up from 4 cabbage plants (1 leaf / plant) / each replicate (4 replicates) in addition to the control replicates and transferred to the laboratory to later examination. Mean numbers of *B. brassicae* (all forms) were counted / 5 inches / leaf, before spray by the selected compounds (Table 1) and consequently after 3, 7 and 14 days post application. Reduction percentage of the targeted insect pest numbers, were calculated according to Henderson and Tilton (1955) equation. Reduction

percentage of the infested and unmarketable plants (Figure 1), were also calculated in the field. One hundred mummified aphids were isolated in test tubes (4 replicates / each compound and the control replicate) before spray and after 3, 7 and 14 days post application. Reduction percentage of the emerged parasitoid (*D. rapae*), were calculated according to the same equation. Data were statistically analyzed by using F-test and means were compared according to Duncan's multiple range tests as described by Steel and Torrie (1982).

Table1. Trade name, common name and application rate of the tested compounds against *B. brassicae* and its parasitoid *D. rapae*.

Trade name	Common name	Application rate
<i>Evure</i> ®	<i>Tau-fluvalinate</i> 21,4% (240 g/l)	10 ml/100 Litter water
<i>Karate</i> ® Zeon	<i>Lambda cyhalothrin</i> Sc 9.4%	31.2 ml/100 Litter water
<i>Biosad</i> 22% SC	<i>Spinosad</i>	10 ml /100 Litter water
<i>Abamectin</i> 1.8%EC	<i>Bermectin</i>	40 ml /100 Litter water
<i>Melody</i> 24%SC	<i>Metoxyfenozide</i>	25 ml/100 Litter water



Figure1. Cabbage aphid *Brevicoryne brassicae* damage symptoms on cabbage plants (A: Healthy plant, B: Infested plant, C: Unmarketable plant)

RESULTS AND DISCUSSION

Effectiveness of two newly introduced European safe alternative compounds (*Evure*® and *Karate*® Zeon) versus two biocide compounds (*Biosad* 22% SC and *Abamectin* 1.8%EC), and the chemical compound (*Melody* 24%SC) were evaluated in the field against the cabbage aphid *B. brassicae* inhabiting cabbage plantations during 2017-2018 and 2018-2019 growing seasons in Assiut governorate,

northern Upper Egypt. Impact of the tested compounds on the infestation levels and the yield income was evaluated. Also, their side effect against the emergence of the aphid parasitoid *D. rapae* was taken in consideration. The obtained results in Table (2) revealed that the newly introduced compound (*Karate*® Zeon) was the most effective compound on the population density of *B. brassicae* during the first season of study with 99.53% reduction in

the pest numbers throughout 14 days post application. The other newly introduced compound (Evure®) reduced the pest numbers by less reduction percentage (93.47%), and ranked the second. The chemical compound (Melody 24%SC) ranked the third and reduced the pest numbers by 92.80% (Less than both of the two newly introduced safe alternative compounds). The least effective compounds against this insect pest were the biocide compounds (Abamectin 1.8% EC and Biosad 22% SC) which reduced the pest numbers by 78.20 and 55.35%, respectively. Highly significant variations ($f = 41.068^{**}$) were recorded between the tested compounds. Data presented in Table (3) showed the effectiveness of the tested compounds to reduce the pest infestation levels. Variation between the most effective compound (Karate® Zeon) and the least effective one (Biosad 22% SC) was not high (ranged between 50.33 and 43.08%). Consequently non-significant variations ($f = 1.495$) were recorded between the tested compounds. Effectiveness of the tested compounds on the damaged (unmarketable) plants (Table 4) showed similar trend with non-significant variations ($f = 0.092$).

Side effect of the tested compounds on the emergence percentage of the aphid parasitoid *D. rapae* was presented in Table (5). Karate® Zeon was the most effective compound against the parasitoid and ranked the first with (91.47%) reduction. The remaining compounds efficacy can be arranged as descending as follows: Melody 24%SC by 50.35 > Evure® by 42.89 > Abamectin 1.8% EC by 19.63 > Biosad 22%

SC by 10.22%. Highly significant variations ($f = 173.703^{**}$) were recorded between the tested compounds. With few exceptions, similar results (Tables 6-9) were obtained during the second season of study.

Data presented in Table (10) and illustrated in Figure (2) expressed about the mean reduction percentages on all of the tested measurements during both experimental seasons. Data revealed that, the newly introduced compound (Karate® Zeon) was the most effective compound on the population density of *B. brassicae* during the entire period of study with 98.98% reduction in the pest numbers. It followed by the other newly introduced safe alternative compound (Evure®) with average reduction 94.20%. The chemical compound (Melody 24%SC) reduced the pest populations by 93.40%. However, the biocide compounds (Abamectin 1.8% EC and Biosad 22% SC) reduced the pest populations by 78.99 and 59.08% and appeared as the least effective compounds. Effectiveness on the infestation levels and damaged (unmarketable) plants showed slight variation between the tested compounds (ranged between 47.46 -55.34 and 46.78-49.10 %, for the above-mentioned measurements, respectively). In general, potency of the tested compounds to reduce the pest populations was highly synchronized with their potency to reduce the pest infestation levels. Also, use of these compounds increased the marketable cabbage plants (yield income) by more than 50%. Unfortunately, the side effect of the most effective compounds (Karate® Zeon) against *B. brassicae* was so high against its parasitoid *D. rapae*. It reduced its

emergence by 91.64 %. On the other hand, moderately reduction percentages on the emerged parasitoid numbers were obtained by using both of (Melody 24%SC and Evure®) by 53.40 and 46.27%, respectively. The least effective compounds against *D. rapae* emergence (Abamectin 1.8% EC and Biosad 22% SC) showed 23.76 and 12.01 % reduction, respectively.

In general it can be note that, the highest effective compound (Karate® Zeon) against *B. brassicae* populations can reduce the effectiveness of the aphid parasitoid *D. rapae* by 91.64%. So, its application could have cautions as aphids control agent. The remaining compounds showed moderately effect on the emerged parasitoid numbers. According to their acceptable effectiveness against *B. brassicae* populations, infestation levels , unmarketable plants and low effectiveness against *D. rapae*, it can be recommended to use the biocide compounds (Abamectin 1.8% EC and Biosad 22% SC) to manage the population density of cabbage aphids in the field by more than one application during the cabbage growing season.

Successful use of Abamectin (Bermectine) 1.8% EC at 40 ml/100L water against the cabbage aphid *B. brassicae* in the field was applied in Northern Egypt by El-Fakharany and Hendawy (2010). They reported that, this compound reduced *B. brassicae* populations by 91.54 and 92.08% during 2008/09 and 2009/10 cabbage growing seasons, respectively. Also, they reported that, this compound had slight effects on the aphid's associated natural enemies (Predators, true spiders and parasitoids). Efficacy of Abamectin against

various stages of the red palm weevil *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae) under laboratory conditions was evaluated in Saudi Arabia by (Albutairi et al., 2016). Their bioassay test showed that, Abamectin at 600 ppm ($\mu\text{g/ml}$) caused 60% mortality against females and males after 24 h. By increasing the concentration to 1000 ppm, the mortality reached 100% for adults. In other applications by some derivatives of the tested products, (Amro and Abdel-Galil, 2012) used Radiant 12% SC (Spinotoram) in the same area of study and reduced onion thrips, *Thrips tabaci* Lindeman infesting onion heads by 89.75%. On the other hand, El-Wakeil and Volkmar (2013) proved that Karate caused the highest percent mortality to wheat insect pests and reduced natural enemy diversities. However, Salem et al. (2018) reported that, Karate and Tracer 24% SC (Spinosad) reduced cereal aphid complex infesting wheat by 99.31 and 97.05%, respectively.

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Table2. Potency of the tested compounds in reducing numbers of cabbage aphids *Brevicoryne brassicae* infesting cabbage plants during 2017-2018 cabbage growing season in Assiut region

Compound	Mean numbers of <i>B. brassicae</i> / 4 leaves (5 inches ² / leaf) / plot and reduction %							GR%	RO
	Before spraying	After 3 days		After 7 days		After 14 days			
		MN	R%	MN	R%	MN	R%		
Evure ®	865.0	148.8	87.76	50.00	96.34	31.0	96.32	93.47B	2
Karate® Zeon	882.5	3.50	99.71	5.00	99.63	7.50	99.26	99.53A	1
Biosad 22% SC	873.8	440.0	64.00	457.0	68.28	625.0	33.76	55.35D	5
Abamectin 1.8%EC	882.5	370.0	69.76	286.3	80.48	150.0	84.36	78.20C	4
Melody 24%SC	886.3	91.25	92.80	62.50	95.76	96.25	89.88	92.80B	3
Control	872.5	1220	-----	1437.5	-----	943.8	-----	-----	

MN = Mean numbers, R% = Reduction %, GR% = General Reduction %, RO = Ranking order
F value between treatments= 41.068**

Table3. Potency of the tested compounds in reducing percentages of the infested cabbage plants by cabbage aphids *Brevicoryne brassicae* during 2017-2018 cabbage growing season in Assiut region

Compound	Mean percentage of the infested cabbage plants / plot and reduction %							GR%	RO
	Before spraying	After 3 days		After 7 days		After 14 days			
		MP	R%	MP	R%	MP	R%		
Evure ®	6.00	6.00	38.00	6.00	53.00	6.25	58.40	49.80A	2
Karate® Zeon	5.00	5.00	38.00	5.00	53.00	5.00	60.00	50.33A	1
Biosad 22% SC	4.00	4.00	38.00	5.00	41.25	5.00	50.00	43.08C	5
Abamectin 1.8%EC	5.00	5.00	38.00	5.75	45.95	6.25	50.00	44.65C	4
Melody 24%SC	7.00	7.00	38.00	8.00	46.42	8.00	54.40	46.27B	3
Control	8.00	13.00	-----	17.00	-----	20.00	-----	-----	

MP = Mean percentage, R% = Reduction %, GR% = General Reduction %, RO = Ranking order
F value between treatments= 1.495

Table4. Potency of the tested compounds in reducing percentages of the unmarketable cabbage plants infested by cabbage aphid *Brevicoryne brassicae* during 2017 -2018 cabbage growing season in Assiut region.

Compound	Mean percentage of the unmarketable cabbage plants / plot and reduction %							GR%	RO
	Before spraying	After 3 days		After 7 days		After 14 days			
		MP	R%	MP	R%	MP	R%		
Evure ®	5.00	5.00	29.00	5.50	58.20	8.00	55.20	47.47A	2
Karate® Zeon	5.00	5.00	29.00	7.00	46.80	7.50	58.00	44.60C	5
Biosad 22% SC	5.00	5.50	21.90	6.25	52.50	6.25	65.00	46.47B	3
Abamectin 1.8%EC	4.00	4.00	29.00	5.00	52.50	6.50	54.36	45.29B	4
Melody 24%SC	6.00	6.00	29.00	7.00	55.92	9.00	58.00	47.64A	1
Control	5.00	7.00	-----	13.00	-----	18.00	-----	-----	

MP = Mean percentage, R% = Reduction %, GR% = General Reduction %, RO = Ranking order
F value between treatments= 0.092

Table5. Potency of the tested compounds in reducing percentages of the aphid emerged parasitoid (*Diaeretiella rapae*) inhabiting cabbage during 2017 -2018 cabbage growing season in Assiut region

Compound	Mean percentage of emerged parasitoids / 100 mummified aphid and reduction %							GR%	RO
	Before spraying	After 3 days		After 7 days		After 14 days			
		MP	R%	MP	R%	MP	R%		
Evure ®	88.75	38.25	57.43	54.75	34.28	55.50	36.37	42.69C	3
Karate® Zeon	86.25	5.25	94.06	7.50	90.46	8.50	89.90	91.47A	1
Biosad 22% SC	88.75	75.50	15.85	77.75	6.72	80.75	8.09	10.22E	5
Abamectin 1.8%EC	83.75	57.00	32.68	69.05	13.08	71.75	13.14	19.63D	4
Melody 24%SC	90.50	43.50	52.48	43.75	49.12	45.50	49.50	50.36B	2
Control	90.75	92.00	-----	85.50	-----	89.50	-----	-----	

MP = Mean percentage, R% = Reduction %, GR% = General Reduction %, RO = Ranking order
F value between treatments= 173.703**

Table6. Potency of the tested compounds in reducing numbers of cabbage aphids *Brevicoryne brassicae* infesting cabbage plants during 2018-2019 cabbage growing season in Assiut region

Compound	Mean numbers of <i>B. brassicae</i> / 4 leaves (5 inches ² / leaf) / plot and reduction %							GR%	RO
	Before spraying	After 3 days		After 7 days		After 14 days			
		MN	R%	MN	R%	MN	R%		
Evure ®	795.5	80.00	93.30	63.50	95.12	42.25	96.35	94.92B	2
Karate® Zeon	805.5	15.50	98.66	18.55	98.78	20.50	97.81	98.42A	1
Biosad 22% SC	855.0	480.5	62.48	395.5	71.94	535.25	54.01	62.81D	5
Abamectin 1.8%EC	799.5	320.0	73.20	270.5	79.26	145.5	86.86	79.77C	4
Melody 24%SC	840.5	85.50	93.30	73.50	94.51	70.00	94.16	93.99B	3
Control	835.0	1250	-----	1360	-----	1150	-----	-----	

MN = Mean numbers, R% = Reduction %, GR% = General Reduction %, RO = Ranking order
F value between treatments= 73.206**

Table7. Potency of the tested compounds in reducing percentages of the infested cabbage plants by cabbage aphids *Brevicoryne brassicae* during 2018-2019 cabbage growing season in Assiut region

Compound	Mean percentage of the infested cabbage plants / plot and reduction %							GR%	RO
	Before spraying	After 3 days		After 7 days		After 14 days			
		MP	R%	MP	R%	MP	R%		
Evure ®	5.50	5.50	50.00	5.50	61.00	6.25	68.08	59.69A	2
Karate® Zeon	6.50	6.50	50.00	6.50	61.00	7.00	70.04	60.35A	1
Biosad 22% SC	6.00	7.00	41.50	7.50	51.25	8.00	62.76	51.84C	5
Abamectin 1.8%EC	5.50	6.00	45.50	6.25	55.54	6.50	66.96	56.00B	4
Melody 24%SC	6.00	6.00	50.00	6.00	61.00	7.00	67.24	59.41A	3
Control	6.00	12.0	-----	15.50	-----	21.50	-----	-----	

MP = Mean percentage, R% = Reduction %, GR% = General Reduction %, RO = Ranking order
F value between treatments= 1.587

Table8. Potency of the tested compounds in reducing percentages of the unmarketable cabbage plants infested by cabbage aphid *Brevicoryne brassicae* during 2018 -2019 cabbage growing season in Assiut region.

Compound	Mean percentage of the unmarketable cabbage plants / plot and reduction %							GR%	RO
	Before spraying	After 3 days		After 7 days		After 14 days			
		MP	R%	MP	R%	MP	R%		
Evure®	6.50	6.50	25.00	6.75	55.28	6.75	71.92	50.73A	2
Karate® Zeon	6.25	6.25	25.00	6.25	57.00	6.50	71.92	51.31A	1
Biosad 22% SC	5.75	6.00	22.00	6.00	55.28	6.25	70.57	49.21B	4
Abamectin 1.8%EC	4.75	5.00	21.25	5.00	54.85	5.50	68.68	48.26B	5
Melody 24%SC	5.00	5.00	25.00	5.25	54.85	5.50	70.30	50.05A	3
Control	6.00	8.00	-----	14.00	-----	22.50	-----	-----	

MP = Mean percentage, R% = Reduction %, GR% = General Reduction %, RO = Ranking order
F value between treatments= 0.039

Table9. Potency of the tested compounds in reducing percentages of the aphid emerged parasitoid (*Diaeretiella rapae*) inhabiting cabbage during 2018 -2019 cabbage growing season in Assiut region

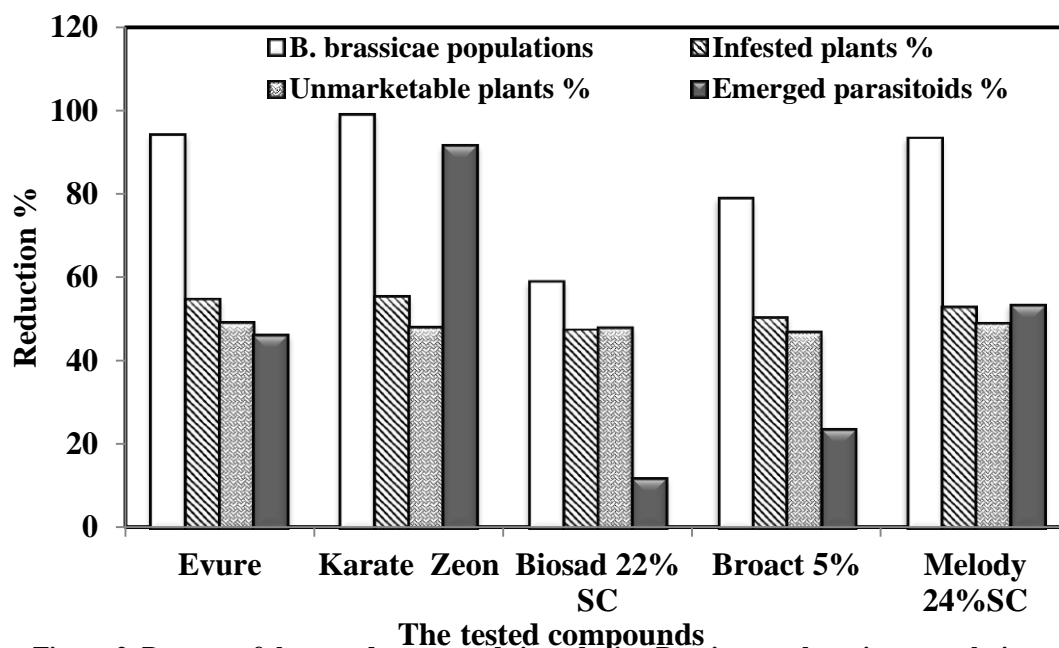
Compound	Mean percentage of emerged parasitoids /100 mummified aphid and reduction %							GR%	RO
	Before spraying	After 3 days		After 7 days		After 14 days			
		MP	R%	MP	R%	MP	R%		
Evure®	87.50	37.50	57.86	52.50	41.20	43.50	50.50	49.85C	3
Karate® Zeon	86.50	6.50	92.16	7.00	92.16	7.50	91.09	91.80A	1
Biosad 22% SC	88.25	80.00	10.52	76.50	14.74	75.25	15.85	13.80E	5
Abamectin 1.8%EC	82.50	62.50	25.52	60.25	28.46	58.50	29.71	27.89D	4
Melody 24%SC	88.50	42.50	52.96	40.25	55.90	39.50	55.45	56.44B	2
Control	89.50	91.50	-----	91.00	-----	90.25	-----	-----	

MP = Mean percentage, R% = Reduction %, GR% = General Reduction %, RO = Ranking order
F value between treatments= 370.711**

Table10. Potency of the tested compounds in reducing *Brevicoryne brassicae* populations, percent infestation, unmarketable cabbage plants and merged parasitoids % during 2017-2018 and 2018-2019 cabbage growing seasons in Assiut region.

Compound	General reduction percentage during 2017-2018 and 2018 2019 cabbage growing seasons							
	B. brassicae Populations		Infested plants %		Unmarketable plants %		Emerged parasitoids %	
	R%	RO	R%	RO	R%	RO	R%	RO
Evure®	94.20	2	54.75	2	49.10	1	46.27	3
Karate® Zeon	98.98	1	55.34	1	47.96	3	91.64	1
Biosad 22% SC	59.08	5	47.46	5	47.88	4	12.01	5
Abamectin 1.8%EC	78.99	4	50.33	4	46.78	5	23.76	4
Melody 24%SC	93.40	3	52.84	3	48.85	2	53.40	2

R% = Reduction %, RO = Ranking Order



The tested compounds
 Figure 2. Potency of the tested compounds in reducing *Brevicoryne brassicae* populations, percent infestation, unmarketable cabbage plants and merged parasitoids % during 2017-2018 and 2018-2019 cabbage growing seasons in Assiut region.

فعالية بعض المركبات الكيميائية والبدائل الآمنة للمبيدات علي من الكرنب والطفيل المصاحب له التي تقطن زراعات الكرنب

فاروق عبد القوى عبد الجليل* , صفاء محمد عبدالرحمن عمرو** , عبد الرحيم أحمد عبد الرحيم** , وداليا يوسف عوض درويش*

* قسم وقاية النبات - كلية الزراعة - جامعة أسيوط.

** معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة - مصر.

الملخص العربي :

أجريت الدراسة لتقييم فعالية مركبين حديثي الأستيراد من الأتحاد الأوربي (Evure® and Karate®) مقارنة بمركبين طبيعيين (Zeon Biosad 22% SC and Abamectin 1.8 % EC) بالإضافة للمركب الكيميائي (Melody 24%SC) ضد حشرة من الكرنب *Brevicoryne brassicae* (Linnaeus) الذي يقطن زراعات الكرنب خلال موسمي نمو الكرنب ١٨/٢٠١٧ و ١٩/٢٠١٨ بأسيوط شمالي صعيد مصر. تم أيضا تقييم فعالية هذه المركبات علي معدل الأصابة وكمية المحصول. كما أخذ في الأعتبار تأثير هذه المركبات علي نسبة أعداد الطفيل *Diaeretiella rapae* (McIntoch) المنبثقة من موميوات المن المتطفل عليه. أظهرت النتائج أن المركب (Karate® Zeon) كان أكثر المركبات فعالية علي كثافة مجاميع حشرة من الكرنب بمتوسط خفض عام ٩٨,٩٨%. تلاه في ذلك مركب (Evure®) بمتوسط خفض عام ٩٤,٢٠%. المركب الكيميائي (Melody 24%SC) تمكن من خفض أعداد الأفة بمقدار ٩٣,٤٠% (أقل من المركبين السابقين). المركبات الطبيعية (Abamectin 1.8% EC and Biosad 22% SC) أظهرت أقل نسبة خفض في تعداد الأفة بمقدار ٧٨,٩٩ و ٥٩,٠٨% علي التوالي. فعالية المركبات المختبرة علي خفض نسبة النباتات المصابة و النباتات غير الصالحة للبيع تراوحت بين ٤٧,٤٦ - ٥٥,٦٤ و ٤٩,١٠% علي التوالي. و بهذا فقد ظهر أن أستخدام هذه المركبات أدي ألي زيادة في المحصول بنسبة تجاوزت ال ٥٠%. لسوء الحظ فإن أكثر المركبات فعالية علي الأفة كان أكثرها فعالية علي الطفيل المصاحب حيث أدي أستخدامه ألي نسبة خفض في أعداد الطفيل المنبثق من الموميوات مقدارها ٦٤,٩١%. و بالتالي فانه يجب أن يكون هناك محاذير عند أستخدام هذا المركب كعنصر لمكافحة المن. نسبة الخفض المقبولة في أعداد الأفة و التي تتبعها نسبة خفض قليلة في أعداد الطفيل المنبثقة عند أستخدام مركبي (Abamectin 1.8% EC and Biosad 22% SC) توجب التوصية بأستخدام هذين المركبين الطبيعيين لمكافحة من الكرنب الذي يصيب الكرنب حتي لو أستدعي ذلك تطبيقها أكثر من مرة في الموسم الواحد.

الكلمات الدالة: الكرنب ومن الصلبيات والطفيليات والمكافحة الكيميائية والبدائل الآمنة للمبيدات.