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BIOPESTICIDES UTILITY FOR CONTROLLING *TETRANYCHUS URTICAE* (KOCH) INFESTING SOYBEAN PLANTS CONCERNING ENVIRONMENTAL IMPACT IN ASSIUT GOVERNORATE, EGYPT.

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ABSTRACT

The effects of fenazaquin (a conventional acaricide), challenger (a natural product isolated from a fermentation culture of *Streptomyces fummanus*), abamectin (a natural product produced by the soil microorganisms *Streptomyces avermiti/is)* and azadirachtin (a natural product from neemplants), were evaluated against *Tetranychus urticae* infesting soybean, *Glycine max*, in Assiut Governorate during the summer seasons of 2005 and 2006. The side effects of these materials on *T. urticae,* associated predators, *Euseius scutalis* (a predatory mite) and *Chrysoperia carnea* (a predatory insect) were also evaluated.

The obtained data revealed that azadirachtin was the most potent compound introducing the population size of *T. urticae* after two seasons. The general mean reduction percentage was 89.31%, followed by abamectin and challenger (86.01 and 70.98% respectively). However, fenazaquin demonstrated low reduction percentages (60.57%). The tested biopesticids were successfully controlled the number of *T. urticae* pest, and they could arrange in descending order of azadirachtin > abamectin > challenger > fenazaquin.

Challenger and abamectin demonstrated an acceptable toxic effect on *E. scutalis.* The general mean reduction percentages were almost 36%. The side effect of the tested acaricides against the predatory mite, *E. scutalis* could be arranged in ascending order of abamechtin < challenger < azadirachtin < fenazaquin. The reduction percentages were 35.92, 35.99, 41.33 and 50.60%, respectively. The least toxic compound against C. *carnea* was abamectin, while the most toxic one was fenazaquin; they reduced the predator populations by 29.91 and 45.37% respectively. The general mean reduction percentages in both seasons could be arranged in ascending order of abamectin < azadirachtin < challenger < fenazaquin.

In conclusion, azadirachtin, and abamectin can be applied effectively against *T. urticae* with minimal impact on the non-target organisms, i.e. the phytoseiid mite *E. scuta/is* and the thysanopterous insect C. *carnea.* They may be classified as IPM-compatible acaricides in the integrated pest management programms against *T. urticae* infesting soybean.

keywords: Biopesticides, predatory mite, predatory insect

INTRODUCTION

Pests may be controlled using either chemical pesticides or biopesticides. However, because of their broad spectrum of activity, chemical pesticides may destroy non-target organisms such as beneficial insects and parasites and predators of destructive pests. Additionally, chemical pesticides are frequently toxic to animals and humans. Furthermore, targeted pests frequently develop resistance when repeatedly exposed to such substances.

Biopesticides make use of naturally occurring pathogens to control insect, fungal and weed infestations of crops. An example of a biopesticide is a bacterium which produces a substance toxic to the infesting pest A biopesticide is generally less harmful to non-target organisms and the environment as a whole than chemical pesticides (Brar et al., 2006).

Tetranychid mites are considered one of the major pests causing considerable damage to vegetable and horticulture crops. The two-spotted spider *Tetranychus urticae* Koch is the most economically important mite species of wide spread nature in Egypt (Omar & El-Khateeb, 2002). Fernando et al. (2008) found that *T. urticae* were not able to process or hydrolyze Cry1Ab, suggesting that the toxin passes through the prey to the third trophic level undegraded, thus presumably retaining its insecticidal properties.

Therefore, the present work aimed to evaluate the efficacy of some biopesticides, i.e. abamectin, challenger and azadirachtin compared with a conventional miticide fenzaquin against *T. urticae* and their side-effect on the predaceous mite *Euseius scutalis,* Athias-Henriot, (Acari: Phytoseiidae) and a predaceous insect *Chrysoperla camea* Stephens (Neuroptera: Chrysopidae) on soybean plants during two successive seasons 2005 and 2006.

MATERIALS AND METHODS

Soybean (*Glycine max)* was planted in 20/4/2005 (1^{st} season) and 23/4/2006 (2^{nd} season), at Assuit Governorate. The experimental area was divided into equal plots of 35 m2 (7x5 m) with four replicates. Treated and untreated plots were arranged in a complete randomized block design, receiving routine agricultural practices. The tested materials were as follows: (1) Abamectin (Vapcomic 1.8% EC at the rate of 40ccl/ 100 liter water), a natural product produced by the soil microorganisms *Streptomyces avermilills.* (2) Azadirachtin (Neemazal 5% EC at the rate of 300cc/ 100 liter water), a natural product from neem plants. (3) Challenger (36% Sc at the rate of 40cc/ 100 liter water), natural product isolated from a fermentation culture of *Streptomyces fummanus*, (4) Fenazaquin (Pride 20% EC at the rate of 60 cc/100 liter water), a conventional acaricide, and (5) Untreated plots for comparison (control).

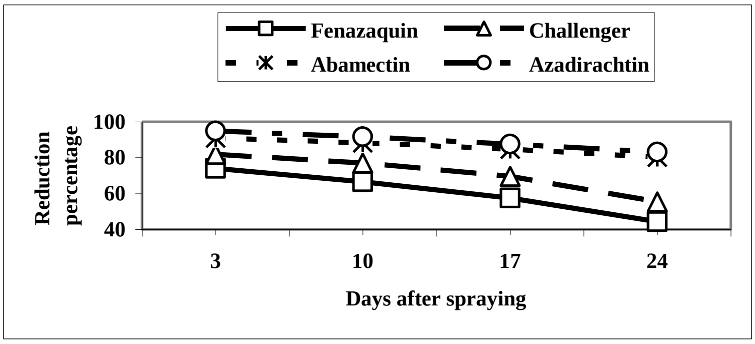
Each material was sprayed on 5/6/2005 in the 1^{st} and on 8/6/2001 in the 2^{nd} season (45 days after plantation) by using a sprayer equipped with one nozzle. Used materials were diluted with water at the rate of 200 liter/feddan (4200m2). Samples of 20 leaves were picked randomly from each plot, before spray and after spraying by 3, 10, 17 and 24 days. The leaves were transferred to the laboratory in paper bags and examined by using binocular microscope. The active individuals (moving stages) of both phytophagous, *T. urticae* koch and predaceous, *E. scuta/is* were counted at two square inches; one from the upper and the other from the lower surface of each leave. The numbers of the insect predator C. *camea* Stephens were directly counted in the field on 20 leaves randomly from each plot. The average number of mites and insects in treated and untreated leaves were counted and the reduction percentages were calculated according to Henderson and Tilton (1955) equation. Data were analyzed by using analysis of variance (ANOVA) test.

RESULTS AND DISCUSSION

In general, data shown in Table (1) indicated that all tested materials were significantly effective against *T. urticae* compared to the untreated plots (control). However, the used materials were more effective in controlling mites infesting soybean plants in 2005 than in 2006. This may be attributed to the variations in the levels of infestation during the experimental periods, 231.25-256 individuals /20 leaves in 2005 and 348- 361.25 individuals /20 leaves in 2006. The field tests in 2005 showed that azadirachtin and abamectin were the most potent compounds in reducing the population size *of T. urticae* after 3 days from application, their reduction percentages were 94.65 and 90.36 %, respectively. They were followed by challenger since its reduction value was 82.18% (Fig. 1). However, the biopesticid fenazaquin was the least effective one (74.52 reduction percent). After 10 days, azadirachtin demonstrated the highest significant reduction in the numbers of *T. urticae* moving stages (91.46%), followed by abamectin (86.56 %). Fenazaquin was the least effective one (65.52%). Azadirachtin still the most potent material after 17 days from application, it reduced the population size of *T. urticae* by 87.37% and abamectin came next (84.07%), fenazaquin was the least effective one (59.53%). After 24 days, the previous trend was existed, since azadirachtin showed the most significant reduction in the numbers of moving stages of *T. urticae* (82.65%), abamectin was next (78.65%) followed by challenger (57.33%) and fenazaquin came in the back (42.0%). After the evaluation period (24 days) the used acaricides can be statistically arranged into three groups:(1) azadirachtin, was high effective in controlling *T. urticae.* The mean reduction percentage of mite populations was higher than 85%, (2) abamectin and challenger were effective in controlling *T. urticae* since the reduction percentage ranged from 70 to 85% and (3) fenazaquin was low effective in controlling *T. urticae* since the reduction percentage ranged from 60 to 70%. Also, the results of field tests carried out in 2006 showed the same trend obtained in 2005 (Table 1).

Table (1). Mean No. of T. urticae motile stages/ 20 soybean leaves as affected by some biopesticids under field conditions during the growing season of 2005 and 2006

Treatment	Year	Before spraying	Periods after spraying (days)										General mean	
			3		10		17		24		Mean			
			No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %
Fenazaquin	2005	256.00	49.50	74.52	59.25	65.52	63.00	59.53	74.00	42.00	61.44	60.39	77.88	60.57
	2006	353.00	83.50	73.34	94.00	67.66	99.50	55.50	100.25	46.47	94.31	60.74		
Challenger	2005	244.50	36.25	82.18	43.50	75.83	51.25	68.56	57.00	57.33	47.00	70.97	57.13	70.98
	2006	358.75	56.50	81.66	61.75	78.41	64.75	70.57	86.00	53.33	67.25	70.99		
Abamectin	2005	249.00	19.25	90.36	23.75	86.56	25.50	84.07	28.00	78.65	24.13	84.91	27.16	86.01
	2006	359.50	26.50	91.38	28.50	90.01	32.00	85.43	33.75	81.65	30.19	87.12		
Azadirachtin	2005	231.25	11.50	94.65	16.25	91.46	21.75	87.38	24.50	82.65	18.50	89.04	21.56	89.31
	2006	348.00	15.75	95.04	23.75	91.94	28.00	87.66	31.00	83.68	24.63	89.58		
Untreated	2005	243.75	204.00	""	180.50	""	163.50	""	134.00	""	170.50	""	209.19	""
	2006	361.25	306.00	""	284.00	""	218.50	""	183.00	""	247.88	""		
LSD at 0.05	2005	8.92	3.50	""	3.19	""	3.06	""	2.74	""	3.08	""	''''	""
	2006	12.99	5.25	""	5.03	""	4.12	""	3.78	""	4.50	""	''''	""



The presented data is average of two seasons

Fig. (1): Reduction percentage of *T. urticea* in relation to spraying time of used biopesticides

Integration of the data presented in Table (1) shows the general mean of reduction percentage in *T. urt;cae* moving stage after two evaluation seasons. It can be concluded that the tested biopesticids were successfully controlled the number of *T. urticae* pest, and they could arrange in descending order of azadirachtin > abamectin > challenger > fenazaquin. The aforementioned results agreed with those obtained by Szwejda (1993). He reported that the two spider mites *T. urticae* and *T. c;nnabar;nus* were of economic importance in Poland. In his experiments with chemical control on both spider mite species, the following compounds gave the best results: fenpyrad, acrinatrin, difenthiuon and abamectin. The mortality reached more than 98%. El-Adawy *et al.* (1995) tested eleven acaricides from different chemical groups and the entomopathogenic fungus; *B. bassiana* against *T. urticae* infesting cucumber under plastic house conditions. They found that chlorfenapyr, abamectin, fenpropathrin, azocyclotin, propargite (Acargite), propargite (comite), fenpyroximate and fenazaquin reduced the infestation by (71.25- 80.38%), whereas hexythiazox, bromopropylate and ethion reduced it by (61.25-62.87%). B. *bassiana* resulted in 80.86% reduction in the mite population.

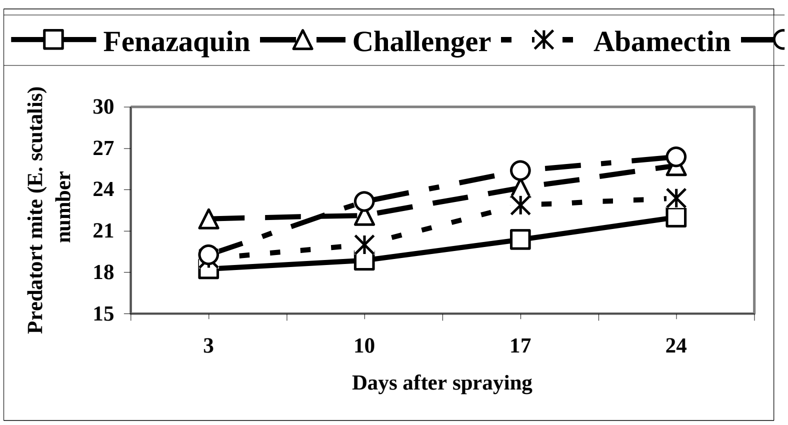
Sundaram and Sloane (1995) investigated pure azadirachtin-A (AZ-A) and 4 neem-based formulations, Margosan-O (RH), Azatin (MO), RH-9999 (PT) and Neem PTIEC4 (AT) containing the insecticide isomer for their repellency, toxicity and oviposition deterrence against *T. urticae.* They found that the deterrent and biological effects decreased in the order AT> PT> MO> RH> AZ-A. Ryabchinskaja *et al.* (1996) found that the preparation of the avermectins group, phytoverm, was highly effective against *T. urticae.* The maximum reduction in its population was 93.1 % 4 days after treatment when phytoverm was applied at 2 liter /ha. Kandybin and Smirnov (1996) mentioned that sue of Actinine, a novel bioacaricide based on *Streptomyces* is effective and ecologically safe to tetranychid control.

The data shown in Table (2) revealed that that all tested materials reduced the number of the phytoseiid predatory mite, *E. scuta/is,* this reduction was not significant. In season 2005, the mean numbers of predator were 6.5, 7.56, 8.81 and 9.38 individuals/20 leaves for fenazaquin, challenger, abamectin and azadirachtin, respectively. In untreated plots the number was 14.19 individuals/20 leaves (Fig. 2). In season 2006, the mean numbers of predator were 33.25, 39.38, 33.81 and 37.69 individuals/20 leaves for fenazaquin, challenger, abamectin and azadirachtin, respectively. In untreated plots the number was 56.06 individuals/20 leaves. In season 2005, the side effect of the tested acaricides against the predatory mite, *E. scutalis* could be arranged in ascending order of abamechtin < azadirachtin < challenger < fenazaquin. While in season 2006, the side effect of the tested acaricides against the predatory mite, *E. scutalis* took ascending arrange in order of challenger < azadirachtin < fenazaquin < abamechtin.

The side-effects of the tested acaricides against the predatory insect *Chrysoperla carnea* are presented in Tables 3. The obtained data reveal that all tested biopesticides significantly reduced the predatory insect in both seasons. The mean numbers of C. *carnea* were 27.13, 31.88, 33.0 and 32.44 individuals/20 plant leaves in the 1st season and they were 15.81, 13.94, 22.44 and 24.25 individuals/ 20 plant leaves in the 2nd season for fenazaquin, challenger, abamectin and azadirachtin, respectively. The general mean of C. *carnea* numbers for both seasons were 21.47, 22.91, 27.72, 28.34 and 37.06 individuals/ 20 plant leaves for fenazaquin, challenger, abamectin, azadirachtin and control, respectively. The least toxic compound against C. *carnea* was azadirachtin, while the most toxic one was fenazaquin(Fig. 3). The general mean reduction percentages in both seasons could be arranged in ascending order of abamectin < azadirachtin < challenger < fenazaquin (Table 3).

Table (2). Mean No. of Euseius scutalis motile stages/ 20 soybean leaves as affected by some biopesticids under field conditions during the growing season of 2005 and 2006

Treatment	Year	Before spraying	Periods after spraying (days)										General mean	
			3		10		17		24		Mean			
			No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %
Fenazaquin	2005	19.25	5.50	44.20	6.00	52.17	7.00	68.33	7.50	67.81	6.50	58.13	19.88	50.60
	2006	51.25	31.00	36.09	31.75	46.42	33.75	46.14	36.50	43.64	33.25	43.07		
Challenger	2005	22.00	6.50	24.64	6.75	38.51	8.00	58.64	9.00	55.85	7.56	44.41	23.47	35.99
	2006	55.00	37.25	17.59	37.50	32.08	40.25	31.07	42.50	29.57	39.38	27.58		
Abamectin	2005	25.25	6.50	13.50	8.00	16.36	10.25	39.17	10.50	40.89	8.81	27.48	21.31	35.92
	2006	49.25	31.50	37.59	32.00	48.10	35.50	45.56	36.25	46.21	33.81	44.37		
Azadirachtin	2005	19.75	6.25	34.95	7.50	38.66	11.25	47.78	12.50	44.96	9.38	41.59	23.53	41.33
	2006	47.00	32.25	39.03	38.75	40.03	39.50	42.19	40.25	43.00	37.69	41.06		
Untreated	2005	23.00	8.25	""	10.50	""	18.50	""	19.50	""	14.19	""	35.13	""
	2006	53.75	46.25	""	56.50	""	59.75	""	61.75	""	56.06	""		
LSD at 0.05	2005	0.80	0.23	""	0.30	""	0.47	""	0.47	""	0.37	""	''''	""
	2006	1.84	1.31	""	1.44	""	1.54	""	1.64	""	1.51	""	''''	""

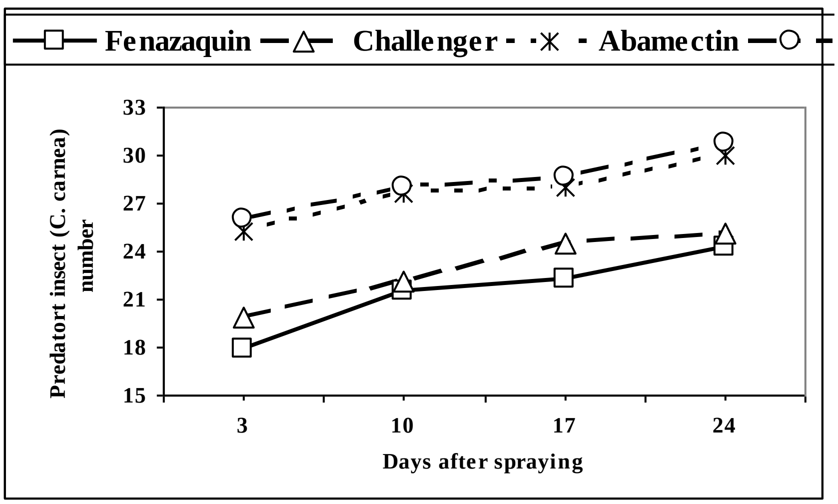


The presented data is average of two seasons

Fig. (2): Number of predator mite (*E. scutalis*) in relation to spraying time of used biopesticides

Table (3). Mean No. of Chrysoperla carnea larvae/ 20 soybean leaves as affected by foliar spray with biopesticids under field conditions during the growing season of 2005 and 2006

Treatment	Year	Before spraying	Periods after spraying (days)										General mean	
			3		10		17		24		Mean			
			No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %
Fenazaquin	2005	46.50	24.50	30.61	27.00	34.19	28.25	34.71	28.75	40.09	27.13	34.90	21.47	47.98
	2006	22.25	11.25	68.35	16.00	58.31	16.25	59.96	19.75	57.58	15.81	61.05		
Challenger	2005	49.00	29.00	13.45	30.25	22.31	34.00	17.19	34.25	24.79	31.88	19.44	22.91	45.37
	2006	18.50	10.75	74.86	14.00	69.67	15.00	69.27	16.00	71.43	13.94	71.31		
Abamectin	2005	47.25	31.50	9.35	33.25	17.65	33.50	21.32	33.75	28.54	33.00	19.22	27.72	29.91
	2006	23.75	19.00	42.95	22.00	38.82	22.50	40.82	26.25	39.82	22.44	40.60		
Azadirachtin	2005	40.50	31.25	22.92	32.00	32.07	32.25	35.08	34.25	37.84	32.44	31.98	28.34	32.14
	2006	25.00	20.75	34.42	24.00	29.74	25.00	30.79	27.25	34.24	24.25	32.30		
Untreated	2005	46.25	35.50	""	41.25	""	43.50	""	48.25	""	42.13	""	37.06	""
	2006	28.00	28.25	""	30.50	""	32.25	""	37.00	""	32.00	""		
LSD at 0.05	2005	1.68	1.12	""	1.20	""	1.29	""	1.28	""	1.25	""	""	""
	2006	0.88	0.72	""	0.79	""	0.85	""	0.93	""	0.78	""	""	""



The presented data is average of two seasons

Fig. (3): Number of predator insect (*C. carnea*) in relation to spraying time of used biopesticides

In this respect, Tzeng and Kao (1996) revealed that the green lacewing Malladabasalis larvae are polyphagous predators which are mass-reared in the laboratory and used for the control of T. urticae on strawberry in Taiwan. They tested the toxicity of 23 pesticides commonly used to control pests on strawberry and other crops. Results revealed that 6 acaricides: hexythiazox, fenbutatin oxide, chinomethionat, fenpyroxi mate, fenothiocarb and abamectin were harmless (<50%) to the larvae of M. basalis. Badawy and El-Arnaouty (1999) found that organophosphorus iseciticides were more toxic than carbamates and biocides against third- instar larvae of Chrysoperla carnea. . Percent moralities were low namely 7 and 40% for pirmicarb and carbosulfan, 4 and 7% for M-Pede (an organic insecticide based on potassium salts of fatty acids) and abamectin, 11 and 9% for Dipel (Bacillus thuringiensis var. Kurstaki) and Biofly (Beauva'iabassiana). They suggested that pirimicarb, natural insecticides and biocides may be useful in integrated pest management programs. Markandeya and Divakar (1999) mentioned that azadirachtin is well known for its effect on pest species, but information on its effects on bioagents is scanty. Therefore, they evaluated a commercial neem formulation (Margosom 1500 ppm) in the laboratory against two parasitoids; Trichogramma chilonis and Bracon breviccrnis and two predators, the wolf spider Lycosa pseujo annulata and the predatory beetle Menochilus sexmaculatus. They found that margosom was safe to all the four bioagents studied.

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استخدام المركبات الحيوية فى مكافحة العنكبوت الأحمر العادى الذى يصيب نباتات فول الصويا وآثارها البيئية فى محافظة أسيوط، مصر.

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تم تقييم بعض المركبات الحيوية (فينازاكوين وهو مبيد اكاروسي تقليدي، تشالينجر وهو منتج طبيعي مفصول من تخمر مستعمرة بكتريا نوع *Streptomyces fummanus* ، أبامكتين وهو منتج طبيعى من الكائنات الدقيقة *Streptomyces avermitilis* ، وأزاديراختين وهو منتج طبيعى من نباتات النيم) ضد أكاروس *Tetranychus urticae* (العنكبوت الأحمر العادي) الذى يصيب نباتات فول الصويا في محافظة أسيوط خلال الموسم الصيفى لعامى ٢٠٠٥ ، ٢٠٠٦ . وكذلك تم تقيم الآثار الجانبية لهذه المركبات على كل من المفترس الأكاروسى *Euseius scutalis* والمفترس الحشرى *Chrysoperia carnea* .

وقد أظهرت النتائج أن أزاديراختين كان أكثر فاعلية فى خفض تعداد العنكبوت الأحمر العادى *T. urticae* بعد موسمين، حيث كان المتوسط العام بنسبة خفض ٨٩,٣١% ، يليه أبامكتين وتشالينجر (٨٦,٠١، ٧٠,٩٨% على الترتيب). وكان أقل المركبات فاعلية فينازاكوين بنسبة خفض ٦٠,٥٧%.

وقد أظهرت نتائج الرش بمركبات تشالينجر وأبامكتين تأثير سام على المفترس الأكاروسى *E. scutalis* بمتوسط عام للخفض تقريباً ٣٦%. والآثار الجانبية للمركبات المختبرة ضد المفترس الأكاروسى يمكن ترتيبها تصاعدياً على النحو التالى أباكتين، ، تشالينجر، أزاديراختين ، فينازاكوين بنسب خفض ٣٥,٩٢، ٣٥,٩٩، ٤١,٣٣، ٥٠,٦٠ % على الترتيب. وكان مركب أباكتين أقل المركبات سمية على المفترس الحشرى *C. carnea* بينما كان مركب فينازاكوين أكثرهم سمية, بنسية خفض ٢٩,٩١، ٤٥,٣٧% على التوالى.