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Comparative Efficacy of Some Reduced Risk Insecticides in Controlling Sucking Insect Complex on Okra

Tomalika Saha, Masum Ahmad, Gopal Das✉

Department of Entomology, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

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Correspondence
Gopal Das
✉: gopal_entom@yahoo.com

ABSTRACT

In the present study, the effect of some reduced risk insecticides was evaluated against sucking insect complex on okra. The selected reduced risk insecticides were Biotrin 0.5% (Matrine 0.5%), Capture 75 WDG (Imidacloprid + Emamectin Benzoate), Kotan 50 WG (Pymetrozine), Ravjum 14.5 SC (Indoxacarb) and Sniper 10 SC (Fenopropathrin + Fenvalerate). A total of four sprays were given at 10 days interval. Data were collected on the number of insects/leaf, number of curled leaves per plant and marketable yield of okra (t/ha). Considering the reduction of jassid populations, the best result was found in case of Kotan 50 WG (0.51 jassid/leaf after given 4th spray) and Sniper 10 SC (0.67 jassid/leaf after given 4th spray) treated plots while the next best treatments were Capture 75 WDG (1.0 jassid/leaf) and Ravjum 14.5 SC (1.56 jassid/leaf) respectively. But Biotrin 0.5% was found ineffective or less effective against sucker complex of okra (8.0 jassid/leaf) and this result was comparable with untreated control (10.25 jassid/leaf). A similar trend was found in case of whitefly and aphid populations following given treatments. Numbers of curled leaves were significantly reduced in insecticides treated plots except Biotrin 0.5%. The highest marketable fruit yield (10.56t/ha) was found from Kotan 50 WG treated plots @ 1.0 g/L that was insignificantly followed by Sniper 10 SC @ 1.5 ml/L (10.44 t/ha). The lowest yield was recorded from control plots (6.12 t/ha) and the plots treated with Biotrin 0.5% (6.50 t/ha).

Introduction

Okra *(Abelmoschus esculentus* L.) belongs to the family Malvaceae which is also known as lady's finger and locally called "Dharos" or “Vendi”. This is one of the most familiar summer vegetables grown in Bangladesh as well as in tropical and sub-tropical parts of the world (Arapitsas, 2008; Saifullah and Rabbani, 2009). Okra nowadays becomes a great substitute when the market undergoes a shortage of both winter and summer vegetables. Okra is a healthy source of carbohydrate, proteins and vitamin C in large quantities (Dilruba *et al.*, 2009), and serves a basic role in human diet (Kahlon *et al*., 2007; Randhawa, 1974; Masood Khan *et al.,* 2001; Saifullah and Rabbani, 2009). Generally, immature pods of okra are the main edible part that consumed as a fried or boiled vegetable or may be added to salads, soups and stews (Kashif *et al.,* 2008; Akintoye *et al.*, 2011). The okra fruit, an eminent source of iodine considered to be useful for the control of goiter (Sultana *et al.*, 2017).

The productivity of okra is now at risk due to the attack of insect pest, mites, nematodes, bacteria and virus. among them insect pests are the foremost factor that cause profound qualitative and quantitative losses in okra yield (Sharma and Sharma, 2001; Dubey and Ganguli, 1998). The major destructive insect pests are jassid, *Amrasca devastans* (Dist.) (Atwal, 1994; Dhandapani *et al*., 2003; Jamshaid *et al*., 2008), whitefly, *Bemisia tabaci* (Genn.) (Sahito *et al.,* 2012), thrip *Thrips tabaci* (Lind.) and aphid, *Aphis gossypii* (Glover) which are altogether known as sucking insect complex causing damage from early seedling to till fruit maturity (Halder *et al*., 2015). These sucking insects mainly suck cell sap from the plant. As a result, the plants get devitalized and photosynthesis become hampered. Moreover, many of them also act as a vector of transmission of many viral diseases (Halder *et al*., 2011; Rai *et al*., 2014).

Most of the okra growers in Bangladesh completely depends on different chemical/conventional insecticides for controlling sucking insects of okra. In most cases, the use of synthetic chemical insecticides causes development of insecticide resistance, high residues of insecticide in the crop yield, insect resurgence, secondary pest outbreak, destruction of natural enemies

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etc (Kodandaram *et al.,* 2010; Solangi and Lohar, 2007; Dittrich *et al*., 1990). Moreover, insecticidal residues cause imbalance of the agro-ecosystem (Sarker and Nath, 1989) as well as okra fruits harvested at short intervals of insecticide spraying, retains high level of insecticide residues which possibly very much hazardous to consumers (Sardana *et al.,* 2006). The threat of using conventional chemical insecticides can be reduced by using safer molecules of chemicals in the management strategies. Therefore, it becomes very crucial to select insecticides that are very selective in action as well as safer to different beneficial fauna (Soni *et al.,* 2004).

In the recent days, several new kinds of insecticides have been formulated which claim to be relatively safer to environment and beneficial organisms as compared to conventional insecticides (Winter and Katz, 2011). These insecticides are termed as reduced risk insecticides and can be considered as possible alternative to conventionals for controlling sucking pests. These insecticides are claimed to be environment friendly, less toxic to non-target organisms and less persistent in nature (Dutta *et al.,* 2017). Among the reduced risk insecticides, Neonicotinoid, Avermectin, Pyridine, Azomethines, Oxadiazine, Pyrethroid are important. Because of their good controlling ability at low rates or doses, high level of selectivity, greater specificity to target pests along with low toxicity to non-target organisms and the environment, these insecticides replaced many old/conventional compounds. Moreover, they are also less likely to cause outbreaks of secondary pests, highly helpful for delaying resistance in key pests such as jassids, whiteflies and aphids and have no cross-resistance with the old and already established insecticides.

Therefore, the present study was conducted to evaluate the efficacy of reduced-risk insecticides with novel mode of action to find out a viable option for sustainable management of sucking insect pest of okra and increasing marketable yield of okra (t/ha).

Materials and Methods

Soil of the experimental field

The field experiment was conducted at the Bangladesh Agricultural University research farm (24°54" N latitude, 90°50"E longitude at an altitude of 18m above ordnance datum). The mean annual temperature, rainfall and relative humidity are 25°C, 200 mm and 79.8%, respectively (based on the last 10 years of data measured in the local weather yard). The soil of the field experiment area was under Old Brahmaputra Alluvial Tract under the Agro Ecological Zone 9 (UNDP and FAO, 1988) with non-calcareous dark grey floodplain soil. Soil contains 10, 80 and 10% sand, silt and clay respectively with the bulk density 1.3g cm^{-3}, total pore volume (TPV) of 50%, and pH of 6.7 at 0-15 cm depth.

Preparation of experimental field

The whole experimental field was well ploughed, cleaned properly and kept for sun dried for 2 weeks. After that 33 plots were prepared with the size of 4 m^2 each to allocate the selected treatments. The experiment was laid out in a randomized complete block design (RCBD) with eleven treatments and three replications for each treatment. Cowdung and other chemical fertilizers were applied as recommended doses for okra plant at the rate of 15 tons cowdung and 90, 20, 26 kg of N_2, P and K respectively per hectare. The N-P-K was applied in the form of urea, triple super phosphate (TSP) and muriate of potash (MP) respectively. The full doses of cowdung, TSP, MP and 1/4th dose of urea were applied as basal dose during land preparation. The rest of the urea was applied as top dressing in three installment at 20 days interval. Once prepared the experimental plots, okra seeds were sown as 2-3 seeds per pit.

Cultural operations, insecticides application and data collection

All cultural operations were provided timely. The selected insecticides were applied in experimental plots when insect populations were raised above the threshold level (Table-1). To confirm the insecticidal efficacy in field condition, a total of four sprays were given at 10 days intervals. Spraying was done within 9.00 to 11.00 AM to avoid bright sun shine and drift caused by strong wind. Firstly, the pre-treated data was collected by visual searches from each count and it was made a day before 1st spraying. The post treatment counts were made at 3, 7 and 10 days after given each spray. Data were collected on number of sucking insects per leaf, number of curled leaves per plant and marketable yield of pods (t/ha). To estimate the mean number of sucking insects per leaf, nine plants were randomly selected from three plots (3 plants/plot) and tagged with identifying marker for counting accuracy. Then, three leaves were randomly selected from each of the plant and insect populations were counted by visual searches. Finally, a mean value was found out from nine plants (27 leaves) and expressed as mean number of insects/leaf. For estimating the mean number of curled leaves, nine plants were randomly selected from three plots and finally mean value was calculated as number of curled leaves/plant. Okra fruits were harvested from the experimental plots at 3 days interval. After harvesting, infested and healthy (uninfested) fruits were kept separately and then weight of healthy/marketable fruits was recorded and final yield was expressed in ton per hectare.

Statistical analysis

The recorded data were compiled and tabulated for statistical analysis. Analysis of variance (ANOVA) was done with the help of computer package MSTAT. The mean differences among the treatments were adjudged with Duncan's Multiple Range Test (DMRT) and Least Significant Difference (LSD) when necessary.

Results

Effect of reduced risk insecticides on the incidence of jassids, whiteflies and aphids on okra

Effect of different reduced risk insecticides on the incidence of jassid and whitefly has been shown in table 2-3. All the selected reduced risk insecticides except Biotrin 0.5% had significant effect on the reduction of jassid populations compared to untreated control (Table-2). From the collected pre-treated data it was observed that the number of jassid populations ranged from 3.89-5.12 per leaf in different plots before treatment application. After treatment application, all the treatments significantly reduced the jassid populations compared to control except Biotrin 0.5%. No significant reduction of jassid population was observed at 3 and 7 DAT after given 1st spray but reduced significantly at 10 DAT. After given 2nd spray, jassid population per leaf was reduced dramatically and this trend was persistently continued till 4th spray. Among four spray, the least number of jassid per leaf was recorded in case of 4th spray compared to control which confirms the persistent efficacy of selected insecticides. It was clearly observed that Biotrin 0.5% was found to be ineffective or less effective against jassids for all sprays (1st to 4th sprays). Biotrin 0.5% is a new generation botanical insecticide and the present result confirmed that Biotrin is not effective against sucking insects due to unknown reason. Among rest of the four insecticides, Kotan 50 WG and Sniper 10 SC were found to be slightly superior than Capture 75 WDG and Ravjum 14.5 SC. It was found that there had significant difference between two doses of Kotan 50 WG and Sniper 10 SC regarding reduction of jassids population.

In case of whitefly, it was observed that the number of whitefly populations ranged from 2.50-3.40 per leaf in different plots before treatment application. Like as jassids result, no significant effect of selected insecticides were found at 3 and 7 DAT compared to control but insect populations reduced significantly at 10 DAT. On the other hand, significant reduction of whitefly populations were found after given 2nd spray compared to control. After 3rd spray, a remarkable reduction of whitefly populations was observed at 10 DAT compared to control. However, the least number of whiteflies per leaf was found after given 4th spray while the differences were significant compared to control. Like as jassids result, Biotrin 0.5% was found still ineffective or less effective against whitefly. Although four selected insecticides were found highly effective against whitefly but Kotan 50 WG and Sniper 10 SC were found slightly better than Capture 75 WDG and Ravjum 14.5 SC regarding reduction of whitefly populations (Table-3).

Aphid infestation was found very scant throughout the study period. This small number of aphid populations were also significantly reduced by using selected reduced risk insecticides except Biotrin 0.5% (data were not shown as tabular form).

Effect of reduced risk insecticides on the development of curled leaves

Curled leaves are usually developed when different sucking insects suck the cell sap from the leaf and also insert some kinds of toxin in leaf tissues. Development of curled leaves is one of the striking indicator of infestation of sucking insects. In the present study, number of curled leaves were counted in control and treated plots to know the efficacy of selected insecticides. Data were shown in figure 1. It was observed that each of the treatment was found significantly effective except Biotrin 0.5%. The highest number of curled leaves was counted from control plots. After given 1st spray, number of curled leaves were reduced slightly and difference with control was not at significant level. After given 2nd spray, a significant reduction of curled leaves were found when okra plants were treated with different insecticides except Biotrin 0.5% compared to control. Among four insecticides, Kotan 50 WG and Sniper 10 SC were found comparatively better than Capture 75 WDG and Ravjum 14.5 SC. After given 3rd spray, number of curled leaves per plant was further reduced than 2nd spray. But curled leaves were continuously increased in case of untreated condition or when plants were not treated with insecticides. After given final or 4th spray, further reduction of curled leaves were found than 3rd spray while Biotrin 0.5% was found still less effective (Fig.1).

Effects of selected reduced risk insecticides on marketable yield of okra

The selected reduced risk insecticides except Biotrin 0.5% had significant effect on the increase of marketable yield of okra (t ha^{-1}) compared to control (Table-4). In case of untreated or control condition, 6.12 t ha-^{1} of yield was recorded. Biotrin 0.5% had no significant effect on the increase of okra yield compared to control. On the other hand, all of the four selected insecticides had profound and significant effect on the increase of yield compared to control. Among four insecticides, Kotan 50 WG and Sniper 10 SC were found comparatively better regarding yield performances. The highest yield was recorded from Kotan 50 WG treated plot @ 1.0 g/L (10.56 t ha^{-1}) that was significantly differed when plants were treated with the concentration of 0.5 g/L (9.42 t ha^{-1}). Moreover, similar results were found in case of Sniper 10 SC while there had significant effect between the concentrations 1.0 (9.45 t ha^{-1}) and 1.5 ml/L (10.44 t ha^{-1}) regarding yield. Capture 75 WDG (8.0 t ha^{-1} @ 0.2 g /L; 8.55 t ha^{-1} @ 0.3 g/L) and Ravjum 14.5 SC (8.28 t ha^{-1} @ 1.0 ml/L; 9.18 t ha^{-1} @ 1.5 ml/L) also had potential effect on the increase of okra yield compared to untreated control (6.12 t ha^{-1}).

Table 1: Specification of different treatments with active ingredients and chemical name.

Treatments	Active ingredients	Chemical group
Untreated Control (T_1)	–	–
Biotrin 0.5% @0.5 ml/L (T_2)	Matrine 0.5%	Botanical
Biotrin 0.5% @1.0 ml/L (T_3)	Matrine 0.5%	Botanical
Capture 75 WDG @0.2 g/L (T_4)	Imidacloprid+Emamectin Benzoate	Neonicotinoid + Avermectin
Capture 75 WDG @0.3 g/L (T_5)	Imidacloprid+Emamectin Benzoate	Neonicotinoid + Avermectin
Kotan 50 WG @0.5 g/L (T_6)	Pymetrozine	Pyridine Azomethines
Kotan 50 WG @1.0 g/L (T_7)	Pymetrozine	Pyridine Azomethines
Ravjum 14.5 SC @1.0 ml/L (T_8)	Indoxacarb	Oxadiazine
Ravjum 14.5 SC @1.5 ml/L (T_9)	Indoxacarb	Oxadiazine
Sniper 10 SC @1.0ml/L (T_{10})	Fenopropathrin + Fenvalerate	Pyrethroid
Sniper 10 SC @1.5 ml/L (T_{11})	Fenopropathrin + Fenvalerate	Pyrethroid

Table 2: Effect of different reduced risk insecticides on the abundances of jassid populations on okra

Treatments	Mean number of jassids per leaf												
	Pre-treatment	Post-treatment number at different DAT after given each spray											
		1st spray			2nd spray			3rd spray			4th spray		
		3	7	10	3	7	10	3	7	10	3	7	10
Untreated Control (T_1)	4.52	5.00	6.23	10.34a	10.00b	9.67c	16.70b	17.90a	14.5b	16.00b	14.56a	10.11b	8.90b
Biotrin 0.5% @0.5 ml/L (T_2)	5.00	4.80	6.00	8.90b	9.00b	10.89b	14.56c	16.89b	14.53b	13.00c	13.51b	9.00c	8.01c
Biotrin 0.5% @1.0 ml/L (T_3)	4.40	5.00	5.23	5.00c	4.50c	4.00d	3.67e	3.30c	2.45cd	2.50d	1.56cd	1.22ef	1.22ef
Capture 75 WDG @0.2 g/L (T_4)	4.00	4.50	4.22	4.00cd	4.12cd	4.00d	4.33d	2.00e	1.50de	2.00de	1.00de	0.90f	1.00fg
Capture 75 WDG @0.3 g/L (T_5)	4.81	5.75	5.60	4.50cd	3.00cd	2.11fg	2.30gh	1.32f	2.00cd	1.10ef	1.10de	1.30ef	1.00fg
Kotan 50 WG @0.5 g/L (T_6)	5.00	4.21	4.50	3.56d	3.11cd	1.23g	1.40i	1.15f	1.14e	0.78f	0.60e	0.65f	0.51h
Kotan 50 WG @1.0 g/L (T_7)	3.89	5.11	4.50	4.22cd	4.00cd	3.51de	3.00f	3.10c	3.00c	3.00d	2.30c	2.12d	2.00d
Ravjum 14.5 SC @1.0 ml/L (T_8)	4.50	4.17	5.00	4.00cd	3.01cd	2.60ef	2.40g	2.50d	2.00cd	2.33d	1.89c	2.50d	1.56de
Ravjum 14.5 SC @1.5 ml/L (T_9)	5.12	5.25	4.50	4.00cd	3.01cd	2.13fg	2.00gh	2.40d	2.00cd	1.22ef	1.00de	1.20ef	1.10ef
Sniper 10 SC @1.0ml/L (T_{10})	4.45	4.00	5.00	3.50d	2.50d	2.00fg	1.60h	1.70e	2.00cd	1.00ef	0.67e	0.70f	0.67gh
Sniper 10 SC @1.5 ml/L (T_{11})	5.00	4.67	5.21	8.23b	12.75a	20.5a	19.0a	18.0a	17.4a	18.67a	14.92a	12.67	10.25a
$LSD_{0.05}$	NS	0.85	1.07	2.49	3.53	5.72	6.54	7.03	6.18	6.58	5.98	4.33	3.67

In a column, means followed by similar letter(s) are not significantly different at 5% level of probability. DAT: Days After Treatment, NS: Not Significant

Table 3: Effect of different reduced risk insecticides on the abundances of whitefly populations on okra

Treatments	Mean number of whitefly per leaf												
	Pre-treatment	Post-treatment number at different DAT after given each spray											
		1st spray			2nd spray			3rd spray			4th spray		
		3	7	10	3	7	10	3	7	10	3	7	10
Untreated Control (T_1)	2.60	3.00	3.20	3.00bc	3.50b	4.00b	4.20b	4.00b	3.00b	3.60b	3.20b	3.10a	3.30a
Biotrin 0.5% @0.5 ml/L (T_2)	3.00	2.80	3.00	2.60cd	3.10bc	3.50c	4.00b	4.00b	4.80a	3.90b	3.00b	3.00a	2.90a
Biotrin 0.5% @1.0 ml/L (T_3)	2.00	3.00	2.80	2.60cd	2.20cd	2.00d	1.60cd	1.50d	1.20c	1.00cd	1.20c	1.00b	0.80b
Capture 75 WDG @0.2 g/L (T_4)	2.50	2.80	2.90	2.10ef	2.00de	1.60e	1.50cd	1.20de	1.20c	1.00cd	0.80c	0.70b	0.60b
Capture 75 WDG @0.3 g/L (T_5)	3.00	2.50	3.00	2.00f	2.00de	1.50e	1.30d	1.20de	1.00c	1.00cd	1.00c	1.00b	0.90b
Kotan 50 WG @0.5 g/L (T_6)	3.10	3.00	2.90	2.20de	1.60e	1.70d	1.20d	1.00e	1.00c	0.85d	0.80c	0.60b	0.40b
Kotan 50 WG @1.0 g/L (T_7)	2.70	3.00	3.20	3.10b	2.50cd	2.00d	2.20c	2.00c	1.50c	1.30cd	1.20c	1.00b	1.00b
Ravjum 14.5 SC @1.0 ml/L (T_8)	3.00	3.00	2.90	3.00bc	2.70bc	1.60e	1.70cd	1.50d	1.30c	1.10cd	1.00c	1.00b	0.70b
Ravjum 14.5 SC @1.5 ml/L (T_9)	3.00	3.20	3.00	2.50de	2.60bc	2.00d	2.20c	2.00c	1.50c	1.50c	1.00c	0.80b	0.75b
Sniper 10 SC @1.0ml/L (T_{10})	3.10	3.00	3.20	2.60cd	2.00de	1.60e	1.00d	1.40de	1.20c	1.10cd	0.90c	0.60b	0.40b
Sniper 10 SC @1.5 ml/L (T_{11})	3.40	3.00	3.50	5.00a	6.34a	6.00a	5.12a	4.60a	5.60a	5.00a	4.20a	3.50a	3.00a
$LSD_{0.05}$	NS	0.89	0.69	1.33	1.44	1.58	1.53	1.39	1.66	1.54	1.27	1.18	1.20

In a column, means followed by similar letter(s) are not significantly different at 5% level of probability. DAT: Days After Treatment, NS: Not Significant

Table 4. Effect of reduced risk insecticides on marketable yield

Treatments	Mean marketable yield of okra (ton/ha)*
Untreated Control (T_1)	6.12d
Biotrin 0.5% @0.5 ml/L (T_2)	6.50d
Biotrin 0.5% @1.0 ml/L (T_3)	6.78d
Capture 75 WDG @0.2 g/L (T_4)	8.00c
Capture 75 WDG @0.3 g/L (T_5)	8.55c
Kotan 50 WG @0.5 g/L (T_6)	9.42bc
Kotan 50 WG @1.0 g/L (T_7)	10.56a
Ravjum 14.5 SC @1.0 ml/L (T_8)	8.28c
Ravjum 14.5 SC @1.5 ml/L (T_9)	9.18bc
Sniper 10 SC @1.0ml/L (T_{10})	9.45b
Sniper 10 SC @1.5 ml/L (T_{11})	10.44a
$LSD_{0.05}$	1.83

[*Yield from 10 consecutive pickings]; In a column, means followed by similar letter (s) are not significantly different at 5% level of probability.

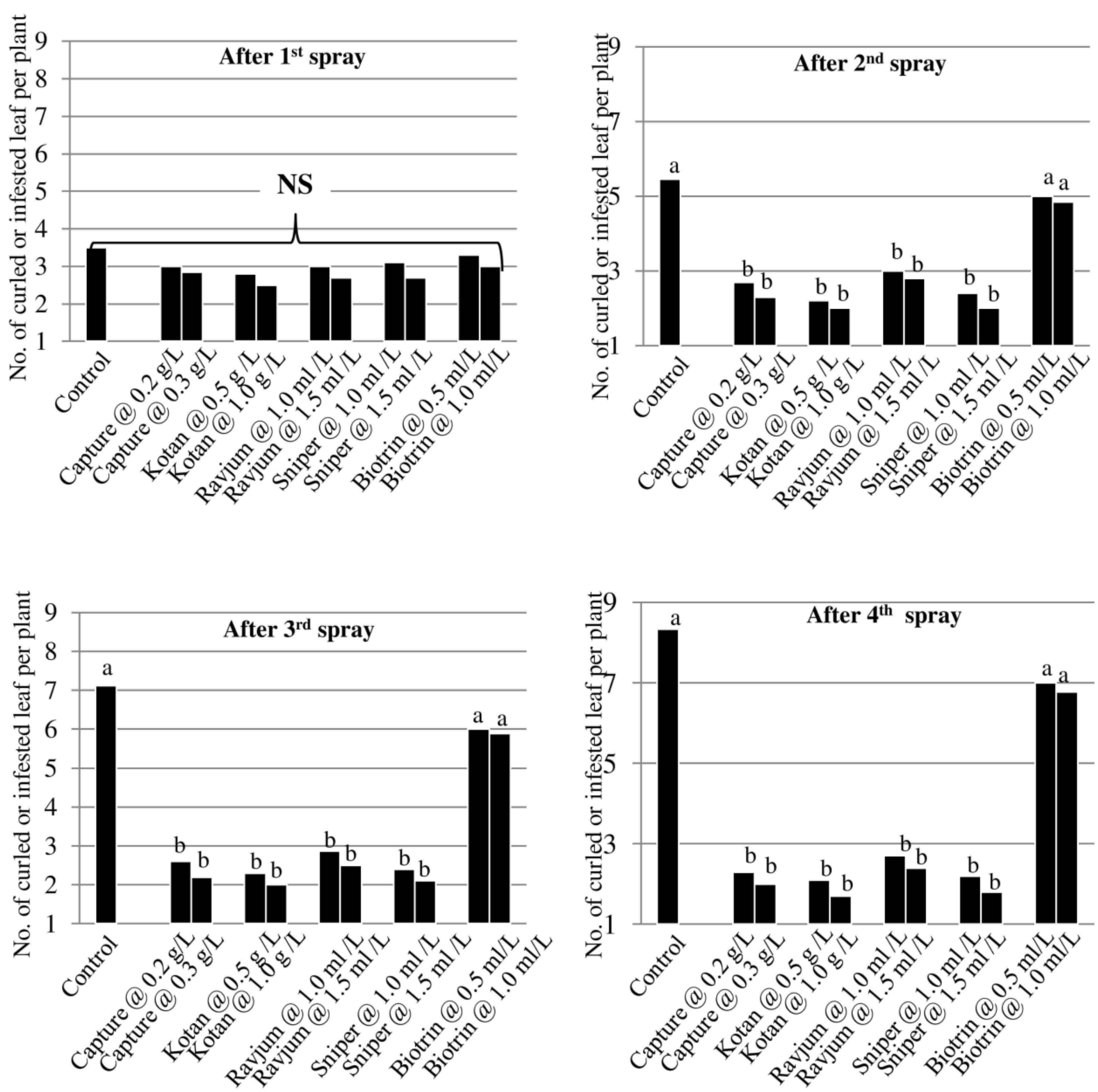

Figure 1. Effect of different insecticides on the reduction of curled leaves after given each spray. In each spray, bar containing different letters are significantly different from each other at 5% level of probability. NS: Not significant

Discussion

In the present study, we demonstrated that the sucking insect populations were significantly reduced compared to control when okra plants were treated with selected reduced risk insecticides except Biotrin 0.5%. Among all the treatments, the lowest infestation was found in Kotan 50 WG (Pymetrozine) and Sniper 10 SC (Fenopropathrin + Fenvalerate) treated plots which are slightly superior than Capture 75 WDG (Imidacloprid + Emamectin Benzoate) and Ravjum 14.5 SC (Indoxacarb). It was observed that no significant reduction of sucking insects population was observed at 3 and 7 DAT when plants were treated with all selected reduced risk insecticides compared to control but reduced significantly at 10 DAT after given 1st spray. Among four sprays, the least number of sucking insect populations per leaf was found after given 4th spray. The present result confirmed that Biotrin 0.5% was found ineffective or less effective against sucker complex of okra. In case of curled leaf infestation, Kotan 50 WG and Sniper 10 SC were found comparatively better than Capture 75 WDG and Ravjum 14.5 SC after given final or 4th spray and Biotrin 0.5% was found still less effective. The highest marketable yield was obtained from the plot treated with Kotan 50 WG @ 1.0 g/L (10.56 t/ha) that was followed by Sniper @ 1.5 ml/L (10.44 t/ha), Ravjum 14.5 SC @ 1.5 ml/L (9.18 t/ha) and Capture 75 WDG @ 0.3 g/L (8.55 t/ha) respectively.

Our results are well supported by Shivanna *et al.* (2011) who found that Fenpropathrin showed superior efficacy in bringing down all the sucking pest population followed by Dimethoate, Imidacloprid and standard check Acetamiprid. Similar results provided by Chinniah and Ali (2000). They conducted a field study on okra, *Abelmoschus esculentus*, to evaluate the biological efficacy of certain insecticides against sucking pests of okra. Carbosulfan (Marshal 25EC), fenpropathrin (Danitol 10EC), bifenthrin (Bifenthrin 10WP), ethion (Ethion 50EC and 50EW), dimethoate (Rogor 30EC), and a neem formulation (Neemitaf, 1500ppm azadirachtin) were tested against the carmine spider mite, *Tetranychus cinnabarinus* and cotton aphid, *Aphis gossypii*. It was revealed that ethion (0.1%) and fenpropathrin (0.01%) were found highly effective. Our current results are in agreement with the findings of Dhawan and Simwat (2000) who conducted an experiment on the effect of indoxacarb on the population of sucking pests like aphids and jassids during 1997 and 1998. In both the years, the population was significantly reduced in indoxacarb treated plots than untreated control. Although different results were also found from the study of Khedkar and Ukey (2003) and it might be happened due to the varietal difference and inappropriate selection of insecticide doses.

Conclusion

From the critical analysis of the present findings it can be concluded that application of Kotan 50 WG (Pymetrozine) @ 1.0 ml/L and Sniper 10 SC (Fenopropathrin + Fenvalerate) @ 1.5 ml/L at 10 days interval may be recommended to control sucking insects on okra. Capture 75 WDG (Imidacloprid + Emamectin Benzoate) @ 0.3 g/L and Ravjum 14.5 SC (Indoxacarb) @ 1.5 ml/L also be useful insecticides against sucking insects as they provided significant protection as well as increased yield. Better results may be achievable from these selected insecticides (except Biotrin 0.5%) if apply in integration with other insecticides or other IPM components.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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